

Space Program Operations Contract

SPACE SHUTTLE ORBITER OPERATIONAL LEVEL C FUNCTIONAL SUBSYSTEM SOFTWARE REQUIREMENTS GUIDANCE, NAVIGATION AND CONTROL PART E

NAVIGATION AIDS SUBSYSTEM OPERATING PROGRAM

PREPARED BY THE BOEING COMPANY
Space Exploration

Under Subcontract 6000132079, PDRD P1433q

December 14, 2007

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**SPACE SHUTTLE ORBITER
OPERATIONAL
LEVEL C
FUNCTIONAL SUBSYSTEM SOFTWARE REQUIREMENTS
GUIDANCE, NAVIGATION, AND CONTROL
PART E
NAVIGATION AIDS
SUBSYSTEM OPERATING SYSTEM**

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**The Boeing Company
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FOREWORD

The primary avionics software system (PASS) requirements for the computer programs that execute in the Shuttle general-purpose computers (GPCs) are specified in the Computer Program Development Specifications (CPDSs) and the Functional Subsystem Software Requirements (FSSR) documents. The requirements are specified at three levels

Level A CPDS – System-level Constraints and capabilities

Level B CPDS – Functional requirements

Level C FSSR – Detailed-level requirements

The Level A CPDS specifies system-level Constraints and capabilities that are not oriented toward any particular program end item. The Level B CPDS specifies system-level requirements for guidance, navigation, and control (GN&C) and detailed requirements for systems management (SM) and vehicle utility (VU). The Level C FSSR's specify the detailed requirements for GN&C and display/controls. The Level C reconfigurable requirements are specified in the systems management and payload documents. The Level A, Level B, and Level C requirements documents are listed in Section 2, Applicable Documents.

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DOCUMENT CHANGE RECORD

The following tabulation summarizes the change activity associated with this document.

DOCUMENT CHANGE RECORD			
Issue and Date	Change Summary/Effectivity		
OI-34 Release December 14, 2007	This baseline release for effectivity OI-34 and subs includes:		
	<u>CR</u>	<u>OI</u>	<u>Title</u>
	93017G	33	Baseline RSS99D0100 with Expanded Downlist
	93160B	32	Year End Roll Over (YERO) Reset
	93175	32	Expand Efectivity of SCR 93160B

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CHANGE REQUEST SUMMARY

The following tabulation lists the paragraphs, tables (T), and figures (F) that have been changed as a result of approved change requests for this release. Changes incorporated prior to this release are listed in Appendix R. Changes from approved change requests (CRs) to this document are indicated by a change bar in the outer margin of the changed page.

CHANGE REQUEST SUMMARY			
Paragraph	CR No.	OI	CR Title
N/A	93175	32	Expand Effectivity of SCR 93160B
4.17.6	93160B	32	Year End Roll Over (YERO) Reset
4.17.6-1.(T)	93160B	32	Year End Roll Over (YERO) Reset
4.17.6-2.(T)	93160B	32	Year End Roll Over (YERO) Reset
4.17.6.1.2	93160B	32	Year End Roll Over (YERO) Reset
4.17.6.10-1.(T)	93160B	32	Year End Roll Over (YERO) Reset
	93017G	33	Baseline RSS99D0100 with Expanded Downlist
4.17.6.10-2.(T)	93160B	32	Year End Roll Over (YERO) Reset
	93017G	33	Baseline RSS99D0100 with Expanded Downlist
4.43.6.5-1.(T)	93160B	32	Year End Roll Over (YERO) Reset
	93017G	33	Baseline RSS99D0100 with Expanded Downlist
4.43.6.5-2.(T)	93017G	33	Baseline RSS99D0100 with Expanded Downlist
4.44.6.3-1.(T)	93160B	32	Year End Roll Over (YERO) Reset
	93017G	33	Baseline RSS99D0100 with Expanded Downlist
4.44.6.3-2.(T)	93017G	33	Baseline RSS99D0100 with Expanded Downlist
4.45.6.2-1.(T)	93160B	32	Year End Roll Over (YERO) Reset
	93017G	33	Baseline RSS99D0100 with Expanded Downlist
4.45.6.2-2.(T)	93017G	33	Baseline RSS99D0100 with Expanded Downlist
4.122.2.4-1.(T)	93017G	33	Baseline RSS99D0100 with Expanded Downlist
4.122.2.4-2.(T)	93017G	33	Baseline RSS99D0100 with Expanded Downlist
4.229.7-1.(T)	93160B	32	Year End Roll Over (YERO) Reset
	93017G	33	Baseline RSS99D0100 with Expanded Downlist

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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of the subsystem operating program (SOP) Level C document is to specify the requirement details and to present formulations of the SOP Level B functional requirements for the orbiter GN&C flight software.

1.2 SCOPE

This document contains the requirement details and formulations for those SOP functions that are operative during Shuttle operations. The SOP functions are those specified in the GN&C Level B functional requirements document. This particular document addresses the navigation aid SOP's.

1.3 ORGANIZATION

This document is organized into the following sections:

- 1.0 Introduction
- 2.0 Applicable documents
- 3.0 Overview
- 4.0 Detail level requirements
- 5.0 Supplemental information

Section 1 defines the purpose, scope, and organization of this document. Section 2 lists the applicable documents. Section 3 provides an overview of the OFT software functions and discusses the contents of Section 4. Section 4 specifies the requirement details and presents formulation of the functional requirements for each subsystem operating program. It also contains applicable tables (Interface Definition Document (IDD) inputs/outputs, I-Loads, K-Loads, and Constants) located at the end of each Principal Function. Section 5 provides supplementary material.

The automated IDD tables provided herein define signal (parameter) interface requirements either between hardware (LRU) and software elements or between software elements and other software elements. A GN&C software element is either a sequenced principal function (PF), crew generated specialist/display function, or an OPS display function. In the event of a conflict between the IDD tables and other internal text input/output tables, the SASCB data base-controlled IDD tables take precedence.

The following table defines the data elements found in the IDD input/output, I-Load, K-Load, and Constant tables for each principal function.

Table 1.3-1. Parameter Element Description		
Title	Definition	Valid Entries
CAT	Category and Qualifier of the I-Load	Four alphanumeric characters: the first three designate the I-Load category; the last one designates the qualifier.
D	Dependency of the I-Load	D = Design M = Mission L = LRU
DESCRIPTION	Parameter description of the K-Load or Constant.	A string of ≤ 64 characters.
DESTINATION	Destination of the output parameter	Abbreviated functional titles. (** Note)
DT or DATA TYPE	Data Type	* See reference (1) for valid I-Load, K-Load and Constant data types. * See reference (2) for valid IDD data types for parameters with destination TLM. * See reference (3) for valid IDD data types for all other parameters.
ENG UNITS or UNITS	Engineering Units	* See reference (1) for valid I-Load, K-Load and Constant units. * See reference (2) for valid IDD units for parameters with destination TLM. * See reference (3) for valid IDD units for all other parameters.
FSSR NAME	Requirements parameter name	A string (with no embedded blanks) of ≤ 32 characters consisting of alphanumerics, underscores, parenthesis, commas and slashes. Parenthesis are used for array elements. Commas separate the different indices of multidimensional arrays. Slashes are used to separate multiple names used for a single MSID.
LAST CR	The last CR affecting the parameter	5 digit number with an alphabetic revision letter.
MC	Memory Configuration	00=Generic 05 = SM4 Orbit P/L 01=GN1 Ascent/GN6 RTLS 06 = P/L9 MMU 02=GN2 Orbit 07 = Not Assigned 03=GN3 Entry 08 = GN8 On-Orbit C/O 04=SM2 On-Orbit 09 = GN9 Preflight
MSID or M/S ID	Measurement/Stimulus Identification	Maximum of 10 alphanumeric characters. * See reference (3) for specifications
NOMENCLATURE	Parameter description of the IDD parameter.	String of ≤ 34 characters (including underscores and blank spaces).
PR or PREC	Precision	D, DP =Double S, SP = Single
SOURCE	Origin of the input parameter	Abbreviated functional titles.

Table 1.3-1. Parameter Element Description		
Title	Definition	Valid Entries
S	Software Utilization	C = Common B = BFS Unique P = Primary X = BFS Derived A = BFS Converted
PR FCTN	Cross reference of the principal function identifiers that are applicable to this parameter.	See Level B GN&C CPDS SS-P-0002-510
VALUE	The value of the K-Load or Constant	* See reference (1) for valid value formats.
* References:	(1) JSC 19350 I-Load Requirements Document Volume I (2) SS-P-0002-140 Level A SS Downlist/Uplink CPDS (3) JSC 18206 Shuttle Data Integration Plan Volume III MAST II/STAR Deliverable Products.	
** Note	IDD output (source) tables which reflect parameters going to input (destination) "TLM" shall not interpreted as a signal actually being downlisted. The parameter is only available for downlist in COMPOOL and does not appear in a downlist format. Parameters actually on the downlist will be designated with a destination denoting the downlist Format with a Rate Code. The Rate Code legend appears at the end of each FSSR data table. To complete the downlist information, Parent MSIDs (indicated by a 'P' in the 9 th character of the MSID) are now included in the software function output data tables in which a Child MSID already appears. A Parent MSID will have the same downlist destinations as its Child(ren) MSID(s).	

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2.0 APPLICABLE DOCUMENTS

2.1 LEVEL A DOCUMENTS

- SS-P-0002-140 Shuttle Downlist/Uplink Software Requirements
- SS-P-0002-150 Shuttle Launch Data Bus Software Interface Requirements
- SS-P-0002-170 Shuttle Systems Level Requirements, Software

2.2 LEVEL B DOCUMENTS

- SS-P-0002-510 Shuttle Functional Level Requirements, GN&C
- SS-P-0002-550 Shuttle Functional Level Requirements, Vehicle Utility
- SS-P-0002-580 Shuttle Functional Level Requirements, Systems Management

2.3 LEVEL C DOCUMENTS

- STS 83-0001 Operational Flight Level C, Functional Subsystem Software Requirements; Guidance, Navigation, and Control, Part A, Entry Through Landing Guidance
- STS 83-0002 Operational Flight Level C, Functional Subsystem Software Requirements; Guidance, Navigation, and Control, Part A, Guidance Ascent/RTLS
- STS 83-0003 Operational Flight Level C, Functional Subsystem Software Requirements; Guidance, Navigation, and Control, Part A, Guidance On-Orbit/Deorbit
- STS 83-0004 Operational Flight Level C, Functional Subsystem Software Requirements; Guidance, Navigation, and Control, Part B, Entry Through Landing Navigation
- STS 83-0005 Operational Flight Level C, Functional Subsystem Software Requirements; Guidance, Navigation, and Control, Part B, Navigation Ascent/RTLS
- STS 83-0006 Operational Flight Level C, Functional Subsystem Software Requirements; Guidance, Navigation, and Control, Part B, On-Orbit Navigation
- STS 83-0007 Operational Flight Level C, Functional Subsystem Software Requirements; Guidance, Navigation, and Control, Part C, Flight Control Entry – GRTLS
- STS 83-0008 Operational Flight Level C, Functional Subsystem Software Requirements; Guidance, Navigation, and Control, Part C, Flight Control Volume 1, Ascent Flight Phase, Volume 2, Ascent
- STS 83-0009 Operational Flight Level C, Functional Subsystem Software Requirements; Guidance, Navigation, and Control, Part C, Flight Control Orbit DAP
- STS 83-0010 Operational Flight Level C, Functional Subsystem Software Requirements; Guidance, Navigation, and Control, Part D, Redundancy Management

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STS 83-0013	Operational Flight Level C, Functional Subsystem Software Requirements; Guidance, Navigation, and Control, Part E, Inertial Measurement Unit Subsystem Operating Program
STS 83-0014	Operational Flight Level C, Functional Subsystem Software Requirements; Guidance, Navigation, and Control, Part E, Volume 1, Navigation Aids Subsystem Operating Program, Volume 2, Star Tracker Subsystem Operating Program
STS 83-0015	Operational Flight Level C, Functional Subsystem Software Requirements; Guidance, Navigation, and Control, Part E, Subsystem Operating Programs, FC Sensor/Controller
STS 83-0016	Operational Flight Level C, Functional Subsystem Software Requirements; Guidance, Navigation, and Control, Part E, Subsystem Operating Programs, FC Effector
STS 87-0017	Operational Flight Level C, Functional Subsystem Software Requirements; Remote Manipulator System
STS 83-0020	Operational Flight Level C, Functional Subsystem Software Requirements; Displays and Controls
STS 83-0026	Operational Flight Level C, Functional Subsystem Software Requirements; Guidance, Navigation, and Control, Sequencing
JSC-19350	Shuttle Flight Software Initialization Loads <ul style="list-style-type: none">• Volume I General Requirements• Volume II Mission I-Load Requirements
JSC-19478	Payload Management, Level C Flight Software Requirements
JSC-19590	Systems Management, Level C Flight Software Requirements

2.4 ICD DOCUMENTS

ICD 3-1011-02	GPC/DEU ICD
ICD 2-1S001	Orbiter Primary Flight Software System and Backup Flight System Software Interface

In the event of a conflict between the documents referenced herein and the contents of this specification, the precedence shall be determined as defined in paragraph 1.3 of CPDS SS-P-0002-170, Volume 1, System Level Requirements, Software.

3.0 OVERVIEW

3.1 SHUTTLE OPERATIONAL PROGRAM

The Shuttle operational program represents the total computer program which operates in the orbiter general-purpose flight computer for Shuttle operations. The requirements are specified at three levels:

- Level A – System level constraints and capabilities
- Level B – Functional requirements
- Level C – Detail level requirements

The Level A specifies system-level constraints and capabilities which are not oriented toward any particular program end item. Levels B and C specify the functional- and detailed-level requirements and are program end item oriented. The Level B and C requirements are specified in separate documents for guidance, navigation, and control (GN&C); systems management (SM); and vehicle utility and data flow.

3.2 GN&C SOFTWARE REQUIREMENTS STRUCTURE

This section describes the top level GN&C software requirements structure for purposes of specifying the functional requirements for Shuttle operations. The structure is described below.

1. Operational Sequence – A collection of sequentially ordered major modes.
2. Major Modes – A collection of functions that may be scheduled by the software or that may be called by the crew. (See Figure 5.2-1.)
3. Function – A task to be performed by the software. Functions are defined as:
 - a. Principal function – A function that can only be initiated by the software. Principal functions may be ordered sequentially, run in parallel, enabled, or inhibited.
 - b. Specialist function – A function that can only be initiated by the crew.

3.3 SOP OVERVIEW

The SOP major functions consist of principal and specialist functions (as defined above). The SOP's basically provide services and interface between the GN&C LRU's and other application programs. The nature of the services and interfaces provided is indicated by the general SOP functions described below:

1. Format conversion to support input/output processing
2. Data compensation to convert data into engineering units by applying biases and scale factors
3. Data transformations and special computations as required by other application programs
4. Generation of appropriate data and interfaces to display and control (D&C)

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5. BITE and failure discrete monitoring and reporting of status to redundancy management (RM) for further processing
6. Self-test execution as required
7. Moding, sequencing, and control at the individual SOP level

The SOP's do not include the specific input/output services provided by FCOS, nor do they include the data selection and failure management functions performed by other application programs.

As indicated earlier, the Level C SOP detailed requirements are specified in several documents. The following list indicates the SOP's addressed in each volume.

1. STS 83-0013 – Inertial measurement unit SOP
2. STS 83-0014 – Navigation aid SOP's, Vol. 1
 - a. Tactical air navigation SOP (TACAN)
 - b. Microwave scan beam landing system SOP (MSBLS)
 - c. Radar altimeter SOP (RA)
 - d. Navigation derived air data SOP (NAVDAD)
 - e. Rendezvous radar SOP (RR)
3. STS 83-0014 – Navigation aid SOP's, Vol. 2 Star Tracker
4. STS 83-0015 – Flight control sensor/controller SOP's
5. STS 83-0016 – Flight control effector SOP's

3.4 SOP SUBSECTION ORGANIZATION

Section 4 of this document contains the SOP requirement details and formulation. Each subsection in Section 4 is dedicated to a particular SOP. The contents of the paragraphs for a typical SOP subsection is discussed below.

A. Requirements Overview. This paragraph provides an introduction to the particular SOP. A functional overview of the applicable LRU performance characteristics, operating modes, and interfaces is presented for the purpose of defining hardware dictated requirements and constraints. An overview of the SOP is presented to indicate functions the SOP provides and its relationship to other application programs.

B. Definitions. This paragraph defines applicable coordinate systems, transformations and other supporting data that are applicable to the SOP.

C. Requirements Traceability. This paragraph contains a traceability table that correlates the detailed requirements of the SOP with the top-level functional requirements specified in the GN&C Level B CPDS.

D. Interface Parameters. This paragraph is reserved for specifying interfaces associated with the applicable SOP.

E. Parameter Initialization. This paragraph defines those parameters that require initialization and specifies their associated values. It does not include initialization processing that requires execution.

F. Detailed Requirements and Formulations. This paragraph defines the functional modules that constitute the applicable SOP. The detailed requirements and formulations are contained in this paragraph. The format and contents of each module consist of the following:

1. Name and purpose of the functional module
2. Functional requirements satisfied by the module
3. Input and output, interfaces, and I-loads that are associated with the module
4. Detailed requirements and formulations including execution rates and processing sequence
5. Special considerations that are applicable to the module
6. Tables – Inputs, outputs, I-loads
7. Flow diagrams

Subparagraphs are generally used to specify the detailed requirements of subfunctions. For each SOP, the organization of the subparagraphs is tailored to individual needs and peculiarities.

3.5 SOP FORMULATION NOTES

This section provides definitive notes for the SOP formulations contained in Section 4.

A. Computation and Coding Considerations. It should be noted that all navigation and communication aid SOP computations can be performed using single precision coding, except where double precision is specified to obtain the required accuracy. Fixed-point/floating-point conversions and computations can be implemented in the manner that most efficiently satisfies the SOP requirements.

B. Programming Deviations. It is recognized that, for the sake of programming efficiency, the detailed design and coding of the SOP software may deviate from the partitioning of functional requirements presented in the SOP functional modules. This deviation, where necessary, is acceptable provided the overall detailed design and coded program comply with the basic intent of the SOP.

3.6 IMPLEMENTATION CONSTRAINTS

The SOP design is capable of recovering from the effects of many transient-type errors. Accordingly, the software design and code shall not preclude this capability by causing a program halt, permanent discontinuance of SOP processing, or loss of protected data as a result of program check or error interrupts. Check or error interrupts shall either be prevented by software safeguards or standard fixup, and error returns shall be provided that are appropriate to the SOP function as described in Level A CPDS, Section 4.6.4. The footnotes specified in the SOP's (F1, F2, F3, etc.) refer to codes described in the Level A CPDS.

3.6.1 Timing

Timing in this document is related to error-free processing conditions. See Level A CPDS SS-P-0002-170, paragraph 4.4.2A, for timing related to error processing conditions.

4.0 DETAIL LEVEL REQUIREMENTS

The subsystem operating programs (SOP's) include all of the software required for operation of the GN&C subsystem hardware external to the data processing subsystem (DPS).

The SOP's provide necessary services and interfaces between the GN&C line replaceable units (LRU's) and other application programs. The major SOP functions are format conversion, data compensation, moding and sequencing, BITE monitoring, self-tests, and special computations. The SOP's do not include the specific input/output services provided by FCOS, nor do they include the data selection and failure management functions performed by other application programs.

This section specifies the detailed requirements for the navigation aid SOP's which are organized as follows.

Section	Title
4.17	Global Positioning System SOP
4.43	TACAN SOP
4.44	Microwave Scan Beam Landing System SOP
4.45	Radar Altimeter SOP
4.122	Navigation-Derived Air Data SOP
4.229	Rendezvous Radar SOP

Of the navigation aid SOP's listed in previous versions of this document, two are not in this book (Vol. 1): The One-Way Doppler Extractor (OWDE) SOP has been deleted since it will not be used on the Shuttle Program; the Star Tracker SOP is being issued as a separate book (Vol. 2).

The input/output functional parameters for the SOP modules, I-loads/K-loads, constants, and variable cross-reference are provided at the end of each section.

Requirements precedence in this document shall be as follows:

1. If there is a conflict between the data in the function subtables and the standard principal function tables, the principal function tables shall have precedence.
2. If there is a conflict between the data in the flow diagrams and the written requirements, the written requirements shall have precedence.

4.0.1 Traceability of Requirements

Table 4.0.1-1 shows the traceability of the software paragraphs in this FSSR with respect to the corresponding Sections of the Level B CPDS' documentation. In addition, Table 4.0.1-2 shows the traceability of the PASS GN&C principal functions located in this FSSR with respect to the applicable BFS paragraphs in the Level C PRD specifications. These tables are provided for information only.

Table 4.0.1-1.Level B to Level C Traceability			
Level B PF Number	Level B PF Name (Acronym)	Level C FSSR Section No.	Related Modules
4.17	Global Positioning System Subsystem Operating Program (GPS SOP)	4.17.6.1 4.17.6.2 4.17.6.3 4.17.6.4 4.17.6.5 4.17.6.6 4.17.6.7 4.17.6.8	GPS_TO_GPC GPS_QAI_CHECK GPS_ALT_DATA GPC_TO_GPS GPS_DISP_COMP GPS_SOP_DL_COMP GPS_IMU_SAVE GPS_SOP_TIME_ADJ_UPLINK
4.43	TACAN Subsystem Operating Program (TACAN SOP)	4.43.6.1 4.43.6.2 4.43.6.3 4.43.6.4	TAC_TEST TAC_DATA TAC_ANT TAC_CHAN
4.44	Microwave Scanbeam Landing System SOP (MSBLS SOP)	4.44.6.1 4.44.6.2	MSB_IN MSB_DATA
4.45	Radar Altimeter SOP (RA SOP)	4.45.6.1	RA_DATA
4.122	Navigation-Derived Air Data SOP (NAV DAD SOP)	4.122.2.1 4.122.2.2 4.122.2.3	DYPRS_N EOAS_N MACH_N
4.229	Rendezvous Radar SOP (RR SOP)	4.229.6.1	RR SOP

Table 4.0.1-2.SOP's FSSR/PRD Correlation					
Principal Function	FSSR Paragraph	FSSR Title	BFS PRD	PRD Paragraph	BFS Title
G4.17	4.17	Global Positioning System Subsystem Operating Program (GPS SOP)	MG038106	3.2.5.2.4	Global Positioning System Hardware Interface Program (GPS_HIP)
G4.43	4.43	TACAN Subsystem Operating Program	MG038106	3.2.5.2.3	TACAN Hardware Interface Processor (TACAN_HIP)
G4.44	4.44	Microwave Scanbeam Landing System SOP	N/A	N/A	N/A
G4.45	4.45	Radar Altimeter SOP	N/A	N/A	N/A
G4.122	4.122	Navigation-Derived Air Data SOP	MG038106	3.2.5.2.2	Navigation Derived Air Data Processor (NAVDAD_PROC)
G4.229	4.229	Rendezvous Radar SOP	N/A	N/A	N/A

4.17 Global Positioning System Subsystem Operating Program

This section defines the detailed functional requirements and formulations for the Global Positioning System (GPS) subsystem operating program (SOP). The GPS SOP defines software associated with GPS receiver command and response processing, GPS data transmittal to the GPC and associated processing, and GPC data transmittal to the GPS receiver and associated processing.

All GPS related software in the GPC is required to handle phased GPS receiver installation in the vehicle in any LRU assignment order and any number of receivers actually installed from 0 to a maximum of 3 except for Horizontal Situation display. This maximum is defined by the K-load parameter, GPS_SW_CAP.

The implementation of this principal function satisfies this requirement by processing data from 3 receivers and bypassing relevant calculations if a receiver is not actually installed on the vehicle.

4.17.1 GPS Requirements Overview

4.17.1.1 GPS Functional Overview

GPS is a space-based radio navigation system which utilizes a constellation of 24 satellites (3 spares) to provide global and continuous coverage for near earth spacecraft. GPS satellite ephemeris data, ranging codes, and time data are provided to the user vehicle receiver (or receivers) which use this data to compute highly accurate measurements of the vehicle range and Doppler from each of the GPS satellites being tracked. This information is processed in the receiver to derive the position and velocity of the user vehicle in the World Geodetic Survey 1984 (WGS84) earth-centered earth-fixed coordinate frame. The implementation of a GPS-based navigation capability on the Orbiter will consist of the following procedures:

1. Output the estimate of the Orbiter's position, velocity, and associated time tag from the GPS receiver(s) to the Orbiter GPC.
2. Output the required status of each receiver and the quality of its state estimates from the GPS receivers(s) to the Orbiter GPC.
3. Perform the appropriate coordinate transformations on and quality checks of these receiver states.
4. Select the GPS receiver state to be used by the Orbiter navigation system.
5. Provide aiding states (position, velocity, attitude and altitude) to the GPS receivers.

A single GPS subsystem is depicted in Figure 4.17.1.1-1. The major components that are required for the GPS function are identified as follows: controls on the panel, an MDM (multiplexer/demultiplexer) that contains the GPS control register, a GPS receiver, a GPS antenna and the on-board computer (GPC). The keyboard and the display electronics unit are also required for GPS receiver command and data monitoring.

4.17.1.1.1 GPS Operating Modes

The software requirements for the GPS SOP are based on the following GPS receiver operations and are provided here for information. They are also reproduced in the Display FSSR, STS-83-0020 Volume I, in the GPS Status Display section.

1. The GPS receiver operating system modes are as follows:

- OFF mode
- INIT mode
- TEST mode
- NAV mode

The GPS receiver OFF mode is controlled by a Power On Panel Switch and cannot be commanded by the crew through the GPC GPS Status Display (G6.51).

The INIT, TEST and NAV modes can be commanded by the crew through the GPC GPS Status Display (G6.51).

2. When the receiver is powered up while it is not under GPC control, the receiver will automatically mode to Power-On Self Test, to INIT, and then to NAV.

Upon power up under GPC control, the GPC receiver will perform Power-On Self Test, transition to the INIT mode, and remain in INIT until commanded to TEST or NAV.

The receiver is under GPC control when it receives valid data with a valid header from the GPC.

3. TEST mode can be commanded by the crew through execution of a display item entry on the GPS Status Display. In TEST mode, the GPS receiver performs full commanded self test using the GPS R/P Built-In-Test (BIT) capability for fault isolation and identification. After the first 6 seconds in TEST mode, the receiver will mode itself to BIT during which period (about 2 minutes) there is no output from the receiver. All GPS receiver data, including the data header, received by the GPC will be zero. When BIT is complete, the receiver will again output valid header and data (BIT FAULT LOG WORDS). The result of the self-test (pass or fail) will be in the fifth bit of word 1 in the Bit Fault Log and will be available for display to the crew. Upon completion of the commanded BIT, the receiver will remain in the TEST mode and will not automatically transition to INIT or NAV. If the receiver is commanded to INIT or NAV during the first 6 seconds of TEST mode, the receiver will not complete the commanded BIT and will transition to the new commanded mode immediately.

Note that the commanded selftest, BIT, is different than the Power-On Self Test in Item 2 above.

4. INIT mode can be commanded by the crew through execution of a display item entry on the GPS Status Display. Initialization operations occur when the receiver is in the INIT mode. The initialization mode allows the timing and frequency standard to attain stable operation as required to activate the digital interfaces with the Orbiter software. Data sent from the GPC to

GPS is used to initialize the receiver position and velocity state. Lever arm correction data and GPS measurement residual edit criteria are also collected by the receiver via the GPC to GPS data. Upon completion of INIT mode, the receiver will remain in INIT and will not automatically transition to NAV, except as indicated in (2).

5. When the receiver is commanded to INIT by the crew or as a result of moding the GPS I/O control to flight GPS I/O in G9, initialization data will be provided to the receiver and the initialization data available flag (Bit 8 of GPS_CONTROL_WORD) will be set ON at the same time the receiver is commanded to INIT.

On receipt of the INIT command from the GPC, the receiver will use the accompanying state information to perform INIT. On completion of INIT, the receiver will set the initialization complete flag to ON (Bit 17 of NAV_MODE_WORD) and sequence to the next commanded mode. Note that if the initialization data available flag is set to ON without the GPC also commanding the INIT mode, the receiver will interpret that data block from the GPC as invalid and the aiding data will not be used for initialization.

When the initialization data is sent to the receiver, the initialization data available flag and the aiding data available flag will be set to ON, and the announced reset, and filter restart, flags will be set to OFF.

6. NAV mode can be commanded by the crew through execution of a display item entry on the GPS Status Display. NAV mode occurs when the GPS receiver is in satellite tracking and navigation operation, providing position and velocity.

There are three navigation submodes: aided (INS), unaided (PVA), and Prelaunch Standby (STA).

The receiver will be in the Prelaunch Standby NAV submode when it is commanded to the NAV mode in: G9 prior to launch; in OPS 1 prior to Major Mode 102; and following transition to G9 after landing. In this nav submode, the receiver will be aided by the GPC with a position vector, a zero velocity vector and attitude aiding data. In the PASS GPS software requirements, the Prelaunch Standby submode is also referred to as the Stationary submode since it is a nav submode which can occur both prelaunch and post landing.

The receiver will be in either the INS or PVA nav submode when it is commanded to NAV in all other OPS. The INS submode occurs when there are valid aiding states provided to the receiver by the GPC. When there are no valid aiding states being provided, the receiver downmodes to the PVA nav submode. Determination of aiding depends on: rate of aiding (must be between 4 and 100 Hertz); senescence of data (< 2 seconds old); validity of data; and reasonableness checks on the aiding data. The receiver will transition from the PVA to INS NAV submodes when it receives valid aiding data over four GPC to GPS input cycles in a one second period.

7. During aided NAV submode operation, the GPS receiver navigation filter is aided by the Orbiter GPC IMU data in the form of a reference state which is computed by the Reference State Processing Principal Function (4.18). Two commands from the GPC, the first of which is controlled by the crew through GPS Status Display item entry, are provided to communicate with the GPS receiver navigation filter.

a. Filter Restart: Commands the receiver to reinitialize its state to the GPC reference state and restart its navigation filter. Upon detecting a change from an OFF to an ON state for this command, the receiver performs the necessary internal actions and sends a completion bit to the GPS SOP. The command is then turned OFF by the SOP when the GPC is notified of the task completion by the receiver. The receiver then receives the OFF command and resets its internal parameters to wait for the next OFF to ON transition for the command. Filter restart commands will not be honored by the receiver when it is in the Prelaunch Standby or PVA NAV submodes. It will be honored in the INS NAV submode.

b. Announced Reset: Commands the receiver to reconfigure its navigation algorithm due to a discontinuity (jump) in the position and velocity aiding states. This command is not crew controlled. Upon detecting a change from an OFF to an ON state for this command, the receiver performs the necessary internal actions and sends a completion bit to the GPS SOP. The command is then turned OFF by the SOP when the GPC is notified of the task completion by the receiver. The receiver then receives the OFF command and resets its internal parameters to wait for the next OFF to ON transition for the command. The minimum time between announced resets shall be greater than two seconds due to the mechanization of the GPS receiver interface messages.

8. GPC navigation covariance information is set to zero indicating GPC data is not applicable.

9. The receiver only acknowledges and enters a commanded mode which is not currently active. For example, commanding TEST mode when the receiver is already in TEST will not restart the receiver self test process. Similarly, commanding INIT when the receiver is already in the INIT mode will not restart the receiver initialization processes.

10. Deleted.

11. The GPS receiver updates its output buffers at the following rates:

- NAV Mode: 10 Hertz if unaided, and at aiding rate for valid aiding
- INIT Mode: 1 Hertz
- TEST Mode: 1 Hertz except during Self Test (BIT) when it is not updated

The GPS receiver high rate navigation solution is provided to the GPC.

12. If the receiver is commanded to a new mode before it has completed its current mode functions, the receiver will complete the current mode functions and then transition to whatever mode is being commanded at that time. The only exception to this is if the receiver is commanded to INIT or NAV during the first 6 seconds of TEST mode. In this case the receiver will not complete its TEST mode functions and will transition to the new commanded mode immediately.

13. The receiver will send all zeros to the GPC for the output data from its non-used sixth channel.

14. The mode command protocol assumes the following: The mode command is sent to the receiver. Receiver gets data appropriate to that mode, with the correct headers, on the same I/O pass with the GPC.

15. The receiver will be capable of operating under conditions of no GPC-GPS I/O, no aiding data from the GPC, and with stale or static GPC aiding data during OPS transitions. In the latter case, the aiding data valid flags will be ON but the data will be stale or static.
16. During receiver selftest, the receiver will provide an I/O capability with the GPC to avoid two successive COMMFAULTS and a FCOS I/O bypass situation. During execution of this mode, the receiver will return invalid data and Header information of '0000'. Valid self test data will be sent to the GPC upon completion of selftest.
17. The navigation data validity bit indicates valid data when the following conditions are satisfied:
 - The Kalman filter estimated error is less than 1000 meters
 - The receiver is in the NAV mode
 - The receiver Performance Monitor (PM) did not detect a critical failure in the previous second
18. The receiver will be capable of receiving Baro altimeter and radar altimeter aiding data simultaneously from the GPC. The GPC software will set either the BARO altimeter data good or the radar altimeter data good to ON (both will not be on simultaneously) to indicate to the receiver which altitude aiding data has preference.
19. The receiver will be capable of deselecting satellites upon command from the GPC.
20. The receiver assumes that two sets of aiding data, (1) position and velocity and (2) attitude data have the same time tag. The time tag of the attitude angles is used by the receiver to calculate rate of change in the attitude.

4.17.1.1.2 GPS Digital Interfaces

The GPS receiver interfaces with the GPC via the serial digital multiplex/demultiplex input and output data channel. The digital I/O halfwords are 16 bits in size. There are two blocks of data sent from GPC to GPS and one block of data sent from GPS to GPC. The format of the GPS GPC I/O data interfaces are illustrated in Table 4.17.1.1.2-1. Depending on the GPS receiver mode, the data blocks take on different messages as detailed in Table 4.17.1.1.2-2 through Table 4.17.1.1.2-7. Each message content is uniquely determined by its hex Header ID. Note that messages 2 and 3 and their hex Header IDs do not have the same corresponding natural order. These data messages shall be packed appropriately into the data blocks by the GPS SOP or the GPS receivers.

4.17.1.1.3 GPS Discrete Interfaces

None.

4.17.1.2 GPS SOP Functional Overview

The GPS SOP performs the following functions:

1. Controls and monitors the operation of the GPS receiver(s).
2. Processes GPS data for use by the other GPC program elements.

3. Processes GPC data for use by the GPS receiver(s).

The GPS SOP is partitioned into 9 modules as follows:

- A. GPS Data Processing. The GPS_TO_GPC module processes the GPS data which is receiver mode dependent.
- B. GPS Data Quality Processing. The GPS_QA1_CHECK module examines the status of the GPS receivers and performs a quality check on the receiver figure of merit.
- C. GPS Altitude Aiding Processing. The GPS_ALT_DATA module performs the data processing necessary for GPS altitude aiding.
- D. GPC To GPS Processing. GPC_TO_GPS module buffers the GPC-derived commands and data which support the GPC-controlled GPS mode selection (TEST, INIT, NAV) and GPS satellite deselection, GPS receiver initialization, GPS receiver navigation filter restart, GPS receiver state announced reset, INS aiding, attitude aiding and altitude aiding.
- E. GPS Display Computations. The GPS_DISP_COMP module calculates parameters needed by the GPS STATUS (SPEC 55) display.
- F. GPS SOP Downlist Computations. The GPS_SOP_DL_COMP module prepares downlist parameters.
- G. GPS IMU Processing. The GPS_IMU_SAVE module reserves the appropriate IMU accumulated velocity counts and time tag for the current GPS states.
- H. GPS SOP Time Adjustment Uplink Processing. The GPS_SOP_TIME_ADJ_UPLINK module changes and stores the GPS SOP's GPS to GMT time adjustment in response to a command uplink of this parameter.
- I. GPS SOP Time Adjustment Module. The GPS_TIME_ADJ module computes the accumulated GPS time adjustment required to center the GPS time tag minus GPC time tag at a predetermined I-Load value.

4.17.1.3 GPS SOP Functional Module Summary

The functional modules that constitute the GPS SOP are identified in Table 4.17.1.3-1. Each of the modules, including functions and formulations, is presented in detail in Section 4.17.6.

4.17.1.4 Reference Documents

TBD

4.17.1.5 Software Protection

The software implementation of the GPS SOP shall protect against program checks and error interrupts caused by transient-type errors or bad data inputs. Specifically, the GPS SOP shall protect against all of the error conditions identified in paragraph 3.6 that are applicable to the GPS software design and code.

4.17.2 Definitions

See the glossary in Section 5.1.

Table 4.17.1.1.2-1. GPC GPS I/O Data Format				
I/O Data Block Name	Size (Halfwords)	Message Contents**		
		TEST Mode	INIT Mode	NAV Mode
GPC_TO_GPS_DATA_ONE(I)*	32	Message 1	Message 1	Message 1
GPC_TO_GPS_DATA_TWO(I)*	32	(None)***	Message 2	Message 3
GPS_TO_GPC_DATA_ONE(I)*	32	Message 4	Message 5	Message 6

* I = GPS receiver LRU number = 1 to 3
 ** Messages 1 through 6 are described in Tables 4.17.1.1.2-2 through Tables 4.17.1.1.2-7
 *** In TEST mode, this second data block to be sent to the receiver will be all zero or blank data. The header, first halfword of GPC_TO_GPS_DATA_TWO data block, contains HEX'0000' will signal the receiver to ignore the rest of the data block message. Thus the GPS receiver will only use the first data block, GPC_TO_GPS_DATA_ONE, in test mode.

Table 4.17.1.1.2-2. Message 1 Format - GPS Receiver Aiding Data					
Data Description	Halfword Number	Data Type	Units	Typical LSB	GPS SOP Related Parameters*
Header (HEX'AAAA')	1	BCH	-	-	
Control word sent to GPS receiver	2-3	HMD	-	-	GPS_CONTROL_WORD**
Aiding state time tag - GPS week from 1/6/1980	4	HXU	week	1	T_REF_WEEK_OUT(I)***
Aiding state time tag - seconds from beginning of GPS week	5-7	EMD****	sec	10 ⁻⁸	T_REF_SEC_OUT(I)***
Position aiding state - X component	8-9	FXS	ft	1/16	\bar{R} _REF_OUT (I,1)***
Position aiding state - Y component	10-11	FXS	ft	1/16	\bar{R} _REF_OUT (I,2)***
Position aiding state - Z component	12-13	FXS	ft	1/16	\bar{R} _REF_OUT (I,3)***
Velocity aiding state - X component	14-15	FXS	ft/sec	1/512	\bar{V} _REF_OUT (I,1)***
Velocity aiding state - Y component	16-17	FXS	ft/sec	1/512	\bar{V} _REF_OUT (I,2)***
Velocity aiding state - Z component	18-19	FXS	ft/sec	1/512	\bar{V} _REF_OUT (I,3)***
Spares	20-23	-	-	-	
Command discretes from Crew to deselect specific Satellites from receiver consideration	24-27	HMD	-	-	DESELECT_SAT_RCVD

Table 4.17.1.1.2-2. Message 1 Format - GPS Receiver Aiding Data

Data Description	Halfword Number	Data Type	Units	Typical LSB	GPS SOP Related Parameters*
Square root of the sum of the position diagonals of Orbiter Nav filter covariance Matrix	28-29	FXU	ft	1	Not used by PASS S/W
Square root of the sum of the velocity diagonals of Orbiter Nav filter covariance Matrix	30	HXU	ft/sec	.01	Not used by PASS S/W
Spares	31-32	-	-	-	

* These GPC parameters are related to the fields defined in the table. Their data attributes can be found where they are defined.

** See Table 4.17.6.4.1-3 for detailed definition of GPS_CONTROL_WORD

*** I = GPS receiver LRU number = 1 to 3 (Parameters without "I" are the same for all GPS receivers)

**** Three 16-bit halfwords totaling a 48-bit fix point number.

Table 4.17.1.1.2-3. Message 2 Format - Antenna Correction Data

Data Description	Halfword Number	Data Type	Units	Typical LSB	GPS SOP Related Parameters*
Header (HEX'CCCC')	1	BCH	-	-	
Upper antenna to nav base lever arm correction in Orbiter structural coordinates	2-4	HXS	ft	1/16	GPS_UPPER_ANTENNA_NB(I)**
Lower antenna to nav base lever arm correction in Orbiter structural coordinates	5-7	HXS	ft	1/16	GPS_LOWER_ANTENNA_NB(I)**
Upper antenna to CG lever arm correction in Orbiter structural coordinates	8-10	HXS	ft	1/16	GPS_UPPER_ANTENNA_CG(I)**
Lower antenna to CG lever arm correction in Orbiter structural coordinates	11-13	HXS	ft	1/16	GPS_LOWER_ANTENNA_CG(I)**
GPS upper antenna boresight direction in Orbiter body structure coordinates	14-16	HXS	-	1/2 ¹⁵	GPS_UPPER_ANTENNA_BORESIGHT(I)**
GPS lower antenna boresight direction in Orbiter body structure coordinates	17-19	HXS	-	1/2 ¹⁵	GPS_LOWER_ANTENNA_BORESIGHT(I)**
GPS pseudo range residual edit criteria***	20	HMD	-	-	-
GPS delta range residual edit criteria***	21	HMD	-	-	-
Spares	22-32	-	-	-	

* These GPC parameters are related to the fields defined in the table. Their data attributes can be found where they are defined.
 ** I = GPS receiver LRU number = 1 to 3
 *** See Tables 4.17.6.4.2-3 and 4.17.6.4.2-4 for detailed definition

Table 4.17.1.1.2-4. Message 3 Format - GPS Receiver Aiding data (Attitude and Altitude)					
Data Description	Halfword Number	Data Type	Units	Typical LSB	GPS SOP Related Parameters*
Header (HEX'BBBB')	1	BCH	-	-	
Orbiter body roll attitude	2	HXS	rad	PI/2 ¹⁵	PHI_OUT
Orbiter body pitch attitude	3	HXS	rad	PI/2 ¹⁵	THETA_OUT
Orbiter body yaw attitude	4	HXS	rad	PI/2 ¹⁵	PSI_OUT
Spare	5-7				
BARO altitude time tag - GPS week from 1/6/1980	8	HXU	week	1	T_GPS_BARO_WEEK_OUT
BARO altitude time tag - seconds from beginning of GPS week	9-11	EMD**	sec	10 ⁻⁸	T_GPS_BARO_SEC_OUT
Radar altitude time tag - GPS week from 1/6/1980	12	HXU	week	1	T_GPS_RADALT_WEEK_OUT
Radar altitude time tag - seconds from beginning of GPS week	13-15	EMD**	sec	10 ⁻⁸	T_GPS_RADALT_SEC_OUT
BARO altitude measurement	16-17	FXS	ft	1	GPS_BARO_DATA_OUT
Radar altitude measurement	18	HXS	ft	1/2	GPS_RADALT_DATA_OUT
Spare	19-32	-	-	-	

* These GPC parameters are related to the fields defined in the table. Their data attributes can be found where they are defined.
 ** Three 16-bit halfwords totaling 48-bit fixed number.

Table 4.17.1.1.2-5. Message 4 Format - GPS Receiver Testing Data					
Data Description	Halfword Number	Data Type	Units	Typical LSB	GPS SOP Related Parameters*
Header (HEX'DDDD')	1	BCH	-	-	
GPS receiver I navigation mode word***	2-3	HMD	-	-	NAV_MODE_WORD(I)**
GPS receiver I test BIT fault log word****	4-21	HMD	-	-	BIT_FAULT_LOG_WORD (I,1 to 18)**
GPS receiver I Time Totalizing Meter (TTM)-counter indicating the total elapsed receiver operating time	22-23	FXU	hours	1	(not used)
GPS receiver I CPCI ID-last four (ASCII) characters from the computer program configuration time	24-25	ASCII	-	-	(not used)
Spare	26-32	-	-	-	

* These GPC parameters are related to the fields defined in the table. Their data attributes can be found where they are defined.
 ** I = GPS receiver LRU number = 1 to 3
 *** GPS receiver navigation mode word is defined in Table 4.17.6.1.1-3
 **** GPS receiver bit fault log word is not defined for the single string GPS configuration

Table 4.17.1.1.2-6. Message 5 Format - GPS Receiver Initialization Data					
Data Description	Halfword Number	Data Type	Units	Typical LSB	GPS SOP Related Parameters*
Header (HEX'EEEE')	1	BCH	-	-	
GPS receiver I navigation mode word***	2-3	HMD	-	-	NAV_MODE_WORD(I)**
Receiver I time tag - GPS week from 1/6/1980	4	HXU	week	1	(not used)
Receiver I time tag - seconds from beginning of GPS week	5-7	EMD****	sec	10 ⁻⁸	(not used)
Receiver I PPS status word	8	HMD	-	-	PPS_STATUS_WORD(I)**
Receiver I almanac reference week number	9	HXU	week	1	ALMANAC_REF_WEEK(I)**
Spare	10-32	-	-	-	

* These GPC parameters are related to the fields defined in the table. Their data attributes can be found where they are defined.
 ** I = GPS receiver LRU number = 1 to 3
 *** GPS receiver navigation mode word is defined in Table 4.17.6.1.1-3
 **** Three 16-bit halfwords totaling a 48-bit fix number

Table 4.17.1.1.2-7. Message 6 Format - GPS Receiver Navigation data					
Data Description	Halfword Number	Data Type	Units	Typical LSB	GPS SOP Related Parameters*
Header (HEX'FFFF')	1	BCH	-	-	
GPS receiver I navigation mode word***	2-3	HMD	-	-	NAV_MODE_WORD(I)**
Receiver I time tag - GPS week from 1/6/1980	4	HXU	week	1	T_GPS_WEEK(I)**
Receiver I time tag - seconds from beginning of GPS week	5-7	EMD§	sec	10 ⁻⁸	T_GPS_SEC(I)**
Receiver I position solution - X component	8-9	FXS	ft	1/16	\bar{R} _GPS_ECEF_SOP (I,1)**
Receiver I position solution - Y component	10-11	FXS	ft	1/16	\bar{R} _GPS_ECEF_SOP (I,2)**
Receiver I position solution - Z component	12-13	FXS	ft	1/16	\bar{R} _GPS_ECEF_SOP (I,3)**
Receiver I velocity solution - X component	14-15	FXS	ft/sec	1/512	\bar{V} _GPS_ECEF_SOP (I,1)**
Receiver I velocity solution - Y component	16-17	FXS	ft/sec	1/512	\bar{V} _GPS_ECEF_SOP (I,2)**
Receiver I velocity solution - Z component	18-19	FXS	ft/sec	1/512	\bar{V} _GPS_ECEF_SOP (I,3)**
Receiver I status, FOM and GDOP word****	20	HMD	-	-	GPS_STATUS_FOM_GDOP(I)**
Receiver I PPS status word§§	21	HMD	-	-	PPS_STATUS_WORD(I)**
Receiver I channel status word*****	22-30	HMD	-	-	CHANNELS_STATUS(I,K)**
Receiver I time figure of merit	31	HMD	-	-	TFOM(I)**
Receiver I age of aiding data	32	HXS	msec	1	GPS_AIDING_DATA_AGE_DL (I)**

* These GPC parameters are related to the fields defined in the table. Their data attributes can be found where they are defined.

** I = GPS receiver LRU number = 1 to 3, K = 1 to 9

*** GPS receiver navigation mode word is defined in Table 4.17.6.1.1-3

**** GPS receiver status, FOM and GDOP word is defined in Table 4.17.6.1.2-3

***** GPS receiver channel status words are defined in Table 4.17.6.1.2.1-3 through Table 4.17.6.1.2.1-11

§ Three 16-bit halfwords totaling a 48-bit fix point number

§§ GPS receiver PPS status words are defined in Table 4.17.6.1.3-3

Table 4.17.1.3-1. GPS SOP Function Modules

Module Name	Applicable Paragraph	Module Description
GPS_TO_GPC	4.17.6.1	GPS data processing
GPS_QA1_CHECK	4.17.6.2	GPS data quality check
GPS_ALT_DATA	4.17.6.3	Altitude aiding data processing
GPC_TO_GPS	4.17.6.4	Output data processing to GPS receivers
GPS_DISP_COMP	4.17.6.5	GPS displays computations
GPS_SOP_DL_COMP	4.17.6.6	GPS SOP downlist computations
GPS_IMU_SAVE	4.17.6.7	IMU data processing
GPS_SOP_TIME_ADJ_UPLINK	4.17.6.8	GPS to GMT time adjustment uplink processing
GPS_TIME_ADJ	4.17.6.9	GPS SOP time adjustment

4.17.3 Functional Requirements Traceability

The detailed requirements and formulations contained herein satisfy the GN&C, Level B, CPDS functional requirements for the GPS SOP.

4.17.4 GPS SOP Interfaces

This section defines the interfaces associated with the GPS SOP. Inputs and outputs of GPS SOP are contained in the IDD Tables 4.17.6.10-1 and 4.17.6.10-2.

4.17.5 Parameter Initialization

This section defines the I-load, K-load and Constant parameters associated with the GPS SOP. Table 4.17.6.10-3 contains the I-load parameters. Table 4.17.6.10-4 contains the K-load parameters. Table 4.17.6.10-5 contains the Constant parameters.

4.17.6 Detailed Requirements and Formulations

This section defines the GPS_SOP functional modules in sufficient detail to create a functional design and generate computer code. Figure 4.17.6-1 presents a flow diagram of the GPS SOP. Each module defines the functional requirements, interface requirements, detailed requirements and formulations, and special considerations if applicable. A flow diagram is also included for each module; however, the flow diagrams are supplementary material and are not intended to convey requirements or to place restrictions on functional design or coding. Tables 4.17.6-1 and 4.17.6-2 contain the input and output parameters for the GPS SOP control function.

The GPS SOP shall function as follows:

1. A homogeneous set of GPS data shall be read into the GPC prior to each execution of the GPS_TO_GPC module, which performs the required data format conversion and scaling. Table 4.17.1.1.2-5 through Table 4.17.1.1.2-7 list the three possible input message data from each of the available GPS receivers. It is not required that the different receivers have the same time tag (i.e. be time homogeneous with each other). However, data from each individual receiver is required to be time homogeneous.

SNAP GPS (GPS_TO_GPC_DATA_ONE₁, GPS_TO_GPC_DATA_ONE₂,
GPS_TO_GPC_DATA_ONE₃)

2. The selected accumulated sensed velocities and the associated time tag shall be snapped from IMU RM for use by the GPS Receiver State Processing principal function.

SNAP IMU (\bar{V} _IMU_GPS_SOP, T_IMU_GPS_SOP, REFS_RDY)

3. The GPS commfault flags (GPS_COMMFAULT₁), GPS bypass flags (GPS_BYPASS₁), and GPS transaction status words (GPS_TSW₁) shall be snapped from system software.

SNAP FCOS (GPS_COMMFAULT₁, GPS_COMMFAULT₂, GPS_COMMFAULT₃,
GPS_BYPASS₁, GPS_BYPASS₂, GPS_BYPASS₃, GPS_TSW₁, GPS_TSW₂,
GPS_TSW₃)

4. Only in Major Mode 304, 305, 602 and 603, Barometric altimeter data is also collected and stored. This includes the Shuttle's barometric altitude, a flag indicating if the Shuttle is in the MACH jump region, its data good flag and the associated time tag, to be adjusted by a premission-loaded time bias. Baro data shall be used for altitude-aiding the GPS receivers.

SNAP BARO (Q_BARO, MACH_JUMP, BARO_DG, T_BARO)

5. Only in Major Mode 305 and 603, Radar altimeter data, consisting of the altitude of the Shuttle, the data good flag, and the time tag (which will subsequently be adjusted by a premission-loaded time bias) shall be collected for altitude-aiding the GPS receivers.

SNAP RADALT (RADALT_HEIGHT, RADALT_DG, T_RADALT)

6. Commands and data from crew via GPS STATUS display are collected. These include command to restart GPS navigation filter, command to mode GPS receiver to 'TEST', 'INIT' or 'NAV', GPS I/O designation, crew deselected satellite list, crew deselected GPS receiver, and crew enabled GPS time adjustment capability. Commands from crew via Horizontal Situation display are also collected. These include command to enable GPS radar altimeter aiding and BARO auto/inhibit/force command.

SNAP GPS_STATUS (GPS_IO_CNTL, FILT_RESTART_RCVD₁,
FILT_RESTART_RCVD₂, FILT_RESTART_RCVD₃,
GPS_MODE_CMD_RCVD₁, GPS_MODE_CMD_RCVD₂,
GPS_MODE_CMD_RCVD₃, CREW_DESELECT_SAT_RCVD,
CREW_DES_RCVR_SOP₁, CREW_DES_RCVR_SOP₂,
CREW_DES_RCVR_SOP₃, GPS_TIME_ADJ_ENBL)

SNAP HSD (GPS_RA_RCVD, BARO_AIF)

Note that GPS_RA_RCVD can only be set by the single GPS configuration.

7. In all OPS modes except OPS9, a time homogeneous set of Reference States and associated flags from the GPS Reference State Proc principal function shall be collected here for aiding the GPS receivers.

SNAP REFERENCE STATE (T_CURRENT_GPS_REF, \bar{R} _REF, \bar{V} _REF,
AIDING_DATA_VALID₁, AIDING_DATA_VALID₂, AIDING_DATA_VALID₃,
GPS_ANNCD_RESET_SET₁, GPS_ANNCD_RESET_SET₂,
GPS_ANNCD_RESET_SET₃, INIT_STATE_SET₁, INIT_STATE_SET₂,
INIT_STATE_SET₃, GPS_FILT_RESTART₁, GPS_FILT_RESTART₂,
GPS_FILT_RESTART₃, GPS_CMD_RESET₁, GPS_CMD_RESET₂,
GPS_CMD_RESET₃, GPS_ANNCD_RESET_TIME_ADJ)

8. The GPS_SOP_TIME_ADJ_UPLINK module is called. This module updates the GPS to GMT time adjustment with a ground update when required.
9. For each of the receivers, the GPS SOP shall perform the following operations, if two-way communication is enabled, GPS_IO_CNTL = 2:

- 9.1 If the flag, `FILT_RESTART_RCVDi`, is ON indicating Crew command to restart GPS navigation filter and the flag, `GPS_FILT_RESTARTi`, is OFF indicating that the GPS filter restart data is not prepared and ready, then the request flag, `FILT_RESTART_REQUESTi`, shall be set ON indicating a request to the GPS Reference State Proc principal function to determine whether a GPS filter restart can currently be commanded, and if so, command the filter restart.

IF `FILT_RESTART_RCVDi` = ON AND `GPS_FILT_RESTARTi` = OFF
THEN `FILT_RESTART_REQUESTi` = ON

- 9.2 From GPS Reference State Proc principal function, the flag, `GPS_FILT_RESTARTi`, is checked next. If it is ON indicating that the GPS filter restart is commanded, and its previous state, `GPS_FILT_RESTART_PREVi`, is OFF, then the clocktime is saved for use by `NAV_MODE_WORD_DATA` module in determining the logic to refresh the filter restart command field on the `GPS_STATUS` display, and the crew command to do filter restart, `GPS_FILT_RESTART_CMDi`, shall be set OFF.

IF `GPS_FILT_RESTARTi` = ON AND `GPS_FILT_RESTART_PREVi` = OFF
THEN `T_FRi` = CLOCKTIME
`GPS_FILT_RESTART_CMDi` = OFF

- 9.3 The Crew commanded GPS mode, `GPS_MODE_CMD_RCVDi`, is checked next. If it is not INIT command, then the command shall be honored on this GPS output pass and the `GPS_INIT_REQUEST_SOPi` flag shall be set to OFF. Otherwise, the `GPS_INIT_REQUEST_SOPi` flag shall be set ON requesting initialization from GPS Reference State Proc principal function, if the current GPS mode, `GPS_MODE_CURRENTi`, is not already in 'INIT' and the initialization is not already commanded.

IF `GPS_MODE_CMD_RCVDi` not = INIT THEN
`GPS_MODE_CMD_SOPi` = `GPS_MODE_CMD_RCVDi`
`GPS_INIT_REQUEST_SOPi` = OFF
ELSE
IF `GPS_MODE_CURRENTi` NOT = 'INIT' AND `INIT_STATE_SETi` = OFF THEN
`GPS_INIT_REQUEST_SOPi` = ON

- 9.4 When the initialization is commanded from GPS Reference State Proc principal function as indicated by the flag, `INIT_STATE_SETi`, being ON, the GPS SOP commanded GPS mode will be INIT.

IF `INIT_STATE_SETi` = ON THEN
`GPS_MODE_CMD_SOPi` = INIT

- 9.5 The `GPS_FILT_RESTARTi` command is stored as follows:

`GPS_FILT_RESTART_PREVi` = `GPS_FILT_RESTARTi`

10. For each of the receivers, the GPS SOP shall perform the following operations:

- 10.1 If 6.25 Hz input is enabled (GPS_IO_CNTL = 1); or if both flight I/O has been enabled and the GPS bypass flag is ON (GPS_IO_CNTL = 2 and GPS_BYPASS_i = ON); or if the GPS command reset flag is ON (GPS_CMD_RESET_i = ON), then perform the following:

```
GPS_INIT_REQUEST_SOPi = OFF
INIT_STATE_SETi = OFF
GPS_FILT_RESTARTi = OFF
FILT_RESTART_REQUESTi = OFF
GPS_FILT_RESTART_CMDi = OFF
GPS_ANNCD_RESET_SETi = OFF
GPS_CMD_RESETi = OFF
```

IF GPS_IO_CNTL = 1, then also check the GPS transaction status word GPS_TSW₁ to determine if it is non-zero. If so, set GPS_COMMFAULT₁ = ON; otherwise set GPS_COMMFAULT₁ = OFF.

```
IF GPS_TSW1 ≠ '0000'
    GPS_COMMFAULT1 = ON
ELSE
    GPS_COMMFAULT1 = OFF
ENDIF
```

- 10.2 Set the FOM_GDOP_STATIC_i flag to on. This flag will subsequently be reset to OFF when the FOM and GDOP are determined to be valid for display.

```
FOM_GDOP_STATICi = ON
```

- 10.3 Check the commfault flag, GPS_COMMFAULT_i. If no communications fault exists, then GPS_TO_GPC is executed to process the incoming GPS data.

```
IF GPS_COMMFAULTi = OFF THEN
    EXECUTE: GPS_TO_GPC CODE
```

11. If the GPS Time Adjustment capability is enabled (GPS_TIME_ADJ_ENBL = ON) then the GPS Time Adjustment computation shall be performed according to information available in section 4.17.6.9 (GPS_TIME_ADJ). Otherwise the accumulated GPS time adjustment (T_GPS_TIME_ADJ_ACC) shall be set to zero. In addition, the flag indicating an announced reset for the GPC-to-GPS time adjustment computation (GPS_ANNCD_RESET_TIME_ADJ) shall be set to OFF.

```
IF (GPS_TIME_ADJ_ENBL = ON) THEN
    EXECUTE: GPS_TIME_ADJ
ELSE
    T_GPS_TIME_ADJ_ACC = 0
    GPS_ANNCD_RESET_TIME_ADJ = OFF
END IF
```

12. If two-way communication is enabled, GPS_IO_CNTL = 2, perform the following:

- 12.1 The GPS SOP shall execute the GPS_ALT_DATA module to set up data for GPS receiver altitude aiding.
- 12.2 The GPS SOP shall execute the GPC_TO_GPS module, which prepares data to be transferred to GPS receivers.
13. If the flag, REFS_RDY, is ON indicating IMU data is available and major mode is not 901, then the GPS SOP shall execute the GPS_IMU_SAVE module, which stores the set of accumulated IMU velocity counts that are most appropriate to the latest GPS state vectors. The appropriateness of the selection of IMU velocity counts is explained in detail in section 4.17.6.7.
14. The GPS SOP shall execute the GPS_DISP_COMP module, which processes GPS data for display.
15. The GPS SOP shall execute the GPS_SOP_DL_COMP module, which prepares GPS downlist data.

At each OPS transition except transition between OPS1 and OPS6 the following variables shall be initialized:

- a. The current GPS mode indicator, GPS_MODE_CURRENT, shall be initialized to blank. The actual operating mode shall be determined via examining the NAV_MODE_WORD by GPS SOP.
- b. The GPS filter restart request flag, FILT_RESTART_REQUEST, shall be set OFF indicating no request to the GPS Reference State Proc principal function to command a GPS filter restart.
- c. The GPS initialization state request flag, GPS_INIT_REQUEST_SOP, shall be initialized to OFF indicating no request to the GPS Reference State Proc principal function to command an initialization.
- d. The GPS initialization state ready flag, INIT_STATE_SET, shall be initialized to OFF indicating that GPS initialization is not commanded.

Prior to the first pass of the GPS SOP, (a) the GPC to GPS and GPS to GPC time reference conversion parameter, T_GPS_OFFSET_SECS, and (b) the number of GPS LRU's installed, NUM_GPS_INSTALLED, shall be initialized as follows:

$$T_GPS_OFFSET_SECS = (T_GPS_OFFSET_DAYS \ 86400) - 86400$$

$$NUM_GPS_INSTALLED = GPS_INSTALLED(1) + GPS_INSTALLED(2) \\ + GPS_INSTALLED(3)$$

For a year-end rollover event, T_GPS_OFFSET_SECS will be incremented by the number of seconds in a year. [Note: A detailed description of this processing can be found in section 4.1.1 Deorbit/Landing Navigation Sequencer (4.123) in STS83-0004, the Entry Through Landing Navigation FSSR.]

T_GPS_OFFSET_SECS and NUM_GPS_INSTALLED shall be preserved across all GN&C OPS transitions.

The GPS SOP is unique among shuttle GN&C applications in that GPS receiver input and output processing is initiated by a timer different from the one that initiates the application and because it is both crew and I-load configurable.

During OPS 1/6, 2, 3, and 8, if GPS_IO_CNTL = 2 (its value in these OPS when at least one GPS receiver is installed), then the GPS I/O, specified in the GPS support section of the SSW Level-A CPDS (SS-P-0002-170), shall be invoked by GPS Input and Output Processes to provide receiver inputs at 1.04 Hz and receiver outputs at 6.25 Hz. Otherwise, if GPS_IO_CNTL = 0 (its value in these OPS when no receivers are installed), then no GPS I/O shall be requested by the GPS Input and Output Processes. GPC TO GPS output shall follow GPS TO GPC input on cycles on which both the input and output occur. The GPS I/O Processes shall execute independent of the GPS SOP and shall be phased within the I/O profile so as to maximize available system I/O performance. However, the various SOP modules shall be sequenced so as to process GPS TO GPC inputs within 240 milli-seconds of their acquisition and provide SOP generated GPC TO GPS outputs that are no more than 240 milli-seconds old. Note that these times are maximums and can not both be maximized so the total of the two times will not exceed 320 ms in any given cycle.

During OPS 9 the following three crew selectable GPS I/O configurations shall be provided as determined by the setting of GPS_IO_CNTL by Item 10 on SPEC 55 (the GPS Status Display):

GPS_IO_CNTL = 0:	disabled GPS receiver I/O (no input and no output)
GPS_IO_CNTL = 1:	6.25 Hz non-commfaultable GPS to GPC input only
GPS_IO_CNTL = 2:	flight GPS I/O of 1.04 Hz GPS TO GPC input and 6.25 Hz GPC TO GPS output (as specified in the GPS Support section of the SSW Level-A CPDS (SS-P-0002-170)).

GPS I/O shall be initially disabled (GPS_IO_CNTL = 0) in OPS 9. Upon transition to OPS 1 and provided that at least one GPS receiver is installed, flight GPS I/O (GPS_IO_CNTL = 2) shall be enabled. Only the flight and disabled GPS I/O configurations shall be supported in the flight OPS. Upon transition to OPS 9 from any other GN&C OPS and provided that at least one GPS receiver is installed, flight GPS I/O (GPS_IO_CNTL = 2) shall be in effect until reconfigured by crew input. During GNC OPS 9, the GPS/GPC I/O process shall suspend operations when the GPS_IO_CNTL is set to 0. If in GNC OPS 9 and GPS_IO_CNTL is set to 1 or 2, the GPS/GPC I/O process shall operate at the rates specified above.

When GPS_IO_CNTL = 1 in OPS 9, the GPS TO GPC input process shall request, on an installed LRU basis, 6.25 Hz non-commfaultable GPS to GPC input. Further, the GPS to GPC input process shall examine the FCOS returned input transaction status word and either clear or set the appropriate GPS_COMMFAULT(I) bits to either enable or disable processing of the input data by the downstream GPS SOP modules. Specifically, if the FCOS returned transaction status word, GPS_TSW(I) for GPS LRU I (where I = 1, 2, or 3), is non-zero, then the receiver commfault bit, GPS_COMMFAULT(I), shall be set. Otherwise, the GPS_COMMFAULT(I) bit shall be cleared. When GPS_IO_CNTL is 0 or 2 the GPS_COMMFAULT(I) bits shall not be cleared or set by the GPS TO GPC input process (this is an FCOS function when GPS_IO_CNTL = 2).

During OPS 9 when GPC to GPS outputs are disabled (GPS_IO_CNTL = 1 or 0) the ground is free to command the GPS receivers using the LDB/TCS operators (see SS-P-0002-150 section 5.3.4 Operator Code 3 (Issue) for example) or via some other GPS receiver test stimuli.

At the first FCOS output to the GPS receivers following an OPS transition, and at succeeding FCOS outputs until the GPS SOP executes, the following requirements shall be met. Note that the following requirements are also applicable when GPS_IO_CNTL transitions to two while in OPS 9:

The default values of both 32 halfword output of the GPS SOP output buffers shall remain as set before the OPS transition, except for the following:

1. The default values of the mode commands (Bit 0, 1, 30 and 31 of GPC_TO_GPS_DATA_ONE_{i,2 TO 3}, I = 1 to 3) at OPS transitions shall insure the default mode command requirements as specified in the Shuttle Display and Controls FSSR STS 83-0020 for the software release for which this FSSR applies. The default values of the major mode (Bit 17 to 27 of GPC_TO_GPS_DATA_ONE_{i,2 TO 3}, I = 1 to 3) shall be that of the new OPS. All other bits in GPC_TO_GPS_DATA_ONE_{i,2 TO 3} shall be set to '0' at all OPS transition except transition between OPS 1 and OPS 6.
2. The header label (first 16 bit halfword) in the first 32 halfword output buffer shall have the value 'AAAA'. Note that the header label (first 16 bit halfword) in the second 32 halfword output buffer will prevent the receiver from processing incorrect mode data in the event that the default mode setting at the OPS transition is different from the mode setting at exit from the previous OPS.

There are no specific requirements on the GPC TO GPS output buffers generated by GPS SOP during the period following an OPS transition and prior to the execution of principal functions which provide data to GPS SOP. It is assumed that the data parameters provided to the GPS SOP and used to generate the GPC TO GPS output buffers are appropriately initialized at OPS transition by the appropriate principal functions. The proper initialization is required in order to preclude GPS SOP from forming erroneous output buffers.

Table 4.17.6-1. GPS SOP Control Input Parameters

Description	Symbol	Source	Type	Prec	Range	Units	Rate
Flag indicating valid aiding reference state for GPS receiver I	AIDING_DATA_VALID(I)**	*	D	-	ON/OFF	-	1.04
BARO auto/inhibit/force switch	BARO_AIF	*	D	-	ON/OFF	-	1.04
Pressure altitude data good indicator	BARO_DG	*	D	-	ON/OFF	-	1.04
Current computer clock time (GMT)	CLOCKTIME	*	F	DP	-	SEC	1.04
Flag indicating filter restart states have been made available for GPS receiver I (snapped copy of GPS_FILTER_RESTART_CMD(I)**)	FILT_RESTART_RCVD(I)**	*, NAV_MODE_WORD_DATA	D	-	ON/OFF	-	1.04
Flag indicating GPS announced reset of receiver I is commanded	GPS_ANNCED_RESET_SET(I)**	*	D	-	ON/OFF	-	6.25
Flag indicating a GPS command reset is required due to a GPS command time-out	GPS_CMD_RESET(I)**	*	D	-	ON/OFF	-	6.25
Flag indicating communication fault status for GPS receiver I	GPS_COMMFAULT(I)**	*	D	-	ON/OFF	-	1.04
Flag indicating GPS filter restart of receiver I is commanded	GPS_FILTER_RESTART(I)**	*	D	-	ON/OFF	-	6.25
Designation of GPS I/O to be performed	GPS_IO_CNTL	*	I	S	0,1,2	-	0.52
Crew requested mode for GPS receiver I	GPS_MODE_CMD_RCVD(I)**	*	I	S	TEST(0) INIT(1) NAV(2)	-	0.52
Crew initiated radar altimeter aiding flag	GPS_RA_RCVD	*	D	-	ON/OFF	-	6.25
GPS receiver I to GPC data buffer one	GPS_TO_GPC_DATA_ONE(I)**	*	D	-	-	-	1.04

Table 4.17.6-1. GPS SOP Control Input Parameters

Description	Symbol	Source	Type	Prec	Range	Units	Rate
Crew deselected GPS receiver	CREW_DES_RCVR_SOP(I)**	*	D	-	ON/OFF	-	0.52
GPS time adjustment enable ind.	GPS_TIME_ADJ_ENBL	*	D	-	ON/OFF	-	0.52
Flag indicating an announced reset for the GPC-to-GPS time adjustment computation	GPS_ANNCD_RESET_TIME_ADJ	*	D	-	ON/OFF	-	6.25
Flag indicating initialization of receiver I is commanded	INIT_STATE_SET(I)**	*	D	-	-	-	6.25
Flag indicating (ON) that the shuttle is in the MACH jump region	MACH_JUMP	*	D	-	ON/OFF	-	1.04
Major Mode indicator	MM_CODE	*	I	S	-	-	6.25
ADS corrected pressure altitude	Q_BARO	*	F	S	-	FT	1.04
Current GPS reference state position	R_REF	*	V	DP	-	FT	6.25
Radar Altimeter data good indicator	RADALT_DG	*	D	-	ON/OFF	-	6.25
Radar Altimeter measurement	RADALT_HEIGHT	*	F	S	-	FT	6.25
Status flag for IMU reference matrix computation	REFS_RDY	*	D	-	ON/OFF	-	-
Time tag for ADS corrected pressure altitude	T_BARO	*	F	DP	-	SEC	1.04
Time tag for current GPS reference state	T_CURRENT_GPS_REF	*	F	DP	-	SEC	6.25
Number of seconds from 1/6/80 to midnight between 12/30 and 12/31 of year prior to launch year	T_GPS_OFFSET_SECS	*	F	DP	-	SEC	on Demand
Time tag of current accumulated IMU velocity counts	T_IMU_GPS_SOP	*	F	DP	-	SEC	1.04/ 6.25
Time tag for radar altimeter data	T_RADALT	*	F	DP	-	SEC	6.25
Current accumulated IMU velocity counts	V_IMU_GPS_SOP	*	V	DP	-	FT/SEC	1.04/ 6.25
Current GPS reference state velocity	V_REF	*	V	DP	-	FT/SEC	6.25
Flag indicating GPS receiver I is to be bypassed	GPS_BYPASS(I)**	*	D	-	ON/OFF	-	1.04
Crew deselect satellite word K	CREW_DESELECT_SAT_RCVD(K)***	*	HMD	-	-	-	6.25
GPS transaction status words	GPS_TSW(I)**	*	HMD	-	-	-	6.25

* See principal function input list in Table 4.17.6.10-1

** I = 1,2,3 (1 to GPS_SW_CAP)

*** K = 1 to 4

Table 4.17.6-2. GPS SOP Control Output Parameters

Description	Symbol	Destination	Type	Prec	Range	Units	Rate
Flag indicating the request for a GPS filter restart	FILT_RESTART_REQUEST(I)**	*	D	-	ON/OFF	-	6.25
Flag indicating static FOM/GDOP data	FOM_GDOP_STATIC(I)**	*	D	-	ON/OFF	-	6.25
Flag indicating GPS announced reset of receiver I is commanded	GPS_ANNCD_RESET_SET(I)**	*	D	-	ON/OFF	-	6.25

Table 4.17.6-2. GPS SOP Control Output Parameters

Description	Symbol	Destination	Type	Prec	Range	Units	Rate
Flag indicating GPS filter restart of receiver I is commanded	GPS_FILT_RESTART(I)**	*	D	-	ON/OFF	-	6.25
Flag indicating the request for a GPS receiver initialization	GPS_INIT_REQUEST_SOP(I)**	*, RCVR_AIDING_DATA	D	-	ON/OFF	-	6.25
GPS SOP commanded GPS mode for GPS receiver I	GPS_MODE_CMD_SOP(I)**	RCVR_AIDING_DATA, GPC_TO_GPS	I	S	0,1,2	-	6.25
GPS receiver I current operating mode indicator	GPS_MODE_CURRENT(I)**	*, GPS_TO_GPC	I	S	0,1,2	-	6.25
Flag indicating initialization of receiver I is commanded	INIT_STATE_SET(I)**	*	D	-	ON/OFF	-	6.25
Crew deselected GPS receiver	CREW_DES_RCVR_SOP(I)**	GPS_TIME_ADJ	D	-	ON/OFF	-	6.25
GPS time adjustment enable ind	GPS_TIME_ADJ_ENBL	GPS_SOP_DL_COMP	D	-	ON/OFF	-	6.25
Accumulated GPC-to-GPS time adjustment	T_GPS_TIME_ADJ_ACC	GPS_TIME_ADJ	HXS	-	-	MSEC	6.25
Flag indicating an announced reset for the GPC-to-GPS time adjustment computation	GPS_ANNCED_RESET_TIME_ADJ	GPS_TIME_ADJ	D	-	ON/OFF	-	6.25
Number of seconds from 1/6/80 to midnight between 12/30 and 12/31 of year prior to launch year	T_GPS_OFFSET_SECS	*, NAV_MESSAGE_DATA, GPS_ALT_DATA, RCVR_AIDING_DATA	I	DP	-	SEC	-
Time indicating the beginning of GPS I receiver filter restart process	T_FR(I)**	NAV_MODE_WORD_DATA	F	DP	-	SEC	6.25
Number of GPS receivers installed	NUM_GPS_INSTALLED	*	HXS	-	0,1,3	-	-

* See principal function output list in Table 4.17.6.10-2

** I = 1,2,3 (1 to GPS_SW_CAP)

4.17.6.1 GPS Data Processing (GPS_TO_GPC)

The purpose of the GPS_TO_GPC functional module is to collect data from each GPS receiver and convert it into a form which is usable by the GPS Receiver State Processing principal function, the GPS Reference State Processing principal function and the Orbiter display processing function.

A. Functional Requirements. The GPS_TO_GPC module is required to perform the following functions:

1. Parse GPS data (GPS_TO_GPC_DATA_ONE) according to GPS receiver's operating mode.
2. Compute GPS parameters such as time, position and velocity vectors by performing the required scaling and conversion to obtain floating point data in the appropriate units.

B. Interface Requirements. The input and output parameters associated with the GPS_TO_GPC functional modules are contained in Table 4.17.6.1-1 and 4.17.6.1-2. I-load parameters are contained in Table 4.17.6.10-3. The content of the data block GPS_TO_GPC_DATA_ONE is dependent upon the GPS receiver mode. Table 4.17.1.1.2-5 through Table 4.17.1.1.2-7 define the three possible data message formats for GPS_TO_GPC_DATA_ONE.

C. Detailed Requirements and Formulations

The following operations shall be performed by GPS_TO_GPC module for each receiver. Figure 4.17.6.1 through Figure 4.17.6.1.4 present the flow diagrams of the GPS_TO_GPC module.

1. Deleted
2. If the header (word 1 of the GPS_TO_GPC_DATA_ONE buffer) is HEX 'DDDD' or HEX 'EEEE' or HEX 'FFFF' steps 3 through 5 below shall be executed only. Otherwise, step 6 is executed.
3. Extract NAV_MODE_WORD from word 2 and 3 of the GPS_TO_GPC_DATA_ONE_i buffer.

$$\text{NAV_MODE_WORD}_i = \text{GPS_TO_GPC_DATA_ONE}_{i,(2\text{ TO }3)}$$

4. Execute NAV_MODE_WORD_DATA code to parse the NAV_MODE_WORD_i. This module is detailed in section 4.17.6.1.1. The flag ILLEGAL_MODE is set in this function and is checked next to determine whether to process the rest of the GPS data buffer.
5. If ILLEGAL_MODE flag is OFF, indicating that the GPS mode as decoded from bits 1, 2, 30 and 31 of NAV_MODE_WORD_i is valid, then Steps 5.1 through 5.3 are executed.

- 5.1 GPS Status Display blanking flags are all turned ON. Section 4.17.6.1.2.1 will turn the flags OFF when the GPS receiver indicates state three or state five tracking and GPS_MODE_CURRENT is NAV.

$$\text{SATS_BLANKING_FLAG}_{i,1\text{ to }5} = \text{ON}$$

- 5.2 If GPS_MODE_CURRENT_i is 'NAV', then GPS_TO_GPC_DATA_ONE_i is extracted according to the NAV message format, Message 6, as defined in Table 4.17.1.1.2-7. This process is accomplished by executing the NAV_MESSAGE_DATA subfunction which is detailed in Section 4.17.6.1.2. Set GPS_BIT_DISP_ENABLE_i = OFF.

Else if GPS_MODE_CURRENT_i is 'INIT', then GPS_TO_GPC_DATA_ONE_i is extracted according to the INIT message format, Message 5, as defined in Table 4.17.1.1.2-6. This process is accomplished by executing the INIT_MESSAGE_DATA subfunction which is detailed in Section 4.17.6.1.3. Set GPS_BIT_DISP_ENABLE_i = OFF.

Else if GPS_BIT_SOP_i is ON, then GPS_TO_GPC_DATA_ONE_i is extracted according to the TEST message format, Message 4, as defined in Table 4.17.1.1.2-5. This process is accomplished by executing the TEST_MESSAGE_DATA subfunction which is detailed in Section 4.17.6.1.4. Set GPS_BIT_DISP_ENABLE_i = ON.

5.3 Set GPS_BIT_SOP_i to OFF.

6. If the current GPS mode is 'TEST' and the input header is zero, then the flag, GPS_BIT_SOP_i, shall be set ON indicating GPS receiver i BIT (Built In Test) is in progress.

D. Special Considerations

GPS_BIT_DISP_ENABLE_i shall be initialized to OFF after all OPS transitions except after OPS 1 to OPS 6.

The SATS_BLANKING_FLAG_{i,6} shall be initialized to ON.

Table 4.17.6.1-1. GPS_TO_GPC Input Parameters							
Description	Name	Input Source	Type	Precision	Range	Units	Rate (Hz)
GPS receiver I to GPC data buffer one	GPS_TO_GPC_DATA_ONE(I)**	*	-	-	-	-	1.04
GPS receiver I current operating mode indicator	GPS_MODE_CURRENT(I)**	NAV_MODE_WORD_DATA, GPS_SOP	I	S	TEST(0) INIT(1) NAV(2)	-	1.04
Flag indicating illegal GPS operating mode	ILLEGAL_MODE	NAV_MODE_WORD_DATA	D	-	ON/OFF	-	1.04
* See principal function input list in Table 4.17.6.10-1							
** I = 1,2,3							

Table 4.17.6.1-2. GPS_TO_GPC Output Parameters							
Description	Name	Destination	Type	Precision	Range	Units	Rate (Hz)
GPS receiver I Nav Mode Word	NAV_MODE_WORD(I)**	NAV_MODE_WORD_DATA	-	-	-	-	6.25
GPS BIT DISPLAY ENABLE Flag	GPS_BIT_DISP_ENABLE(I)**	GPS_DISP_COMP	D	-	ON/OFF	-	6.25
GPS receiver I self test in progress flag	GPS_BIT_SOP(I)**	GPS_DISP_COMP GPS_SOP_DL_COMP	D	-	ON/OFF	-	6.25
Satellite blanking flag for GPS Status Display	SATS_BLANKING_FLAG(I,K)**	CHANNEL_STATUS_DATA, *	-	-	-	-	1.04

** I = 1,2,3, K= 1 to 6

4.17.6.1.1 NAV_MODE_WORD Data Processing (NAV_MODE_WORD_DATA)

The purpose of the NAV_MODE_WORD_DATA code is to parse the NAV_MODE_WORD according to the format as defined in Table 4.17.6.1.1-3.

A. Functional Requirements. The NAV_MODE_WORD_DATA code is required to perform the following functions:

1. Parse NAV_MODE_WORD according to the format defined in Table 4.17.6.1.1-3.

B. Interface Requirements. The input and output parameters associated with the NAV_MODE_WORD_DATA module are contained in Table 4.17.6.1.1-1 and 4.17.6.1.1-2.

C. Detailed Requirements and Formulations

The following operations shall be performed by the NAV_MODE_WORD_DATA code for each receiver. Figure 4.17.6.1.1 presents the flow diagram of the NAV_MODE_WORD_DATA code. Table 4.17.6.1.1-3 defines the format of the NAV_MODE_WORD parent word.

1. The GPS data validity flag is set according to the bit 0 of NAV_MODE_WORD_i

```
IF BIT 0 of NAV_MODE_WORDi = 1 THEN
    GPS_NAV_DATA_VALIDi = ON
ELSE
    GPS_NAV_DATA_VALIDi = OFF
```

2. The current GPS receiver operation mode is determined first by examining bits 1, 2, 30 and 31 of NAV_MODE_WORD_i. Table 4.17.6.1.1-3 lists the definition for GPS_MODE_CURRENT_i assignment. The flag ILLEGAL_MODE is set OFF indicating that the GPS_MODE_CURRENT_i takes on either 'NAV' or 'INIT' or 'TEST'. Otherwise, it is set to ON.

```
ILLEGAL_MODE = OFF
```

```

IF BIT 1 and 2 of NAV_MODE_WORDi = (1,0) and
  BIT 30 and 31 of NAV_MODE_WORDi = (0,1)
  THEN GPS_MODE_CURRENTi = 'NAV'

```

ELSE

```

IF BIT 1 and 2 of NAV_MODE_WORDi = (0,1) and
  BIT 30 and 31 of NAV_MODE_WORDi = (1,0)
  THEN GPS_MODE_CURRENTi = 'INIT'

```

ELSE

```

IF BIT 1 and 2 of NAV_MODE_WORDi = (0,0) and
  BIT 30 and 31 of NAV_MODE_WORDi = (1,1)
  THEN GPS_MODE_CURRENTi = 'TEST'
ELSE ILLEGAL_MODE = ON

```

3. Steps 3.1 to 3.6 are executed if a valid receiver mode was detected, as indicated by ILLEGAL_MODE set to OFF.

- 3.1 GPS stationary mode flag is extracted as follows:

```

IF BIT 4 of NAV_MODE_WORDi = 1 THEN
  STATIONARY_MODE_SOPi = ON
ELSE
  STATIONARY_MODE_SOPi = OFF

```

The STATIONARY_MODE_SOP_i, being on, indicates that the GPS receiver *i* is in STATIONARY mode during prelaunch.

- 3.2 GPS NAV filter mode is determined from bits 13 and 14 of NAV_MODE_WORD_i as follows:

```

IF GPS_MODE_CURRENTi NOT = 'NAV' THEN
  GPS_NAV_SUBMODEi = 'Ø'
ELSE
  IF BIT 13 of NAV_MODE_WORDi = 0 and BIT 14 of NAV_MODE_WORDi = 0
  THEN
    GPS_NAV_SUBMODEi = 'PVA'
  ELSE
    IF BIT 13 of NAV_MODE_WORDi = 0 and BIT 14 of
    NAV_MODE_WORDi = 1
    THEN
      GPS_NAV_SUBMODEi = 'INS'
    ELSE
      GPS_NAV_SUBMODEi = 'Ø'

```

- 3.3 If bit 16 of the NAV_MODE_WORD_i is ON, indicating that the GPS receiver has acknowledged the receipt of announced reset states and accomplished the announced reset process, then the flag GPS_ANNCD_RESET_SET_i will be set to OFF.

```

IF BIT 16 of NAV_MODE_WORDi = 1 THEN
  GPS_ANNCD_RESET_SETi = OFF

```

- 3.4 If bit 17 of the NAV_MODE_WORD_i is ON, indicating that the GPS receiver has acknowledged the receipt of initialization states and accomplished the initialization process, then the flag INIT_STATE_SET_i will be set to OFF.

IF BIT 17 of NAV_MODE_WORD_i = 1 THEN
INIT_STATE_SET_i = OFF

- 3.5 If bit 19 of the NAV_MODE_WORD_i is ON, indicating that the GPS receiver has acknowledged the receipt of initialization states for GPS NAV filter restart and accomplished NAV filter restart process and GPS_FILT_RESTART_i has been issued for more than an I-load time, DT_FR_DISP_REFRESH, then the flag GPS_FILT_RESTART_i will be set to OFF.

IF BIT 19 of NAV_MODE_WORD_i = 1 and (CLOCKTIME – T_FR_i) >
DT_FR_DISP_REFRESH
THEN
GPS_FILT_RESTART_i = OFF

D. Special Considerations:

The GPS_MODE_CURRENT_i (i = 1 to 3) shall be initialized to ‘Ø’, during all OPS transitions except between OPS1 and OPS6.

Table 4.17.6.1.1-1. NAV_MODE_WORD_DATA Input Parameters

Description	Name	Input Source	Type	Precision	Range	Units	Rate (Hz)
GPS receiver I Nav Mode Word	NAV_MODE_WORD(I)**	GPS_TO_GPC	–	–	–	–	1.04
Current clock computer time GMT	CLOCKTIME	*	F	DP	–	–	1.04
Time indicating the beginning of GPS I receiver Filter Restart process	T_FR(I)**	GPS_SOP	F	DP	–	–	1.04

* See principal function input list in table 4.17.6.10-1
** I = 1,2,3

Table 4.17.6.1.1-2. NAV_MODE_WORD_DATA Output Parameters							
Description	Name	Destination	Type	Precision	Range	Units	Rate (Hz)
Flag indicating valid GPS receiver I data	GPS_NAV_DATA_VALID(I)**	NAV_MESSAGE_DATA, GPS_DISP_COMP, GPS_TIME_ADJ	D	–	ON/OFF	–	6.25
Flag indicating GPS filter restart of receiver I is commanded	GPS_FILT_RESTART(I)**	RCVR_AIDING_DATA,*	D	–	ON/OFF	–	6.25
GPS receiver I current operating mode indicator	GPS_MODE_CURRENT(I)**	GPS_TO_GPC, GPS_DISP_COMP, RCVR_AIDING_DATA,* , GPS_TIME_ADJ	CHAR	–	TEST/INIT/NAV/‘Ø’	–	6.25
GPS receiver I navigation submode indicator	GPS_NAV_SUBMODE(I)**	GPS_DISP_COMP	CHAR	–	PVA/INS/‘Ø’	–	6.25
Flag indicating illegal GPS operating mode	ILLEGAL_MODE	GPS_TO_GPC	D	–	ON/OFF	–	6.25
Flag indicating initialization of receiver I is commanded	INIT_STATE_SET(I)**	RCVR_AIDING_DATA,*	D	–	ON/OFF	–	6.25
Flag indicating GPS announced reset of receiver I is commanded	GPS_ANNC_RESET_SET(I)**	RCVR_AIDING_DATA,*	D	–	ON/OFF	–	6.25
Flag indicating GPS receiver I in stationary mode	STATIONARY_MODE_SOP(I)**	GPS_DISP_COMP	D	–	ON/OFF	–	6.25

* See principal function output list in Table 4.17.6.10-2
** I = 1,2,3

Table 4.17.6.1.1-3. Format of NAV_MODE_WORD			
Bit Parameter	Bit no.	Bit value	Meaning
Nav data Validity flag	0	1	Valid*
Actual GPS Receiver Mode	1 - 2	<u>1</u> <u>2</u>	
		0 0	Test mode
		0 1	Initialization Mode
		1 0	Navigation Mode
		(all others)	(illegal mode)

Table 4.17.6.1.1-3. Format of NAV_MODE_WORD

Bit Parameter	Bit no.	Bit value	Meaning
BIT in Progress	3	0	BIT in progress**
Prelaunch Standby Mode Bit	4	1	Standby mode during prelaunch
Init Data Request	5	1	Need init data
Almanac downloaded	6	1	Almanac downloaded
PPS or SPS Mode	7	1	PPS operation
		0	SPS operation
UTC Valid	8	1	UTC Valid
		0	UTC not valid
Lever arm correction	9	1	Lever arm correction used
		0	Lever arm correction not used
Spares	10 - 12		
GPS Filter Mode	13 - 14	<u>13</u> <u>14</u>	
		0 0	PVA Mode
		0 1	INS Mode
		1 0	Not Used
		1 1	Not Used
Spare	15		
Announced reset complete	16	1	Announced reset complete
Initialization states complete	17	1	Initialization states set
IMU reconfiguration complete	18	1	IMU reconfiguration complete (Not used)
Filter restart complete	19	1	Filter restart process complete
Receiver self-reset	20	1	Receiver autonomously reset
Spares	21 - 29	–	Not used
Compliment of Bit 1,2	30 - 31	<u>30</u> <u>31</u>	
		1 1	Test mode
		1 0	Initialization mode
		0 1	Navigation mode

* The Navigation Data Validity flag indicates valid NAV data when all of the following are true:
1. GPS receiver Kalman Filter estimated position uncertainty is less than 1000 meters.
2. The receiver is in NAV mode.
3. The receiver's performance monitor (PM) did not detect a critical failure in the previous second.
** Not applicable

4.17.6.1.2 NAV Message Data Processing (NAV_MESSAGE_DATA)

The purpose of the NAV_MESSAGE_DATA code is to parse the GPS_TO_GPC_DATA_ONE according to the 'NAV' message format, Message 6, as defined in Table 4.17.1.1.2-7.

A. Functional Requirements. The NAV_MESSAGE_DATA code is required to perform the following function:

1. Parse GPS data (GPS_TO_GPC_DATA_ONE) according to the 'NAV' message format.

B. Interface Requirements. The input and output parameters associated with the NAV_MESSAGE_DATA modules are contained in Table 4.17.6.1.2-1 and 4.17.6.1.2-2. I-load parameters are contained in Table 4.17.6.10-3.

C. Detailed Requirements and Formulations

The following operations shall be performed by the NAV_MESSAGE_DATA code for each receiver. Figure 4.17.6.1.2 presents the flow diagram of the NAV_MESSAGE_DATA code. Table 4.17.6.1.2-3 defines the format of the parent word, GPS_STATUS_FOM_GDOP. The definition of values taken on by FOM_NEW (figure of merit) is described in Table 4.17.6.1.2-4. Table 4.17.6.1.2-5 defines the format of the parent word, GPS_TFOM. The definition of values taken on by TFOM (time figure of merit) is described in Table 4.17.6.1.2-6.

1. Raw navigation related GPS data is parsed for downlist as follows:

$$\begin{aligned} \text{GPS_WEEK_DL}_i &= \text{GPS_TO_GPC_DATA_ONE}_{i,4} \\ \text{GPS_SEC_DL}_i &= \text{GPS_TO_GPC_DATA_ONE}_{i,5 \text{ to } 7} \\ \text{GPS_ECEF_POS_X_DL}_i &= \text{GPS_TO_GPC_DATA_ONE}_{i,8 \text{ to } 9} \\ \text{GPS_ECEF_POS_Y_DL}_i &= \text{GPS_TO_GPC_DATA_ONE}_{i,10 \text{ to } 11} \\ \text{GPS_ECEF_POS_Z_DL}_i &= \text{GPS_TO_GPC_DATA_ONE}_{i,12 \text{ to } 13} \\ \text{GPS_ECEF_VEL_X_DL}_i &= \text{GPS_TO_GPC_DATA_ONE}_{i,14 \text{ to } 15} \\ \text{GPS_ECEF_VEL_Y_DL}_i &= \text{GPS_TO_GPC_DATA_ONE}_{i,16 \text{ to } 17} \\ \text{GPS_ECEF_VEL_Z_DL}_i &= \text{GPS_TO_GPC_DATA_ONE}_{i,18 \text{ to } 19} \\ \text{GPS_STATUS_FOM_GDOP}_i &= \text{GPS_TO_GPC_DATA_ONE}_{i,20} \\ \text{PPS_STATUS_WORD}_i &= \text{GPS_TO_GPC_DATA_ONE}_{i,21} \\ \text{GPS_TFOM}_i &= \text{GPS_TO_GPC_DATA_ONE}_{i,31} \\ \text{GPS_AIDING_DATA_AGE_DL}_i &= \text{GPS_TO_GPC_DATA_ONE}_{i,32} \\ \text{GPS_AOA}_i &= \text{GPS_AIDING_DATA_AGE_DL}_i \end{aligned}$$

2. GPS channel status data is obtained by executing the CHANNEL_STATUS_DATA code as described in Section 4.17.6.1.2.1.
3. Raw GPS time tag consists of two components, T_GPS_WEEK and T_GPS_SEC, which are the GPS week number from January 6, 1980 and the seconds from the beginning of the GPS week respectively. These variables are extracted from the GPS_TO_GPC_DATA_ONE_i with appropriate scaling as defined in Table 4.17.1.1.2-7.

$$\begin{aligned} \text{T_GPS_SEC} &= \text{SCALAR}(\text{INTEGER}(\text{GPS_SEC_DL}_i)) * \text{SF_TIME} \\ \text{T_GPS_WEEK} &= \text{INTEGER}(\text{GPS_WEEK_DL}_i) \end{aligned}$$

The GPS time tag in GMT seconds is then formed by adding T_GPS_SEC, converting T_GPS_WEEK to seconds, subtracting the leap second correction, the time offset, the GPS to GMT time adjustment, and the accumulated GPC-to-GPS time adjustment as follows:

$$T_GPS_CURRENT_i = T_GPS_SEC + T_GPS_WEEK*7*SEC_PER_DAY - \\ LEAP_SEC_CORR - T_GPS_OFFSET_SECS - \\ T_GPS_TO_GMT_ADJ - (T_GPS_TIME_ADJ_ACC/1000)$$

where T_GPS_OFFSET_SECS is the number of seconds from January 6, 1980 to midnight (12 a.m.) between December 30 and 31 of the calendar year prior to the launch year.

If new GPS state is not available as indicated by the stale T_GPS_SEC value, perform step 3.1. Otherwise, continue with step 3.2 to determine the status of the newly read GPS Nav data.

IF T_GPS_SEC = T_GPS_SEC_PREV_i THEN

3.1 Set the FOM_GDOP_STATIC_i flag to OFF to indicate valid FOM and GDOP data in between GPS input updates.

FOM_GDOP_STATIC_i = OFF

3.2 Else if the GPS nav data validity flag (GPS_NAV_DATA_VALID_i) is ON and the GPS time is within I-load value (GPS_QA_TIME_THRESH) from current Orbiter clocktime and either the previous GPS state has been IMU-bracketed as indicated by IMU_BRACKET_NEW_i flag being ON or the IMU buffer is not full as indicated by GPS_IMU_BUFFER_FULL flag being OFF, then the NAV message input data processing shall continue as detailed in paragraph 3.2.1 to 3.2.9 below.

ELSE IF (GPS_NAV_DATA_VALID_i = ON and
(ABS(CLOCKTIME - T_GPS_CURRENT_i) < GPS_QA_TIME_THRESH) and
(IMU_BRACKET_NEW_i = ON or GPS_IMU_BUFFER_FULL = OFF)) THEN:

3.2.1 If T_GPS_CURRENT_i is greater than the time of the last parsed NAV message (T_GPS_NEW_i) by more than LAST_READ_DT_LIM I-load, then reset FOM_GOOD_CNT_i to 1.

IF (T_GPS_CURRENT_i - T_GPS_NEW_i) > LAST_READ_DT_LIM THEN
FOM_GOOD_CNT_i = 1

3.2.2 The IMU_BRACKET_NEW_i flag is set OFF indicating that the new GPS state is not yet determined to be IMU-bracketed.

IMU_BRACKET_NEW_i = OFF

3.2.3 The new GPS time tag is copied from the current GPS time tag.

T_GPS_NEW_i = T_GPS_CURRENT_i

3.2.4 The GPS position and velocity state output is extracted from GPS_TO_GPC_DATA_ONE_i and scaled as follows:

```

R_GPS_ECEF_NEWi,1 =
    SCALAR(INTEGER(GPS_ECEF_POS_X_DLi))*SF_POS
R_GPS_ECEF_NEWi,2 =
    SCALAR(INTEGER(GPS_ECEF_POS_Y_DLi))*SF_POS
R_GPS_ECEF_NEWi,3 =
    SCALAR(INTEGER(GPS_ECEF_POS_Z_DLi))*SF_POS

V_GPS_ECEF_NEWi,1 =
    SCALAR(INTEGER(GPS_ECEF_VEL_X_DLi))*SF_VEL
V_GPS_ECEF_NEWi,2 =
    SCALAR(INTEGER(GPS_ECEF_VEL_Y_DLi))*SF_VEL
V_GPS_ECEF_NEWi,3 =
    SCALAR(INTEGER(GPS_ECEF_VEL_Z_DLi))*SF_VEL

```

3.2.5 Derive GDOP and Figure of merit (FOM) values from GPS_STATUS_FOM_GDOP word as defined in Table 4.17.6.1.2-3. Set the FOM_GDOP_STATIC_i flag OFF to indicate valid FOM and GDOP data.

```

GDOP_NEWi = INTEGER (GPS_STATUS_FOM_GDOPi, 7 to 10)
FOM_NEWi = INTEGER (GPS_STATUS_FOM_GDOPi, 11 to 14)
FOM_GDOP_STATICi = OFF

```

3.2.6 If the FOM is less than one or greater than nine, then set the FOM to nine

```

IF (FOM_NEWi < 1 or FOM_NEWi > 9) THEN
    FOM_NEWi = 9

```

3.2.7 The T_GPS_SEC is saved into T_GPS_SEC_PREV_i which is used in paragraph 2 above to determine a change in GPS input buffer.

3.2.8 A first level quality assessment on the GPS NAV data collected is performed by executing the GPS_QA1_CHECK code as described in Section 4.17.6.2

3.2.9 If the Major Mode is 901, 601, or is less than 200 then store the FOM and the fail FOM flag for display.

```

IF((MM_CODE = 901) OR (MM_CODE = 601) OR (MM_CODE < 200)) THEN
    FOM_NAVi = FOM_NEWi
    GPS_FAIL_FOM_DISPi = GPS_FAIL_FOM_NEWi

```

D. Special Considerations:

The variables T_GPS_NEW_i and T_GPS_SEC_PREV_i (i = 1 to 3) shall be initialized to 0.

Table 4.17.6.1.2-1. NAV_MESSAGE_DATA Input Parameters

Description	Name	Input Source	Type	Precision	Range	Units	Rate (Hz)
Clock computer (GMT)	CLOCKTIME	*	F	DP	–	sec	6.25
Flag indicating that the IMU buffer is full	GPS_IMU_BUFFER_FULL	GPS_IMU_SAVE	D	–	ON/OFF	–	6.25
Flag indicating GPS NAV data validity	GPS_NAV_DATA_VALID(I)**	NAV_MODE_WORD_DATA	D	–	ON/OFF	–	1.04
GPS receiver I to GPC data buffer one	GPS_TO_GPC_DATA_ONE(I)**	*	–	–	–	–	1.04
Flag indicating GPS data has been time-bracketed by IMU data	IMU_BRACKET_NEW(I)**	GPS_IMU_SAVE	D	–	ON/OFF	–	6.25
Number of seconds from 1/6/80 to midnight between 12/30 and 12/31 of year prior to the launch year	T_GPS_OFFSET_SECS	GPS_SOP	I	DP	–	–	1.04
GPS to GMT time adjustment	T_GPS_TO_GMT_ADJ	GPS_SOP_TIME_ADJ_UPLINK	F	DP	–	sec	–
Accumulated GPC-to-GPS time adjustment	T_GPS_TIME_ADJ_ACC	GPS_TIME_ADJ	HXS	–	–	msec	6.25
Major Mode Indicator	MM_CODE	*	I	S	–	–	6.25
Flag indicating GPS failed FOM threshold	GPS_FAIL_FOM_NEW _i	GPS_QA1_CHECK	D	–	ON/OFF	–	6.25

* See principal function input list in Table 4.17.6.10-1

** I = 1,2,3 (1 to GPS_SW_CAP)

Table 4.17.6.1.2-2. NAV_MESSAGE_DATA Output Parameters							
Description	Name	Destination	Type	Precision	Range	Units	Rate (Hz)
Flag indicating GPS data has been time-bracketed by IMU data	IMU_BRACKET_NEW(I)**	GPS_IMU_SAVE	D	–	ON/OFF	–	6.25
Raw GPS week number	GPS_WEEK_DL(I)**	*	HXU	–	–	–	6.25
Raw GPS time (seconds portion)	GPS_SEC_DL(I)**	*	BSU	–	–	–	6.25
Raw GPS ECEF x position component	GPS_ECEF_POS_X_DL(I)**	*	FXS	–	–	–	6.25
Raw GPS ECEF y position component	GPS_ECEF_POS_Y_DL(I)**	*	FXS	–	–	–	6.25
Raw GPS ECEF z position component	GPS_ECEF_POS_Z_DL(I)**	*	FXS	–	–	–	6.25
Raw GPS ECEF x velocity component	GPS_ECEF_VEL_X_DL(I)**	*	FXS	–	–	–	6.25
Raw GPS ECEF y velocity component	GPS_ECEF_VEL_Y_DL(I)**	*	FXS	–	–	–	6.25
Raw GPS ECEF z velocity component	GPS_ECEF_VEL_Z_DL(I)**	*	FXS	–	–	–	6.25
Raw GPS aiding data age	GPS_AIDING_DATA_AGE_DL(I)**	*	HXS	–	–	–	6.25
GPS receiver I STATUS, FOM and GDOP word	GPS_STATUS_FOM_GDOP(I)**	GPS_DISP_COMP, *	BSU	–	–	–	6.25
Current GPS time figure of merit	GPS_TFOM(I)**	GPS_SOP_DL_COMP	I	S	–	–	6.25
Time tag of “NEW” GPS receiver I data	T_GPS_NEW(I)**	GPS_IMU_SAVE, *	F	DP	–	sec	6.25
Position vector of “NEW” GPS I data	R_GPS_ECEF_NEW(I)**	GPS_IMU_SAVE, *	V	DP	–	ft	6.25
Velocity vector of “NEW” GPS I data	V_GPS_ECEF_NEW(I)**	GPS_IMU_SAVE, *	V	S	–	ft/sec	6.25
Figure of merit associated with “NEW” GPS I data	FOM_NEW(I)**	GPS_IMU_SAVE, GPS_QA1_CHECK	I	S	0-9	–	6.25
GDOP value associated with “NEW” GPS receiver I data	GDOP_NEW(I)**	*	I	S	1-15	–	6.25
NAV FOM for receiver I	FOM_NAV(I)**	*	I	S	0-9	–	6.25
Age-of-aiding data from GPS receiver	GPS_AOA(I)**	GPS_TIME_ADJ	HXS	–	–	msec	6.25

Table 4.17.6.1.2-2. NAV_MESSAGE_DATA Output Parameters							
Description	Name	Destination	Type	Precision	Range	Units	Rate (Hz)
GPS I FOM threshold fail flag	GPS_FAIL_FOM_DISP(I)**	*	D	–	ON/OFF	–	6.25
Flag indicating static FOM/GDOP data	FOM_GDOP_STATIC(I)**	*	D	–	ON/OFF	–	6.25
Counter indicating the number of cycles FOM has been good	FOM_GOOD_CNT(I)**	GPS_QA1_CHECK	I	S	–	–	6.25
* See principal function output list in Table 4.17.6.10-2 ** I = 1,2,3 (1 to GPS_SW_CAP)							

Table 4.17.6.1.2-3. Format of GPS_STATUS_FOM_GDOP				
Bit Parameter	Bit no.	Data Type	LSB Location	Meaning
Spare	0 - 1	–	–	Not used
Incorporating < 4 meas	2	Binary	2	1 = Rcvr incorporated less than 4 meas
RPU fail	3	Binary	3	1 = Receiver processing unit failure
Spare	4	–	–	Not used
Battery low	5	Binary	5	1 = Receiver battery low
Spare	6	–	–	Not used
GDOP	7 - 10	BSU	10	Integer (4 bit) indication of Geometric Dilution of Precision
FOM	11 - 14	BSU	14	Integer (4 bit) indication of Estimated position error
Spare	15	–	–	Not used

Table 4.17.6.1.2-4. Definition of FOM	
FOM (Figure of Merit)	Estimated Position Error (Three Dimensional RSS)
1	0 - 25 meters
2	26 - 50 meters
3	51 - 75 meters
4	76 - 100 meters
5	101 - 200 meters
6	201 - 500 meters
7	501 - 1000 meters
8	1001 - 5000 meters
9	Greater than 5000 meters

Table 4.17.6.1.2-5. Format of GPS_TFOM				
Bit Parameter	Bit no.	Data Type	LSB Location	Meaning
Spare	0 - 11	–	–	Not used
TFOM	12 - 15	BSU	15	Integer (4 bit) indication of Estimated time error

Table 4.17.6.1.2-6. Definition of TFOM	
TFOM (Time Figure of Merit)	Estimated Time Error
0	Proper/Nominal Operation
1	< 1 nanosecond
2	1 to 10 nanoseconds
3	10 to 100 nanoseconds
4	100 to 1000 nanoseconds
5	1 to 10 microseconds
6	10 to 100 microseconds
7	100 to 1000 microseconds
8	1 to 10 milliseconds
9	> 10 milliseconds

4.17.6.1.2.1 GPS Channels Status Data Processing (CHANNEL_STATUS_DATA)

The purpose of the CHANNEL_STATUS_DATA code is to parse the CHANNELS_STATUS words according to the formats as defined in Table 4.17.6.1.2.1-3 through Table 4.17.6.1.2.1-11.

A. Functional Requirements. The CHANNEL_STATUS_DATA code is required to perform the following functions:

1. Retrieve GPS channel status data (CHANNELS_STATUS) from the buffer GPS_TO_GPC_DATA_ONE according to the format defined in Table 4.17.1.1.2-7.
2. Parse GPS channel status data (CHANNELS_STATUS) according to the format defined in Table 4.17.6.1.2.1-3 through Table 4.17.6.1.2.1-11.

B. Interface Requirements. The input and output parameters associated with the CHANNEL_STATUS_DATA modules are contained in Table 4.17.6.1.2.1-1 and 4.17.6.1.2.1-2.

C. Detailed Requirements and Formulations

The following operations shall be performed by the CHANNEL_STATUS_DATA code for each receiver. Figure 4.17.6.1.2.1 presents the flow diagram of the CHANNEL_STATUS_DATA code. Tables 4.17.6.1.2.1-3 through 4.17.6.1.2.1-11 define the format of the parent word CHANNEL_STATUS used in this module.

1. GPS Channel status information is extracted from word 22 to 30 of the GPS_TO_GPC_DATA_ONE as follows:

```
DO FOR k = 1 to 8
    CHANNELS_STATUSi,k = GPS_TO_GPC_DATA_ONEi,(k+21)
```

2. Parameters are extracted from CHANNELS_STATUS_i according to the format defined in Table 4.17.6.1.2.1-3 through Table 4.17.6.1.2.1-11.

Current satellite numbers (SATS_TRACKED_{i,j}) tracked by all five channels operating in State 5¹ or State 3² are obtained from bit 10 to 15 of CHANNELS_STATUS_{i,j} as follows:

```
IF BIT 4 TO 6 of CHANNELS_STATUSi,1 = BIT('101') or = BIT('011')
    SATS_TRACKEDi,1 = INTEGER(BITS 10 to 15 of CHANNELS_STATUSi,1)
    SAT_BLANKING_FLAGi,1 = OFF
ELSE
    SATS_TRACKEDi,1 = 0
IF BIT 4 TO 6 of CHANNELS_STATUSi,3 = BIT('101') or = BIT('011')
    SATS_TRACKEDi,2 = INTEGER(BITS 10 to 15 of CHANNELS_STATUSi,3)
    SAT_BLANKING_FLAGi,2 = OFF
ELSE
    SATS_TRACKEDi,2 = 0
IF BIT 4 TO 6 of CHANNELS_STATUSi,5 = BIT('101') or = BIT('011')
    SATS_TRACKEDi,3 = INTEGER(BITS 10 to 15 of CHANNELS_STATUSi,5)
    SAT_BLANKING_FLAGi,3 = OFF
ELSE
    SATS_TRACKEDi,3 = 0
```

```

IF BIT 4 TO 6 of CHANNELS_STATUSi,7 = BIT('101') or = BIT('011')
    SATS_TRACKEDi,4 = INTEGER(BITS 10 to 15 of CHANNELS_STATUSi,7)
    SAT_BLANKING_FLAGi,4 = OFF
ELSE
    SATS_TRACKEDi,4 = 0
IF BIT 4 TO 6 of CHANNELS_STATUSi,8 = BIT('101') or = BIT('011')
    SATS_TRACKEDi,5 = INTEGER(BITS 10 to 15 of CHANNELS_STATUSi,8)
    SAT_BLANKING_FLAGi,5 = OFF
ELSE
    SATS_TRACKEDi,5 = 0
    
```

1. Under state 5 operation, GPS receiver has both code and carrier tracking.
2. Under state 3 operation, GPS receiver has only code loop tracking.

D. Special Consideration:

The following two parameters shall be initialized to zero:

SATS_TRACKED_{i,6}
 CHANNELS_STATUS_{i,9} for i = 1, 2, 3

Table 4.17.6.1.2.1-1. CHANNEL_STATUS_DATA Input Parameters							
Description	Name	Input Source	Type	Precision	Range	Units	Rate (Hz)
GPS receiver I to GPC data buffer one	GPS_TO_GPC_DATA_ONE(I)**	*	-	-	-	-	1.04
Satellite blanking flag for GPS Status Display	SATS_BLANKING_FLAG(I,K)**	GPS_TO_GPC	-	-	-	-	1.04
* See principal function input list in Table 4.17.6.10-1 ** I = 1,2,3 (1 to GPS_SW_CAP), K = 1 to 6							

Table 4.17.6.1.2.1-2. CHANNEL_STATUS_DATA Output Parameters							
Description	Name	Destination	Type	Precision	Range	Units	Rate (Hz)
Channel status words for GPS Receiver I	CHANNELS_STATUS(I,J)**	*	-	-	-	-	1.04
Satellite number tracked by all six channels of GPS receiver I	SATS_TRACKED(I,K)**	*	I	S	0 - 63	-	1.04
Satellite blanking flag for GPS Status Display	SATS_BLANKING_FLAG(I,K)**	*	-	-	-	-	1.04
* See principal function output list in Table 4.17.6.10-2 ** I = 1,2,3, K = 1 to 6, J = 1 to 9 (I = 1 to GPS_SW_CAP)							

Table 4.17.6.1.2.1-3. Format of GPS Channel Status Word 1 (CHANNELS_STATUS(i,1))				
Bit Parameter	Bit no.	Data Type	LSB Location	Meaning
Channel 1 Fault	0	Binary	0	1 = Fault
Channel 1 Antenna	1	Binary	1	1 = Upper; 0 = Lower
Channel 1 Frequency	2	Binary	2	1 = L2; 0 = L1
Channel 1 Ephemeris	3	Binary	3	1 = Ephemeris downloaded
Channel 1 State	4 - 6	UFXP	6	Integer (3 bit) indication of channel operating state
Channel 1 Hardware Channel No.	7 - 9	UFXP	9	Integer (3 bit) indication of receiver physical channel
Channel 1 Satellite Number	10 - 15	UFXP	15	Integer (6 bit) indication of PRN number of satellite being tracked

Table 4.17.6.1.2.1-4. Format of GPS Channel Status Word 2 (CHANNELS_STATUS(i,2))				
Bit Parameter	Bit no.	Data Type	LSB Location	Meaning
Channel 1 Signal to Noise Ratio, C/No	0 - 5	UFXP	5	Integer (6 bit) indication of signal to noise ratio with LSB to be 1 dB Hz
Channel 1 Code Tracking Status	6 - 7	UFXP	7	Integer (2 bit) indication of the type of tracking code 0 = P Code, 2 = C/A Code 1 = Y Code
Channel 2 Signal to Noise Ratio, C/No	8 - 13	UFXP	13	Integer (6 bit) indication of signal to noise ratio with LSB to be 1 dB Hz
Channel 2 Code Tracking Status	14 - 15	UFXP	15	Integer (2 bit) indication of the type of tracking code 0 = P Code, 2 = C/A Code 1 = Y Code

Table 4.17.6.1.2.1-5. Format of GPS Channel Status Word 3 (CHANNELS_STATUS(i,3))				
Bit Parameter	Bit no.	Data Type	LSB Location	Meaning
Channel 2 Fault	0	Binary	0	1 = Fault
Channel 2 Antenna	1	Binary	1	1 = Upper; 0 = Lower
Channel 2 Frequency	2	Binary	2	1 = L2; 0 = L1
Channel 2 Ephemeris	3	Binary	3	1 = Ephemeris downloaded
Channel 2 State	4 - 6	UFXP	6	Integer (3 bit) indication of channel operating state
Channel 2 Hardware Channel No.	7 - 9	UFXP	9	Integer (3 bit) indication of receiver physical channel
Channel 2 Satellite Number	10 - 15	UFXP	15	Integer (6 bit) indication of PRN number of satellite being tracked

Table 4.17.6.1.2.1-6. Format of GPS Channel Status Word 4 (CHANNELS_STATUS(i,4))				
Bit Parameter	Bit no.	Data Type	LSB Location	Meaning
Channel 3 Signal to Noise Ratio, C/No	0 - 5	UFXP	5	Integer (6 bit) indication of signal to noise ratio with LSB to be 1 dB Hz
Channel 3 Code Tracking Status	6 - 7	UFXP	7	Integer (2 bit) indication of the type of tracking code 0 = P Code, 2 = C/A Code 1 = Y Code
Channel 4 Signal to Noise Ratio, C/No	8 - 13	UFXP	13	Integer (6 bit) indication of signal to noise ratio with LSB to be 1 dB Hz
Channel 4 Code Tracking Status	14 - 15	UFXP	15	Integer (2 bit) indication of the type of tracking code 0 = P Code, 2 = C/A Code 1 = Y Code

Table 4.17.6.1.2.1-7. Format of GPS Channel Status Word 5 (CHANNELS_STATUS(i,5))				
Bit Parameter	Bit no.	Data Type	LSB Location	Meaning
Channel 3 Fault	0	Binary	0	1 = Fault
Channel 3 Antenna	1	Binary	1	1 = Upper; 0 = Lower
Channel 3 Frequency	2	Binary	2	1 = L2; 0 = L1
Channel 3 Ephemeris	3	Binary	3	1 = Ephemeris downloaded
Channel 3 State	4 - 6	UFXP	6	Integer (3 bit) indication of channel operating state
Channel 3 Hardware Channel No.	7 - 9	UFXP	9	Integer (3 bit) indication of receiver physical channel
Channel 3 Satellite Number	10 - 15	UFXP	15	Integer (6 bit) indication of PRN number of satellite being tracked

Table 4.17.6.1.2.1-8. Format of GPS Channel Status Word 6 (CHANNELS_STATUS(i,6))				
Bit Parameter	Bit no.	Data Type	LSB Location	Meaning
Channel 5 Signal to Noise Ratio, C/No	0 - 5	UFXP	5	Integer (6 bit) indication of signal to noise ratio with LSB to be 1 dB Hz
Channel 5 Code Tracking Status	6 - 7	UFXP	7	Integer (2 bit) indication of the type of tracking code 0 = P Code, 2 = C/A Code 1 = Y Code
Channel 1 Pseudo Range Measurement Edit	8	Binary	8	1 = Edit
Channel 2 Pseudo Range Measurement Edit	9	Binary	9	1 = Edit
Channel 3 Pseudo Range Measurement Edit	10	Binary	10	1 = Edit
Channel 4 Pseudo Range Measurement Edit	11	Binary	11	1 = Edit
Channel 1 Delta Range Measurement Edit	12	Binary	12	1 = Edit
Channel 2 Delta Range Measurement Edit	13	Binary	13	1 = Edit
Channel 3 Delta Range Measurement Edit	14	Binary	14	1 = Edit
Channel 4 Delta Range Measurement Edit	15	Binary	15	1 = Edit

Table 4.17.6.1.2.1-9. Format of GPS Channel Status Word 7 (CHANNELS_STATUS(i,7))				
Bit Parameter	Bit no.	Data Type	LSB Location	Meaning
Channel 4 Fault	0	Binary	0	1 = Fault
Channel 4 Antenna	1	Binary	1	1 = Upper; 0 = Lower
Channel 4 Frequency	2	Binary	2	1 = L2; 0 = L1
Channel 4 Ephemeris	3	Binary	3	1 = Ephemeris downloaded
Channel 4 State	4 - 6	UFXP	6	Integer (3 bit) indication of channel operating state
Channel 4 Hardware Channel No.	7 - 9	UFXP	9	Integer (3 bit) indication of receiver physical channel
Channel 4 Satellite Number	10 - 15	UFXP	15	Integer (6 bit) indication of PRN number of satellite being tracked

Table 4.17.6.1.2.1-10. Format of GPS Channel Status Word 8 (CHANNELS_STATUS(i,8))				
Bit Parameter	Bit no.	Data Type	LSB Location	Meaning
Channel 5 Fault	0	Binary	0	1 = Fault
Channel 5 Antenna	1	Binary	1	1 = Upper; 0 = Lower
Channel 5 Frequency	2	Binary	2	1 = L2; 0 = L1
Channel 5 Ephemeris	3	Binary	3	1 = Ephemeris downloaded
Channel 5 State	4 - 6	UFXP	6	Integer (3 bit) indication of channel operating state
Channel 5 Hardware Channel No.	7 - 9	UFXP	9	Integer (3 bit) indication of receiver physical channel
Channel 5 Satellite Number	10 - 15	UFXP	15	Integer (6 bit) indication of PRN number of satellite being tracked

Table 4.17.6.1.2.1-11. Format of GPS Channel Status Word 9 (CHANNELS_STATUS(i,9))				
Bit Parameter	Bit no.	Data Type	LSB Location	Meaning
	0 - 15	–	–	Not Applicable

4.17.6.1.3 INIT Message Data Processing (INIT_MESSAGE_DATA)

The purpose of the INIT_MESSAGE_DATA code is to parse the GPS_TO_GPC_DATA_ONE according to the 'INIT' message format, Message 5, as defined in Table 4.17.1.1.2-6.

A. Functional Requirements. The INIT_MESSAGE_DATA code is required to perform the following functions:

1. Parse GPS data (GPS_TO_GPC_DATA_ONE) according to the 'INIT' message format.

B. Interface Requirements. The input and output parameters associated with the INIT_MESSAGE_DATA modules are contained in Table 4.17.6.1.3-1 and 4.17.6.1.3-2. I-load parameters are contained in Table 4.17.6.10-3.

C. Detailed Requirements and Formulations

The following operations shall be performed by the INIT_MESSAGE_DATA code for each receiver. Figure 4.17.6.1.3 presents the flow diagram of the INIT_MESSAGE_DATA code. Table 4.17.6.1.3-3 defines the format for the parent word PPS_STATUS_WORD.

1. The PPS status word and Almanac reference week are derived as follows:

$$\begin{aligned} \text{PPS_STATUS_WORD}_i &= \text{GPS_TO_GPC_DATA_ONE}_{i,8} \\ \text{ALMANAC_REF_WEEK}_i &= \text{GPS_TO_GPC_DATA_ONE}_{i,9} \end{aligned}$$

Table 4.17.6.1.3-1. INIT_MESSAGE_DATA Input Parameters							
Description	Name	Input Source	Type	Precision	Range	Units	Rate (Hz)
GPS receiver I to GPC data buffer one	GPS_TO_GPC_DATA_ONE(I)**	*	-	-	-	-	1.04
* See principal function input list in Table 4.17.6.10-1 ** I = 1,2,3 (1 to GPS_SW_CAP)							

Table 4.17.6.1.3-2. INIT_MESSAGE_DATA Output Parameters							
Description	Name	Destination	Type	Precision	Range	Units	Rate (Hz)
GPS receiver I PPS status	PPS_STATUS_WORD(I)**	*	D	-	-	-	6.25
GPS receiver I almanac week number	ALMANAC_REF_WEEK(I)**	*	I	S	-	-	6.25
* See principal function output list in Table 4.17.6.10-2 ** I = 1,2,3 (1 to GPS_SW_CAP)							

Table 4.17.6.1.3-3. Definition of PPS_STATUS_WORD			
Bit Parameter	Bit no.	Bit value	Meaning*
Daily Key In Use (Verified)	0	1	CKw User: Key for the current day has been verified against SV subframe data. GUK User: Key for the current day has been obtained from and verified against the SV subframe data.
		0	CKw User: The receiver does not contain a verified key for the current day. GUK User: The receiver does not contain a verified key for the current day.
Daily Key In Use (Unverified)	1	1	CKw User: Key entered is in use but has not been verified against SV subframe data. GUK User: The receiver is waiting for subframe data and does not contain a key for the current day.
		0	CKw User: Key for the current day has been verified or the key for the current day is incorrect or not loaded GUK User: Key for the current day has been obtained and verified or the GUK issue number is invalid or expired.
Daily Key In Use (Incorrect)	2	1	CKw User: The receiver does not contain a key for the current day. The verification process will not be attempted if the key loaded is not for the current week based on receiver time. GUK User: The issue number is invalid. The receiver does not contain a key for the current day.
		0	CKw User: Set when the key for the current day is entered or updated. GUK User: Set when a new GUK is entered.
Key Failed Parity	3	1	If any key entered contains a parity error.
		0	If new keys are entered that pass the parity test.
GUK User:	4	1	Receiver using GUVs.
2 Hour Alert	5	1	Indicating that there is 2 hours or less before expiration of the current key if the subsequent key is not available.
Insufficient Key	6	1	Indicating that insufficient consecutive keys have been loaded to accomplish the Mission Duration.
Erase Failure	7	1	Indicating that the receiver failed to erase or zeroize a portion of memory.
Receiver Contains Keys	8	1	Key entry successful.
Mission Duration	9 - 15	0 - 44	Representing the number of consecutive days for which the receiver has keys (from the current day) Bit 9 is MSB and bit 15 is LSB.
<p>* CKw - Crypto Key Weekly GUK - Group Unique Key GUV - Group Unique Variable</p>			

4.17.6.1.4 TEST Message Data Processing (TEST_MESSAGE_DATA)

The purpose of the TEST_MESSAGE_DATA code is to parse the GPS_TO_GPC_DATA_ONE according to the ‘TEST’ message format, Message 4, as defined in Table 4.17.1.1.2-5.

A. Functional Requirements. The TEST_MESSAGE_DATA code is required to perform the following functions:

1. Parse GPS data (GPS_TO_GPC_DATA_ONE) according to the ‘TEST’ message format.

B. Interface Requirements. The input and output parameters associated with the TEST_MESSAGE_DATA modules are contained in Table 4.17.6.1.4-1 and 4.17.6.1.4-2. I-load parameters are contained in Table 4.17.6.10-3.

C. Detailed Requirements and Formulations

The following operations shall be performed by the TEST_MESSAGE_DATA code for each receiver. Figure 4.17.6.1.4 presents the flow diagram of the TEST_MESSAGE_DATA code.

1. The GPS self-test results as recorded in BIT_FAULT_LOG_WORD’s are extracted from GPS_TO_GPC_DATA_ONE locations defined in Table 4.17.1.1.2-5 TEST message format.

For k = 1 to 18

$$\text{BIT_FAULT_LOG_WORD}_{i,k} = \text{GPS_TO_GPC_DATA_ONE}_{i,(k+3)}$$

2. The self-test fail flag is extracted from BIT_FAULT_LOG_WORD_{i,1} as follows:
IF BIT 4 of BIT_FAULT_LOG_WORD_{i,1} = 1 THEN GPS_FAIL_ST_FLAG_i = ON
ELSE GPS_FAIL_ST_FLAG_i = OFF

D. Special Considerations

The GPS_FAIL_ST_FLAG_i (i=1,2,3) flags shall be initialized to OFF, and shall retain their current values across all OPS transitions.

Table 4.17.6.1.4-1. TEST_MESSAGE_DATA Input Parameters							
Description	Name	Input Source	Type	Precision	Range	Units	Rate (Hz)
GPS receiver I to GPC data buffer one	GPS_TO_GPC_DATA_ONE(I)**	*	–	–	–	–	1.04
* See principal function input list in Table 4.17.6.10-1 ** I = 1,2,3 (1 to GPS_SW_CAP)							

Table 4.17.6.1.4-2. TEST_MESSAGE_DATA Output Parameters							
Description	Name	Destination	Type	Precision	Range	Units	Rate (Hz)
GPS receiver I test log words	BIT_FAULT_LOG_WORD(I,K)**	*	-	-	-	-	6.25
GPS receiver I fail self test flag	GPS_FAIL_ST_FLAG(I)	GPS_SOP_DL_COMP GPS_DISP_COMP	D	-	ON/OFF	-	6.25
* See principal function output list in Table 4.17.6.10-2 ** I = 1,2,3 K = 1 to 18 (I = 1 to GPS_SW_CAP)							

4.17.6.2 GPS Data Quality Check Processing (GPS_QA1_CHECK)

The purpose of the GPS data quality check function is to provide the first level of redundancy management for GPS states based on the figures of merit provided by the receivers.

A. Functional Requirements. The GPS_QA1_CHECK module shall perform the following function:

1. Determine when the receiver figure of merit passes the first level quality assessment check (QA1). Passing QA1 requires the receiver figure of merit to be less than or equal to the I-loaded threshold value for an I-loaded number of consecutive cycles.

B. Interface Requirements. The input and output parameters associated with the GPS_QA1_CHECK module are contained in Table 4.17.6.2-1 and 4.17.6.2-2. I-load parameters are contained in Table 4.17.6.10-3.

C. Detailed Requirements and Formulations. The following operations shall be performed by the GPS_QA1_CHECK module. Figure 4.17.6.2 presents a flow diagram of the GPS_QA1_CHECK functional requirements.

- 1.0 If the GPS figure of merit (FOM_NEW_i) is less than or equal to the I-loaded threshold value (MAX_FOM_ACCEPT_PFS), then execute step 1.1. Otherwise, set the flag GPS_FAIL_FOM_NEW_i to ON and reset FOM_GOOD_CNT_i to 1.

IF FOM_NEW_i ≤ MAX_FOM_ACCEPT_PFS THEN

Execute step 1.1

ELSE

GPS_FAIL_FOM_NEW_i = ON

FOM_GOOD_CNT_i = 1

- 1.1 If FOM_GOOD_CNT_i is greater than or equal to the I-loaded minimum number of consecutive cycles (FOM_GOOD_COUNT_MIN), then reset GPS_FAIL_FOM_NEW_i to OFF. Otherwise, set GPS_FAIL_FOM_NEW_i to ON and increment FOM_GOOD_CNT_i by 1.

```

IF FOM_GOOD_CNTi ≥ FOM_GOOD_COUNT_MIN THEN
    GPS_FAIL_FOM_NEWi = OFF
ELSE
    GPS_FAIL_FOM_NEWi = ON
    FOM_GOOD_CNTi = FOM_GOOD_CNTi + 1

```

D. Special Considerations. FOM_GOOD_CNT_i shall be initialized to 1 after all OPS transitions except between OPS 1 and OPS 6.

Table 4.17.6.2-1. GPS_QA1_CHECK Input Parameters							
Description	Name	Input Source	Type	Precision	Range	Units	Rate (Hz)
Counter indicating the number of cycles FOM has been good	FOM_GOOD_CNT(I)**	NAV_MESSAGE_DATA	I	S	–	–	1.04
Figure of merit associated with “NEW” GPS I data	FOM_NEW(I)**	NAV_MESSAGE_DATA	I	S	–	–	1.04
** I = 1,2,3 (1 to GPS_SW_CAP)							

Table 4.17.6.2-2. GPS_QA1_CHECK Output Parameters							
Description	Name	Destination	Type	Precision	Range	Units	Rate (Hz)
Flag indicating GPS failed FOM threshold	GPS_FAIL_FOM_NEW(I)**	GPS_IMU_SAVE, NAV_MESSAGE_DATA	D	–	ON/OFF	–	6.25
** I = 1,2,3 (1 to GPS_SW_CAP)							

4.17.6.3 GPS Altitude Aiding Data Processing (GPS_ALT_DATA)

The purpose of the GPS altitude aiding data processing function is to process data from the air data system and/or radar altimeter for eventual altitude aiding to the GPS receivers at 6.25 Hz rate.

A. Functional Requirements. The GPS_ALT_DATA module is required to perform the following functions:

1. Determine if BARO and radar altimeter altitude data is valid. If they are good then they shall be collected and prepared as altitude aiding data to all GPS receivers.
2. Collect, store and process data from ADTA SOP and RA SOP.

B. Interface Requirements. The input and output parameters associated with GPS_ALT_DATA module are contained in Tables 4.17.6.3-1 and 4.17.6.3-2. I-load parameters are contained in Table 4.17.6.10-3.

C. Detailed Requirements and Formulations. The following operations shall be performed by the GPS_ALT_DATA module. Figure 4.17.6.3 presents a flow diagram of the GPS_ALT_DATA functional requirements.

1. In order to avoid unnecessary computation, the following step 2 and step 3 are performed only if BARO time tag is changed, indicating new BARO data is received.

IF T_BARO NOT = T_BARO_PREV THEN do step 2 and 3 below.

2. A five part test shall be made to determine if the GPS_BARO_DG_OUT flag shall be set ON or OFF. If the Major Mode is not 304, not 305, not 602 and not 603 or BARO_AIF flag is in 'INHIBIT' or the pressure altitude data good flag, BARO_DG, is OFF or the Mach jump flag, MACH_JUMP, is ON or the earth relative vehicle velocity magnitude, REL_VEL_MAG, is greater than the maximum velocity for BARO processing, RV_MAX, or the altitude of the vehicle wheels, ALT_WHEELS, is less than the BARO processing cutoff low altitude, ALT_BARO_CUTOFF_LOW, then the GPS_BARO_DG_OUT flag is set to OFF, otherwise GPS_BARO_DG_OUT is set to ON and the following altitude aiding information is computed from air data below.

The time tag and pressure corrected altitude from the ADTA SOP shall be processed as follows:

$$\begin{aligned} \text{TOTAL_SEC} &= \text{T_BARO} + \text{LEAP_SEC_CORR} + \text{T_GPS_OFFSET_SECS} - \\ &\quad \text{TIME_BIAS_BARO} + \text{T_GPS_TO_GMT_ADJ} + \\ &\quad (\text{T_GPS_TIME_ADJ_ACC}/1000) \\ \text{T_GPS_BARO_SEC_OUT} &= \text{MOD}(\text{TOTAL_SEC}, (7*\text{SEC_PER_DAY})) \\ \text{GPS_BARO_DATA_OUT} &= \text{Q_BARO} \\ \text{T_GPS_BARO_WEEK_OUT} &= \text{FLOOR}(\text{TOTAL_SEC}/(7*\text{SEC_PER_DAY})) \end{aligned}$$

3. The new BARO time is saved into previous buffer for use in step 1 above on the next cycle.

T_BARO_PREV = T_BARO

4. If the crew has not enabled radar altimeter aiding, GPS_RA_RCVD = OFF (via Item 46 on the GPS single string configuration HSD (SPEC 50)) or the Major mode is not 305 and not 603 or vehicle altitude (ALT_WHEELS) is outside the I-loaded ranges of operation, ALT_RA_CUTOFF_HIGH and ALT_RA_CUTOFF_LOW, then the data good flag for the GPS radar altimeter aiding, GPS_RADALT_DG_OUT, will be set OFF. Otherwise, the data good flag for the GPS radar altimeter aiding will be set to the value of the data good flag, RADALT_DG, from the radar altimeter SOP. If the data good flag, RADALT_DG, is ON then the altitude information is computed from radar data below and the BARO data good flag, GPS_BARO_DG_OUT, shall be set OFF.

Note, GPS_RA_RCVD can only be set by the single string HSD.

Note, radar altimeter aiding takes precedence over BARO data aiding.

The time tag and data from the radar altimeter SOP shall be processed as follows:

```
IF RADALT_DG = ON THEN
  TOTAL_SEC = T_RADALT + LEAP_SEC_CORR + T_GPS_OFFSET_SECS -
    TIME_BIAS_RADALT + T_RA_GPS_DELAY + T_GPS_TO_GMT_ADJ +
    (T_GPS_TIME_ADJ_ACC/1000)
  T_GPS_RADALT_SEC_OUT = MOD(TOTAL_SEC, (7*SEC_PER_DAY))
  GPS_RADALT_DATA_OUT = (RADALT_HEIGHT + DELH_RA_GPS +
    H_DOT_ELLIPSOID*T_RA_GPS_DELAY)
  T_GPS_RADALT_WEEK_OUT = FLOOR(TOTAL_SEC/(7*SEC_PER_DAY))
  GPS_BARO_DG_OUT = OFF
```

D. Special Considerations:

The flags GPS_BARO_DG_OUT and GPS_RADALT_DG_OUT, shall be initialized to OFF.

The parameter, T_BARO_PREV, shall be initialized to 0.

The I-load ALT_RA_CUTOFF_HIGH is also used to disable radar altimeter aiding on the Horizontal Situation Display by having a value less than or equal to zero. Radar altimeter aiding can only be enabled on the single string HSD.

Table 4.17.6.3-1. GPS_ALT_DATA Input Parameters

Description	Name	Input Source	Type	Precision	Range	Units	Rate (Hz)
ADS corrected pressure altitude	Q_BARO	*	F	S	–	ft	1.04
ADS corrected pressure altitude time tag	T_BARO	*	F	DP	–	sec	1.04
Pressure altitude data good	BARO_DG	*	D	–	ON/ OFF	–	1.04
Flag indicating (ON) that the Shuttle is in the MACH jump region	MACH_JUMP	*	D	–	ON/ OFF	–	1.04
Magnitude of vehicle relative velocity	REL_VEL_MAG	*	F	S	–	ft/sec	1.04
Altitude to rear wheels	ALT_WHEELS	*	F	S	–	ft	6.25
Altitude Rate	H_DOT_ELLIPSOID	*	F	S	–	ft/sec	6.25
Radar Altitude Data Good	RADALT_DG	*	D	–	ON/ OFF	–	6.25
Crew initiated radar altimeter aiding flag	GPS_RA_RCVD	*	D	–	ON/ OFF	–	6.25
Radar Altitude measurement	RADALT_HEIGHT	*	F	S	–	ft	6.25
Radar Altitude time tag	T_RADALT	*	F	DP	–	sec	6.25
Number of seconds from 1/6/80 to midnight between 12/30 and 12/31 of year prior to launch year	T_GPS_OFFSET_SECS	GPS_SOP	I	DP	–	sec	–
BARO auto/inhibit/force switch	BARO_AIF	*	I	S	(0)AUTO/ (1)INHIBIT/ (2)FORCE	–	1.04
Major mode code number	MM_CODE	*	I	S	–	–	6.25
GPS to GMT time adjustment	T_GPS_TO_GMT_ADJ	GPS_SOP_ TIME_ADJ_ UPLINK	F	DP	–	sec	–
Accumulated GPC-to-GPS time adjustment	T_GPS_TIME_ADJ_ACC	GPS_TIME_ ADJ	HXS	–	–	msec	6.25

* See principal function input list in Table 4.17.6.10-1.

Table 4.17.6.3-2. GPS_ALT_DATA Output Parameters

Description	Name	Output Destination	Type	Precision	Range	Units	Rate (Hz)
Baro Data Good	GPS_BARO_DG_OUT	RCVR_AIDING_DATA	D	–	ON/OFF	–	6.25
Baro Measurement	GPS_BARO_DATA_OUT	NAV_AIDING_DATA	F	S	–	ft	6.25
Baro Time Tag (Weeks)	T_GPS_BARO_WEEK_OUT	NAV_AIDING_DATA	I	S	–	week	6.25
Baro Time Tag (Seconds)	T_GPS_BARO_SEC_OUT	NAV_AIDING_DATA	F	DP	–	sec	6.25
Radar Altitude Data Good	GPS_RADALT_DG_OUT	RCVR_AIDING_DATA	D	–	ON/OFF	–	6.25
Radar Altitude measurement	GPS_RADALT_DATA_OUT	NAV_AIDING_DATA	F	S	–	ft	6.25
Radar Altitude time tag (Weeks)	T_GPS_RADALT_WEEK_OUT	NAV_AIDING_DATA	I	S	–	week	6.25
Radar Altitude time tag (Seconds)	T_GPS_RADALT_SEC_OUT	NAV_AIDING_DATA	F	DP	–	sec	6.25

4.17.6.4 GPC To GPS Data Processing (GPC_TO_GPS)

The purpose of the GPC to GPS data processing function is to format, scale and convert data from the GPS SOP for the GPS receivers. This function is required to form the appropriate outgoing messages according to the GPS receiver mode. The Receiver Aiding Data message (GPS Control Word and aiding state vector) is always output to the GPS receiver. The Receiver Aiding Data message (Attitude and Altitude aiding data) is output whenever the GPS receiver is in NAV mode. The Antenna Correction Data message (antenna lever arm/boresight data and residual edit criteria) is output whenever the GPS receiver is in INIT mode.

A. Functional Requirements. The GPC_TO_GPS module is required to perform the following functions:

1. Collect data to be processed and sent to GPS receivers.
2. Data scaling and conversion into format suitable for GPS receivers.
3. Packing of GPS control word.

B. Interface Requirements. The input and output parameters associated with GPC_TO_GPS module are contained in Tables 4.17.6.4-1 and 4.17.6.4-2. I-load parameters are contained in Table 4.17.6.10-3.

C. Detailed Requirements and Formulations. The following operations shall be performed by the GPC_TO_GPS module. Figure 4.17.6.4 through 4.17.6.4.3 present flow diagrams of the GPC_TO_GPS functional requirements.

1. If the Major Mode is not 901, and one of the aiding data valid flags is ON:

MM_CODE NOT = 901
and
(AIDING_DATA_VALID₁ = ON
or
AIDING_DATA_VALID₂ = ON
or
AIDING_DATA_VALID₃ = ON)

The M50 to WGS84 coordinate transformation matrix for the time of the GPS reference states is computed.

$$M_M50_TO_WGS84 = \text{TRANSPOSE}(\text{EARTH_FIXED_TO_M50_COORD} \\ (\text{T_CURRENT_GPS_REF}) * M_WGS84_TO_EF)$$

The reference state in WGS84 coordinates is computed and stored in intermediate variables.

$$\bar{R}_REF_ECEF = M_M50_TO_WGS84 \bar{R}_REF$$

$$\bar{V}_REF_ECEF = M_M50_TO_WGS84 \bar{V}_REL(\bar{V}_REF, \bar{R}_REF)$$

2. The GPC_TO_GPS module shall pack the GPC_TO_GPS_DATA_ONE and GPC_TO_GPS_DATA_TWO buffers for each of the receivers in the format as defined by the Table 4.17.1.1.2-1 through 4.17.1.1.2-4.
 - 2.1 Independent of the GPS operating mode, the GPC_TO_GPS module shall execute the RCVR_AIDING_DATA code to pack the GPC_TO_GPS_DATA_ONE_i buffer with state aiding data to the GPS receivers. The RCVR_AIDING_DATA code is described in detail in Section 4.17.6.4.1.
 - 2.2 Depending on the GPS SOP commanded GPS mode of each GPS receiver, data is packed into the buffers differently. If GPS_MODE_CMD_SOP_i is in 'NAV' mode then the GPC_TO_GPS module will execute NAV_AIDING_DATA code to pack the GPC_TO_GPS_DATA_TWO_i buffer with attitude and altitude aiding data to the GPS receivers. The NAV_AIDING_DATA code is described in detail in Section 4.17.6.4.3.
 - 2.3 If GPS_MODE_CMD_SOP_i is in 'INIT' mode then the GPC_TO_GPS module will execute INIT_DATA code to pack the GPC_TO_GPS_DATA_TWO_i buffer with antenna location, boresight direction information, and residual edit criteria to the GPS receivers. The INIT_DATA code is described in detail in Section 4.17.6.4.2.
 - 2.4 If GPS_MODE_CMD_SOP_i is neither 'INIT' or 'NAV' mode, the GPC_TO_GPS_DATA_TWO_i buffer will be zeroed.

D. Special Considerations:

1. The EARTH_FIXED_TO_M50_COORD coordinate transformation function is defined in the Level C Functional Subsystem Software Requirements Guidance, Navigation, and Control Part B, Ascent/RTLS Navigation, Section 4.4.2, Coordinate Transformations.

2. The V_REL function is defined in the Level C Functional Subsystem Software Requirements Guidance, Navigation, and Control Part B, Entry Navigation.

Table 4.17.6.4-1. GPC_TO_GPS Input Parameters							
Description	Name	Input Source	Type	Precision	Range	Units	Rate (Hz)
Flag indicating (ON) valid aiding reference states	AIDING_DATA_VALID(I)**	*	D	–	ON/OFF	–	6.25
Current GPS reference position state	\bar{R} _REF	*	V	DP	–	ft	6.25
Current GPS reference velocity state	\bar{V} _REF	*	V	DP	–	ft/sec	6.25
Time tag for GPS reference states	T_CURRENT_GPS_REF	*	F	DP	–	sec	6.25
GPS SOP commanded GPS Mode	GPS_MODE_CMD_SOP(I)**	GPS_SOP	I	S	0(TEST) 1(INIT) 2(NAV)	–	1.04
Transformation matrix from mean equator and equinox of 1950 to true equator and Greenwich Meridian of date	M_M50TOEF_AT_EPOCH	*	M	DP	±1.0	–	6.25
Major Mode Code	MM_CODE	*	I	S	–	–	6.25
Time tag for M_M50TOEF_AT_EPOCH	T_EPOCH	*	F	DP	–	–	6.25
* See principal function input list in Table 4.17.6.10-1 ** I = 1,2,3 (I = 1 to GPS_SW_CAP)							

Table 4.17.6.4-2. GPC_TO_GPS Output Parameters

Description	Name	Destination	Type	Precision	Range	Units	Rate (Hz)
GPC to GPS receiver I data buffer two	GPC_TO_GPS_DATA_TWO(I)**	*	-	-	-	-	6.25
M50 to WGS84 coordinate transformation	M_M50_TO_WGS84	RCVR_AIDING_DATA	M	DP	-	-	6.25
Current GPS reference position state in WGS84 coordinates	\bar{R} _REF_ECEF	RCVR_AIDING_DATA	V	DP	-	ft	6.25
Current GPS reference velocity state in WGS84 coordinates	\bar{V} _REF_ECEF	RCVR_AIDING_DATA	V	DP	-	ft/sec	6.25

* See principal function output list in Table 4.17.6.10-2

** I = 1,2,3 (I = 1 to GPS_SW_CAP)

4.17.6.4.1 GPS Receiver Aiding Data Processing (RCVR_AIDING_DATA)

The purpose of the receiver aiding data processing function is to format, scale and convert data for packing the GPC_TO_GPS_DATA_ONE buffer which provides receiver with control word, state aiding, and crew manual satellite deselection.

A. Functional Requirements. The RCVR_AIDING_DATA code is required to perform the following functions:

1. Packing of GPS control word.
2. Collection of state and attitude aiding data to be processed.
3. Data scaling and conversion into format suitable for GPS receivers.

B. Interface Requirements. The input and output parameters associated with RCVR_AIDING_DATA module are contained in Table 4.17.6.4.1-1 and 4.17.6.4.1-2. I-load parameters are contained in Table 4.17.6.10-3.

C. Detailed Requirements and Formulations.

The following operations shall be performed by the RCVR_AIDING_DATA module. Figure 4.17.6.4.1 presents the flow diagram of the RCVR_AIDING_DATA functional requirements. Table 4.17.6.4.1-3 defines the format of the parent word GPS_CONTROL_WORD used in this module.

1. The GPS_CONTROL_WORD shall be packed as follows according to the definitions listed in Table 4.17.6.4.1-3.

- 1.1 GPS_MODE_CMD_SOP_i will be used to set bit 0, 1, 30 and 31 of GPS_CONTROL_WORD.

IF GPS_MODE_CMD_SOP_i = NAV THEN

BIT 0 and 1 of GPS_CONTROL_WORD = (1,0) and

BIT 30 and 31 of GPS_CONTROL_WORD = (0,1)

ELSE

IF GPS_MODE_CMD_SOP_i = INIT THEN

BIT 0 and 1 of GPS_CONTROL_WORD = (0,1) and

BIT 30 and 31 of GPS_CONTROL_WORD = (1,0)

ELSE

IF GPS_MODE_CMD_SOP_i = TEST THEN

BIT 0 and 1 of GPS_CONTROL_WORD = (0,0) and

BIT 30 and 31 of GPS_CONTROL_WORD = (1,1)

- 1.2 Bits 2 through 15 of GPS_CONTROL_WORD will be set as follows:

IF GPS_ANNCD_RESET_SET_i = ON THEN

BIT 2 of GPS_CONTROL_WORD = 1

ELSE

BIT 2 of GPS_CONTROL_WORD = 0

IF GPS_BARO_DG_OUT = ON and GPS_MODE_CMD_SOP_i = 'NAV' THEN
 BIT 3 of GPS_CONTROL_WORD = 1

ELSE
 BIT 3 of GPS_CONTROL_WORD = 0

IF GPS_RADALT_DG_OUT = ON and GPS_MODE_CMD_SOP_i = 'NAV' THEN
 BIT 4 of GPS_CONTROL_WORD = 1

ELSE
 BIT 4 of GPS_CONTROL_WORD = 0

IF AIDING_DATA_VALID_i = ON THEN
 BIT 6 of GPS_CONTROL_WORD = 1

ELSE
 BIT 6 of GPS_CONTROL_WORD = 0

IF INIT_STATE_SET_i = ON THEN
 BIT 8 of GPS_CONTROL_WORD = 1

ELSE
 BIT 8 of GPS_CONTROL_WORD = 0

IF GPS_MODE_CMD_SOP_i = 'INIT' THEN
 BIT 10 of GPS_CONTROL_WORD = 1

ELSE
 BIT 10 of GPS_CONTROL_WORD = 0

IF GPS_FILT_RESTART_i = ON THEN
 BIT 15 of GPS_CONTROL_WORD = 1

ELSE
 BIT 15 of GPS_CONTROL_WORD = 0

2. GPC major mode number is packed into bits 17 to 27 of GPS_CONTROL_WORD.

 BIT 17 to 27 of GPS_CONTROL_WORD = BINARY(MM_CODE)

3. The major mode shall be checked to monitor whether it is in OPS9 post OPS305 or OPS603.

 IF (MM_CODE = 901 and (MM_CODE_PREV = 305 or MM_CODE_PREV = 603))
 THEN OPS9_ROLLOUT_COMPLETE = ON

 where OPS9_ROLLOUT_COMPLETE shall be initialized to OFF.

The current major mode shall also be saved for next pass.

 MM_CODE_PREV = MM_CODE

4. State and attitude aiding data are collected next. During GN&C OPS9 prior to OPS1, the aiding states to the GPS receivers are the GROUND IMU DISP attitude and aiding states which are all time tagged to the most current Clocktime. Bit 6 of the GPS_CONTROL_WORD shall be set to 1 to indicate to receiver valid aiding states. The ATT_AIDING_DATA_VALID_i flag is also set on. During OPS1 prior to valid aiding states available from GPS Reference State Proc principal function, aiding states are those used last in

OPS9 prelaunch time tagged to the current Clocktime. The bit 6 of the GPS_CONTROL_WORD is set to 1 and ATT_AIDING_DATA_VALID_i flag shall be set to ON. During OPS9 post OPS305 or OPS603, the previous position and attitude aiding state shall continuously be used for aiding, while the velocity aiding state shall be a zero vector indicating that vehicle is stopped on the runway and time tagged with the current Clocktime.

IF (MM_CODE = 901 and OPS9_ROLLOUT_COMPLETE = OFF) THEN

T_REF_i = CLOCKTIME

BIT 6 of GPS_CONTROL_WORD = 1

ATT_AIDING_DATA_VALID_i = ON

IF GPS_INIT_REQUEST_SOP_i = ON THEN

INIT_STATE_SET_i = ON

GPS_INIT_REQUEST_SOP_i = OFF

ELSE

IF (MM_CODE = 101 and AIDING_DATA_VALID_i = OFF) THEN

T_REF_i = CLOCKTIME

BIT 6 of GPS_CONTROL_WORD = 1

ATT_AIDING_DATA_VALID_i = ON

IF GPS_INIT_REQUEST_SOP_i = ON THEN

INIT_STATE_SET_i = ON

GPS_INIT_REQUEST_SOP_i = OFF

ELSE

IF OPS9_ROLLOUT_COMPLETE = ON THEN

T_REF_i = CLOCKTIME

\bar{V} _REF_OUT_i = (0,0,0)

IF GPS_INIT_REQUEST_SOP_i = ON THEN

INIT_STATE_SET_i = ON

GPS_INIT_REQUEST_SOP_i = OFF

ELSE

do paragraph 4.1 and 4.2 below

- 4.1 During all other OPS phases under which the flag AIDING_DATA_VALID_i is ON indicating valid aiding states available, the state aiding data comes from the reference state which is computed in the GPS Reference State Proc principal function. The reference state shall be transformed to the WGS84 (World Geodetic Survey 1984) earth-fixed frame as shown in Section 4.17.6.4.

IF AIDING_DATA_VALID_i = ON THEN

T_REF_i = T_CURRENT_GPS_REF

\bar{R} _REF_OUT_i = \bar{R} _REF_ECEF

\bar{V} _REF_OUT_i = \bar{V} _REF_ECEF

Regardless of the value of AIDING_DATA_VALID_i, do paragraph 4.2 below.

- 4.2 The attitude aiding states are collected from ATT_PROC principal function, if the topodetic Euler angles availability flag, EULER_GPS_AVAIL, is ON.

```

IF EULER_GPS_AVAIL = ON THEN
    PHI_OUT = PHI
    PSI_OUT = PSI
    THETA_OUT = THETA
    ATT_AIDING_DATA_VALIDi = ON
ELSE
    ATT_AIDING_DATA_VALIDi = OFF

```

The attitude aiding parameters collected and computed above shall only be packed into GPC_TO_GPS_DATA_TWO_i buffer when the receiver is in NAV mode. This is done in NAV_AIDING_DATA code described in Section 4.17.6.4.3.

5. Compute the week and second components of the time to be associated with the aiding states.

```

TOTAL_SEC = T_REFi + LEAP_SEC_CORR + T_GPS_OFFSET_SECS +
            T_GPS_TO_GMT_ADJ + (T_GPS_TIME_ADJ_ACC/1000)
T_REF_WEEK_OUT = FLOOR(TOTAL_SEC / (7*SEC_PER_DAY))
T_REF_SEC_OUT = MOD(TOTAL_SEC, (7*SEC_PER_DAY))

```

6. Bit 16 of GPS_CONTROL_WORD is set according to ATT_AIDING_DATA_VALID_i flag.

```

IF ATT_AIDING_DATA_VALIDi = ON and GPS_MODE_CMD_SOPi = 'NAV'
    THEN
        BIT 16 of GPS_CONTROL_WORD = 1
ELSE
    BIT 16 of GPS_CONTROL_WORD = 0

```

7. The 24th through 27th halfwords of the GPC_TO_GPS_DATA_ONE buffer contain the crew deselect satellite status.

```

GPC_TO_GPS_DATA_ONEi,24 = CREW_DESELECT_SAT_RCVD1
GPC_TO_GPS_DATA_ONEi,25 = CREW_DESELECT_SAT_RCVD2
GPC_TO_GPS_DATA_ONEi,26 = CREW_DESELECT_SAT_RCVD3
GPC_TO_GPS_DATA_ONEi,27 = CREW_DESELECT_SAT_RCVD4

```

8. Finally, the parameters collected and computed above are scaled and packed into GPC_TO_GPS_DATA_ONE_i buffer forming the Message 1 as defined in Table 4.17.1.1.2-2.

```

GPC_TO_GPS_DATA_ONEi,1 = HEX('AAAA')
GPC_TO_GPS_DATA_ONEi,(2 to 3) = GPS_CONTROL_WORD
GPC_TO_GPS_DATA_ONEi,4 = BINARY(T_REF_WEEK_OUT)
GPC_TO_GPS_DATA_ONEi,(5 to 7) = BINARY(INTEGER(T_REF_SEC_OUT /
                                           SF_TIME))
GPC_TO_GPS_DATA_ONEi,(8 to 9) = BINARY(INTEGER(R_REF_OUTi,1 / SF_POS))
GPC_TO_GPS_DATA_ONEi,(10 to 11) = BINARY(INTEGER(R_REF_OUTi,2 / SF_POS))
GPC_TO_GPS_DATA_ONEi,(12 to 13) = BINARY(INTEGER(R_REF_OUTi,3 / SF_POS))
GPC_TO_GPS_DATA_ONEi,(14 to 15) = BINARY(INTEGER(V_REF_OUTi,1 / SF_VEL))
GPC_TO_GPS_DATA_ONEi,(16 to 17) = BINARY(INTEGER(V_REF_OUTi,2 / SF_VEL))
GPC_TO_GPS_DATA_ONEi,(18 to 19) = BINARY(INTEGER(V_REF_OUTi,3 / SF_VEL))

```

D. Special Considerations:

1. OPS9_ROLLOUT_COMPLETE flag shall be initialized to OFF. The previous major mode indicator MM_CODE_PREV shall be a major-function-based parameter and initialized to any number other than 305 and 603.
2. \bar{R} _REF_OUT_i, \bar{V} _REF_OUT_i, PHI_OUT, PSI_OUT, THETA_OUT, ATT_AIDING_DATA_VALID, and AIDING_DATA_VALID are required to remain the same across the following OPS transitions, OPS1 to OPS6, OPS3 to OPS9, OPS6 to OPS9 and OPS9 to OPS1. The attitude data carried across the transition from OPS6 to OPS9 and OPS3 to OPS9 shall be used for attitude aiding post rollout in OPS9.
3. The GPC_TO_GPS_DATA_ONE_{i,(20 to 32)} shall be initialized to 0.
4. Bit 5 of GPS_CONTROL_WORD shall be initialized to zero at all OPS transitions except OPS1 to OPS6. This is required to insure that the GPS receiver differential navigation capability is not enabled. The Shuttle GPS implementation does not support this capability.

Bit 7 of GPS_CONTROL_WORD shall be initialized to 1; this enables the crew satellite de-selection capability.

Bit 9 of GPS_CONTROL_WORD shall be initialized to 0.
5. \bar{V} _REF_OUT_i shall be initialized to (0,0,0) upon entry into OPS 9.

Table 4.17.6.4.1-1. RCVR_AIDING_DATA Input Parameters

Description	Name	Input Source	Type	Precision	Range	Units	Rate (Hz)
Flag indicating valid aiding reference state	AIDING_DATA_VALID(I)**	*	D	–	ON/OFF	–	1.04
Current Clock Computer Time (GMT)	CLOCKTIME/ CLOCK	*	F	DP		sec	1.04
BARO Data Good	GPS_BARO_DG_OUT	GPS_ALT_DATA	D	–	ON/OFF	–	1.04
RADALT Data Good	GPS_RADALT_DG_OUT	GPS_ALT_DATA	D	–	ON/OFF	–	6.25
GPS filter restart flag	GPS_FILT_RESTART(I)**	*, NAV_MODE_WORD_DATA	D	–	ON/OFF	–	1.04
GPS SOP commanded GPS mode	GPS_MODE_CMD_SOP(I)**	GPS_SOP	I	S	0(TEST) 1(INIT) 2(NAV)	–	1.04
Flag indicating GPS receiver I requesting Initialization State	GPS_INIT_REQUEST_SOP(I)**	NAV_MODE_WORD_DATA, GPS_SOP	D	–	ON/OFF	–	1.04
GPS reference state init flag	INIT_STATE_SET(I)**	*, NAV_MODE_WORD_DATA	D	–	ON/OFF	–	1.04
Major mode code	MM_CODE	*	I	S	–	–	1.04
GPS reference state announced reset flag	GPS_ANNC_D_RESET_SET(I)**	*, NAV_MODE_WORD_DATA	D	–	ON/OFF	–	1.04
Current GPS reference position state in WGS84 coordinates	R_REF_ECEF	GPC_TO_GPS	V	DP	–	ft	6.25
Time tag for current GPS reference state	T_CURRENT_GPS_REF	*	F	DP	–	sec	6.25
Current GPS reference velocity state in WGS84 coordinates	V_REF_ECEF	GPC_TO_GPS	V	DP	–	ft/sec	6.25
Topodetic Euler angles availability flag	EULER_GPS_AVAIL	*	D	–	ON/OFF	–	6.25
Body roll attitude euler angle	PHI	*	F	S	–	deg	6.25
Body yaw attitude euler angle	PSI	*	F	S	–	deg	6.25
Body pitch attitude euler angle	THETA	*	F	S	–	deg	6.25

Table 4.17.6.4.1-1. RCVR_AIDING_DATA Input Parameters							
Description	Name	Input Source	Type	Precision	Range	Units	Rate (Hz)
GPS receiver I current operating mode indicator	GPS_MODE_CURRENT(I)**	NAV_MODE_WORD_DATA	CHAR	–	TEST/INIT/NAV/‘ δ ’	–	1.04
Number of seconds from 1/6/80 to midnight between 12/30 and 12/31 of year prior to launch year	T_GPS_OFFSET_SECS	GPS_SOP	I	DP	–	sec	–
Crew deselect satellite word 1	CREW_DESELECT_SAT_RCVD(1)	*	HMD	–	–	–	6.25
Crew deselect satellite word 2	CREW_DESELECT_SAT_RCVD(2)	*	HMD	–	–	–	6.25
Crew deselect satellite word 3	CREW_DESELECT_SAT_RCVD(3)	*	HMD	–	–	–	6.25
Crew deselect satellite word 4	CREW_DESELECT_SAT_RCVD(4)	*	HMD	–	–	–	6.25
X-comp of GPS I ECEF position	R_REF_OUT(I,1)**	*	F	DP	–	ft	6.25
Y-comp of GPS I ECEF position	R_REF_OUT(I,2)**	*	F	DP	–	ft	6.25
Z-comp of GPS I ECEF position	R_REF_OUT(I,3)**	*	F	DP	–	ft	6.25
GPS to GMT time adjustment	T_GPS_TO_GMT_ADJ	GPS_SOP_TIME_ADJ_UPLINK	F	DP	–	sec	–
Accumulated GPC-to-GPS time adjustment	T_GPS_TIME_ADJ_ACC	GPS_TIME_ADJ	HXS	–	–	msec	6.25
* See principal function input list in Table 4.17.6.10-1 ** I = 1,2,3, (I = 1 to GPS_SW_CAP)							

Table 4.17.6.4.1-2. RCVR_AIDING_DATA Output Parameters

Description	Name	Destination	Type	Precision	Range	Units	Rate (Hz)
GPC to GPS receiver I data buffer one	GPC_TO_GPS_DATA_ONE(I)**	*	-	-	-	-	6.25
Body roll attitude euler angle	PHI_OUT	NAV_AIDING_DATA	F	S	-	Deg	6.25
Body yaw attitude euler angle	PSI_OUT	NAV_AIDING_DATA	F	S	-	Deg	6.25
Body pitch attitude euler angle	THETA_OUT	NAV_AIDING_DATA	F	S	-	Deg	6.25
Rollout complete flag	OPS9_ROLLOUT_COMPLETE	GPS_DISP_COMP	D	-	ON/OFF	-	6.25

* See principal function output list in Table 4.17.6.10-2

** I = 1,2,3 (1 to GPS_SW_CAP)

Table 4.17.6.4.1-3. Definition of GPS_CONTROL_WORD

Bit Parameter Description	Bit no.	Bit Value	Meaning	Related Parameter (Source)
Command GPS rcvr to be in TEST, INIT or NAV mode	0,1	0 0 0 1 1 0	Command TEST mode Command INIT mode Command NAV mode	GPS_MODE_CMD_SOP (GPS SOP)
Flag indicating position and velocity vectors available for receiver announced reset	2	1	Aiding states are valid for GPS receiver announced reset	GPS_ANNCED_RESET_SET (GPS REF STATE PROC)
Flag indicating BARO data good	3	1	Valid Baro aiding data	GPS_BARO_DG_OUT (GPS SOP)
Flag indicating radar data good	4	1	Valid Radar aiding data	GPS_RADALT_DG_OUT (GPS SOP)
Command GPS rcvr to operate in DIFFERENTIAL mode	5	1	Command GPS to do DIFFERENTIAL mode	Not applicable
Flag indicating valid aiding data	6	1	Valid state aiding data	AIDING_DATA_VALID (GPS REF STATE PROC, GPS SOP)
Satellite de-selection command	7	1	Crew de-select GPS satellites	Not applicable
Flag indicating position and velocity vectors ready for GPS receiver initialization	8	1	Aiding states are valid for GPS receiver initialization	INIT_STATE_SET (GPS REF STATE PROC)
Flag indicating position and velocity vectors available for receiver state reset due to IMU reconfiguration	9	1	Not used	
Flag indicating lever arm correction data available	10	1	GPC to GPS data buffer 2 contains valid lever arm and antenna boresight data	GPS_MODE_CMD_SOP (GPS SOP)
Spare	11 - 14		not used	
Flag indicating crew's request for GPS filter to restart	15	1	Crew command GPS receiver to restart (reinitialize) navigation filter	GPS_FILT_RESTART (GPS REF STATE PROC)
Flag indicating valid attitude data	16	1	GPC to GPS buffer 2 contains valid attitude aiding data	ATT_AIDING_DATA_VALID (GPS SOP)
Major mode	17 - 27		Major mode indicator	MM_CODE
Spare	28 - 29		not used	
Compliments of bit 0 and 1	30 - 31	1 1 1 0 0 1	Command TEST mode Command INIT mode Command NAV mode	GPS_MODE_CMD_SOP (GPS SOP)

4.17.6.4.2 Initialization Data Processing (INIT_DATA)

The purpose of this function is to format, scale and convert initialization data to pack the GPC_TO_GPS_DATA_TWO buffer. The receiver initialization data include all antenna location and boresight information, as well as GPS measurement residual edit criteria.

A. Functional Requirements. The INIT_DATA code is required to perform the following functions:

1. Collection of GPS antenna location and boresight data to be processed.
2. Data scaling and conversion into format suitable for GPS receivers.
3. Collect and convert GPS pseudo range and delta range residual edit criteria.

B. Interface Requirements. The input and output parameters associated with INIT_DATA module are contained in Table 4.17.6.4.2-1 and 4.17.6.4.2-2. I-load parameters are contained in Table 4.17.6.10-3.

C. Detailed Requirements and Formulations. The following operations shall be performed by the INIT_DATA module. Figure 4.17.6.4.2 presents the flow diagram of the INIT_DATA functional requirements.

1. The GPS antenna offset corrections and antenna boresight directions are scaled and packed into GPC_TO_GPS_DATA_TWO buffer forming the Message 2 as defined in Table 4.17.1.1.2-3.

```

GPC_TO_GPS_DATA_TWOi,1 = HEX('CCCC')
GPC_TO_GPS_DATA_TWOi,2 =
    BINARY(INTEGER (GPS_UPPER_ANTENNA_NBi,1 / SF_ANT))
GPC_TO_GPS_DATA_TWOi,3 =
    BINARY(INTEGER (GPS_UPPER_ANTENNA_NBi,2 / SF_ANT))
GPC_TO_GPS_DATA_TWOi,4 =
    BINARY(INTEGER (GPS_UPPER_ANTENNA_NBi,3 / SF_ANT))
GPC_TO_GPS_DATA_TWOi,5 =
    BINARY(INTEGER (GPS_LOWER_ANTENNA_NBi,1 / SF_ANT))
GPC_TO_GPS_DATA_TWOi,6 =
    BINARY(INTEGER (GPS_LOWER_ANTENNA_NBi,2 / SF_ANT))
GPC_TO_GPS_DATA_TWOi,7 =
    BINARY(INTEGER (GPS_LOWER_ANTENNA_NBi,3 / SF_ANT))
GPC_TO_GPS_DATA_TWOi,8 =
    BINARY(INTEGER (GPS_UPPER_ANTENNA_CGi,1 / SF_ANT))
GPC_TO_GPS_DATA_TWOi,9 =
    BINARY(INTEGER (GPS_UPPER_ANTENNA_CGi,2 / SF_ANT))
GPC_TO_GPS_DATA_TWOi,10 =
    BINARY(INTEGER (GPS_UPPER_ANTENNA_CGi,3 / SF_ANT))
GPC_TO_GPS_DATA_TWOi,11 =
    BINARY(INTEGER (GPS_LOWER_ANTENNA_CGi,1 / SF_ANT))
GPC_TO_GPS_DATA_TWOi,12 =
    BINARY(INTEGER (GPS_LOWER_ANTENNA_CGi,2 / SF_ANT))
GPC_TO_GPS_DATA_TWOi,13 =
    BINARY(INTEGER (GPS_LOWER_ANTENNA_CGi,3 / SF_ANT))
GPC_TO_GPS_DATA_TWOi,14 =

```

BINARY(INTEGER (GPS_UPPER_ANTENNA_BORESIGHT_{i,1} / SF_BORE))
 GPC_TO_GPS_DATA_TWO_{i,15} =
 BINARY(INTEGER (GPS_UPPER_ANTENNA_BORESIGHT_{i,2} / SF_BORE))
 GPC_TO_GPS_DATA_TWO_{i,16} =
 BINARY(INTEGER (GPS_UPPER_ANTENNA_BORESIGHT_{i,3} / SF_BORE))
 GPC_TO_GPS_DATA_TWO_{i,17} =
 BINARY(INTEGER (GPS_LOWER_ANTENNA_BORESIGHT_{i,1} / SF_BORE))
 GPC_TO_GPS_DATA_TWO_{i,18} =
 BINARY(INTEGER (GPS_LOWER_ANTENNA_BORESIGHT_{i,2} / SF_BORE))
 GPC_TO_GPS_DATA_TWO_{i,19} =
 BINARY(INTEGER (GPS_LOWER_ANTENNA_BORESIGHT_{i,3} / SF_BORE))

2. GPC_TO_GPS_DATA_TWO_{i,20} shall be packed with GPS pseudo range residual edit criteria according to the format defined in Table 4.17.6.4.2-3.

BIT 0 of GPC_TO_GPS_DATA_TWO_{i,20} = GPS_PR_EDIT_MAX_HOLD
 BIT 1 to 5 of GPC_TO_GPS_DATA_TWO_{i,20} =
 BINARY(GPS_PR_EDIT_MAX_STEP)
 BIT 6 to 10 of GPC_TO_GPS_DATA_TWO_{i,20} =
 BINARY(GPS_PR_EDIT_STEP_SIZE)
 BIT 11 to 15 of GPC_TO_GPS_DATA_TWO_{i,20} =
 BINARY(GPS_PR_EDIT_THRESHOLD)

3. GPC_TO_GPS_DATA_TWO_{i,21} shall be packed with GPS delta range residual edit criteria according to the format defined in Table 4.17.6.4.2-4.

BIT 0 of GPC_TO_GPS_DATA_TWO_{i,21} = GPS_DR_EDIT_MAX_HOLD
 BIT 1 to 5 of GPC_TO_GPS_DATA_TWO_{i,21} =
 BINARY(GPS_DR_EDIT_MAX_STEP)
 BIT 6 to 10 of GPC_TO_GPS_DATA_TWO_{i,21} =
 BINARY(GPS_DR_EDIT_STEP_SIZE)
 BIT 11 to 15 of GPC_TO_GPS_DATA_TWO_{i,21} =
 BINARY(GPS_DR_EDIT_THRESHOLD)

- 4 GPC_TO_GPS_DATA_TWO_{i,(22 to 32)} = 0

Table 4.17.6.4.2-1. INIT_DATA Input Parameters

Description	Name	Input Source	Type	Precision	Range	Units	Rate (Hz)
(NONE)							

Table 4.17.6.4.2-2. INIT_DATA Output Parameters							
Description	Name	Destination	Type	Precision	Range	Units	Rate (Hz)
GPC to GPS receiver I data buffer two	GPC_TO_GPS_DATA_TWO(I)**	*	-	-	-	-	6.25
* See principal function output list in Table 4.17.6.10-2 ** I = 1,2,3 (1 to GPS_SW_CAP)							

Table 4.17.6.4.2-3. Definition of GPC_TO_GPS_DATA_TWO _{i,20} - Init Data Only				
Parameter Description	Bit no.	LSB Location	Meaning	Related Parameter (Source)
PR Test Max Level Hold	0	-	Flag value of 1 indicates a maximum pseudo range edit threshold is in effect	GPS_PR_EDIT_MAX_HOLD
PR Test Max Step Number	1 - 5	5	Number of steps (cycles) to reach the maximum pseudo range edit threshold	GPS_PR_EDIT_MAX_STEP
PR Test Step Size	6 - 10	10	Size of the pseudo range edit threshold increment (sigma) per step (cycle)	GPS_PR_EDIT_STEP_SIZE
PR Test Threshold	11 - 15	15	Minimum pseudo range edit threshold	GPS_PR_EDIT_THRESHOLD

Table 4.17.6.4.2-4. Definition of GPC_TO_GPS_DATA_TWO _{i,21} - Init Data Only				
Parameter Description	Bit no.	LSB Location	Meaning	Related Parameter (Source)
DR Test Max Level Hold	0	-	Flag value of 1 indicates a maximum delta range edit threshold is in effect	GPS_DR_EDIT_MAX_HOLD
DR Test Max Step Number	1 - 5	5	Number of steps (cycles) to reach the maximum delta range edit threshold	GPS_DR_EDIT_MAX_STEP
DR Test Step Size	6 - 10	10	Size of the delta range edit threshold increment (sigma) per step (cycle)	GPS_DR_EDIT_STEP_SIZE
DR Test Threshold	11 - 15	15	Minimum delta range edit threshold	GPS_DR_EDIT_THRESHOLD

December 14, 2007

4.17.6.4.3 Nav Aiding Data Processing (NAV_AIDING_DATA)

The purpose of the nav aiding data processing function is to format, scale and convert data to pack the GPC_TO_GPS_DATA_TWO buffer which provides GPS receivers with vehicle attitude and altitude aiding information. The collection of the attitude and altitude parameters are done in RCVR_AIDING_DATA code which is described in Section 4.17.6.4.1.

A. Functional Requirements. The NAV_AIDING_DATA code is required to perform the following functions:

1. Data scaling and conversion of attitude and altitude information into format suitable for GPS receivers.

B. Interface Requirements. The input and output parameters associated with NAV_AIDING_DATA module are contained in Table 4.17.6.4.3-1 and 4.17.6.4.3-2. I-load parameters are contained in Table 4.17.6.10-3.

C. Detailed Requirements and Formulations. The following operations shall be performed by the NAV_AIDING_DATA module. Figure 4.17.6.4.3 presents the flow diagram of the NAV_AIDING_DATA functional requirements.

The attitude and altitude aiding data collected and computed in RCVR_AIDING_DATA module is scaled and packed into GPC_TO_GPS_DATA_TWO buffer forming the Message 3 as defined in Table 4.17.1.1.2-4.

```

GPC_TO_GPS_DATA_TWOi,1 = HEX('BBBB')
GPC_TO_GPS_DATA_TWOi,2 = BINARY(INTEGER (PHI_OUT/SF_ATT))
GPC_TO_GPS_DATA_TWOi,3 = BINARY(INTEGER (THETA_OUT/SF_ATT))
GPC_TO_GPS_DATA_TWOi,4 = BINARY(INTEGER (PSI_OUT/SF_ATT))
GPC_TO_GPS_DATA_TWOi,(5 to 7) = 0
GPC_TO_GPS_DATA_TWOi,8 = BINARY(T_GPS_BARO_WEEK_OUT)
GPC_TO_GPS_DATA_TWOi,(9 to 11) = BINARY(INTEGER
(T_GPS_BARO_SEC_OUT/SF_TIME))
GPC_TO_GPS_DATA_TWOi,12 = BINARY(T_GPS_RADALT_WEEK_OUT)
GPC_TO_GPS_DATA_TWOi,(13 to 15) = BINARY(INTEGER
(T_GPS_RADALT_SEC_OUT/SF_TIME))
GPC_TO_GPS_DATA_TWOi,(16 to 17) = BINARY(INTEGER
(GPS_BARO_DATA_OUT/SF_BARO))
GPC_TO_GPS_DATA_TWOi,18 = BINARY(INTEGER
(GPS_RADALT_DATA_OUT/SF_RA))
GPC_TO_GPS_DATA_TWOi,(19 to 32) = 0

```

Table 4.17.6.4.3-1. NAV_AIDING_DATA Input Parameters							
Description	Name	Input Source	Type	Precision	Range	Units	Rate (Hz)
Body roll attitude euler angle	PHI_OUT	RCVR_AIDING_DATA, *	F	S	–	deg	6.25
Body yaw attitude euler angle	PSI_OUT	RCVR_AIDING_DATA, *	F	S	–	deg	6.25
Body pitch attitude euler angle	THETA_OUT	RCVR_AIDING_DATA, *	F	S	–	deg	6.25
Baro Measurement	GPS_BARO_DATA_OUT	GPC_ALT_DATA	F	S	–	ft	6.25
Baro Time Tag (Weeks)	T_GPS_BARO_WEEK_OUT	GPC_ALT_DATA	I	S	–	week	6.25
Baro Time Tag (Seconds)	T_GPS_BARO_SEC_OUT	GPC_ALT_DATA	F	DP	–	sec	6.25
Radar Altitude measurement	GPS_RADALT_DATA_OUT	GPC_ALT_DATA	F	S	–	ft	6.25
Radar Altitude time tag (Weeks)	T_GPS_RADALT_WEEK_OUT	GPC_ALT_DATA	I	S	–	week	6.25
Radar Altitude time tag (Seconds)	T_GPS_RADALT_SEC_OUT	GPC_ALT_DATA	F	DP	–	sec	6.25

Table 4.17.6.4.3-2. NAV_AIDING_DATA Output Parameters							
Description	Name	Destination	Type	Precision	Range	Units	Rate (Hz)
GPC to GPS receiver I data buffer two	GPC_TO_GPS_DATA_TWO(I)**	*	–	–	–	–	6.25
<p>* See principal function output list in Table 4.17.6.10-2 ** I = 1,2,3 (1 to GPS_SW_CAP)</p>							

4.17.6.5 GPS Display Computations (GPS_DISP_COMP)

The purpose of the GPS display computations function is to collect and compute GPS related information that are used for display only.

A. Functional Requirements. The GPS_DISP_COMP module is required to perform the following function:

1. Determine the GPS status value to be displayed for each receiver.
2. Determine the GPS operating mode to be displayed for each receiver.

B. Interface Requirements. The input and output parameters associated with GPS_DISP_COMP module are contained in Tables 4.17.6.5-1 and 4.17.6.5-2.

C. Detailed Requirements and Formulations. The following operations shall be performed by the GPS_DISP_COMP module for each receiver. Figure 4.17.6.5 presents a flow diagram of the GPS_DISP_COMP functional requirements. Table 4.17.6.5-3 defines the format of GPS_RCVR_STATUS word.

1. The GPS_RCVR_STATUS_i value for displaying of the receiver status is set up as shown below for each GPS receivers.

The displayed values are listed below in order of precedence:

- GPS receiver is not installed.
- GPS receiver data is missing due to COMMFAULT.
- GPS receiver built-in test is in progress (self test).
- GPS receiver processing unit failure.
- GPS receiver battery level low warning.
- GPS receiver navigation data is not valid.
- GPS receiver is operating properly

Before the following assignments, GPS_RCVR_STATUS_{i,(1 to 3)} shall be blanked indicating receiver operating properly.

```

IF GPS_INSTALLEDi = 'OFF' THEN
    GPS_RCVR_STATUSi = NI
ELSE IF GPS_COMMFAULTi = ON THEN
    GPS_RCVR_STATUSi = M
ELSE IF GPS_BIT_SOPi = ON THEN
    GPS_RCVR_STATUSi = BIT

    ELSE IF BIT 3 of GPS_STATUS_FOM_GDOPi = 1 THEN
        GPS_RCVR_STATUSi = RPF
        RCVR_FAILi = ON
    
```


- ```
ELSE
 RCVR_FAILi = OFF
 IF BIT 5 of GPS_STATUS_FOM_GDOPi = 1 THEN
 GPS_RCVR_STATUSi = BATT
 ELSE IF GPS_NAV_DATA_VALIDi = OFF and
 GPS_MODE_CURRENTi = 'NAV' THEN
 GPS_RCVR_STATUSi = DGF
```
2. The current GPS operating mode to be displayed on the GPS STATUS display is prepared next. If GPS\_MODE\_CURRENT<sub>i</sub> is 'NAV', then GPS\_MODE\_DISP<sub>i</sub> shall be the last selected site if the flag, STATIONARY\_MODE\_SOP<sub>i</sub>, is ON, otherwise it shall be the same as the GPS\_NAV\_SUBMODE<sub>i</sub>. If GPS\_MODE\_CURRENT<sub>i</sub> is not 'NAV', the GPS\_MODE\_DISP<sub>i</sub> shall be the same as GPS\_MODE\_CURRENT<sub>i</sub>.

```
IF GPS_MODE_CURRENTi = 'NAV' THEN
 IF STATIONARY_MODE_SOPi = ON THEN
 IF (MM_CODE = 101) or (MM_CODE = 901 AND
 OPS9_ROLLOUT_COMPLETE = OFF) THEN
 GPS_MODE_DISPi = SEL_TEST_ID(1 to 3)
 ELSE
 GPS_MODE_DISPi = SEL_SITE_ID(1 to 3)
```

```
ELSE
 GPS_MODE_DISPi = GPS_NAV_SUBMODEi
```

```
ELSE
 GPS_MODE_DISPi = GPS_MODE_CURRENTi
```

3. If GPS\_BIT\_DISP\_ENABLE = OFF, then set GPS\_FAIL\_ST<sub>i</sub> to 'Ø'; otherwise, test GPS\_FAIL\_ST\_FLAG<sub>i</sub>. If GPS\_FAIL\_ST\_FLAG<sub>i</sub> is ON then set GPS\_FAIL\_ST<sub>i</sub> to '↓'; else, set GPS\_FAIL\_ST<sub>i</sub> to '↑'.

```
IF GPS_BIT_DISP_ENABLEi = OFF THEN
 GPS_FAIL_STi = 'Ø'
ELSE IF GPS_FAIL_ST_FLAGi = ON THEN
 GPS_FAIL_STi = '↓'
ELSE
 GPS_FAIL_STi = '↑'
```

#### D. Special Considerations.

The RCVR\_FAIL<sub>i</sub> (i = 1 to 3) flags shall be initialized to OFF and the GPS\_FAIL\_ST<sub>i</sub> (I = 1 to 3) indicators shall be initialized to 'Ø'. In addition, RCVR\_FAIL<sub>i</sub> shall retain their current values across all OPS transitions.

Table 4.17.6.5-1. GPS\_DISP\_COMP Input Parameters

| Description                                          | Name                     | Input Source       | Type | Precision | Range             | Units | Rate (Hz) |
|------------------------------------------------------|--------------------------|--------------------|------|-----------|-------------------|-------|-----------|
| GPS commfault flag                                   | GPS_COMMFAULT(I)**       | *                  | D    | –         | ON/OFF            | –     | 1.04      |
| GPS BIT DISPLAY ENABLE Flag                          | GPS_BIT_DISP_ENABLE(I)** | GPS_TO_GPC         | D    | –         | ON/OFF            | –     | 6.25      |
| GPS receiver self test in progress flag              | GPS_BIT_SOP(I)**         | GPS_TO_GPC         | D    | –         | ON/OFF            | –     | 1.04      |
| Flag indicating navigation data valid                | GPS_NAV_DATA_VALID(I)**  | NAV_MODE_WORD_DATA | D    | –         | ON/OFF            | –     | 1.04      |
| GPS receiver status, figure of merit and GDOP word   | GPS_STATUS_FOM_GDOP(I)** | NAV_MESSAGE_DATA   | HMD  | 16 bits   | –                 | –     | 1.04      |
| GPS receiver I current operating mode indicator      | GPS_MODE_CURRENT(I)**    | NAV_MODE_WORD_DATA | CHAR | –         | TEST/INIT/NAV/‘Ø’ | –     | 1.04      |
| GPS receiver I navigation submode indicator          | GPS_NAV_SUBMODE(I)**     | NAV_MODE_WORD_DATA | CHAR | –         | PVA/INS/‘Ø’       | –     | 1.04      |
| Flag indicating GPS receiver I is in stationary mode | STATIONARY_MODE_SOP(I)** | NAV_MODE_WORD_DATA | D    | –         | ON/OFF            | –     | 1.04      |
| GPS receiver I fail self-test flag                   | GPS_FAIL_ST_FLAG(I)**    | TEST_MESSAGE_DATA  | D    | –         | ON/OFF            | –     | 6.25      |
| Major Mode Code                                      | MM_CODE                  | *                  | I    | S         | –                 | –     | 1.04      |
| Runway name for the selected landing site            | SEL_SITE_ID              | *                  | CHAR | –         | –                 | –     | 1.04      |
| Selected IMU calibration site name                   | SEL_TEST_ID              | *                  | CHAR | –         | –                 | –     | 1.04      |
| Rollout complete flag                                | OPS9_ROLLOUT_COMPLETE    | RCVR_AIDING_DATA   | D    | –         | –                 | –     | 1.04      |

\* See principal function input list in Table 4.17.6.10-1

\*\* I = 1,2,3 (1 to GPS\_SW\_CAP)

| Table 4.17.6.5-2. GPS_DISP_COMP Output Parameters         |                      |                    |      |           |                                                                  |       |           |
|-----------------------------------------------------------|----------------------|--------------------|------|-----------|------------------------------------------------------------------|-------|-----------|
| Description                                               | Name                 | Output Destination | Type | Precision | Range                                                            | Units | Rate (Hz) |
| Status of GPS receiver I                                  | GPS_RCVR_STATUS(I)** | *                  | I    | S         | 0(NI)<br>1(M)<br>2(BIT)<br>3(RPF)<br>4(BATT)<br>5(DGF)<br>6('⌘') | –     | 6.25      |
| Current GPS receiver I operating mode for display         | GPS_MODE_DISP(I)**   | *                  | CHAR | –         | INIT,<br>TEST,<br>PVA,<br>INS,<br>'⌘',<br>(site)                 | –     | 6.25      |
| GPS I fail self-test indicator                            | GPS_FAIL_ST(I)**     | *                  | VAR  | –         | '⌘',<br>↑,<br>↓                                                  | –     | 6.25      |
| Flag indicating GPS receiver processing unit fail         | RCVR_FAIL(I)**       | *                  | D    | –         | ON/OFF                                                           | –     | 6.25      |
| * See principal function output list in Table 4.17.6.10-2 |                      |                    |      |           |                                                                  |       |           |
| ** I = 1,2,3 (1 to GPS_SW_CAP)                            |                      |                    |      |           |                                                                  |       |           |

| Table 4.17.6.5-3. Definition of GPS_RCVR_STATUS <sub>i</sub> word |       |                                                                 |                                                                       |
|-------------------------------------------------------------------|-------|-----------------------------------------------------------------|-----------------------------------------------------------------------|
| Display                                                           | Value | Meaning                                                         | Related Parameter                                                     |
| NI                                                                | 0     | GPS receiver is not installed                                   | GPS_INSTALLED <sub>i</sub> is OFF                                     |
| M                                                                 | 1     | GPS receiver data is missing due to COMMFAULT                   | GPS_COMMFAULT <sub>i</sub> is ON                                      |
| BIT                                                               | 2     | GPS receiver Built In Test is in progress (commanded Self-Test) | GPS_BIT_SOP <sub>i</sub> is ON                                        |
| RPF                                                               | 3     | GPS receiver processing unit failure                            | BIT 3 of GPS_STATUS_FOM_GDOP <sub>i</sub> is ON                       |
| BATT                                                              | 4     | GPS receiver battery is low                                     | BIT 5 of GPS_STATUS_FOM_GDOP <sub>i</sub> is ON                       |
| DGF                                                               | 5     | GPS receiver navigation data invalid                            | GPS_NAV_DATA_VALID <sub>i</sub>                                       |
| '⌘'                                                               | 6     | GPS receiver is operating properly                              | Blank field will be displayed if none of the above conditions is true |
| Note: The displayed values are listed in order of precedence.     |       |                                                                 |                                                                       |

#### 4.17.6.6 GPS SOP Downlist Computations (GPS\_SOP\_DL\_COMP)

The purpose of the GPS SOP downlist computation is to prepare parameters for downlist.

A. Functional Requirements. The GPS\_SOP\_DL\_COMP module is required to perform the following function:

1. Prepare GPS data for downlist.

B. Interface Requirements. The input and output parameters associated with GPS\_SOP\_DL\_COMP module are contained in Tables 4.17.6.6-1 and 4.17.6.6-2.

C. Detailed Requirements and Formulations. The following operations shall be performed by the GPS\_SOP\_DL\_COMP module. Figure 4.17.6.6 presents the flow diagram of the GPS\_SOP\_DL\_COMP functional requirements. Table 4.17.6.6-3 summarizes the bit assignment of GPS\_SOP\_COLLECTION\_WORD.

1. The downlist parent words, GPS\_SOP\_COLLECTION\_WORD and GPS\_SOP\_COLLECTION\_WORD\_TWO, are blanked first.  
  
 BITS 0 to 15 of GPS\_SOP\_COLLECTION\_WORD = 0  
 BITS 0 to 15 of GPS\_SOP\_COLLECTION\_WORD\_TWO = 0
2. Bits 1, 2 and 3 of GPS\_SOP\_COLLECTION\_WORD are set to GPS\_COMMFAULT<sub>1</sub>, GPS\_COMMFAULT<sub>2</sub> and GPS\_COMMFAULT<sub>3</sub>.  
  
 BIT 1 of GPS\_SOP\_COLLECTION\_WORD = GPS\_COMMFAULT<sub>1</sub>  
 BIT 2 of GPS\_SOP\_COLLECTION\_WORD = GPS\_COMMFAULT<sub>2</sub>  
 BIT 3 of GPS\_SOP\_COLLECTION\_WORD = GPS\_COMMFAULT<sub>3</sub>
3. BIT 4 of GPS\_SOP\_COLLECTION\_WORD is set to GPS\_RA\_RCVD.  
  
 BIT 4 of GPS\_SOP\_COLLECTION\_WORD = GPS\_RA\_RCVD
4. Bits 5 to 7 of GPS\_SOP\_COLLECTION\_WORD are set to GPS\_FAIL\_ST\_FLAG<sub>1</sub>, GPS\_FAIL\_ST\_FLAG<sub>2</sub>, and GPS\_FAIL\_ST\_FLAG<sub>3</sub>.  
  
 BIT 5 of GPS\_SOP\_COLLECTION\_WORD = GPS\_FAIL\_ST\_FLAG<sub>1</sub>  
 BIT 6 of GPS\_SOP\_COLLECTION\_WORD = GPS\_FAIL\_ST\_FLAG<sub>2</sub>  
 BIT 7 of GPS\_SOP\_COLLECTION\_WORD = GPS\_FAIL\_ST\_FLAG<sub>3</sub>
5. Bit 8 of GPS\_SOP\_COLLECTION\_WORD is set to GPS\_TIME\_ADJ\_ENBL  
  
 Bit 8 of GPS\_SOP\_COLLECTION\_WORD = GPS\_TIME\_ADJ\_ENBL
6. Flags indicating GPS receivers Built-in-Test in progress are packed into GPS\_SOP\_COLLECTION\_WORD as follows:  
  
 BIT 9 of GPS\_SOP\_COLLECTION\_WORD = GPS\_BIT\_SOP<sub>1</sub>  
 BIT 10 of GPS\_SOP\_COLLECTION\_WORD = GPS\_BIT\_SOP<sub>2</sub>  
 BIT 11 of GPS\_SOP\_COLLECTION\_WORD = GPS\_BIT\_SOP<sub>3</sub>

7. GPS receiver Time-Figure-of-Merits are packed as follows:

BITS 12 to 15 of GPS\_SOP\_COLLECTION\_WORD = BITS 12 to 15 of GPS\_TFOM<sub>2</sub>

BITS 1 to 4 of GPS\_SOP\_COLLECTION\_WORD\_TWO = BITS 12 to 15 of GPS\_TFOM<sub>1</sub>

BITS 5 to 8 of GPS\_SOP\_COLLECTION\_WORD\_TWO = BITS 12 to 15 of GPS\_TFOM<sub>3</sub>

| Table 4.17.6.6-1. GPS_SOP_DL_COMP Input Parameters       |                       |                   |      |           |        |       |           |
|----------------------------------------------------------|-----------------------|-------------------|------|-----------|--------|-------|-----------|
| Description                                              | Name                  | Input Source      | Type | Precision | Range  | Units | Rate (Hz) |
| GPS commfault flag                                       | GPS_COMMFault(I)**    | *                 | D    | 1 Bit     | ON/OFF |       | 1.04      |
| GPS receiver I Time Figure of Merit                      | GPS_TFOM(I)           | NAV_MESSAGE_DATA  | I    | S         | –      | –     | 1.04      |
| GPS receiver I self-test in progress flag                | GPS_BIT_SOP(I)**      | GPS_TO_GPC        | D    | –         | ON/OFF | –     | 1.04      |
| Crew initiated radar altimeter aiding flag               | GPS_RA_RCVD           | *                 | D    | –         | ON/OFF | –     | 6.25      |
| GPS receiver I fail self-test flag                       | GPS_FAIL_ST_FLAG(I)** | TEST_MESSAGE_DATA | D    | –         | ON/OFF | –     | 6.25      |
| GPS time adjustment enable ind                           | GPS_TIME_ADJ_ENBL     | GPS_SOP           | D    | –         | ON/OFF | –     | 6.25      |
| * See principal function input list in Table 4.17.6.10-1 |                       |                   |      |           |        |       |           |
| ** I = 1,2,3 (1 to GPS_SW_CAP)                           |                       |                   |      |           |        |       |           |

| Table 4.17.6.6-2. GPS_SOP_DL_COMP Output Parameters       |                             |                    |      |           |       |       |           |
|-----------------------------------------------------------|-----------------------------|--------------------|------|-----------|-------|-------|-----------|
| Description                                               | Name                        | Output Destination | Type | Precision | Range | Units | Rate (Hz) |
| GPS SOP collection word for downlist                      | GPS_SOP_COLLECTION_WORD     | *                  | HMD  | –         | –     | –     | 6.25      |
| GPS SOP collection word two for downlist                  | GPS_SOP_COLLECTION_WORD_TWO | *                  | HMD  | –         | –     | –     | 6.25      |
| * See principal function output list in Table 4.17.6.10-2 |                             |                    |      |           |       |       |           |

| Table 4.17.6.6-3. Definition of GPS_SOP_COLLECTION_WORD |           |         |           |                                                                       |                               |
|---------------------------------------------------------|-----------|---------|-----------|-----------------------------------------------------------------------|-------------------------------|
| Parameter Description                                   | MSID      | Bit No. | Bit Value | Meaning                                                               | Related Parameter             |
| Spare                                                   |           | 0       |           |                                                                       |                               |
| GPS 1 commfault flag                                    | V93X1237X | 1       | 1         | GPS receiver 1 commfaulted                                            | GPS_COMMFAULT <sub>1</sub>    |
| GPS 2 commfault flag                                    | V93X1152X | 2       | 1         | GPS receiver 2 commfaulted                                            | GPS_COMMFAULT <sub>2</sub>    |
| GPS 3 commfault flag                                    | V93X1238X | 3       | 1         | GPS receiver 3 commfaulted                                            | GPS_COMMFAULT <sub>3</sub>    |
| Crew initiated radar altimeter aiding flag              | V93X1129X | 4       | 1         | Crew has initiated radar altimeter aiding                             | GPS_RA_RCVD                   |
| GPS 1 fail self-test                                    | V93X3243X | 5       | 1         | GPS receiver 1 fail self-test                                         | GPS_FAIL_ST_FLAG <sub>1</sub> |
| GPS 2 fail self-test                                    | V93X3244X | 6       | 1         | GPS receiver 2 fail self-test                                         | GPS_FAIL_ST_FLAG <sub>2</sub> |
| GPS 3 fail self-test                                    | V93X3245X | 7       | 1         | GPS receiver 3 fail self-test                                         | GPS_FAIL_ST_FLAG <sub>3</sub> |
| GPS time adjustment enable indicator                    | V94X0220X | 8       | 1         | GPC-to-GPS Time Adjustment capability is enabled.                     | GPS_TIME_ADJ_ENBL             |
| GPS 1 Built-In Test in progress flag                    | V93X1002X | 9       | 1         | GPS receiver 1 BIT in progress                                        | GPS_BIT_SOP <sub>1</sub>      |
| GPS 2 Built-In Test in progress flag                    | V93X1003X | 10      | 1         | GPS receiver 2 BIT in progress                                        | GPS_BIT_SOP <sub>2</sub>      |
| GPS 3 Built-In Test in progress flag                    | V93X1004X | 11      | 1         | GPS receiver 3 BIT in progress                                        | GPS_BIT_SOP <sub>3</sub>      |
| GPS 2 Time Figure of Merit                              | V93U1001C | 12 - 15 | –         | Binary number representing the Time Figure of Merit of GPS receiver 2 | GPS_TFOM <sub>2</sub>         |

| Table 4.17.6.6-4. Definition of GPS_SOP_COLLECTION_WORD_TWO |           |         |           |                                                                       |                       |
|-------------------------------------------------------------|-----------|---------|-----------|-----------------------------------------------------------------------|-----------------------|
| Parameter Description                                       | MSID      | Bit No. | Bit Value | Meaning                                                               | Related Parameter     |
| Spare                                                       |           | 0       |           |                                                                       |                       |
| GPS 1 Time Figure of Merit                                  | V93U3001C | 1-4     | –         | Binary number representing the Time Figure of Merit of GPS receiver 1 | GPS_TFOM <sub>1</sub> |
| GPS 3 Time Figure of Merit                                  | V93U9001C | 5-8     | –         | Binary number representing the Time Figure of Merit of GPS receiver 3 | GPS_TFOM <sub>3</sub> |
| Spare                                                       |           | 14      |           |                                                                       |                       |
| Spare                                                       |           | 15      |           |                                                                       |                       |

#### 4.17.6.7 GPS IMU Data Processing (GPS\_IMU\_SAVE)

The purpose of the GPS IMU data processing is (1) to reserve a set of selected accumulated IMU velocity counts from IMU RM and its associated time tag to be assigned to the GPS state vector, and (2) to choose the latest available GPS state vector which is bracketed in time by the available IMU data. The IMU data selection process requires that the chosen IMU data is the closest in time, but prior, to the corresponding GPS state. These saved IMU velocity counts shall be used by the GPS Receiver State Proc principal function to propagate the GPS state vector.

A. Functional Requirements. The GPS\_IMU\_SAVE module is required to perform the following function:

1. Store the most recent IMU data in buffer which accommodates 12 sets of selected IMU counts.
2. Determine the most appropriate IMU counts from the buffer to assign to the selected GPS states.

B. Interface Requirements. The input and output parameters associated with GPS\_IMU\_SAVE module are contained in Tables 4.17.6.7-1 and 4.17.6.7-2.

C. Detailed Requirements and Formulations. The following operations shall be performed by the GPS\_IMU\_SAVE module. Figure 4.17.6.7 presents a flow diagram of the GPS\_IMU\_SAVE functional requirements.

1. The time tag and the selected accumulated velocity counts shall be stored into the buffer in a cyclic manner. The buffer is designed to accommodate 12 sets of IMU data. With GPS SOP running at 6.25 Hz, the buffer size of 12 is equivalent to 1.92 seconds of IMU data. With aiding, the receiver outputs state vector at the state aiding time. The output state read by GPC can be up to 640 ms old. The 1.92 seconds of buffer size is well padded to cover the inherent latency and other system transport lags.

If the buffer index is equal to or greater than 12, it shall be set to 1 and the flag to indicate that the buffer is full shall be set to ON, otherwise, the index shall be increased by 1. The IMU data shall be stored in the appropriate buffers.

```
IF GPS_IMU_INDEX >= 12 THEN
 GPS_IMU_INDEX = 1
 GPS_IMU_BUFFER_FULL = ON
ELSE
 GPS_IMU_INDEX = GPS_IMU_INDEX + 1
```

```
 $\bar{V}_{IMU_BUFFER_{GPS_IMU_INDEX}} = \bar{V}_{IMU_GPS_SOP}$
 $T_{IMU_BUFFER_{GPS_IMU_INDEX}} = T_{IMU_GPS_SOP}$
```

2. Before the IMU buffers are fully stored, the GPS data good flags (GPS\_DG\_SOP<sub>i</sub>) are overridden to the OFF state indicating that no IMU data is yet available for the GPS Receiver State Proc to propagate the GPS states properly.

```
IF GPS_IMU_BUFFER_FULL = OFF THEN GPS_DG_SOP = (OFF,OFF,OFF)
ELSE do step 3 below
```

3. The following shall be performed for each of the GPS receivers.

3.1 If the new GPS navigation data is not already IMU bracketed as indicated by the flag, IMU\_BRACKET\_NEW<sub>i</sub> being OFF, then the following paragraphs 3.1.1 and 3.1.2 are performed.

3.1.1 The IMU time tag buffer shall be examined in order to find the most current IMU data that is NOT more recent than the GPS state. Firstly, the flag indicating search complete, FOUND\_LOW, shall be set OFF. Next, the 12 elements of the T\_IMU\_BUFFER is checked against the new GPS time, T\_GPS\_NEW<sub>i</sub>. This comparison shall be initiated at the most current IMU time which resides in the buffer pointed by the index, GPS\_IMU\_INDEX. If the GPS time is less than the IMU time, the search index will be lowered by one. However, if the index is zero or negative, it shall be added to the size of the buffer, 12, in order to continue the search. If the IMU time is found to be less than or equal to the GPS time, the search process terminates. The IMU data will be saved and assigned to the associated input GPS state.

```
FOUND_LOW = OFF
DO FOR k = 0 to 11 WHILE (FOUND_LOW = OFF)
 INDEX = GPS_IMU_INDEX - k
 IF INDEX <= 0 THEN
 INDEX = INDEX + 12
 IF T_GPS_NEWi >= T_IMU_BUFFERINDEX THEN
 FOUND_LOW = ON
```

```
 $\bar{V}_{IMU_NEW}_i = \bar{IMU_BUFFER}_{INDEX}$
 $T_{IMU_NEW}_i = T_{IMU_BUFFER}_{INDEX}$
```

3.1.2 If the loop index, k, in step 3.1.1 above is found to be greater than zero, indicating that the new GPS data is bracketed by IMU data in time, then the flag IMU\_BRACKET\_NEW<sub>i</sub> is set ON and the associated input GPS state and IMU data are copied into the parameters for output to the GPS Receiver State Proc principal function.

```
IF k > 0 THEN
 IMU_BRACKET_NEWi = ON
 T_GPS_SOPi = T_GPS_NEWi
 $\bar{R}_{GPS_ECEF_SOP}_i = \bar{R}_{GPS_ECEF_NEW}_i$
 $\bar{V}_{GPS_ECEF_SOP}_i = \bar{V}_{GPS_ECEF_NEW}_i$
 GPS_DG_SOPi = ON
 GPS_FAIL_FOM_SOPi = GPS_FAIL_FOM_NEWi
 FOM_SOPi = FOM_NEWi
 $\bar{V}_{IMU_SAVE_SOP} = \bar{V}_{IMU_NEW}_i$
 T_IMU_SAVE_SOPi = T_IMU_NEWi
```

#### D. Special Consideration.

1. The GPS\_IMU\_INDEX shall be initialized to zero at each OPS transition except OPS1 to OPS6. The GPS\_IMU\_BUFFER\_FULL shall be initialized to OFF at each OPS transition except OPS1 to OPS6. When IMU SOP executes at 1.04 Hz, the IMU\_BUFFER will store multiple copies of same IMU data, since the module is executed at 6.25 Hz.



2. The flag IMU\_BRACKET\_NEW<sub>i</sub> shall be initialized to ON.
3. In the unlikely event that the GPS state is older in time than the oldest IMU data in the IMU BUFFER, the oldest IMU velocity counts are chosen to be associated with the GPS state which is then considered IMU-bracketed.

Table 4.17.6.7-1. GPS\_IMU\_SAVE Input Parameters

| Description                                                  | Name                   | Input Source     | Type | Precision | Range  | Units  | Rate (Hz)     |
|--------------------------------------------------------------|------------------------|------------------|------|-----------|--------|--------|---------------|
| Figure of merit associated with “NEW” GPS I data             | FOM_NEW(I)**           | NAV_MESSAGE_DATA | I    | S         | 1 - 9  | –      | 1.04          |
| Flag indicating GPS I failed FOM threshold                   | GPS_FAIL_FOM_NEW(I)**  | GPS_QA1_CHECK    | D    | –         | ON/OFF | –      |               |
| Position vector of “NEW” GPS I data                          | R_GPS_ECEF_NEW(I)**    | NAV_MESSAGE_DATA | V    | DP        | –      | ft     | 1.04          |
| Time tag of “NEW” GPS receiver I data                        | T_GPS_NEW(I)**         | NAV_MESSAGE_DATA | S    | DP        | –      | sec    | 1.04          |
| Time tag of current accumulated IMU velocity counts          | T_IMU_GPS_SOP          | *                | F    | DP        | –      | sec    | 1.04/<br>6.25 |
| Velocity vector of “NEW” GPS I data                          | V_GPS_ECEF_NEW(I)**    | NAV_MESSAGE_DATA | V    | S         | –      | ft/sec | 1.04          |
| Current selected accumulated IMU velocity counts             | $\bar{V}$ _IMU_GPS_SOP | *                | V    | DP        |        | ft/sec | 1.04/<br>6.25 |
| Flag indicating GPS data has been time bracketed by IMU data | IMU_BRACKET_NEW(I)**   | NAV_MESSAGE_DATA | D    | –         | ON/OFF | –      | 6.25          |

\* See principal function input list in Table 4.17.6.10-1  
\*\* I = 1,2,3 (1 to GPS\_SW\_CAP)

| Table 4.17.6.7-2. GPS_IMU_SAVE Output Parameters                                |                                 |                    |      |           |        |        |           |
|---------------------------------------------------------------------------------|---------------------------------|--------------------|------|-----------|--------|--------|-----------|
| Description                                                                     | Name                            | Output Destination | Type | Precision | Range  | Units  | Rate (Hz) |
| Figure of merit associated with GPS data sent to GPS Receiver State Proc        | FOM_SOP(I)**                    | *                  | I    | S         | 1 - 9  | –      | 6.25      |
| Data good flag of GPS data sent to GPS Receiver State Proc                      | GPS_DG_SOP(I)**                 | *                  | D    | –         | ON/OFF |        | 6.25      |
| Failing FOM flag for GPS data sent to GPS Receiver State Proc                   | GPS_FAIL_FOM_SOP(I)**           | *                  | D    | –         | ON/OFF |        | 6.25      |
| Flag indicating that the IMU buffer is full                                     | GPS_IMU_BUFFER_FULL             | NAV_MESSAGE_DATA   | D    | –         | ON/OFF | –      | 6.25      |
| Flag indicating GPS data has been time-bracketed by IMU data                    | IMU_BRACKET_NEW(I)**            | NAV_MESSAGE_DATA   | D    | –         | ON/OFF | –      | 6.25      |
| Position vector of GPS data sent to GPS Receiver State Proc                     | $\bar{R}_{GPS\_ECEF\_SOP(I)**}$ | *                  | V    | DP        | –      | ft     | 6.25      |
| Time tag of GPS data sent to GPS Receiver State Proc                            | T_GPS_SOP(I)**                  | *                  | S    | DP        | –      | sec    | 6.25      |
| Time tag of IMU counts associated with GPS data sent to GPS Receiver State Proc | T_IMU_SAVE_SOP(I)**             | *                  | S    | DP        | –      | sec    | 6.25      |
| Velocity vector of GPS data sent to GPS Receiver State Proc                     | $\bar{V}_{GPS\_ECEF\_SOP(I)**}$ | *                  | V    | S         | –      | ft/sec | 6.25      |
| Accumulated IMU velocity count associated with the GPS receiver I states        | $\bar{V}_{IMU\_SAVE\_SOP(I)**}$ | *                  | V    | DP        |        | ft/sec | 6.25      |

\* See principal function output list in Table 4.17.6.10-2  
 \*\* I = 1,2,3 (1 to GPS\_SW\_CAP)

**4.17.6.8 GPS SOP Time Adjustment Uplink Processing (GPS\_SOP\_TIME\_ADJ\_UPLINK)**

The flight software shall provide the capability to adjust the GPS SOP time calculations in response to a command uplink from the ground in OPS 9, OPS 1/6, MM201, and OPS 3. The GPS SOP shall use the uplinked GPS-to-GMT time adjustment factor (T\_GPS\_TO\_GMT\_ADJ) contained in this uplink during all GNC OPS phases where the GPS SOP is running.

A. Functional Requirements. The flight software is required to process the GPS SOP Time Adjustment uplink, update the GPS-to-GMT time adjustment parameter and make it available for use in the GPS SOP.

B. Interface Requirements. The input and output parameters associated with the GPS SOP Time Adjustment uplink processing are listed in Tables 4.17.6.8-1 and 4.17.6.8-2.

C. Detailed Requirements. The following operations shall be performed by the flight software when processing the GPS SOP Time Adjustment uplink:

1. The Op Code associated with the uplink shall be tested to see if this is a GPS SOP Time Adjustment uplink, indicated by the Op Code being set to 0111111 binary (63 decimal). If the OP Code is equal to 0111111 binary, then proceed with step 2. Otherwise, this is not a GPS SOP Time Adjustment uplink, and further processing is not required.

IF OP\_CODE = 0111111, then do step 2.

2. Set the GPS-to-GMT time adjustment factor (T\_GPS\_TO\_GMT\_ADJ) equal to the uplinked value (GPS\_TO\_GMT\_ADJ). Then, set the Op Code to 0000000 to prevent repeated processing of the uplink.

T\_GPS\_TO\_GMT\_ADJ = GPS\_TO\_GMT\_ADJ  
OP\_CODE = 0000000

D. Special Considerations. Processing of the GPS SOP Time Adjustment uplink shall occur any time the uplink is received, regardless of whether the GPS SOP is running or not. The GPS-to-GMT time adjustment parameter (T\_GPS\_TO\_GMT\_ADJ) shall initially be set to zero, and shall be carried across all GN&C OPS transitions and used by the GPS SOP in all OPS where the GPS SOP is running.

E. Supplementary Information. Figure 4.17.6.8 is a flowchart illustrating the functional requirements for the GPS SOP Time Adjustment uplink processing.

| Table 4.17.6.8-1. GPS SOP Time Adjustment Uplink Processing Input Parameters |                |                   |      |           |       |       |           |
|------------------------------------------------------------------------------|----------------|-------------------|------|-----------|-------|-------|-----------|
| Description                                                                  | Name           | Input Source      | Type | Precision | Range | Units | Rate (Hz) |
| Uplink operations code                                                       | OP_CODE        | Uplink Processing | HXS  | -         | -     | -     | 6.25      |
| Buffered GPS to GMT time adjustment                                          | GPS_TO_GMT_ADJ | Uplink Processing | F    | DP        | -     | sec   | On Demand |

| Table 4.17.6.8-2. GPS SOP Time Adjustment Uplink Processing Output Parameters |                  |                                                  |      |           |       |       |           |
|-------------------------------------------------------------------------------|------------------|--------------------------------------------------|------|-----------|-------|-------|-----------|
| Description                                                                   | Name             | Destination                                      | Type | Precision | Range | Units | Rate (Hz) |
| Uplink operations code                                                        | OP_CODE          | Uplink Processing                                | HXS  | -         | -     | -     | On Demand |
| GPS to GMT time adjustment                                                    | T_GPS_TO_GMT_ADJ | NAV_MESSAGE_DATA, RCVR_AIDING_DATA, GPS_ALT_DATA | F    | DP        | -     | sec   | On Demand |

#### 4.17.6.9 GPS SOP Time Adjustment (GPS\_TIME\_ADJ)

The flight software shall provide the capability to adjust the GPS SOP time when this capability is enabled.

A. Functional Requirements. This module computes the accumulated GPS time adjustment required to center the GPS time tag minus the GPC time tag at a predetermined I-Load value.

B. Interface Requirements. The input and output parameters associated with the GPS SOP Time Adjustment are listed in Table 4.17.6.9-1 and Table 4.17.6.9-2.

C. Detailed Requirements. The following operation shall be performed by the flight software when processing GPS SOP Time Adjustment.

1. GPS age-of-aiding data shall be selected based on GPS receiver communication fault statuses and the GPS receiver modes and data validities. An index (INDEX) with possible values from 0 to 7 is used as a pointer to the appropriate GPS\_AOA selection algorithms. If INDEX equals 0, the software shall perform no age-of-aiding data selection. The INDEX is computed as follows:

INDEX =

1 ((NOT GPS\_COMMFAULT<sub>1</sub>) AND (GPS\_MODE\_CURRENT<sub>1</sub> = "NAV") AND  
(NOT CREW\_DES\_RCVR\_SOP<sub>1</sub>) AND (GPS\_NAV\_DATA\_VALID<sub>1</sub> = ON))  
+ 2 ((NOT GPS\_COMMFAULT<sub>2</sub>) AND (GPS\_MODE\_CURRENT<sub>2</sub> = "NAV") AND  
(NOT CREW\_DES\_RCVR\_SOP<sub>2</sub>) AND (GPS\_NAV\_DATA\_VALID<sub>2</sub> = ON))  
+ 4 ((NOT GPS\_COMMFAULT<sub>3</sub>) AND (GPS\_MODE\_CURRENT<sub>3</sub> = "NAV") AND  
(NOT CREW\_DES\_RCVR\_SOP<sub>3</sub>) AND (GPS\_NAV\_DATA\_VALID<sub>3</sub> = ON))

- 1.1 If INDEX equals 7, then the selected age-of-aiding (GPS\_AOA\_SEL) is the mid value of the three GPS receivers age-of-aiding.

IF (INDEX = 7) THEN

GPS\_AOA\_SEL = MIDVAL(GPS\_AOA<sub>1</sub>, GPS\_AOA<sub>2</sub>, GPS\_AOA<sub>3</sub>)

END IF

- 1.2 If INDEX equals 6, then the selected age-of-aiding is the average of age-of-aiding from GPS receiver 2 and 3.

IF (INDEX = 6) THEN

GPS\_AOA\_SEL = 0.5\*(GPS\_AOA<sub>2</sub> + GPS\_AOA<sub>3</sub>)

END IF

- 1.3 If INDEX equals 5, then the selected age-of-aiding is the average of age-of-aiding from GPS receiver 1 and 3.

IF (INDEX = 5) THEN

GPS\_AOA\_SEL = 0.5\*(GPS\_AOA<sub>1</sub> + GPS\_AOA<sub>3</sub>)

END IF

- 1.4 If INDEX equals 4, then the selected age-of-aiding is the age-of-aiding from GPS receiver 3.

```
IF (INDEX = 4) THEN
 GPS_AOA_SEL = GPS_AOA3
END IF
```

- 1.5 If INDEX equals 3, then the selected age-of-aiding is the average of age-of-aiding from GPS receiver 1 and 2.

```
IF (INDEX = 3) THEN
 GPS_AOA_SEL = 0.5*(GPS_AOA1 + GPS_AOA2)
END IF
```

- 1.6 If INDEX equals 2, then the selected age-of-aiding is the age-of-aiding from GPS receiver 2.

```
IF (INDEX = 2) THEN
 GPS_AOA_SEL = GPS_AOA2
END IF
```

- 1.7 If INDEX equals 1, then the selected age-of-aiding is the age-of-aiding from GPS receiver 1.

```
IF (INDEX = 1) THEN
 GPS_AOA_SEL = GPS_AOA1
END IF
```

2. The remnant of the GPC-to-GPS time adjustment (T\_GPS\_GPC\_REM) is equal to the selected age-of-aiding data minus the predetermined I-Load value (GPC\_GPS\_TARGET).

$$T\_GPS\_GPC\_REM = GPS\_AOA\_SEL - GPC\_GPS\_TARGET$$

3. If the flag indicating GPS announced reset for the GPC-to-GPS time adjustment (GPS\_ANNCD\_RESET\_TIME\_ADJ) is ON, then the accumulated GPS time adjustment (T\_GPS\_TIME\_ADJ\_ACC) shall be incremented with the remnant of the GPC-to-GPS time adjustment. Furthermore, the flag indicating GPS announced reset for the GPC-to-GPS time adjustment shall be set to OFF.

```
IF (GPS_ANNCD_RESET_TIME_ADJ = ON) THEN

 T_GPS_TIME_ADJ_ACC = T_GPS_TIME_ADJ_ACC + T_GPS_GPC_REM
 GPS_ANNCD_RESET_TIME_ADJ = OFF
```

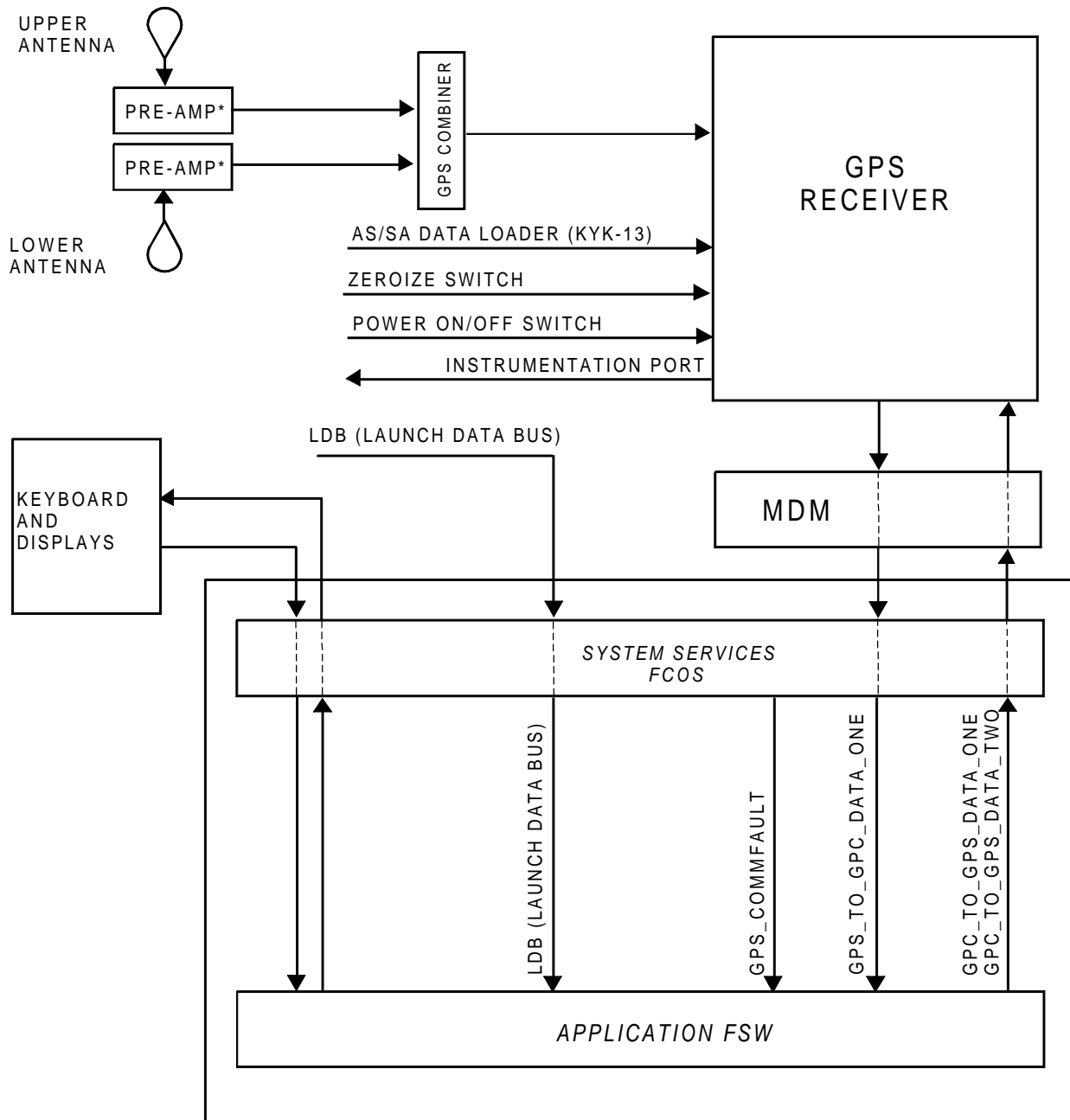
```
END IF
```

D. Special Considerations. The accumulated GPS time adjustment, T\_GPS\_TIME\_ADJ\_ACC, shall be a major-function-based parameter and initialized to 0 in OPS 1.

| Table 4.17.6.9-1 GPS SOP Time Adjustment Input Parameters                                                                                                                               |                          |                    |      |           |                               |       |           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------|------|-----------|-------------------------------|-------|-----------|
| Description                                                                                                                                                                             | Name                     | Input Source       | Type | Precision | Range                         | Units | Rate (Hz) |
| Flag indicating commfault status for GPS receiver I                                                                                                                                     | GPS_COMMFAULT (I)**      | *                  | D    | -         | ON/OFF                        | -     | 1.04      |
| Flag indicating an announced reset for the GPC-to-GPS time adjustment computation                                                                                                       | GPS_ANNCD_RESET_TIME_ADJ | GPS_SOP,*          | D    | -         | ON/OFF                        | -     | 6.25      |
| Target value of GPS time minus GPC time                                                                                                                                                 | GPC_GPS_TARGET           | ***                | I    | S         | -                             | MSEC  | 6.25      |
| GPS receiver I current operating mode indicator                                                                                                                                         | GPS_MODE_CURRENT(I)**    | NAV_MODE_WORD_DATA | CHAR | -         | TEST/<br>INIT/<br>NAV/<br>'B' | -     | 6.25      |
| Flag indicating valid GPS NAV receiver I data                                                                                                                                           | GPS_NAV_DATA_VALID(I)**  | NAV_MODE_WORD_DATA | D    | -         | ON/OFF                        | -     | 6.25      |
| Crew deselected GPS receiver I                                                                                                                                                          | CREW_DES_RCVR_SOP(I)**   | GPS_SOP            | D    | -         | ON/OFF                        | -     | 6.25      |
| Age-of-aiding data from GPS receiver I                                                                                                                                                  | GPS_AOA(I)**             | NAV_MESSAGE_DATA   | HXS  | -         | -                             | MSEC  | 6.25      |
| <p>* See principal function input parameter listed in Table 4.17.6.10-1<br/> ** I ranges from 1 to GPS_SW_CAP<br/> *** See principal function I-Loads parameters, Table 4.17.6.10-3</p> |                          |                    |      |           |                               |       |           |

| Table 4.17.6.9-2 GPS SOP Time Adjustment Output Parameters           |                    |                                                                   |      |           |       |       |           |
|----------------------------------------------------------------------|--------------------|-------------------------------------------------------------------|------|-----------|-------|-------|-----------|
| Description                                                          | Name               | Destination                                                       | Type | Precision | Range | Units | Rate (Hz) |
| Selected age-of-aiding data from GPS receivers                       | GPS_AOA_SEL        | *                                                                 | HXS  | -         | -     | MSEC  | 6.25      |
| Accumulated GPC-to-GPS time adjustment                               | T_GPS_TIME_ADJ_ACC | *,<br>RCVR_AIDING_DATA,<br>GPS_ALT_DATA_CODE,<br>NAV_MESSAGE_DATA | HXS  | -         | -     | MSEC  | 6.25      |
| * See principal funtion output parameter listed in Table 4.17.6.10-2 |                    |                                                                   |      |           |       |       |           |





\* SINGLE STRING GPS ONLY

FIGURE 4.17.1.1-1. GPS Subsystem Block Diagram



\* Air data shall be snapped in Major Mode 304, 305, 602 and 603 only.

\*\* Radar altimeter data shall be snapped in Major Mode 305 and 603 only.

\*\*\* GPS Reference State Proc data shall not be collected in OPS 9.

FIGURE 4.17.6-1.(1) GPS\_SOP (Sheet 1 of 3)

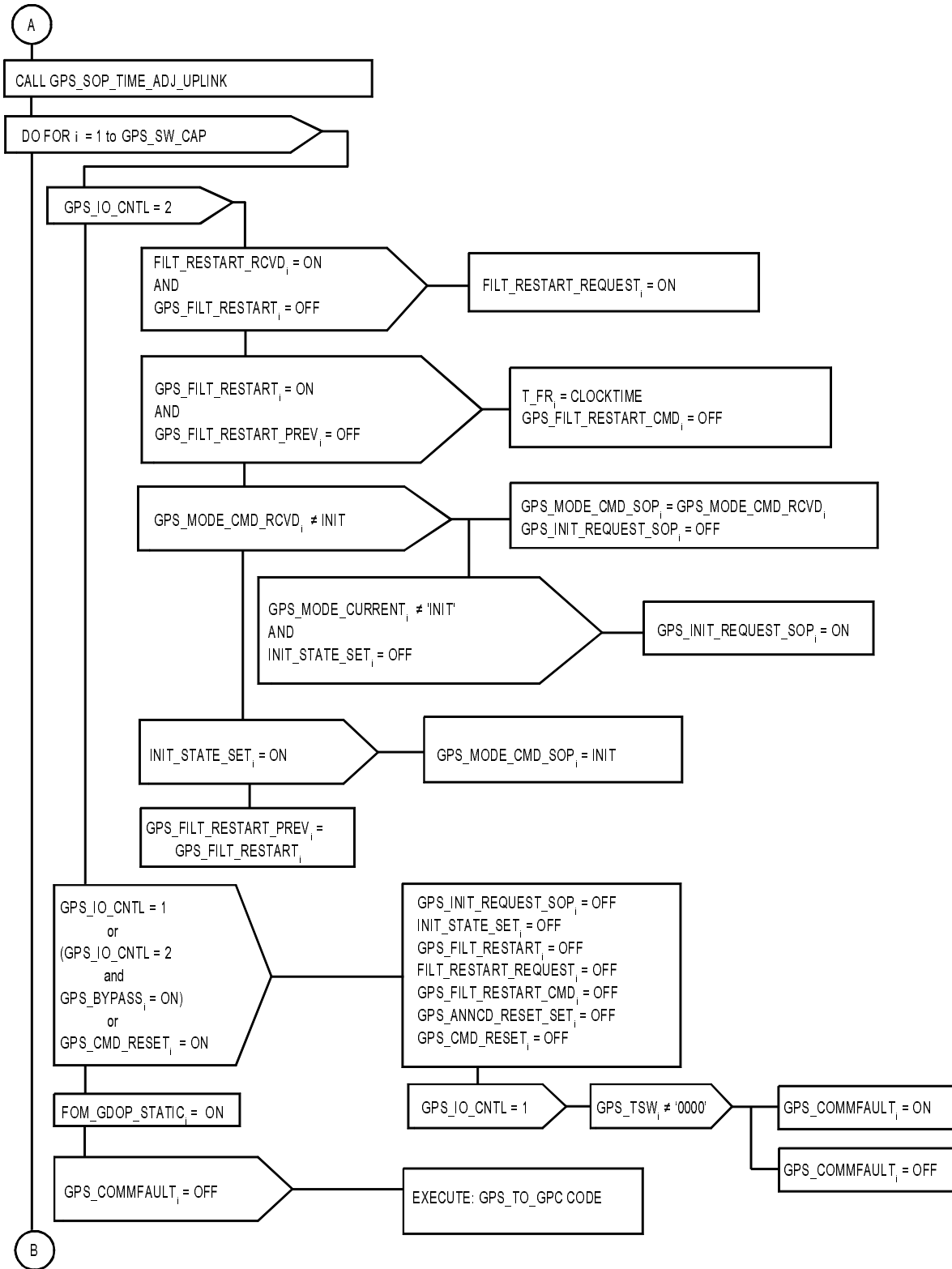


FIGURE 4.17.6-1.(2) GPS\_SOP (Sheet 2 of 3)

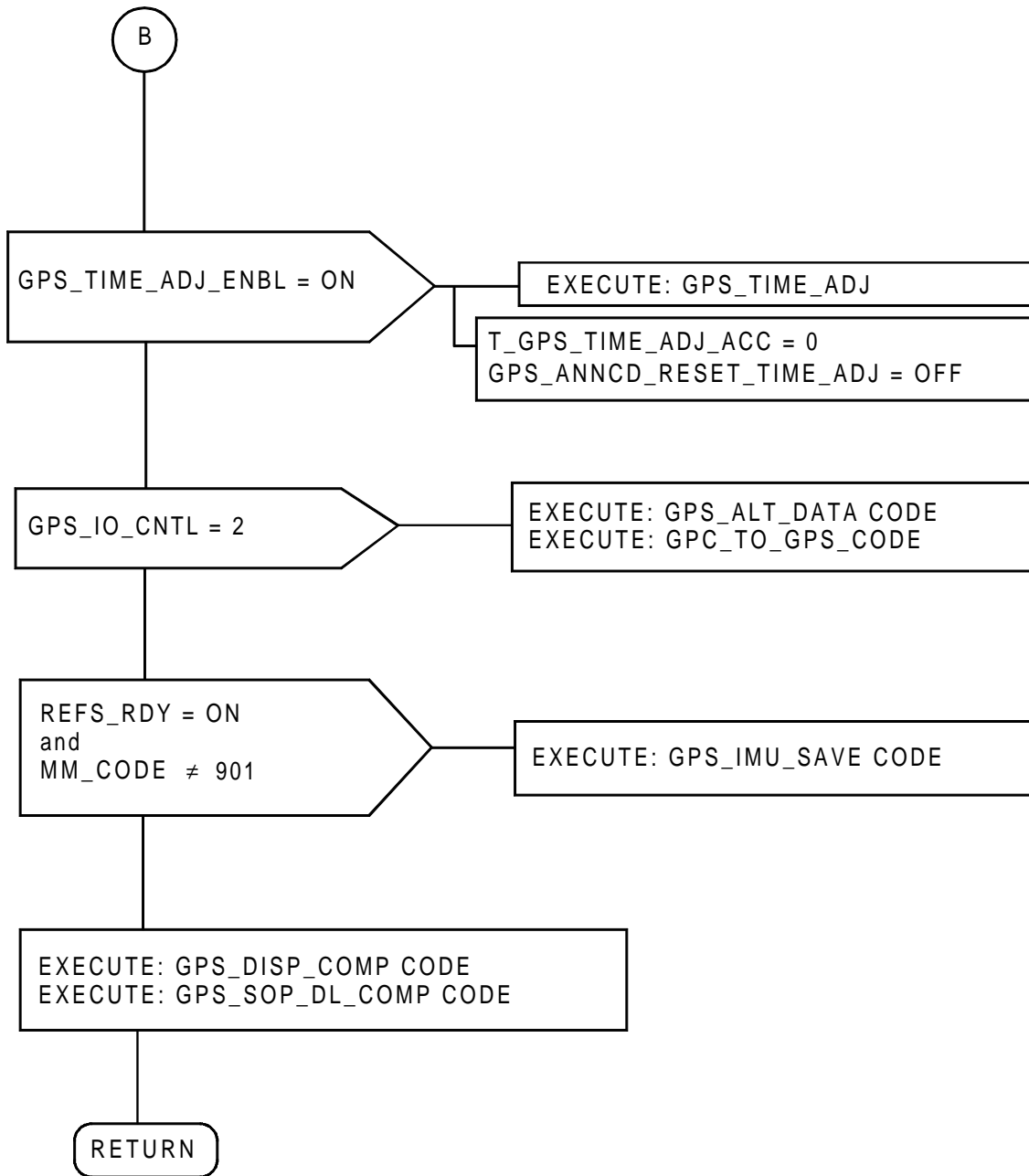


FIGURE 4.17.6-1.(3) GPS\_SOP (Sheet 3 of 3)

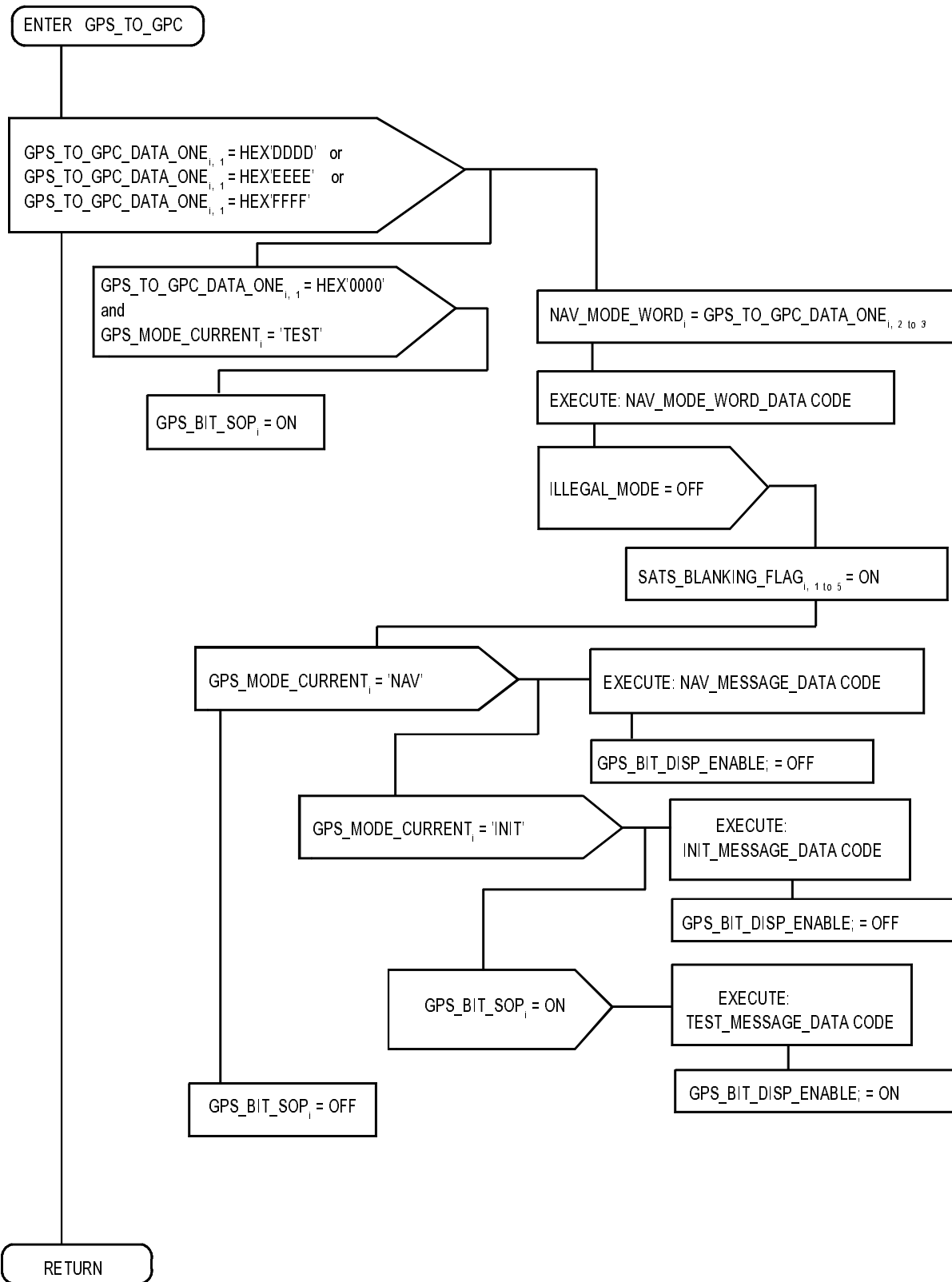


FIGURE 4.17.6.1. GPS\_TO\_GPC CODE

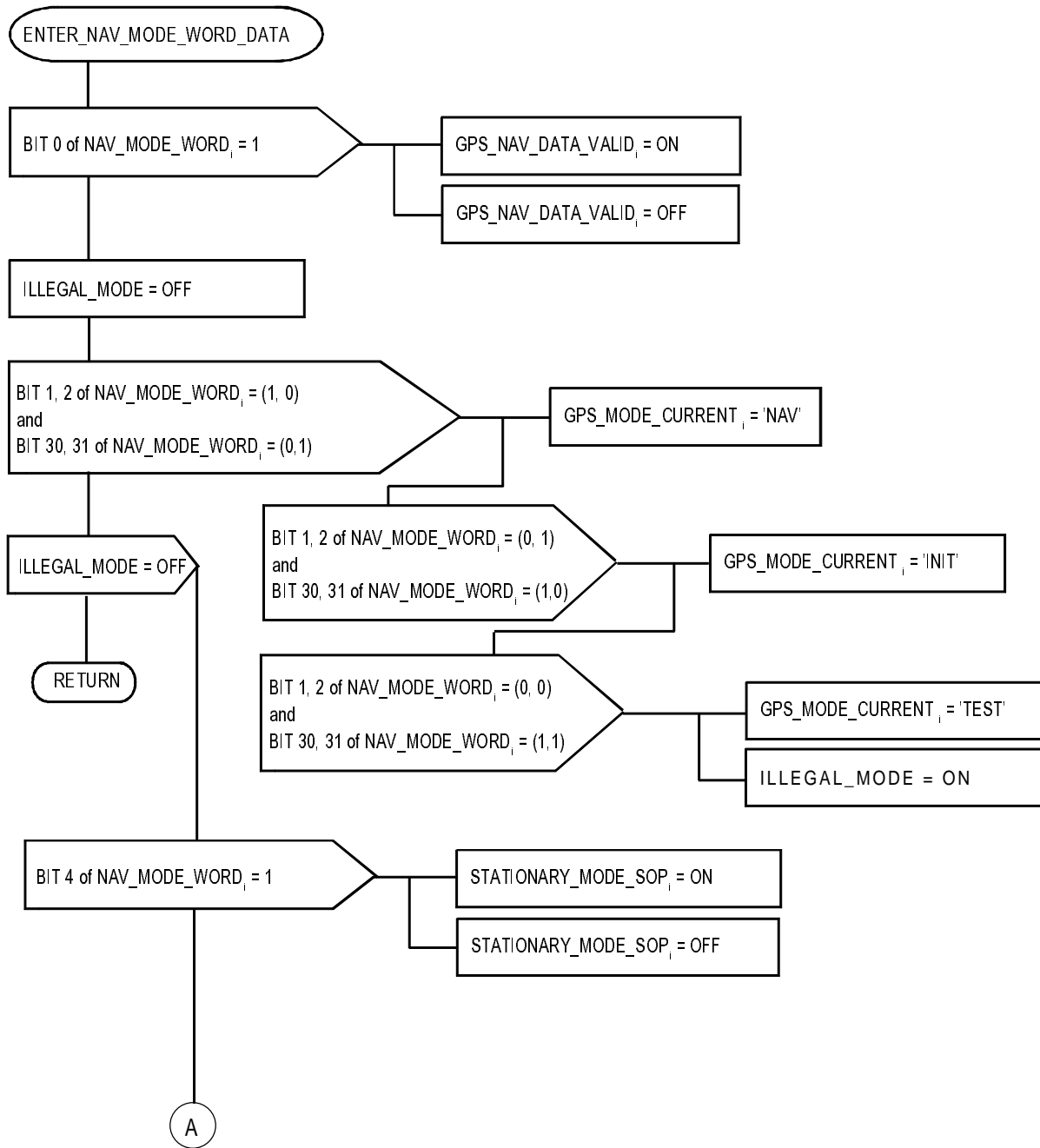


FIGURE 4.17.6.1.1.(1) NAV\_MODE\_WORD\_DATA (Sheet 1 of 2)

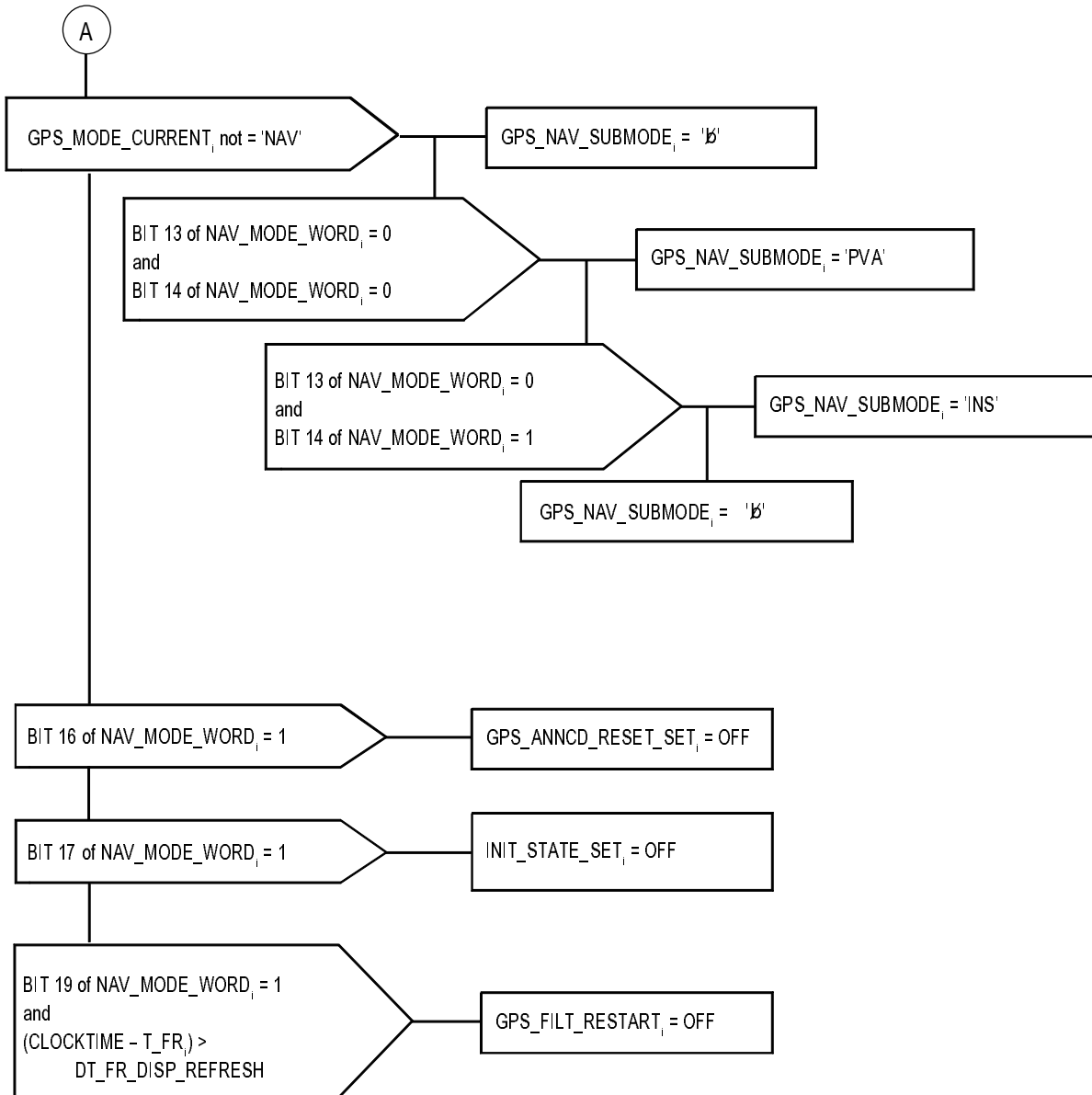


FIGURE 4.17.6.1.1.(2) NAV\_MODE\_WORD\_DATA (Sheet 2 of 2)

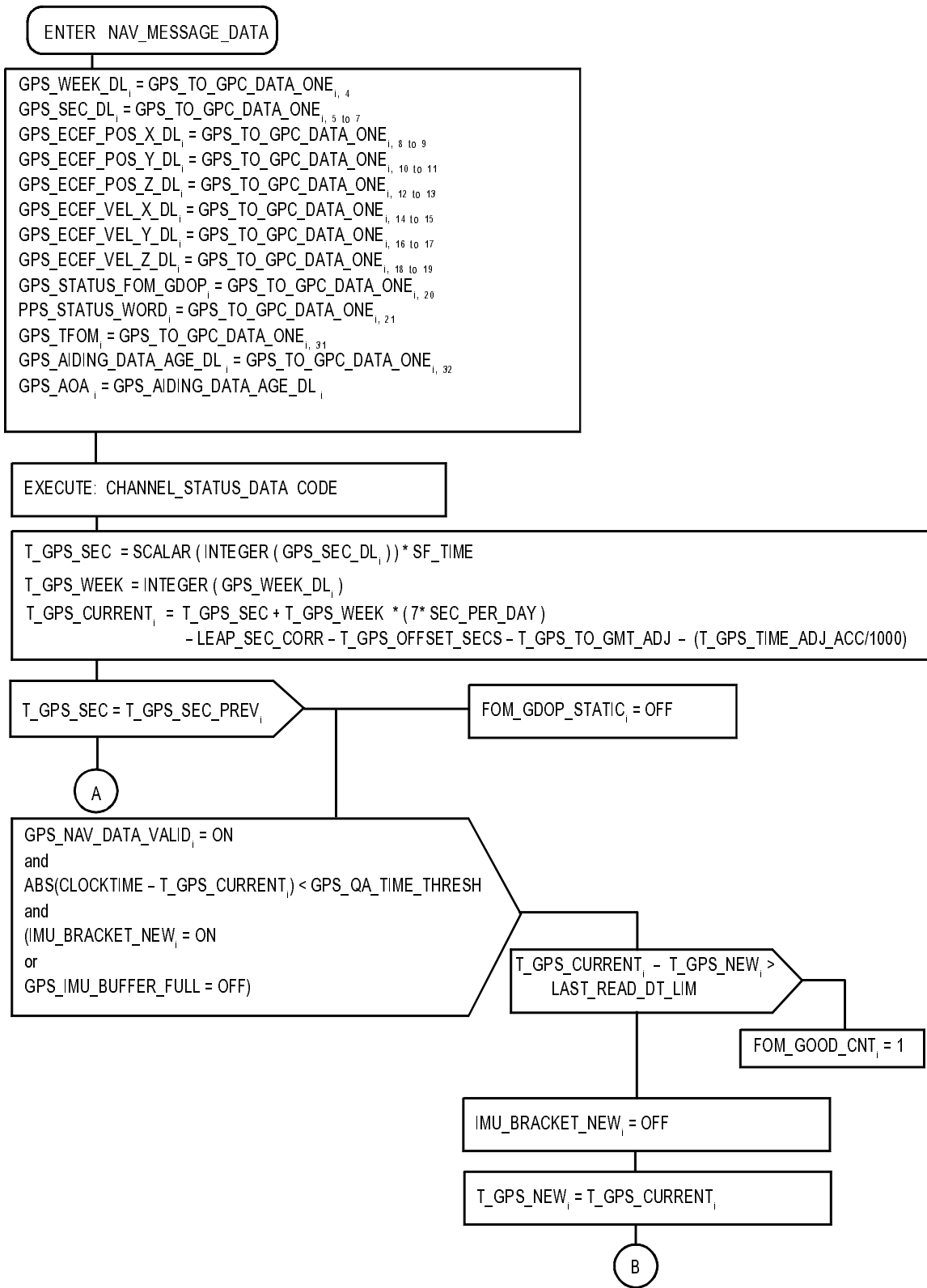


FIGURE 4.17.6.1.2.(1) NAV\_MESSAGE\_DATA CODE (Sheet 1 of 2)



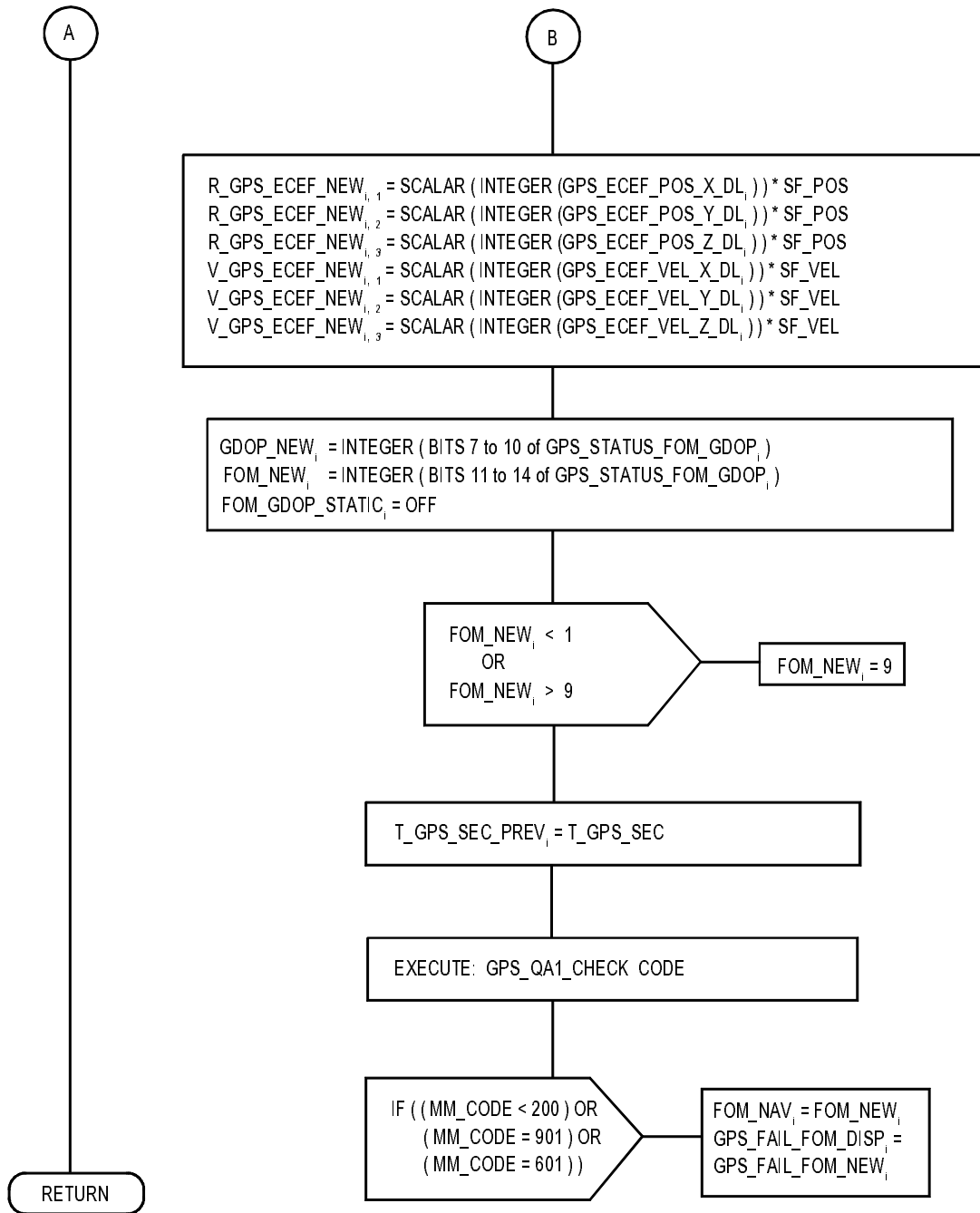


FIGURE 4.17.6.1.2.(2) NAV\_MESSAGE\_DATA CODE (Sheet 2 of 2)

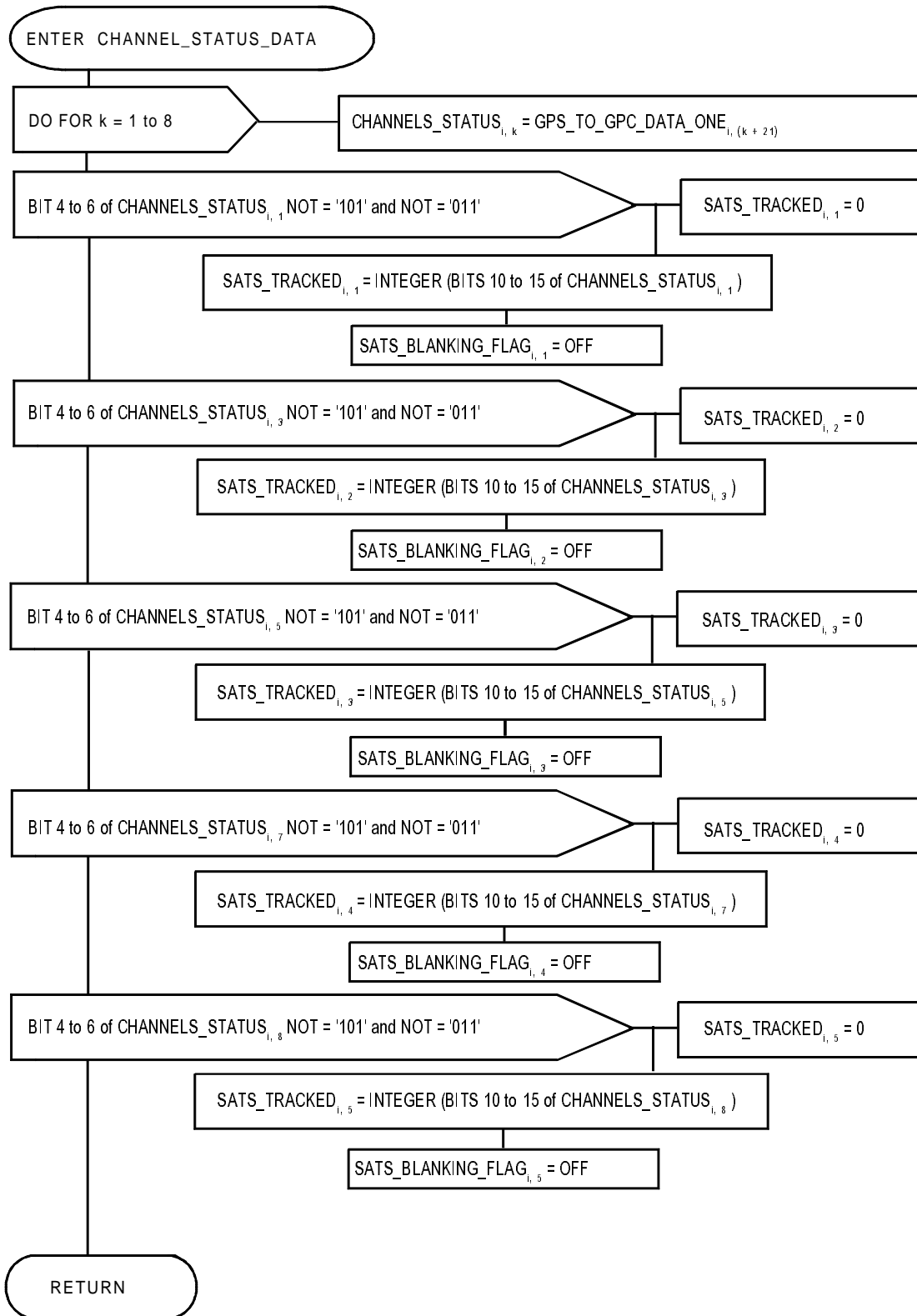


FIGURE 4.17.6.1.2.1. CHANNEL\_STATUS\_DATA CODE

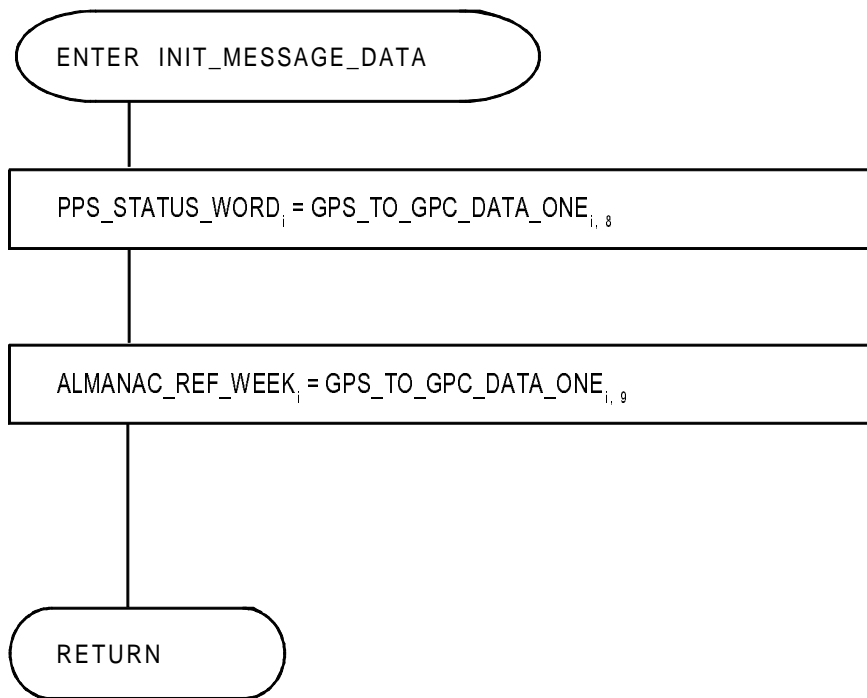


FIGURE 4.17.6.1.3. INIT\_MESSAGE\_DATA CODE

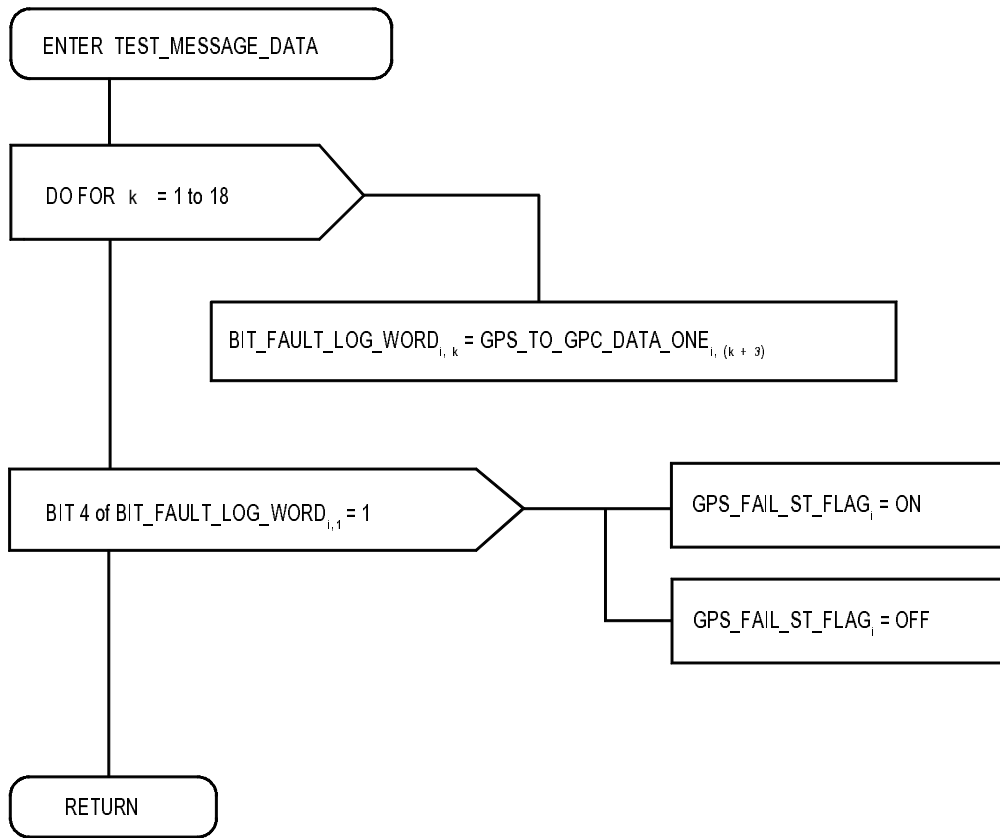


FIGURE 4.17.6.1.4. TEST\_MESSAGE\_DATA CODE

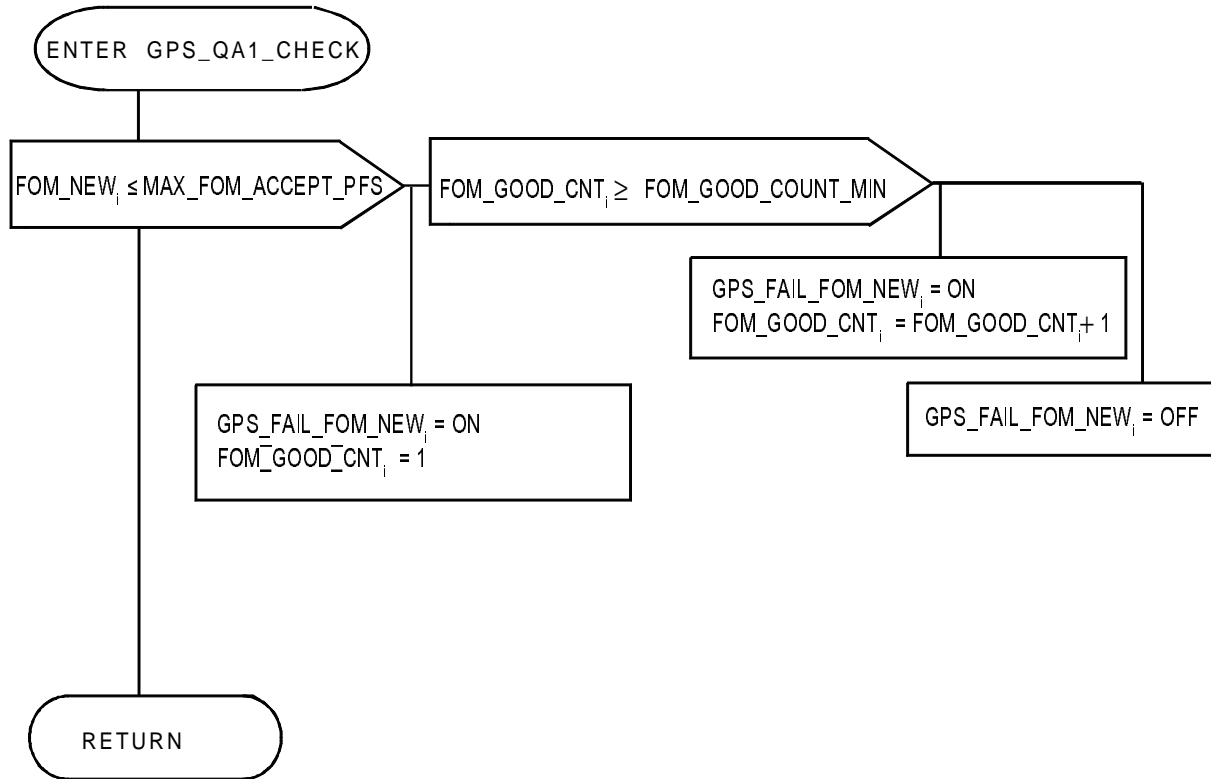


FIGURE 4.17.6.2. GPS\_QA1\_CHECK CODE

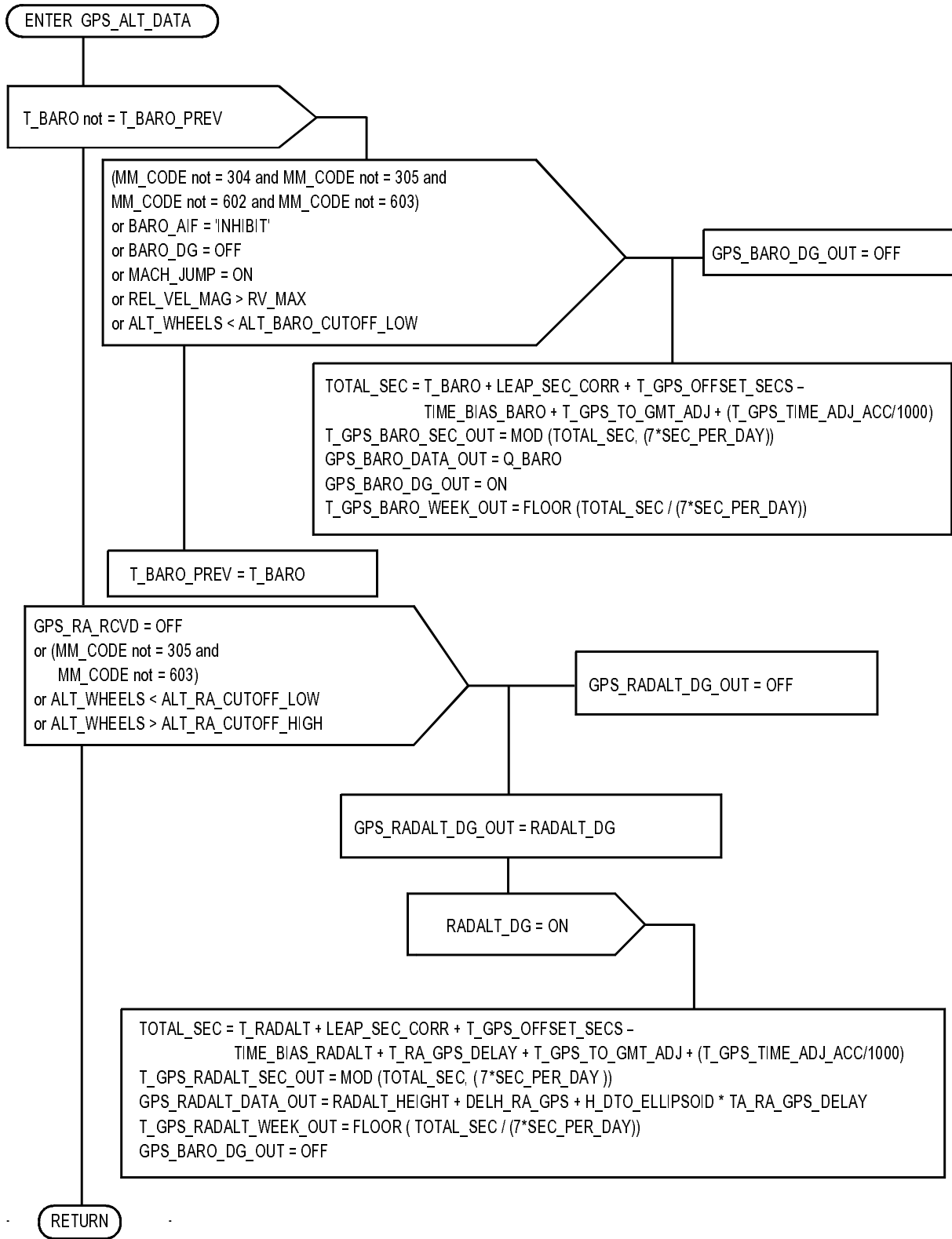


FIGURE 4.17.6.3. GPS\_ALT\_DATA CODE

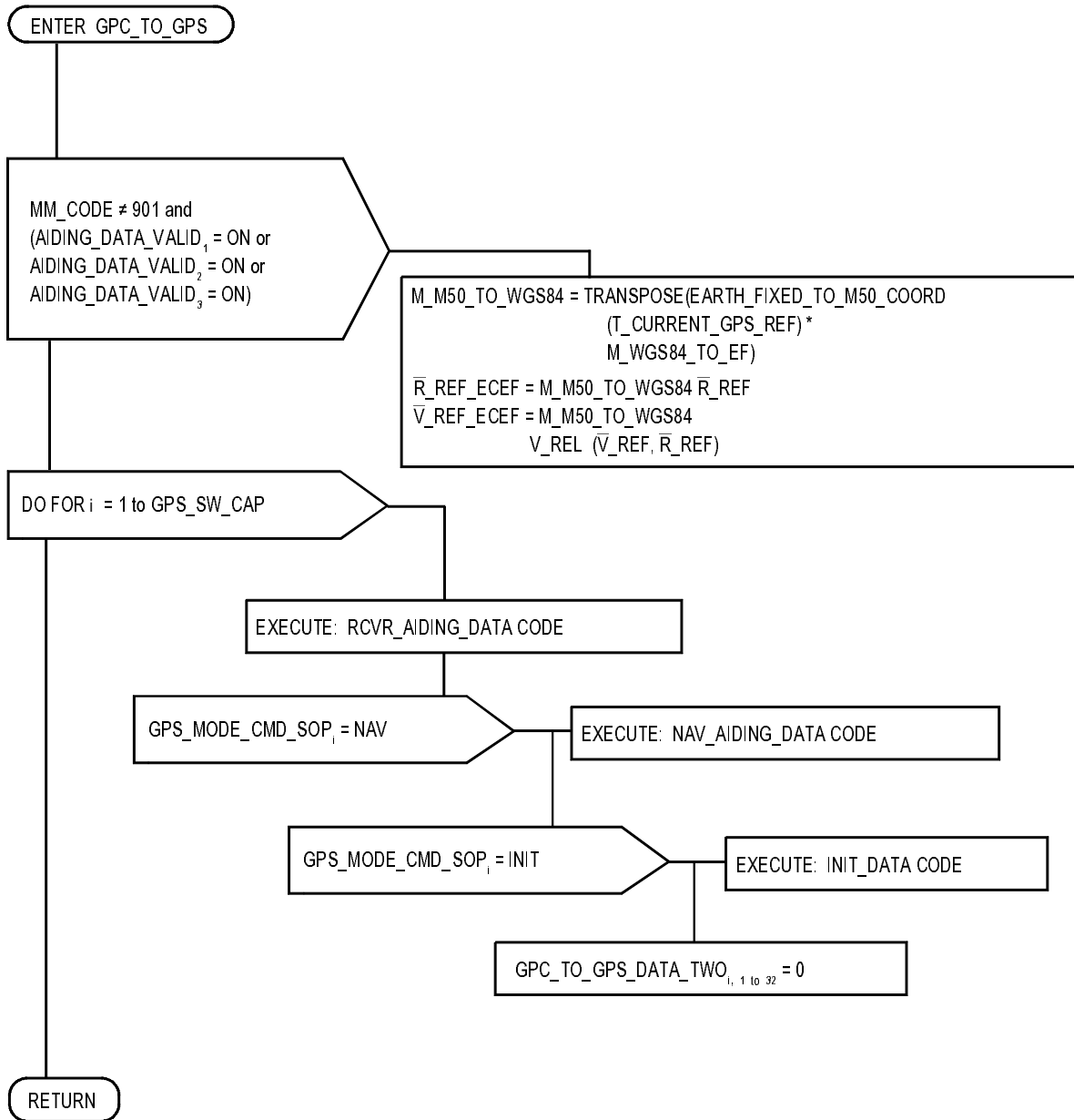


FIGURE 4.17.6.4. GPC\_TO\_GPS CODE

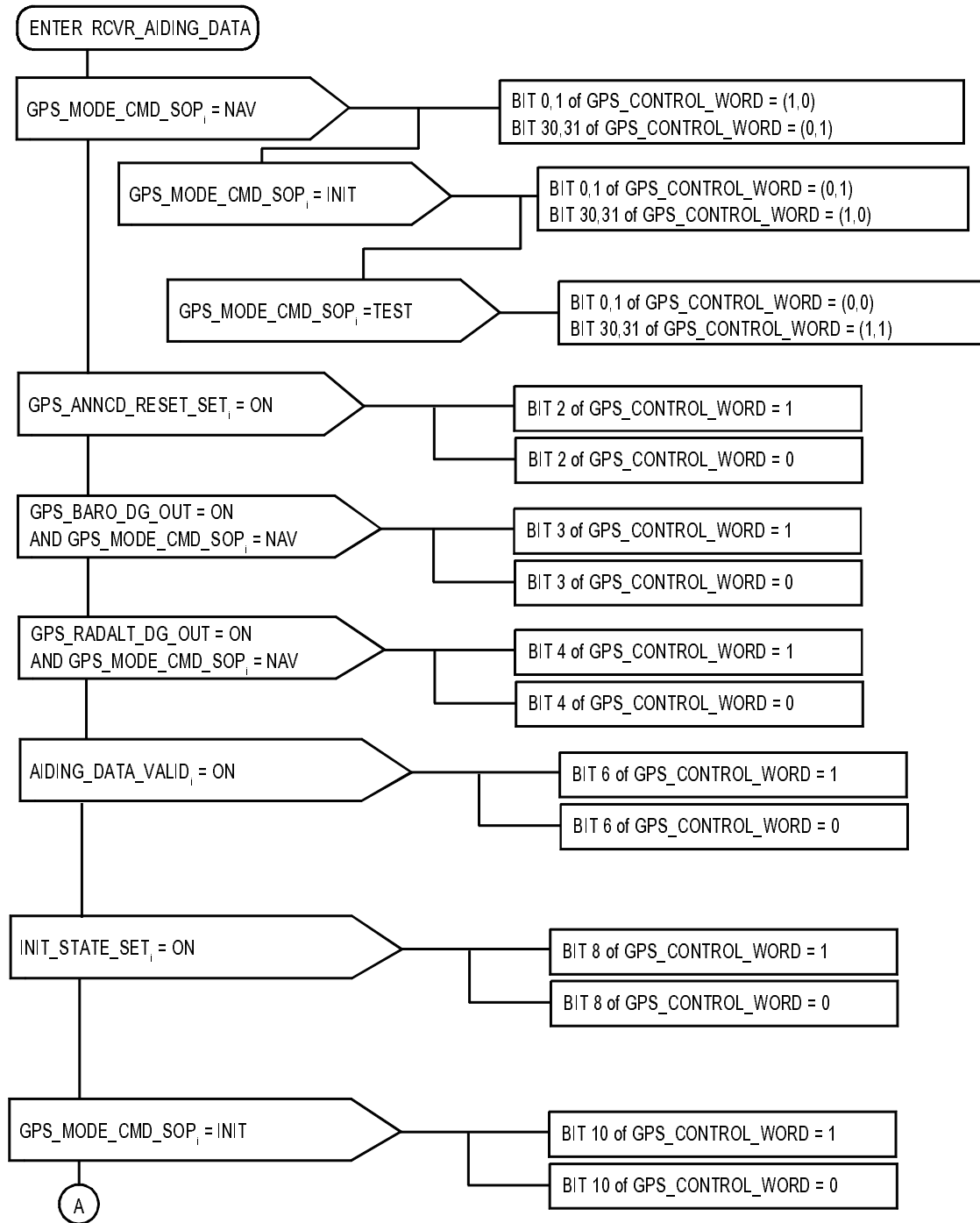


FIGURE 4.17.6.4.1.(1)RCVR\_AIDING\_DATA CODE (Sheet 1 of 4)





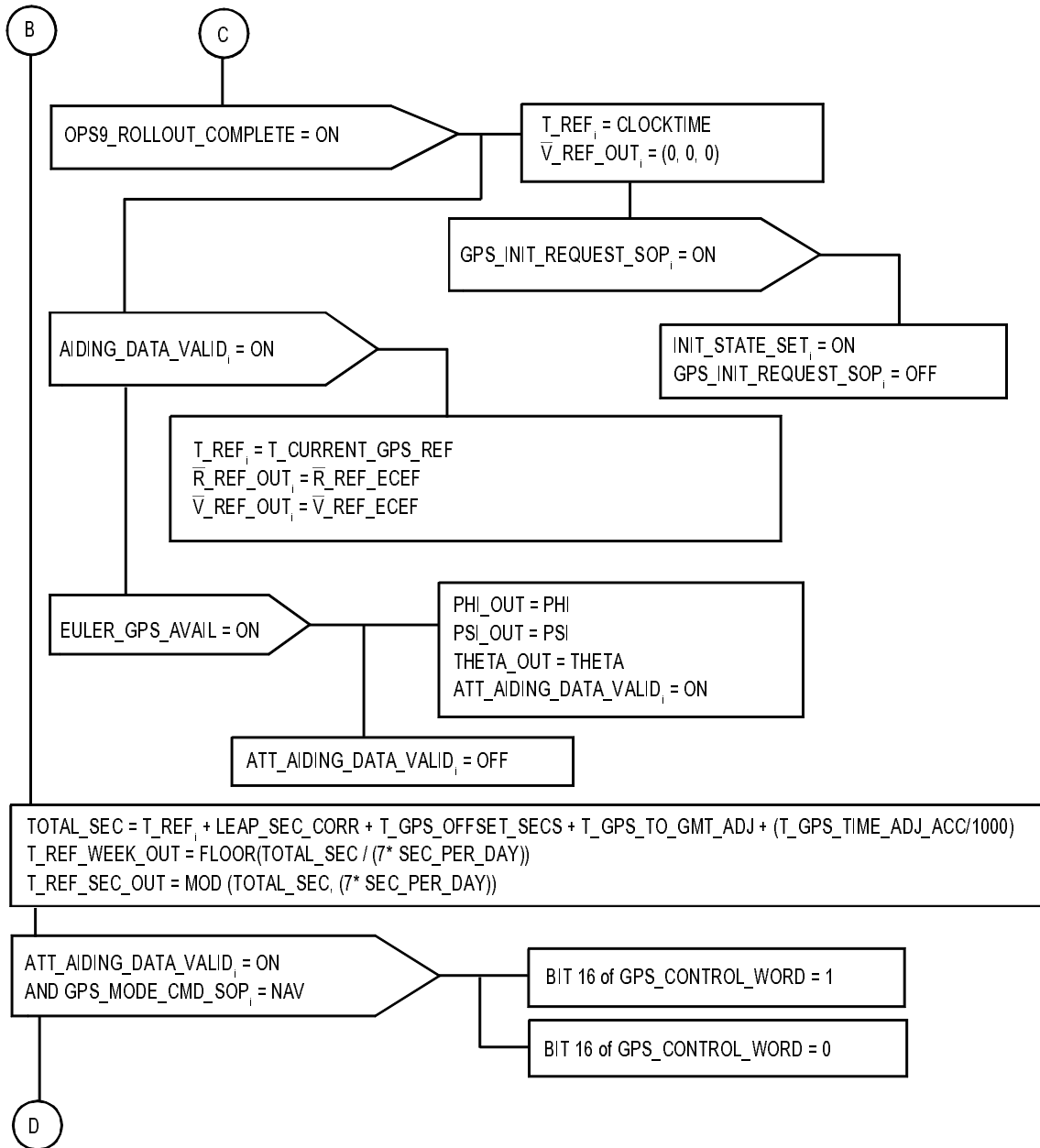


FIGURE 4.17.6.4.1.(3) RCVR\_AIDING\_DATA CODE (Sheet 3 of 4)

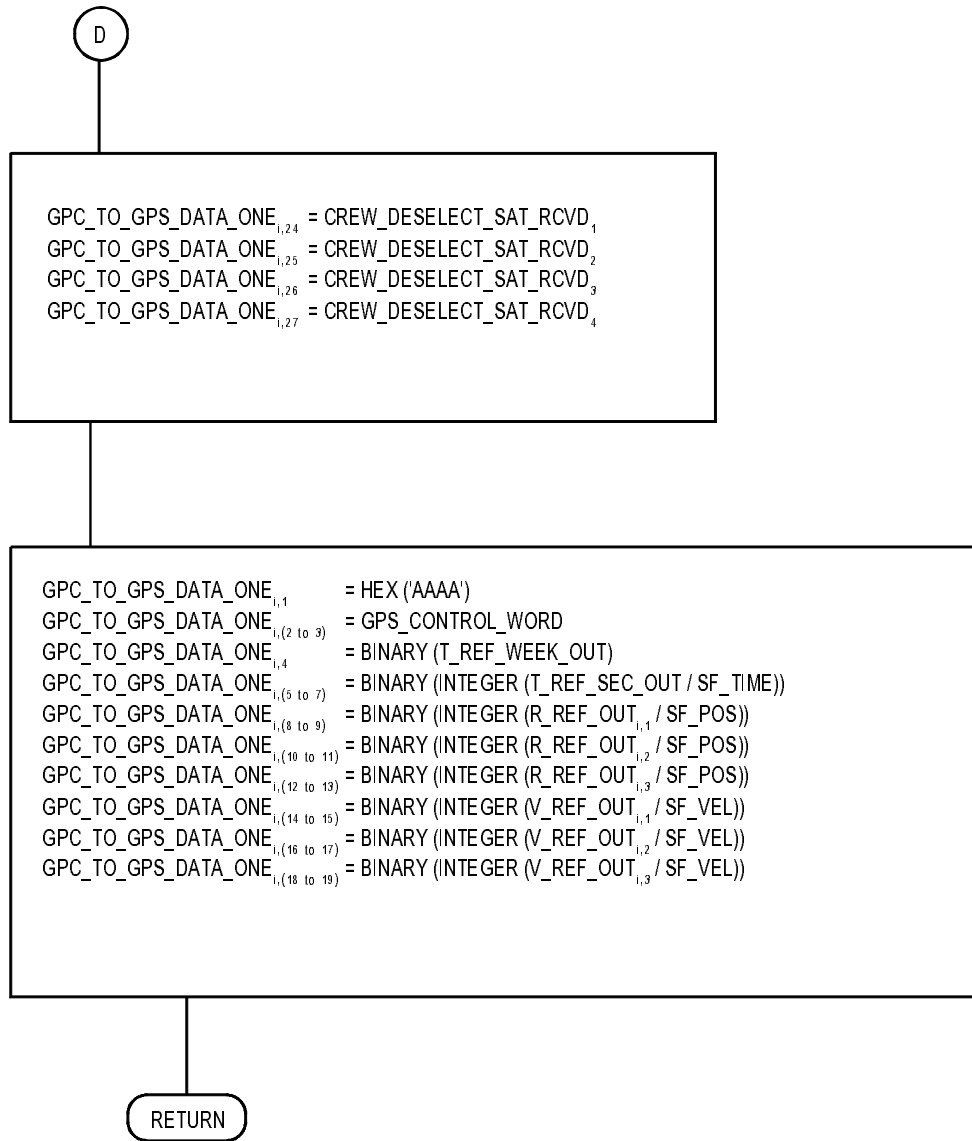


FIGURE 4.17.6.4.1.(4)RCVR\_AIDING\_DATA CODE (Sheet 4 of 4)



FIGURE 4.17.6.4.2. INIT\_DATA CODE

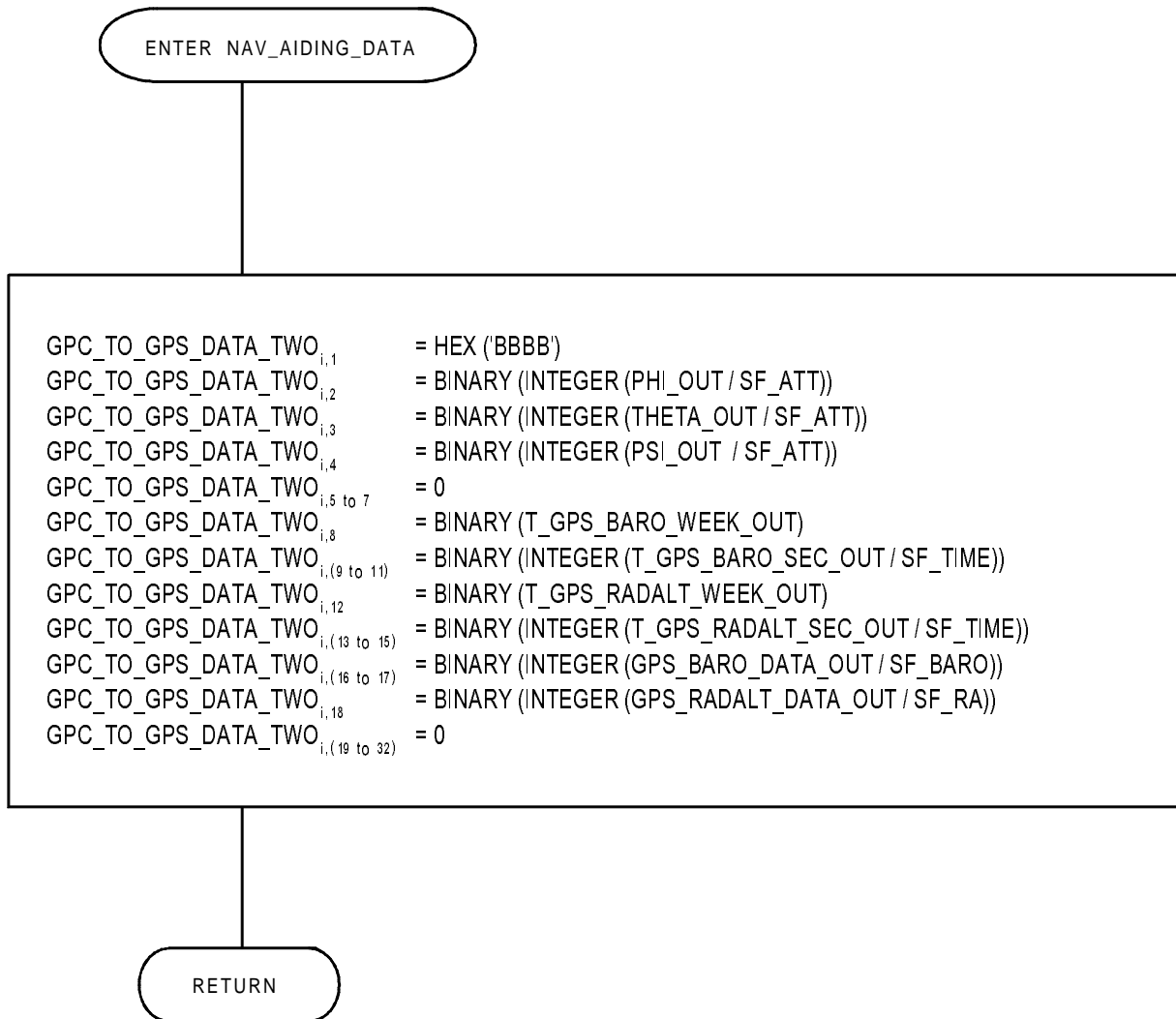


FIGURE 4.17.6.4.3. NAV\_AIDING\_DATA CODE

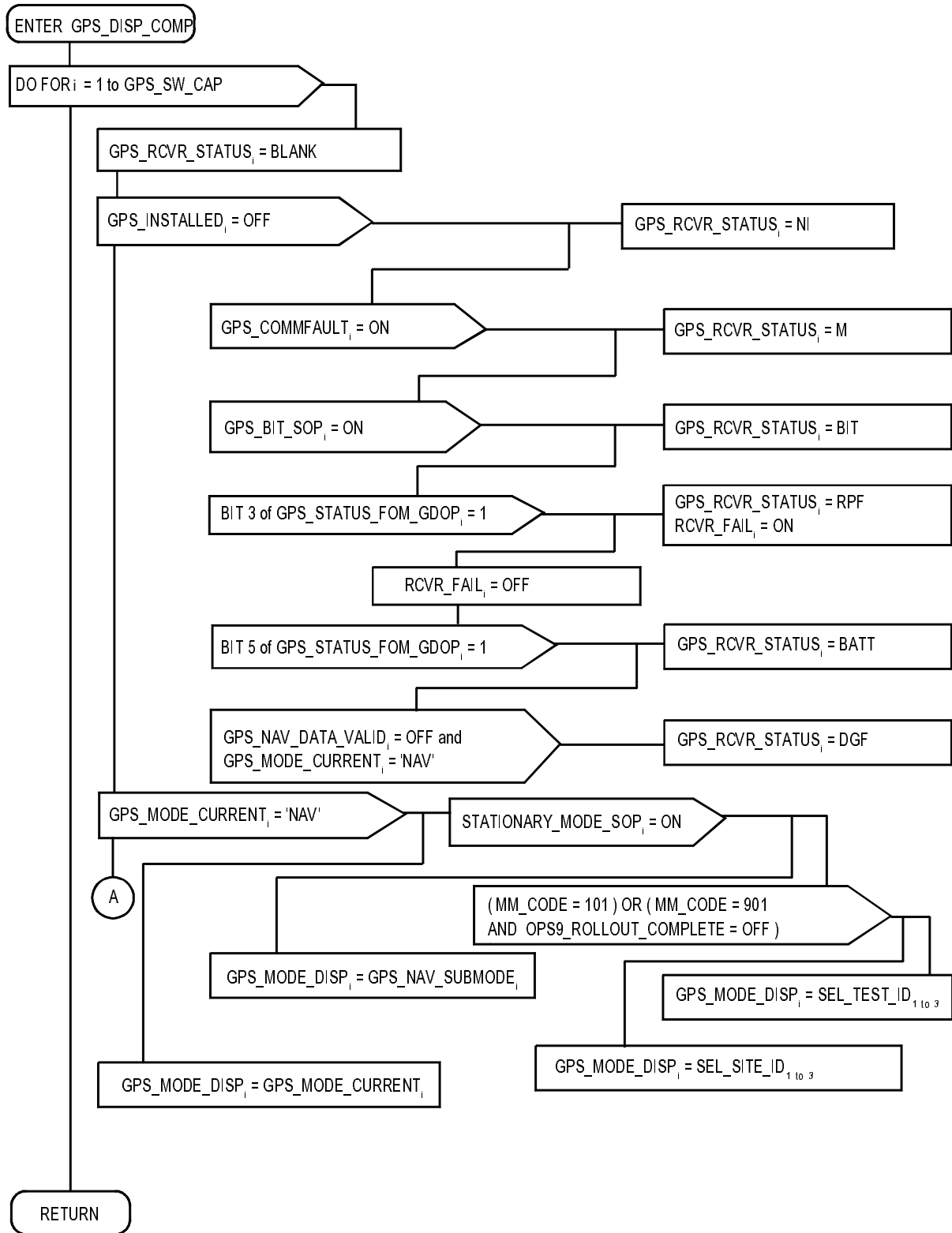


FIGURE 4.17.6.5.(1) GPS\_DISP\_COMP CODE (Sheet 1 of 2)

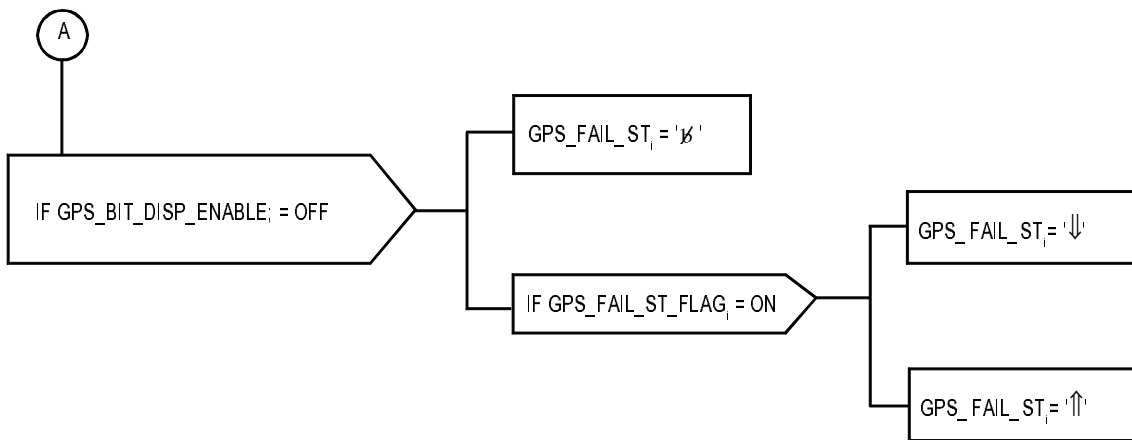


FIGURE 4.17.6.5.(2) GPS\_DISP\_COMP CODE (Sheet 2 of 2)

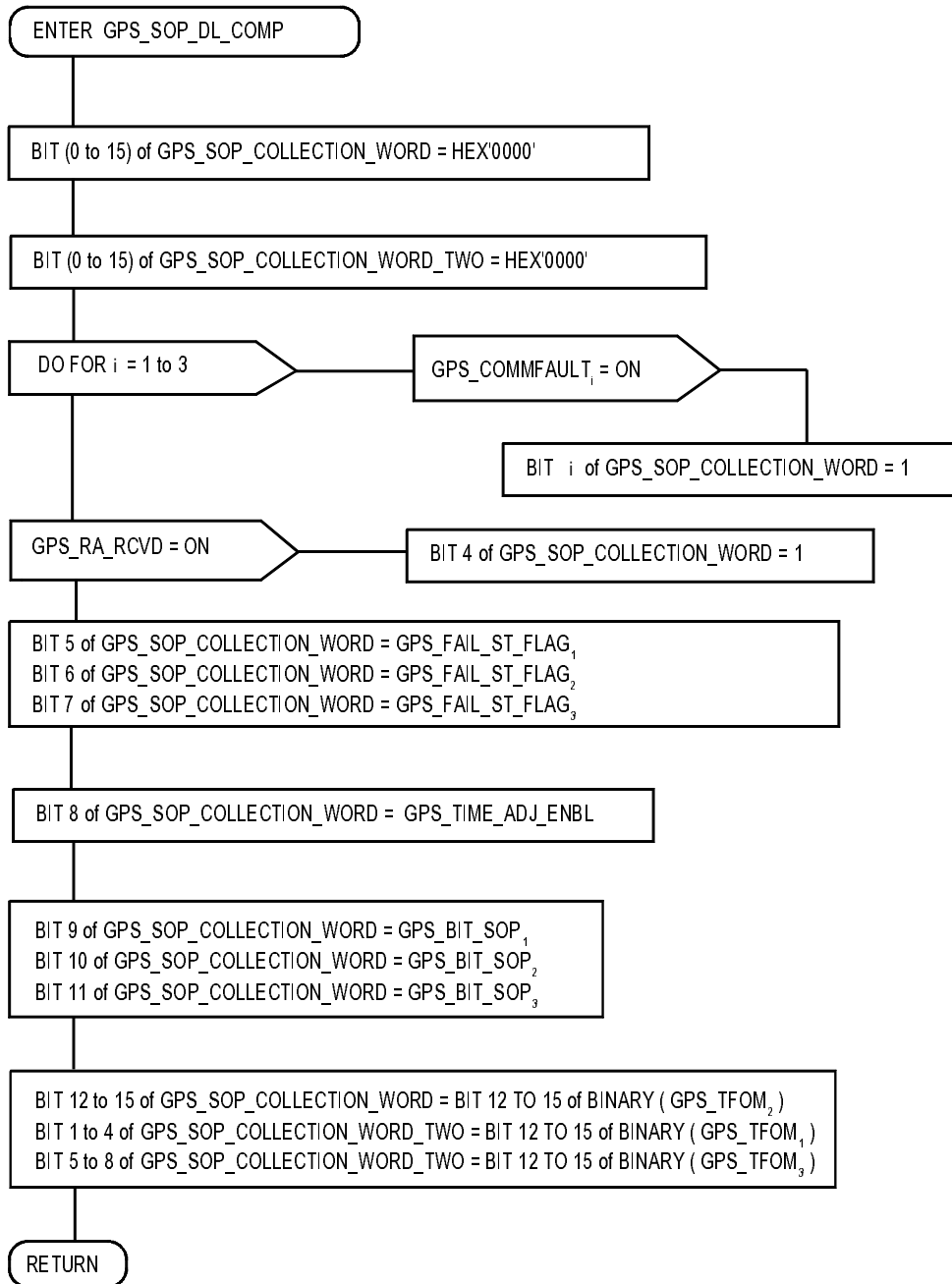


FIGURE 4.17.6.6. GPS\_SOP\_DL\_COMP CODE



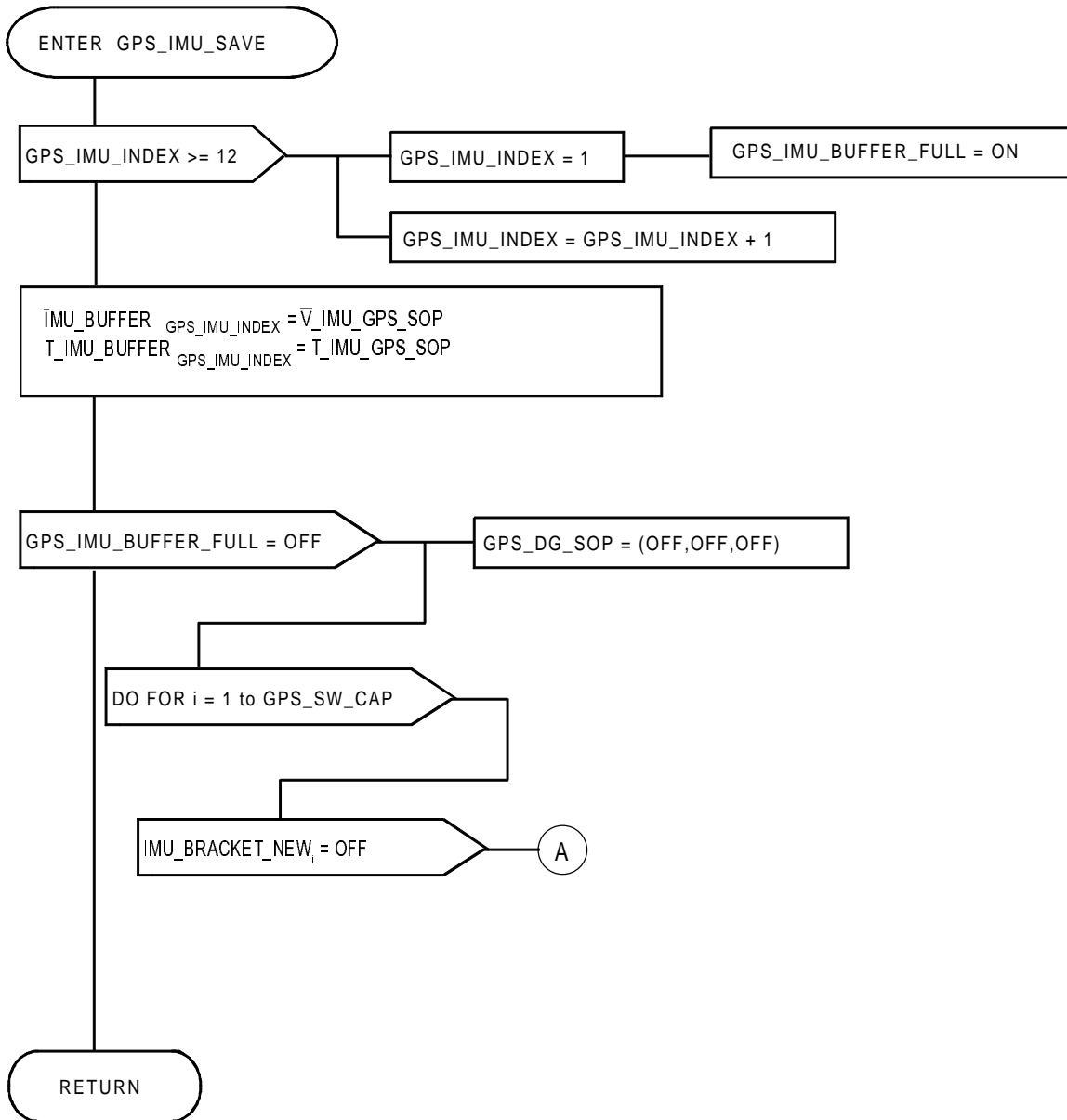


FIGURE 4.17.6.7.(1) GPS\_IMU\_SAVE CODE (Sheet 1 of 2)

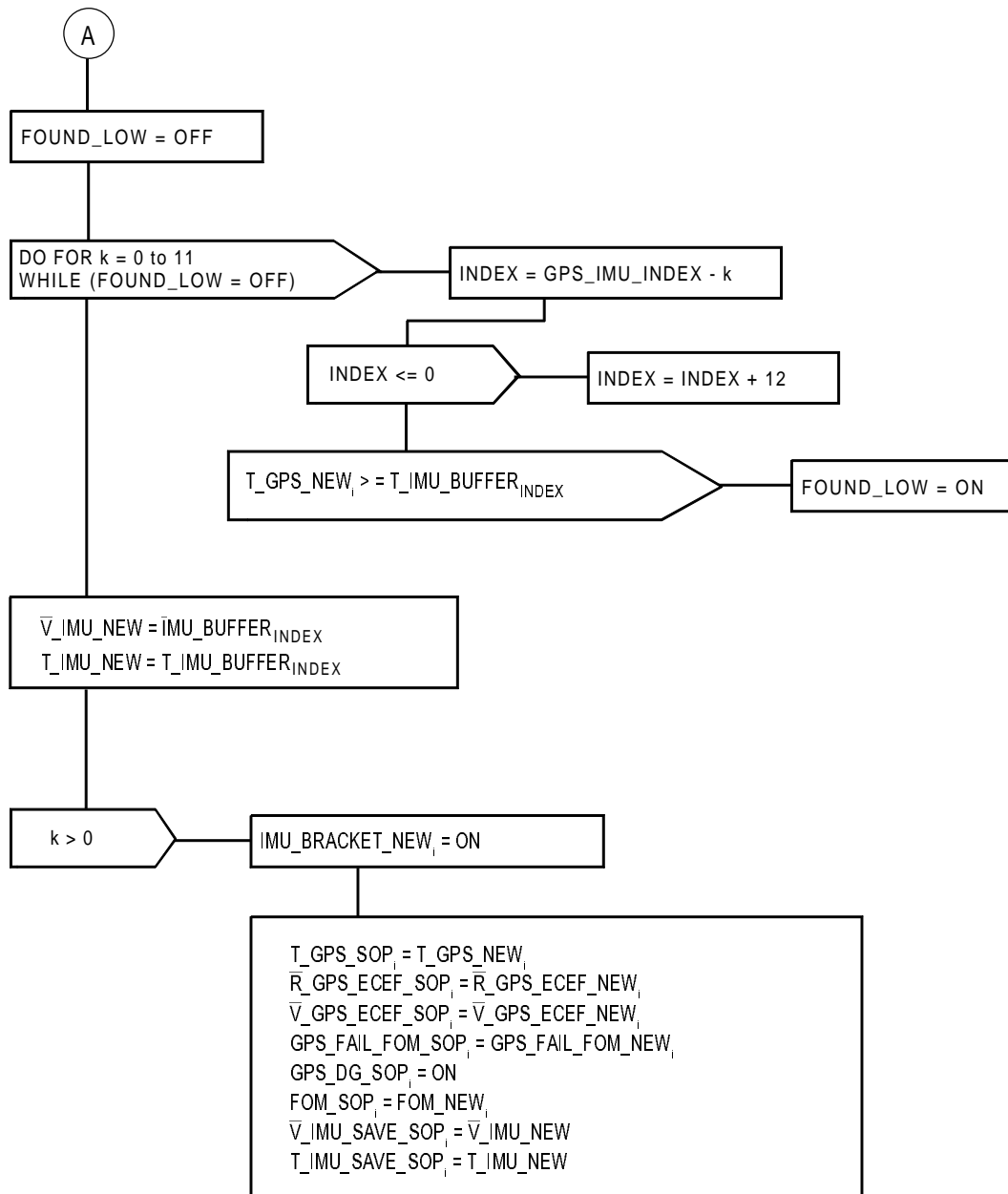


FIGURE 4.17.6.7.(2) GPS\_IMU\_SAVE CODE (Sheet 2 of 2)

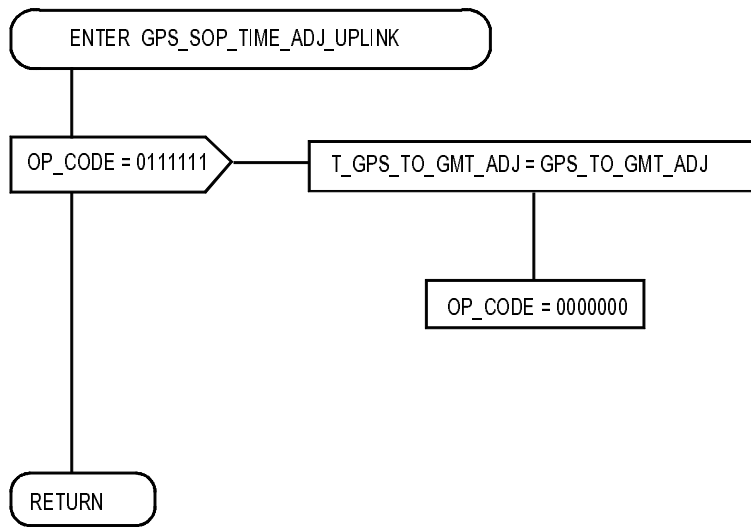


FIGURE 4.17.6.8. GPS\_SOP\_TIME\_ADJ\_UPLINK

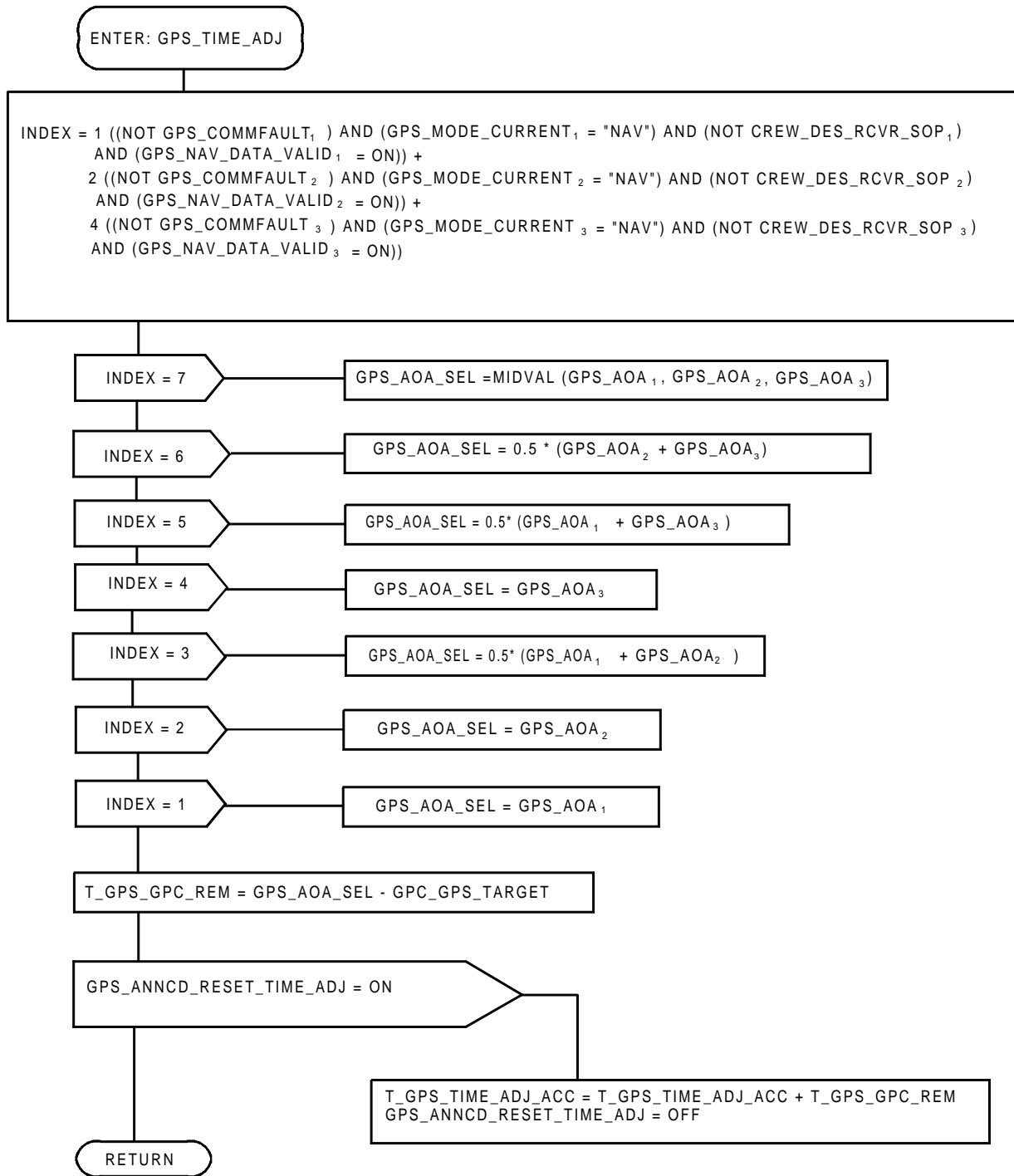


FIGURE 4.17.6.9 GPS\_TIME\_ADJ

**4.17.6.10 GPS SOP (4.17) Principal Function Tables**

This section contains the GPS SOP principal function input/output, I-load, K-load, constants and variable cross-reference tables which are presented in Tables 4.17.6.10-0 through 4.17.6.10-5 respectively.

| Table 4.17.6.10-0. GPS SOP Principal Function Variable Cross-Reference |                          |
|------------------------------------------------------------------------|--------------------------|
| FSSR Name                                                              | Source Name              |
| BARO_DG                                                                | ALT_DG                   |
| CREW_DESELECT_SAT_RCVD                                                 | CREW_DESELECT_SAT        |
| CREW_DES_RCVR_SOP                                                      | CREW_DESELECT_RCVR       |
| FILT_RESTART_RCVD                                                      | GPS_FILT_RESTART_CMD     |
| GPS_MODE_CMD_RCVD                                                      | GPS_MODE_CMD             |
| GPS_RA_RCVD                                                            | GPS_RA_AID               |
| GPS_TIME_ADJ_ENBL                                                      | GPS_TIME_ADJ_CMD         |
| GPS_TO_GMT_ADJ                                                         | T_GPS_TO_GMT_ADJ         |
| MACH_JUMP                                                              | ADS_MJ                   |
| OP_CODE                                                                | UP_OP_CODE               |
| Q_BARO                                                                 | HPC                      |
| PSI                                                                    | PSI/PSI_TOPO             |
| PHI                                                                    | PHI/PHI_TOPO             |
| T_BARO                                                                 | T_HPC                    |
| T_IMU_GPS_SOP                                                          | TIME_V                   |
| T_RADALT                                                               | RA_TIME                  |
| THETA                                                                  | THETA/THETA_TOPO         |
| RADALT_DG                                                              | DG_RADALT                |
| RADALT_HEIGHT                                                          | Q_RADALT                 |
| $\bar{V}$ _IMU_GPS_SOP                                                 | $\bar{S}$ EL_VEL_GPS_M50 |

TABLE 4.17.6.10-1. INPUT FUNCTIONAL PARAMETERS FOR GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME                  | M/S ID     | NOMENCLATURE                       | SOURCE             | UNITS | DATA<br>TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|----------------------------|------------|------------------------------------|--------------------|-------|--------------|------------------|---------|-------------|
| ADS_MJ                     | V95X3112X  | ADS MACH JUMP FLAG                 | ADTA SOP           |       | BD           |                  | 93017G  | *           |
| AIDING_DATA_VALID(1)       | V90X3266X  | GPS 1 AIDING REF STATE VALID       | GPS REF STATE PROC |       | BD           |                  | 91051K  |             |
| AIDING_DATA_VALID(2)       | V90X3267X  | GPS 2 AIDING REF STATE VALID       | GPS REF STATE PROC |       | BD           |                  | 91051K  |             |
| AIDING_DATA_VALID(3)       | V90X3268X  | GPS 3 AIDING REF STATE VALID       | GPS REF STATE PROC |       | BD           |                  | 91051K  |             |
| ALT_DG                     | V95X3111X  | PRESSURE ALTITUDE DATA GOOD FLAG   | ADTA SOP           |       | BD           |                  | 93017G  | *           |
| ALT_WHEELS                 | V95H0165CA | ALT TO REAR WHEELS/NAV BASE(ENTRY) | RTLS UPP           | FT    |              |                  | 93017G  | *           |
| ALT_WHEELS                 | V95H0165CB | ALT TO REAR WHEELS/NAV BASE(ENTRY) | ENT UPP            | FT    | DPL          |                  | 93017G  | *           |
| ALT_WHEELS                 | V95H0165CC | ALT TO REAR WHEELS/NAV BASE(ENTRY) | TAEM UPP           | FT    | DPL          |                  | 93017G  | *           |
| ALT_WHEELS                 | V95H0165CD | ALT TO REAR WHEELS/NAV BASE(ENTRY) | A/L UPP            | FT    | DPL          |                  | 93017G  | *           |
| BARO_AIF                   | V93J4473C  | ADTA A/I/F EDIT CMD                | HORIZ SIT DISP     |       | HXS          |                  | 93017G  | *           |
| CLOCK/CLOCKTIME            | V91W5000C  | CLOCK-COMPUTER(GMT)                | FCOS               | S     |              |                  | 93160B  | *           |
| CREW_DESELECT_RCVR(1)      | V93X1205XA | DESELECT GPS 1 RCVR CMD            | GPS STATUS DISP    |       | BD           |                  | 92817C  |             |
| CREW_DESELECT_RCVR(1)      | V93X1205XB | DESELECT GPS 1 RCVR CMD            | HORIZ SIT DISP     |       | BD           |                  | 92817C  |             |
| CREW_DESELECT_RCVR(1)      | V93X1205XC | DESELECT GPS 1 RCVR CMD            | REL NAV DISP       |       | BD           |                  | 92817C  |             |
| CREW_DESELECT_RCVR(2)      | V93X1206XA | DESELECT GPS 2 RCVR CMD            | GPS STATUS DISP    |       | BD           |                  | 92817C  |             |
| CREW_DESELECT_RCVR(2)      | V93X1206XB | DESELECT GPS 2 RCVR CMD            | HORIZ SIT DISP     |       | BD           |                  | 92817C  |             |
| CREW_DESELECT_RCVR(2)      | V93X1206XC | DESELECT GPS 2 RCVR CMD            | REL NAV DISP       |       | BD           |                  | 92817C  |             |
| CREW_DESELECT_RCVR(3)      | V93X1207XA | DESELECT GPS 3 RCVR CMD            | GPS STATUS DISP    |       | BD           |                  | 92817C  |             |
| CREW_DESELECT_RCVR(3)      | V93X1207XB | DESELECT GPS 3 RCVR CMD            | HORIZ SIT DISP     |       | BD           |                  | 92817C  |             |
| CREW_DESELECT_RCVR(3)      | V93X1207XC | DESELECT GPS 3 RCVR CMD            | REL NAV DISP       |       | BD           |                  | 92817C  |             |
| CREW_DESELECT_SAT(1)       | V94M6062P  | CREW DESELECT SATELLITE WORD 1     | GPS STATUS DISP    |       | HMD          |                  | 93017G  | *           |
| CREW_DESELECT_SAT(2)       | V94M6063P  | CREW DESELECT SATELLITE WORD 2     | GPS STATUS DISP    |       | HMD          |                  | 93017G  | *           |
| CREW_DESELECT_SAT(3)       | V94M6064P  | CREW DESELECT SATELLITE WORD 3     | GPS STATUS DISP    |       | HMD          |                  | 92067D  |             |
| CREW_DESELECT_SAT(4)       | V94M6065P  | CREW DESELECT SATELLITE WORD 4     | GPS STATUS DISP    |       | HMD          |                  | 92067D  |             |
| DG_RADALT                  | V90X4003X  | RALT HEIGHT DATA GOOD              | SF                 |       | BD           |                  | 93017G  | *           |
| EARTH_POLE(1)              | V90U0190C  | X-COMP UNIT VCTR ALONG EARTH AXIS  | RNP MAT COMP       | ND    | DPL          |                  | 93090E  |             |
| EARTH_POLE(2)              | V90U0191C  | Y-COMP UNIT VCTR ALONG EARTH AXIS  | RNP MAT COMP       | ND    | DPL          |                  | 93090E  |             |
| EARTH_POLE(3)              | V90U0192C  | Z-COMP UNIT VCTR ALONG EARTH AXIS  | RNP MAT COMP       | ND    | DPL          |                  | 93090E  |             |
| EULER_GPS_AVAIL            | V90X2610XA | TOPODETTIC EULER ANGLES AVAIL FLAG | ORB ATT PROC       |       | BD           |                  | 92144C  |             |
| EULER_GPS_AVAIL            | V90X2610XB | TOPODETTIC EULER ANGLES AVAIL FLAG | A/E ATT PROC       |       | BD           |                  | 92144C  |             |
| GPS_ANNCNCD_RESET_SET(1)   | V90X3290XA | GPS 1 REF STATE ANNCNCD RESET      | GPS REF STATE PROC |       | BD           |                  | 92067D  |             |
| GPS_ANNCNCD_RESET_SET(2)   | V90X3291XA | GPS 2 REF STATE ANNCNCD RESET      | GPS REF STATE PROC |       | BD           |                  | 92067D  |             |
| GPS_ANNCNCD_RESET_SET(3)   | V90X3292XA | GPS 3 REF STATE ANNCNCD RESET      | GPS REF STATE PROC |       | BD           |                  | 92067D  |             |
| GPS_ANNCNCD_RESET_TIME_ADJ | V90X0437X  | GPS ANNCNCD RESET FOR TIME ADJ     | GPS REF STATE PROC |       | BD           |                  | 92817C  |             |
| GPS_BYPASS(1)              | V91X0026X  | FF1 GPS1 BYPASS (GPS)              | FCOS               |       | BD           |                  | 92289A  |             |
| GPS_BYPASS(2)              | V91X0027X  | FF2 GPS2 BYPASS (GPS)              | FCOS               |       | BD           |                  | 92289A  |             |
| GPS_BYPASS(3)              | V91X0028X  | FF3 GPS3 BYPASS (GPS)              | FCOS               |       | BD           |                  | 92289A  |             |
| GPS_CMD_RESET(1)           | V90X0444X  | GPS 1 COMMAND RESET FLAG           | GPS REF STATE PROC |       | BD           |                  | 92289A  |             |
| GPS_CMD_RESET(2)           | V90X0445X  | GPS 2 COMMAND RESET FLAG           | GPS REF STATE PROC |       | BD           |                  | 92289A  |             |
| GPS_CMD_RESET(3)           | V90X0446X  | GPS 3 COMMAND RESET FLAG           | GPS REF STATE PROC |       | BD           |                  | 92289A  |             |
| GPS_COMMFAULT(1)           | V91X0015X  | FF1 GPS1 COMMFAULT                 | FCOS               |       | BD           |                  | 92067D  |             |
| GPS_COMMFAULT(2)           | V91X0016X  | FF2 GPS2 COMMFAULT                 | FCOS               |       | BD           |                  | 92067D  |             |
| GPS_COMMFAULT(3)           | V91X0017X  | FF3 GPS3 COMMFAULT                 | FCOS               |       | BD           |                  | 92067D  |             |
| GPS_FILT_RESTART(1)        | V90X3269XB | GPS1 FILTER RESTART FLAG           | GPS REF STATE PROC |       | BD           |                  | 92049C  |             |
| GPS_FILT_RESTART(2)        | V90X3270XB | GPS2 FILTER RESTART FLAG           | GPS REF STATE PROC |       | BD           |                  | 92049C  |             |
| GPS_FILT_RESTART(3)        | V90X3271XB | GPS3 FILTER RESTART FLAG           | GPS REF STATE PROC |       | BD           |                  | 92049C  |             |

TABLE 4.17.6.10-1. INPUT FUNCTIONAL PARAMETERS FOR GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME                 | M/S ID     | NOMENCLATURE                      | SOURCE             | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|---------------------------|------------|-----------------------------------|--------------------|-------|-----------|---------|---------|-------|
| GPS_FILT_RESTART_CMD(1)   | V93X1220X  | GPS 1 FILT RESTART CMD            | GPS STATUS DISP    |       | BD        |         | 91051K  |       |
| GPS_FILT_RESTART_CMD(2)   | V93X1221X  | GPS 2 FILT RESTART CMD            | GPS STATUS DISP    |       | BD        |         | 91051K  |       |
| GPS_FILT_RESTART_CMD(3)   | V93X1222X  | GPS 3 FILT RESTART CMD            | GPS STATUS DISP    |       | BD        |         | 91051K  |       |
| GPS_INIT_REQUEST_SOP(1)   | V90X3018XA | GPS 1 REQUEST INITIAL STATE       | GPS REF STATE PROC |       | BD        |         | 92067D  |       |
| GPS_INIT_REQUEST_SOP(2)   | V90X3019XA | GPS 2 REQUEST INITIAL STATE       | GPS REF STATE PROC |       | BD        |         | 92067D  |       |
| GPS_INIT_REQUEST_SOP(3)   | V90X3020XA | GPS 3 REQUEST INITIAL STATE       | GPS REF STATE PROC |       | BD        |         | 92067D  |       |
| GPS_IO_CNTL               | V93J1231C  | GPS I/O CONTROL                   | GPS STATUS DISP    |       | HXS       |         | 92056D  |       |
| GPS_MODE_CMD(1)           | V93U1223C  | GPS 1 MODE CMD                    | GPS STATUS DISP    |       | HXS       |         | 92069B  |       |
| GPS_MODE_CMD(2)           | V93U1224C  | GPS 2 MODE CMD                    | GPS STATUS DISP    |       | HXS       |         | 92069B  |       |
| GPS_MODE_CMD(3)           | V93U1225C  | GPS 3 MODE CMD                    | GPS STATUS DISP    |       | HXS       |         | 92069B  |       |
| GPS_RA_AID                | V93X1204X  | GPS RCVR USE RA DATA AIDING CMD   | HORIZ SIT DISP     |       | BD        |         | 91051K  |       |
| GPS_TIME_ADJ_CMD          | V93X1111X  | GPS TIME ADJUST CMD               | GPS STATUS DISP    | ND    | BD        |         | 92817C  |       |
| GPS_TO_GPC_DATA_ONE(1,1)  | V74U2318B  | GPS1 INPUT HEADER                 | GPS1               |       | BCH       |         | 93017G  | *     |
| GPS_TO_GPC_DATA_ONE(1,10) | V74U2327B  | GPS 1 TO GPC DATA ONE HALFWORD 10 | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(1,11) | V74U2328B  | GPS 1 TO GPC DATA ONE HALFWORD 11 | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(1,12) | V74U2329B  | GPS 1 TO GPC DATA ONE HALFWORD 12 | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(1,13) | V74U2330B  | GPS 1 TO GPC DATA ONE HALFWORD 13 | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(1,14) | V74U2331B  | GPS 1 TO GPC DATA ONE HALFWORD 14 | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(1,15) | V74U2332B  | GPS 1 TO GPC DATA ONE HALFWORD 15 | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(1,16) | V74U2333B  | GPS 1 TO GPC DATA ONE HALFWORD 16 | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(1,17) | V74U2334B  | GPS 1 TO GPC DATA ONE HALFWORD 17 | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(1,18) | V74U2335B  | GPS 1 TO GPC DATA ONE HALFWORD 18 | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(1,19) | V74U2336B  | GPS 1 TO GPC DATA ONE HALFWORD 19 | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(1,2)  | V74M2319P  | GPS1 NAV MODE WORD 1              | GPS1               |       | HMD       |         | 93017G  | *     |
| GPS_TO_GPC_DATA_ONE(1,20) | V74U2337B  | GPS 1 TO GPC DATA ONE HALFWORD 20 | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(1,21) | V74U2338B  | GPS 1 TO GPC DATA ONE HALFWORD 21 | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(1,22) | V74U2339B  | GPS 1 TO GPC DATA ONE HALFWORD 22 | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(1,23) | V74U2340B  | GPS 1 TO GPC DATA ONE HALFWORD 23 | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(1,24) | V74U2341B  | GPS 1 TO GPC DATA ONE HALFWORD 24 | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(1,25) | V74U2342B  | GPS 1 TO GPC DATA ONE HALFWORD 25 | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(1,26) | V74U2343B  | GPS 1 TO GPC DATA ONE HALFWORD 26 | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(1,27) | V74U2344B  | GPS 1 TO GPC DATA ONE HALFWORD 27 | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(1,28) | V74U2345B  | GPS 1 TO GPC DATA ONE HALFWORD 28 | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(1,29) | V74U2346B  | GPS 1 TO GPC DATA ONE HALFWORD 29 | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(1,3)  | V74M2320P  | GPS1 NAV MODE WORD 2              | GPS1               |       | HMD       |         | 93017G  | *     |
| GPS_TO_GPC_DATA_ONE(1,30) | V74U2347B  | GPS 1 TO GPC DATA ONE HALFWORD 30 | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(1,31) | V74U2348B  | GPS 1 TO GPC DATA ONE HALFWORD 31 | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(1,32) | V74U2349B  | GPS 1 TO GPC DATA ONE HALFWORD 32 | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(1,4)  | V74U2321B  | GPS 1 TO GPC DATA ONE HALFWORD 4  | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(1,5)  | V74U2322B  | GPS 1 TO GPC DATA ONE HALFWORD 5  | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(1,6)  | V74U2323B  | GPS 1 TO GPC DATA ONE HALFWORD 6  | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(1,7)  | V74U2324B  | GPS 1 TO GPC DATA ONE HALFWORD 7  | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(1,8)  | V74U2325B  | GPS 1 TO GPC DATA ONE HALFWORD 8  | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(1,9)  | V74U2326B  | GPS 1 TO GPC DATA ONE HALFWORD 9  | GPS1               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(2,1)  | V74U1920B  | GPS2 INPUT HEADER                 | GPS2               |       | BCH       |         | 93017G  | *     |
| GPS_TO_GPC_DATA_ONE(2,10) | V74U2356B  | GPS 2 TO GPC DATA ONE HALFWORD 10 | GPS2               |       | HMD       |         | 92069B  |       |

TABLE 4.17.6.10-1. INPUT FUNCTIONAL PARAMETERS FOR GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME                 | M/S ID    | NOMENCLATURE                      | SOURCE | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|---------------------------|-----------|-----------------------------------|--------|-------|-----------|---------|---------|-------|
| GPS_TO_GPC_DATA_ONE(2,11) | V74U2357B | GPS 2 TO GPC DATA ONE HALFWORD 11 | GPS2   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(2,12) | V74U2358B | GPS 2 TO GPC DATA ONE HALFWORD 12 | GPS2   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(2,13) | V74U2359B | GPS 2 TO GPC DATA ONE HALFWORD 13 | GPS2   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(2,14) | V74U2360B | GPS 2 TO GPC DATA ONE HALFWORD 14 | GPS2   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(2,15) | V74U2361B | GPS 2 TO GPC DATA ONE HALFWORD 15 | GPS2   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(2,16) | V74U2362B | GPS 2 TO GPC DATA ONE HALFWORD 16 | GPS2   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(2,17) | V74U2363B | GPS 2 TO GPC DATA ONE HALFWORD 17 | GPS2   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(2,18) | V74U2364B | GPS 2 TO GPC DATA ONE HALFWORD 18 | GPS2   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(2,19) | V74U2365B | GPS 2 TO GPC DATA ONE HALFWORD 19 | GPS2   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(2,2)  | V74M1921P | GPS2 NAV MODE WORD 1              | GPS2   |       | HMD       |         | 93017G  | *     |
| GPS_TO_GPC_DATA_ONE(2,20) | V74U2366B | GPS 2 TO GPC DATA ONE HALFWORD 20 | GPS2   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(2,21) | V74U2367B | GPS 2 TO GPC DATA ONE HALFWORD 21 | GPS2   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(2,22) | V74U2368B | GPS 2 TO GPC DATA ONE HALFWORD 22 | GPS2   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(2,23) | V74U2369B | GPS 2 TO GPC DATA ONE HALFWORD 23 | GPS2   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(2,24) | V74U2370B | GPS 2 TO GPC DATA ONE HALFWORD 24 | GPS2   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(2,25) | V74U2371B | GPS 2 TO GPC DATA ONE HALFWORD 25 | GPS2   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(2,26) | V74U2372B | GPS 2 TO GPC DATA ONE HALFWORD 26 | GPS2   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(2,27) | V74U2373B | GPS 2 TO GPC DATA ONE HALFWORD 27 | GPS2   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(2,28) | V74U2374B | GPS 2 TO GPC DATA ONE HALFWORD 28 | GPS2   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(2,29) | V74U2375B | GPS 2 TO GPC DATA ONE HALFWORD 29 | GPS2   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(2,3)  | V74M1934P | GPS2 NAV MODE WORD 2              | GPS2   |       | HMD       |         | 93017G  | *     |
| GPS_TO_GPC_DATA_ONE(2,30) | V74U2376B | GPS 2 TO GPC DATA ONE HALFWORD 30 | GPS2   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(2,31) | V74U2377B | GPS 2 TO GPC DATA ONE HALFWORD 31 | GPS2   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(2,32) | V74U2378B | GPS 2 TO GPC DATA ONE HALFWORD 32 | GPS2   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(2,4)  | V74U2350B | GPS 2 TO GPC DATA ONE HALFWORD 4  | GPS2   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(2,5)  | V74U2351B | GPS 2 TO GPC DATA ONE HALFWORD 5  | GPS2   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(2,6)  | V74U2352B | GPS 2 TO GPC DATA ONE HALFWORD 6  | GPS2   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(2,7)  | V74U2353B | GPS 2 TO GPC DATA ONE HALFWORD 7  | GPS2   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(2,8)  | V74U2354B | GPS 2 TO GPC DATA ONE HALFWORD 8  | GPS2   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(2,9)  | V74U2355B | GPS 2 TO GPC DATA ONE HALFWORD 9  | GPS2   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(3,1)  | V74U2379B | GPS3 INPUT HEADER                 | GPS3   |       | BCH       |         | 93017G  | *     |
| GPS_TO_GPC_DATA_ONE(3,10) | V74U2388B | GPS 3 TO GPC DATA ONE HALFWORD 10 | GPS3   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(3,11) | V74U2389B | GPS 3 TO GPC DATA ONE HALFWORD 11 | GPS3   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(3,12) | V74U2390B | GPS 3 TO GPC DATA ONE HALFWORD 12 | GPS3   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(3,13) | V74U2391B | GPS 3 TO GPC DATA ONE HALFWORD 13 | GPS3   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(3,14) | V74U2392B | GPS 3 TO GPC DATA ONE HALFWORD 14 | GPS3   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(3,15) | V74U2393B | GPS 3 TO GPC DATA ONE HALFWORD 15 | GPS3   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(3,16) | V74U2394B | GPS 3 TO GPC DATA ONE HALFWORD 16 | GPS3   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(3,17) | V74U2395B | GPS 3 TO GPC DATA ONE HALFWORD 17 | GPS3   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(3,18) | V74U2396B | GPS 3 TO GPC DATA ONE HALFWORD 18 | GPS3   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(3,19) | V74U2397B | GPS 3 TO GPC DATA ONE HALFWORD 19 | GPS3   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(3,2)  | V74M2380P | GPS3 NAV MODE WORD 1              | GPS3   |       | HMD       |         | 93017G  | *     |
| GPS_TO_GPC_DATA_ONE(3,20) | V74U2398B | GPS 3 TO GPC DATA ONE HALFWORD 20 | GPS3   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(3,21) | V74U2399B | GPS 3 TO GPC DATA ONE HALFWORD 21 | GPS3   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(3,22) | V74U2400B | GPS 3 TO GPC DATA ONE HALFWORD 22 | GPS3   |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(3,23) | V74U2401B | GPS 3 TO GPC DATA ONE HALFWORD 23 | GPS3   |       | HMD       |         | 92069B  |       |



TABLE 4.17.6.10-1. INPUT FUNCTIONAL PARAMETERS FOR GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME                 | M/S ID     | NOMENCLATURE                      | SOURCE             | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|---------------------------|------------|-----------------------------------|--------------------|-------|-----------|---------|---------|-------|
| GPS_TO_GPC_DATA_ONE(3,24) | V74U2402B  | GPS 3 TO GPC DATA ONE HALFWORD 24 | GPS3               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(3,25) | V74U2403B  | GPS 3 TO GPC DATA ONE HALFWORD 25 | GPS3               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(3,26) | V74U2404B  | GPS 3 TO GPC DATA ONE HALFWORD 26 | GPS3               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(3,27) | V74U2405B  | GPS 3 TO GPC DATA ONE HALFWORD 27 | GPS3               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(3,28) | V74U2406B  | GPS 3 TO GPC DATA ONE HALFWORD 28 | GPS3               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(3,29) | V74U2407B  | GPS 3 TO GPC DATA ONE HALFWORD 29 | GPS3               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(3,3)  | V74M2381P  | GPS3 NAV MODE WORD 2              | GPS3               |       | HMD       |         | 93017G  | *     |
| GPS_TO_GPC_DATA_ONE(3,30) | V74U2408B  | GPS 3 TO GPC DATA ONE HALFWORD 30 | GPS3               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(3,31) | V74U2409B  | GPS 3 TO GPC DATA ONE HALFWORD 31 | GPS3               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(3,32) | V74U2410B  | GPS 3 TO GPC DATA ONE HALFWORD 32 | GPS3               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(3,4)  | V74U2382B  | GPS 3 TO GPC DATA ONE HALFWORD 4  | GPS3               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(3,5)  | V74U2383B  | GPS 3 TO GPC DATA ONE HALFWORD 5  | GPS3               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(3,6)  | V74U2384B  | GPS 3 TO GPC DATA ONE HALFWORD 6  | GPS3               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(3,7)  | V74U2385B  | GPS 3 TO GPC DATA ONE HALFWORD 7  | GPS3               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(3,8)  | V74U2386B  | GPS 3 TO GPC DATA ONE HALFWORD 8  | GPS3               |       | HMD       |         | 92069B  |       |
| GPS_TO_GPC_DATA_ONE(3,9)  | V74U2387B  | GPS 3 TO GPC DATA ONE HALFWORD 9  | GPS3               |       | HMD       |         | 92069B  |       |
| GPS_TSW(1)                | V91U0032C  | GPS 1 TRANSACTION STATUS WORD     | FCOS               |       | HMD       |         | 91051K  |       |
| GPS_TSW(2)                | V91U0033C  | GPS 2 TRANSACTION STATUS WORD     | FCOS               |       | HMD       |         | 91051K  |       |
| GPS_TSW(3)                | V91U0034C  | GPS 3 TRANSACTION STATUS WORD     | FCOS               |       | HMD       |         | 91051K  |       |
| HPC                       | V95H3001C  | ADS CORRECTED PRESSURE ALTITUDE   | ADTA SOP           | FT    | SPL       |         | 93017G  | *     |
| H_DOT_ELLIPSOID/H_DOT     | V95L0265CA | EST ALTITUDE RATE                 | RTLS UPP           | FT/S  | SPL       |         | 93017G  | *     |
| H_DOT_ELLIPSOID/H_DOT     | V95L0265CB | EST ALTITUDE RATE                 | TAEM UPP           | FT/S  | SPL       |         | 93017G  | *     |
| H_DOT_ELLIPSOID/H_DOT     | V95L0265CC | EST ALTITUDE RATE                 | A/L UPP            | FT/S  | SPL       |         | 93017G  | *     |
| H_DOT_ELLIPSOID/H_DOT     | V95L0265CD | EST ALTITUDE RATE                 | ENT UPP            | FT/S  | SPL       |         | 93017G  | *     |
| INIT_STATE_SET(1)         | V90X3278XA | GPS 1 REFERENCE STATE INITIALIZED | GPS REF STATE PROC |       | BD        |         | 92067D  |       |
| INIT_STATE_SET(2)         | V90X3279XA | GPS 2 REFERENCE STATE INITIALIZED | GPS REF STATE PROC |       | BD        |         | 92067D  |       |
| INIT_STATE_SET(3)         | V90X3280XA | GPS 3 REFERENCE STATE INITIALIZED | GPS REF STATE PROC |       | BD        |         | 92067D  |       |
| MM_CODE                   | V90Q8001C  | MAJOR MODE CODE                   | UI                 |       | HXS       |         | 93017G  | *     |
| M_M50TOEF_AT_EPOCH(1,1)   | V97U5738C  | M50 TO EF TRANS MATRIX ELEM 1,1   | RNP MAT COMP       | ND    | DPL       |         | 93090E  |       |
| M_M50TOEF_AT_EPOCH(1,2)   | V97U5739C  | M50 TO EF TRANS MATRIX ELEM 1,2   | RNP MAT COMP       | ND    | DPL       |         | 93090E  |       |
| M_M50TOEF_AT_EPOCH(1,3)   | V97U5740C  | M50 TO EF TRANS MATRIX ELEM 1,3   | RNP MAT COMP       | ND    | DPL       |         | 93090E  |       |
| M_M50TOEF_AT_EPOCH(2,1)   | V97U5741C  | M50 TO EF TRANS MATRIX ELEM 2,1   | RNP MAT COMP       | ND    | DPL       |         | 93090E  |       |
| M_M50TOEF_AT_EPOCH(2,2)   | V97U5742C  | M50 TO EF TRANS MATRIX ELEM 2,2   | RNP MAT COMP       | ND    | DPL       |         | 93090E  |       |
| M_M50TOEF_AT_EPOCH(2,3)   | V97U5743C  | M50 TO EF TRANS MATRIX ELEM 2,3   | RNP MAT COMP       | ND    | DPL       |         | 93090E  |       |
| M_M50TOEF_AT_EPOCH(3,1)   | V97U5744C  | M50 TO EF TRANS MATRIX ELEM 3,1   | RNP MAT COMP       | ND    | DPL       |         | 93090E  |       |
| M_M50TOEF_AT_EPOCH(3,2)   | V97U5745C  | M50 TO EF TRANS MATRIX ELEM 3,2   | RNP MAT COMP       | ND    | DPL       |         | 93090E  |       |
| M_M50TOEF_AT_EPOCH(3,3)   | V97U5746C  | M50 TO EF TRANS MATRIX ELEM 3,3   | RNP MAT COMP       | ND    | DPL       |         | 93090E  |       |
| PHI/PHI_TOPO              | V90H2202C  | BODY ROLL ATTITUDE EULER ANGLE    | A/E ATT PROC       | DEG   | SPL       |         | 93017G  | *     |
| PHI/PHI_TOPO              | V90H2202CA | BODY ROLL ATTITUDE EULER ANGLE    | ORB ATT PROC       | DEG   | SPL       |         | 92144C  |       |
| PHI_OUT                   | V94H6066C  | BODY ROLL EULER ANGLE AT SEL SITE | GROUND IMU DISP    | DEG   | SPL       |         | 92067D  |       |
| PSI/PSI_TOPO              | V90H2230C  | BODY YAW ATTITUDE EULER ANGLE     | A/E ATT PROC       | DEG   | SPL       |         | 93017G  | *     |
| PSI/PSI_TOPO              | V90H2230CA | BODY YAW ATTITUDE EULER ANGLE     | ORB ATT PROC       | DEG   | SPL       |         | 92144C  |       |
| PSI_OUT                   | V94H6067C  | BODY YAW EULER ANGLE AT SEL SITE  | GROUND IMU DISP    | DEG   | SPL       |         | 92067D  |       |
| Q_RADALT                  | V90H4002C  | SELECTED RALT HEIGHT-RAW          | SF                 | FT    | SPL       |         | 93017G  | *     |
| RA_TIME                   | V95W7000C  | RADAR ALTIMETER TIME              | RA SOP             | S     | DPL       |         | 93017G  | *     |
| REFS_RDY                  | V95X0780XA | REFSMAT COMPUTATION COMPLETED     | IMU INT PROC       |       | BD        |         | 93017G  | *     |

TABLE 4.17.6.10-1. INPUT FUNCTIONAL PARAMETERS FOR GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME          | M/S ID     | NOMENCLATURE                       | SOURCE             | UNITS | DATA<br>TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|--------------------|------------|------------------------------------|--------------------|-------|--------------|------------------|---------|-------------|
| REL_VEL_MAG        | V95L0151CA | GND REL VEL MAGNITUDE IN M50 SYS   | RTLS UPP           | FT/S  | SPL          |                  | 93017G  | *           |
| REL_VEL_MAG/V      | V95L0151CB | GND REL VEL MAGNITUDE IN M50 SYS   | A/L UPP            | FT/S  | SPL          |                  | 93017G  | *           |
| REL_VEL_MAG/V      | V95L0151CC | GND REL VEL MAGNITUDE IN M50 SYS   | ENT UPP            | FT/S  | SPL          |                  | 93017G  | *           |
| REL_VEL_MAG/V      | V95L0151CD | GND REL VEL MAGNITUDE IN M50 SYS   | TAEM UPP           | FT/S  | SPL          |                  | 93017G  | *           |
| R_REF(1)           | V90H3281C  | X-COMP OF GPS REF STATE POS VEC    | GPS REF STATE PROC | FT    | DPL          |                  | 92369B  |             |
| R_REF(2)           | V90H3282C  | Y-COMP OF GPS REF STATE POS VEC    | GPS REF STATE PROC | FT    | DPL          |                  | 92369B  |             |
| R_REF(3)           | V90H3283C  | Z-COMP OF GPS REF STATE POS VEC    | GPS REF STATE PROC | FT    | DPL          |                  | 92369B  |             |
| R_REF_OUT(1,1)     | V90H3662C  | X-COMP OF GPS 1 REF STATE POS VEC  | GROUND IMU DISP    | FT    | DPL          |                  | 92067D  |             |
| R_REF_OUT(1,2)     | V90H3663C  | Y-COMP OF GPS 1 REF STATE POS VEC  | GROUND IMU DISP    | FT    | DPL          |                  | 92067D  |             |
| R_REF_OUT(1,3)     | V90H3664C  | Z-COMP OF GPS 1 REF STATE POS VEC  | GROUND IMU DISP    | FT    | DPL          |                  | 92067D  |             |
| R_REF_OUT(2,1)     | V90H3665C  | X-COMP OF GPS 2 REF STATE POS VEC  | GROUND IMU DISP    | FT    | DPL          |                  | 92067D  |             |
| R_REF_OUT(2,2)     | V90H3666C  | Y-COMP OF GPS 2 REF STATE POS VEC  | GROUND IMU DISP    | FT    | DPL          |                  | 92067D  |             |
| R_REF_OUT(2,3)     | V90H3667C  | Z-COMP OF GPS 2 REF STATE POS VEC  | GROUND IMU DISP    | FT    | DPL          |                  | 92067D  |             |
| R_REF_OUT(3,1)     | V90H3668C  | X-COMP OF GPS 3 REF STATE POS VEC  | GROUND IMU DISP    | FT    | DPL          |                  | 92067D  |             |
| R_REF_OUT(3,2)     | V90H3669C  | Y-COMP OF GPS 3 REF STATE POS VEC  | GROUND IMU DISP    | FT    | DPL          |                  | 92067D  |             |
| R_REF_OUT(3,3)     | V90H3670C  | Z-COMP OF GPS 3 REF STATE POS VEC  | GROUND IMU DISP    | FT    | DPL          |                  | 92067D  |             |
| SEL_SITE_ID        | V90U0378CA | SELECTED LANDING SITE ID           | ASC SITE LOOKUP    |       |              |                  | 92522D  |             |
| SEL_SITE_ID        | V90U0378CB | SELECTED LANDING SITE ID           | ENT SITE LOOKUP    |       |              |                  | 92522D  |             |
| SEL_TEST_ID        | V91U5085CA | CURRENT SITE SELECT                | GROUND IMU DISP    |       | VAR          |                  | 91051K  |             |
| SEL_VEL_GPS_M50(1) | V90L2631C  | SEL TOTAL M50 X VEL FOR GPS        | IMU RM             | FT/S  | DPL          |                  | 92369B  |             |
| SEL_VEL_GPS_M50(2) | V90L2632C  | SEL TOTAL M50 Y VEL FOR GPS        | IMU RM             | FT/S  | DPL          |                  | 92369B  |             |
| SEL_VEL_GPS_M50(3) | V90L2633C  | SEL TOTAL M50 Z VEL FOR GPS        | IMU RM             | FT/S  | DPL          |                  | 92369B  |             |
| THETA/THETA_TOPO   | V90H2217C  | BODY PITCH ATTITUDE EULER ANGLE    | A/E ATT PROC       | DEG   | SPL          |                  | 93017G  | *           |
| THETA/THETA_TOPO   | V90H2217CA | BODY PITCH ATTITUDE EULER ANGLE    | ORB ATT PROC       | DEG   | SPL          |                  | 92144C  |             |
| THETA_OUT          | V94H6068C  | BODY PITCH EULER ANGLE AT SEL SITE | GROUND IMU DISP    | DEG   | SPL          |                  | 92067D  |             |
| TIME_V             | V90W2553CA | TIME OF SEL TOTAL M50 VEL          | IMU RM             | S     |              |                  | 91051K  |             |
| T_CURRENT_GPS_REF  | V90W3581C  | TIME TAG FOR GPS REFERENCE STATES  | GPS REF STATE PROC | S     | DPL          |                  | 92035D  |             |
| T_EPOCH            | V97W5528C  | TIME TAG FOR M_M50TOEF_AT_EPOCH    | RNP MAT COMP       | S     | DPL          |                  | 93090E  |             |
| T_GPS_OFFSET_SECS  | V91W0029CA | GPS OFFSET SECONDS                 | D/L NAV SEQ        | S     | DPL          |                  | 93160B  | *           |
| T_GPS_TO_GMT_ADJ   | V91W0035C  | GPS TO GMT TIME ADJUSTMENT         | UL                 | S     | DPL          |                  | 92364D  |             |
| T_HPC              | V95W3400C  | ADS CORRECTED PRESS ALT TIME TAG   | ADTA SOP           | S     | DPL          |                  | 93017G  | *           |
| UP_OP_CODE         | V96J3521C  | OP CODE FOR UPLINK                 | UL                 |       | HXS          |                  | 92067D  |             |
| V_REF(1)           | V90L3308C  | X-COMP OF GPS REF STATE VEL VEC    | GPS REF STATE PROC | FT/S  | DPL          |                  | 92369B  |             |
| V_REF(2)           | V90L3309C  | Y-COMP OF GPS REF STATE VEL VEC    | GPS REF STATE PROC | FT/S  | DPL          |                  | 92369B  |             |
| V_REF(3)           | V90L3310C  | Z-COMP OF GPS REF STATE VEL VEC    | GPS REF STATE PROC | FT/S  | DPL          |                  | 92369B  |             |

NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME                | M/S ID    | NOMENCLATURE      | DESTINATION                                                             | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|--------------------------|-----------|-------------------|-------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| ALMANAC_REF_WEEK(1)      | V74W4460B | GPS1 ALMANAC WEEK | DL FMT 44/1<br>DL FMT 45/1                                              |       | HXU       |         | 93017G  | *     |
| ALMANAC_REF_WEEK(2)      | V74W1460B | GPS2 ALMANAC WEEK | DL FMT 60/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1 |       | HXU       |         | 93017G  | *     |
| ALMANAC_REF_WEEK(3)      | V74W3460B | GPS3 ALMANAC WEEK | DL FMT 60/1<br>DL FMT 44/1<br>DL FMT 45/1                               |       | HXU       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(1,1)  | V74M4942P | GPS1 LOG WD1      | DL FMT 60/1<br>DL FMT 22/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1 |       | HMD       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(1,10) | V74M4951P | GPS1 LOG WD10     | DL FMT 60/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1                |       | HMD       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(1,11) | V74M4952P | GPS1 LOG WD11     | DL FMT 60/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1                |       | HMD       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(1,12) | V74M4953P | GPS1 LOG WD12     | DL FMT 60/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1                |       | HMD       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(1,13) | V74M4954P | GPS1 LOG WD13     | DL FMT 60/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1                |       | HMD       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(1,14) | V74M4955P | GPS1 LOG WD14     | DL FMT 60/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1                |       | HMD       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(1,15) | V74M4956P | GPS1 LOG WD15     | DL FMT 60/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1                |       | HMD       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(1,16) | V74M4957P | GPS1 LOG WD16     | DL FMT 60/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1                |       | HMD       |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME                | M/S ID    | NOMENCLATURE  | DESTINATION                                                                                           | UNITS | DATA<br>TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|--------------------------|-----------|---------------|-------------------------------------------------------------------------------------------------------|-------|--------------|------------------|---------|-------------|
| BIT_FAULT_LOG_WORD(1,17) | V74M4958P | GPS1 LOG WD17 | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                              |       | HMD          |                  | 93017G  | *           |
| BIT_FAULT_LOG_WORD(1,18) | V74M3098P | GPS1 LOG WD18 | TLM                                                                                                   |       | HMD          |                  | 92067D  |             |
| BIT_FAULT_LOG_WORD(1,2)  | V74M4943P | GPS1 LOG WD2  | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                              |       | HMD          |                  | 93017G  | *           |
| BIT_FAULT_LOG_WORD(1,3)  | V74M4944P | GPS1 LOG WD3  | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                              |       | HMD          |                  | 93017G  | *           |
| BIT_FAULT_LOG_WORD(1,4)  | V74M4945P | GPS1 LOG WD4  | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                              |       | HMD          |                  | 93017G  | *           |
| BIT_FAULT_LOG_WORD(1,5)  | V74M4946P | GPS1 LOG WD5  | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                              |       | HMD          |                  | 93017G  | *           |
| BIT_FAULT_LOG_WORD(1,6)  | V74M4947P | GPS1 LOG WD6  | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                              |       | HMD          |                  | 93017G  | *           |
| BIT_FAULT_LOG_WORD(1,7)  | V74M4948P | GPS1 LOG WD7  | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                              |       | HMD          |                  | 93017G  | *           |
| BIT_FAULT_LOG_WORD(1,8)  | V74M4949P | GPS1 LOG WD8  | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                              |       | HMD          |                  | 93017G  | *           |
| BIT_FAULT_LOG_WORD(1,9)  | V74M4950P | GPS1 LOG WD9  | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                              |       | HMD          |                  | 93017G  | *           |
| BIT_FAULT_LOG_WORD(2,1)  | V74M1942P | GPS2 LOG WD1  | DL FMT 22/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD          |                  | 93017G  | *           |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME                | M/S ID    | NOMENCLATURE  | DESTINATION                                                                            | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|--------------------------|-----------|---------------|----------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| BIT_FAULT_LOG_WORD(2,10) | V74M1951P | GPS2 LOG WD10 | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(2,11) | V74M1952P | GPS2 LOG WD11 | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(2,12) | V74M1953P | GPS2 LOG WD12 | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(2,13) | V74M1954P | GPS2 LOG WD13 | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(2,14) | V74M1955P | GPS2 LOG WD14 | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(2,15) | V74M1956P | GPS2 LOG WD15 | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(2,16) | V74M1957P | GPS2 LOG WD16 | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME                | M/S ID    | NOMENCLATURE  | DESTINATION                                                                            | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|--------------------------|-----------|---------------|----------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| BIT_FAULT_LOG_WORD(2,17) | V74M1958P | GPS2 LOG WD17 | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(2,18) | V74M1397P | GPS2 LOG WD18 | TLM                                                                                    |       | HMD       |         | 91051K  |       |
| BIT_FAULT_LOG_WORD(2,2)  | V74M1943P | GPS2 LOG WD2  | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(2,3)  | V74M1944P | GPS2 LOG WD3  | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(2,4)  | V74M1945P | GPS2 LOG WD4  | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(2,5)  | V74M1946P | GPS2 LOG WD5  | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(2,6)  | V74M1947P | GPS2 LOG WD6  | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(2,7)  | V74M1948P | GPS2 LOG WD7  | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME                | M/S ID    | NOMENCLATURE  | DESTINATION                                                                            | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|--------------------------|-----------|---------------|----------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| BIT_FAULT_LOG_WORD(2,8)  | V74M1949P | GPS2 LOG WD8  | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(2,9)  | V74M1950P | GPS2 LOG WD9  | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(3,1)  | V74M5942P | GPS3 LOG WD1  | DL FMT 22/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                |       | HMD       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(3,10) | V74M5951P | GPS3 LOG WD10 | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | HMD       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(3,11) | V74M5952P | GPS3 LOG WD11 | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | HMD       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(3,12) | V74M5953P | GPS3 LOG WD12 | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | HMD       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(3,13) | V74M5954P | GPS3 LOG WD13 | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | HMD       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(3,14) | V74M5955P | GPS3 LOG WD14 | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | HMD       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(3,15) | V74M5956P | GPS3 LOG WD15 | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | HMD       |         | 93017G  | *     |
| BIT_FAULT_LOG_WORD(3,16) | V74M5957P | GPS3 LOG WD16 | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | HMD       |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME                | M/S ID    | NOMENCLATURE          | DESTINATION                                                                                           | UNITS | DATA<br>TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|--------------------------|-----------|-----------------------|-------------------------------------------------------------------------------------------------------|-------|--------------|------------------|---------|-------------|
| BIT_FAULT_LOG_WORD(3,17) | V74M5958P | GPS3 LOG WD17         | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                              |       | HMD          |                  | 93017G  | *           |
| BIT_FAULT_LOG_WORD(3,18) | V74M3108P | GPS3 LOG WD18         | TLM                                                                                                   |       | HMD          |                  | 92067D  |             |
| BIT_FAULT_LOG_WORD(3,2)  | V74M5943P | GPS3 LOG WD2          | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                              |       | HMD          |                  | 93017G  | *           |
| BIT_FAULT_LOG_WORD(3,3)  | V74M5944P | GPS3 LOG WD3          | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                              |       | HMD          |                  | 93017G  | *           |
| BIT_FAULT_LOG_WORD(3,4)  | V74M5945P | GPS3 LOG WD4          | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                              |       | HMD          |                  | 93017G  | *           |
| BIT_FAULT_LOG_WORD(3,5)  | V74M5946P | GPS3 LOG WD5          | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                              |       | HMD          |                  | 93017G  | *           |
| BIT_FAULT_LOG_WORD(3,6)  | V74M5947P | GPS3 LOG WD6          | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                              |       | HMD          |                  | 93017G  | *           |
| BIT_FAULT_LOG_WORD(3,7)  | V74M5948P | GPS3 LOG WD7          | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                              |       | HMD          |                  | 93017G  | *           |
| BIT_FAULT_LOG_WORD(3,8)  | V74M5949P | GPS3 LOG WD8          | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                              |       | HMD          |                  | 93017G  | *           |
| BIT_FAULT_LOG_WORD(3,9)  | V74M5950P | GPS3 LOG WD9          | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                              |       | HMD          |                  | 93017G  | *           |
| CHANNELS_STATUS(1,1)     | V74M4960P | GPS1 CHAN STATUS WD 1 | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD          |                  | 93017G  | *           |



TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME            | M/S ID    | NOMENCLATURE          | DESTINATION                                                                                                          | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|----------------------|-----------|-----------------------|----------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| CHANNELS_STATUS(1,2) | V74M4961P | GPS1 CHAN STATUS WD 2 | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1                               |       | HMD       |         | 93017G  | *     |
| CHANNELS_STATUS(1,3) | V74M4962P | GPS1 CHAN STATUS WD 3 | DL FMT 60/1<br>DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |         | 93017G  | *     |
| CHANNELS_STATUS(1,4) | V74M4963P | GPS1 CHAN STATUS WD 4 | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                |       | HMD       |         | 93017G  | *     |
| CHANNELS_STATUS(1,5) | V74M4964P | GPS1 CHAN STATUS WD 5 | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                |       | HMD       |         | 93017G  | *     |
| CHANNELS_STATUS(1,6) | V74M4965P | GPS1 CHAN STATUS WD 6 | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                |       | HMD       |         | 93017G  | *     |
| CHANNELS_STATUS(1,7) | V74M4966P | GPS1 CHAN STATUS WD 7 | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                |       | HMD       |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME            | M/S ID    | NOMENCLATURE          | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|----------------------|-----------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|------------------|---------|-------------|
| CHANNELS_STATUS(1,8) | V74M4967P | GPS1 CHAN STATUS WD 8 | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | HMD       |                  | 93017G  | *           |
| CHANNELS_STATUS(2,1) | V74M1960P | GPS2 CHAN STATUS WD 1 | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |                  | 93017G  | *           |
| CHANNELS_STATUS(2,2) | V74M1961P | GPS2 CHAN STATUS WD 2 | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |                  | 93017G  | *           |
| CHANNELS_STATUS(2,3) | V74M1962P | GPS2 CHAN STATUS WD 3 | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |                  | 93017G  | *           |
| CHANNELS_STATUS(2,4) | V74M1963P | GPS2 CHAN STATUS WD 4 | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |                  | 93017G  | *           |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME            | M/S ID    | NOMENCLATURE          | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|----------------------|-----------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| CHANNELS_STATUS(2,5) | V74M1964P | GPS2 CHAN STATUS WD 5 | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |         | 93017G  | *     |
| CHANNELS_STATUS(2,6) | V74M1965P | GPS2 CHAN STATUS WD 6 | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |         | 93017G  | *     |
| CHANNELS_STATUS(2,7) | V74M1966P | GPS2 CHAN STATUS WD 7 | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |         | 93017G  | *     |
| CHANNELS_STATUS(2,8) | V74M1967P | GPS2 CHAN STATUS WD 8 | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |         | 93017G  | *     |
| CHANNELS_STATUS(3,1) | V74M5960P | GPS3 CHAN STATUS WD 1 | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | HMD       |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME            | M/S ID    | NOMENCLATURE          | DESTINATION                                                                                           | UNITS | DATA<br>TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|----------------------|-----------|-----------------------|-------------------------------------------------------------------------------------------------------|-------|--------------|------------------|---------|-------------|
| CHANNELS_STATUS(3,2) | V74M5961P | GPS3 CHAN STATUS WD 2 | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD          |                  | 93017G  | *           |
| CHANNELS_STATUS(3,3) | V74M5962P | GPS3 CHAN STATUS WD 3 | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD          |                  | 93017G  | *           |
| CHANNELS_STATUS(3,4) | V74M5963P | GPS3 CHAN STATUS WD 4 | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD          |                  | 93017G  | *           |
| CHANNELS_STATUS(3,5) | V74M5964P | GPS3 CHAN STATUS WD 5 | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD          |                  | 93017G  | *           |
| CHANNELS_STATUS(3,6) | V74M5965P | GPS3 CHAN STATUS WD 6 | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD          |                  | 93017G  | *           |
| CHANNELS_STATUS(3,7) | V74M5966P | GPS3 CHAN STATUS WD 7 | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD          |                  | 93017G  | *           |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME                 | M/S ID     | NOMENCLATURE                      | DESTINATION                                                                                           | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|---------------------------|------------|-----------------------------------|-------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| CHANNELS_STATUS(3,8)      | V74M5967P  | GPS3 CHAN STATUS WD 8             | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |         | 93017G  | *     |
| FILT_RESTART_REQUEST(1)   | V90X3006X  | GPS 1 FILTER RESTART REQUEST FLAG | GPS REF STATE PROC                                                                                    |       | BD        |         | 91051K  |       |
| FILT_RESTART_REQUEST(2)   | V90X3007X  | GPS 2 FILTER RESTART REQUEST FLAG | GPS REF STATE PROC                                                                                    |       | BD        |         | 91051K  |       |
| FILT_RESTART_REQUEST(3)   | V90X3008X  | GPS 3 FILTER RESTART REQUEST FLAG | GPS REF STATE PROC                                                                                    |       | BD        |         | 91051K  |       |
| FOM_GDOP_STATIC(1)        | V94X6142X  | GPS 1 FOM/GDOP STATIC FLAG        | GPS STATUS DISP<br>HORIZ SIT DISP                                                                     |       | BD        |         | 92369B  |       |
| FOM_GDOP_STATIC(2)        | V94X6143X  | GPS 2 FOM/GDOP STATIC FLAG        | GPS STATUS DISP<br>HORIZ SIT DISP                                                                     |       | BD        |         | 92369B  |       |
| FOM_GDOP_STATIC(3)        | V94X6144X  | GPS 3 FOM/GDOP STATIC FLAG        | GPS STATUS DISP<br>HORIZ SIT DISP                                                                     |       | BD        |         | 92369B  |       |
| FOM_NAV(1)                | V94H1082CB | GPS 1 NAV FOM                     | GPS STATUS DISP<br>HORIZ SIT DISP                                                                     |       | HXS       |         | 92067D  |       |
| FOM_NAV(2)                | V94H1083CB | GPS 2 NAV FOM                     | GPS STATUS DISP<br>HORIZ SIT DISP                                                                     |       | HXS       |         | 92067D  |       |
| FOM_NAV(3)                | V94H1084CB | GPS 3 NAV FOM                     | GPS STATUS DISP<br>HORIZ SIT DISP                                                                     |       | HXS       |         | 92067D  |       |
| FOM_SOP(1)                | V90H3009C  | GPS 1 FIGURE OF MERIT             | ENT NAV<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV                                                     |       | HXS       |         | 92067D  |       |
| FOM_SOP(2)                | V90H3010C  | GPS 2 FIGURE OF MERIT             | ENT NAV<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV                                                     |       | HXS       |         | 92067D  |       |
| FOM_SOP(3)                | V90H3011C  | GPS 3 FIGURE OF MERIT             | ENT NAV<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV                                                     |       | HXS       |         | 92067D  |       |
| GDOP_NEW(1)               | V94H0921C  | GPS 1 CURRENT GDOP                | GPS STATUS DISP                                                                                       |       | HXS       |         | 91051K  |       |
| GDOP_NEW(2)               | V94H0922C  | GPS 2 CURRENT GDOP                | GPS STATUS DISP                                                                                       |       | HXS       |         | 91051K  |       |
| GDOP_NEW(3)               | V94H0923B  | GPS 3 CURRENT GDOP                | GPS STATUS DISP                                                                                       |       | HXS       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(1,1)  | V93U1240B  | GPS1 OUTPUT HEADER                | GPS1                                                                                                  |       | BCH       |         | 92067D  |       |
| GPC_TO_GPS_DATA_ONE(1,10) | V93U1249C  | GPC TO GPS 1 DATA ONE HALFWORD 10 | GPS1                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(1,11) | V93U1250C  | GPC TO GPS 1 DATA ONE HALFWORD 11 | GPS1                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(1,12) | V93U1251C  | GPC TO GPS 1 DATA ONE HALFWORD 12 | GPS1                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(1,13) | V93U1252C  | GPC TO GPS 1 DATA ONE HALFWORD 13 | GPS1                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(1,14) | V93U1253C  | GPC TO GPS 1 DATA ONE HALFWORD 14 | GPS1                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(1,15) | V93U1254C  | GPC TO GPS 1 DATA ONE HALFWORD 15 | GPS1                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(1,16) | V93U1255C  | GPC TO GPS 1 DATA ONE HALFWORD 16 | GPS1                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(1,17) | V93U1256C  | GPC TO GPS 1 DATA ONE HALFWORD 17 | GPS1                                                                                                  |       | HMD       |         | 91051K  |       |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME                 | M/S ID    | NOMENCLATURE                      | DESTINATION                                                                                                   | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|---------------------------|-----------|-----------------------------------|---------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| GPC_TO_GPS_DATA_ONE(1,18) | V93U1257C | GPC TO GPS 1 DATA ONE HALFWORD 18 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(1,19) | V93U1258C | GPC TO GPS 1 DATA ONE HALFWORD 19 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(1,2)  | V93M1241P | GPS1 CONTROL WORD 1               | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1<br>GPS1 |       | HMD       |         | 93017G  | *     |
| GPC_TO_GPS_DATA_ONE(1,20) | V93U1259C | GPC TO GPS 1 DATA ONE HALFWORD 20 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(1,21) | V93U1260C | GPC TO GPS 1 DATA ONE HALFWORD 21 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(1,22) | V93U1261C | GPC TO GPS 1 DATA ONE HALFWORD 22 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(1,23) | V93U1262C | GPC TO GPS 1 DATA ONE HALFWORD 23 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(1,24) | V93U1263C | GPC TO GPS 1 DATA ONE HALFWORD 24 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(1,25) | V93U1264C | GPC TO GPS 1 DATA ONE HALFWORD 25 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(1,26) | V93U1265C | GPC TO GPS 1 DATA ONE HALFWORD 26 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(1,27) | V93U1266C | GPC TO GPS 1 DATA ONE HALFWORD 27 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(1,28) | V93U1267C | GPC TO GPS 1 DATA ONE HALFWORD 28 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(1,29) | V93U1268C | GPC TO GPS 1 DATA ONE HALFWORD 29 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(1,3)  | V93M1242P | GPS1 CONTROL WORD 2               | GPS1<br>TLM                                                                                                   |       | HMD       |         | 92067D  |       |
| GPC_TO_GPS_DATA_ONE(1,30) | V93U1269C | GPC TO GPS 1 DATA ONE HALFWORD 30 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(1,31) | V93U1270C | GPC TO GPS 1 DATA ONE HALFWORD 31 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(1,32) | V93U1271C | GPC TO GPS 1 DATA ONE HALFWORD 32 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(1,4)  | V93U1243C | GPC TO GPS 1 DATA ONE HALFWORD 4  | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(1,5)  | V93U1244C | GPC TO GPS 1 DATA ONE HALFWORD 5  | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(1,6)  | V93U1245C | GPC TO GPS 1 DATA ONE HALFWORD 6  | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(1,7)  | V93U1246C | GPC TO GPS 1 DATA ONE HALFWORD 7  | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(1,8)  | V93U1247C | GPC TO GPS 1 DATA ONE HALFWORD 8  | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(1,9)  | V93U1248C | GPC TO GPS 1 DATA ONE HALFWORD 9  | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,1)  | V93U1186B | GPS2 OUTPUT HEADER                | GPS2                                                                                                          |       | BCH       |         | 92067D  |       |
| GPC_TO_GPS_DATA_ONE(2,10) | V93U1278C | GPC TO GPS 2 DATA ONE HALFWORD 10 | GPS2                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,11) | V93U1279C | GPC TO GPS 2 DATA ONE HALFWORD 11 | GPS2                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,12) | V93U1280C | GPC TO GPS 2 DATA ONE HALFWORD 12 | GPS2                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,13) | V93U1281C | GPC TO GPS 2 DATA ONE HALFWORD 13 | GPS2                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,14) | V93U1282C | GPC TO GPS 2 DATA ONE HALFWORD 14 | GPS2                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,15) | V93U1283C | GPC TO GPS 2 DATA ONE HALFWORD 15 | GPS2                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,16) | V93U1284C | GPC TO GPS 2 DATA ONE HALFWORD 16 | GPS2                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,17) | V93U1285C | GPC TO GPS 2 DATA ONE HALFWORD 17 | GPS2                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,18) | V93U1286C | GPC TO GPS 2 DATA ONE HALFWORD 18 | GPS2                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,19) | V93U1287C | GPC TO GPS 2 DATA ONE HALFWORD 19 | GPS2                                                                                                          |       | HMD       |         | 91051K  |       |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME                 | M/S ID    | NOMENCLATURE                      | DESTINATION                                                                                                                                 | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|---------------------------|-----------|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| GPC_TO_GPS_DATA_ONE(2,2)  | V93M0556P | GPS2 CONTROL WORD 1               | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1<br>GPS2 |       | HMD       |         | 93017G  | *     |
| GPC_TO_GPS_DATA_ONE(2,20) | V93U1288C | GPC TO GPS 2 DATA ONE HALFWORD 20 | GPS2                                                                                                                                        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,21) | V93U1289C | GPC TO GPS 2 DATA ONE HALFWORD 21 | GPS2                                                                                                                                        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,22) | V93U1290C | GPC TO GPS 2 DATA ONE HALFWORD 22 | GPS2                                                                                                                                        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,23) | V93U1291C | GPC TO GPS 2 DATA ONE HALFWORD 23 | GPS2                                                                                                                                        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,24) | V93U1292C | GPC TO GPS 2 DATA ONE HALFWORD 24 | GPS2                                                                                                                                        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,25) | V93U1293C | GPC TO GPS 2 DATA ONE HALFWORD 25 | GPS2                                                                                                                                        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,26) | V93U1294C | GPC TO GPS 2 DATA ONE HALFWORD 26 | GPS2                                                                                                                                        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,27) | V93U1295C | GPC TO GPS 2 DATA ONE HALFWORD 27 | GPS2                                                                                                                                        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,28) | V93U1296C | GPC TO GPS 2 DATA ONE HALFWORD 28 | GPS2                                                                                                                                        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,29) | V93U1297C | GPC TO GPS 2 DATA ONE HALFWORD 29 | GPS2                                                                                                                                        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,3)  | V93M0557P | GPS2 CONTROL WORD 2               | GPS2<br>TLM                                                                                                                                 |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,30) | V93U1298C | GPC TO GPS 2 DATA ONE HALFWORD 30 | GPS2                                                                                                                                        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,31) | V93U1299C | GPC TO GPS 2 DATA ONE HALFWORD 31 | GPS2                                                                                                                                        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,32) | V93U1300C | GPC TO GPS 2 DATA ONE HALFWORD 32 | GPS2                                                                                                                                        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,4)  | V93U1272C | GPC TO GPS 2 DATA ONE HALFWORD 4  | GPS2                                                                                                                                        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,5)  | V93U1273C | GPC TO GPS 2 DATA ONE HALFWORD 5  | GPS2                                                                                                                                        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,6)  | V93U1274C | GPC TO GPS 2 DATA ONE HALFWORD 6  | GPS2                                                                                                                                        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,7)  | V93U1275C | GPC TO GPS 2 DATA ONE HALFWORD 7  | GPS2                                                                                                                                        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,8)  | V93U1276C | GPC TO GPS 2 DATA ONE HALFWORD 8  | GPS2                                                                                                                                        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(2,9)  | V93U1277C | GPC TO GPS 2 DATA ONE HALFWORD 9  | GPS2                                                                                                                                        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(3,1)  | V93U1305B | GPS3 OUTPUT HEADER                | GPS3                                                                                                                                        |       | BCH       |         | 92067D  |       |
| GPC_TO_GPS_DATA_ONE(3,10) | V93U1314C | GPC TO GPS 3 DATA ONE HALFWORD 10 | GPS3                                                                                                                                        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(3,11) | V93U1315C | GPC TO GPS 3 DATA ONE HALFWORD 11 | GPS3                                                                                                                                        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(3,12) | V93U1316C | GPC TO GPS 3 DATA ONE HALFWORD 12 | GPS3                                                                                                                                        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(3,13) | V93U1317C | GPC TO GPS 3 DATA ONE HALFWORD 13 | GPS3                                                                                                                                        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(3,14) | V93U1318C | GPC TO GPS 3 DATA ONE HALFWORD 14 | GPS3                                                                                                                                        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(3,15) | V93U1319C | GPC TO GPS 3 DATA ONE HALFWORD 15 | GPS3                                                                                                                                        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(3,16) | V93U1320C | GPC TO GPS 3 DATA ONE HALFWORD 16 | GPS3                                                                                                                                        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(3,17) | V93U1321C | GPC TO GPS 3 DATA ONE HALFWORD 17 | GPS3                                                                                                                                        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(3,18) | V93U1322C | GPC TO GPS 3 DATA ONE HALFWORD 18 | GPS3                                                                                                                                        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(3,19) | V93U1323C | GPC TO GPS 3 DATA ONE HALFWORD 19 | GPS3                                                                                                                                        |       | HMD       |         | 91051K  |       |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME                 | M/S ID    | NOMENCLATURE                      | DESTINATION                                                                                                   | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|---------------------------|-----------|-----------------------------------|---------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| GPC_TO_GPS_DATA_ONE(3,2)  | V93M1306P | GPS3 CONTROL WORD 1               | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1<br>GPS3 |       | HMD       |         | 93017G  | *     |
| GPC_TO_GPS_DATA_ONE(3,20) | V93U1324C | GPC TO GPS 3 DATA ONE HALFWORD 20 | GPS3                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(3,21) | V93U1325C | GPC TO GPS 3 DATA ONE HALFWORD 21 | GPS3                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(3,22) | V93U1326C | GPC TO GPS 3 DATA ONE HALFWORD 22 | GPS3                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(3,23) | V93U1327C | GPC TO GPS 3 DATA ONE HALFWORD 23 | GPS3                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(3,24) | V93U1328C | GPC TO GPS 3 DATA ONE HALFWORD 24 | GPS3                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(3,25) | V93U1329C | GPC TO GPS 3 DATA ONE HALFWORD 25 | GPS3                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(3,26) | V93U1330C | GPC TO GPS 3 DATA ONE HALFWORD 26 | GPS3                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(3,27) | V93U1331C | GPC TO GPS 3 DATA ONE HALFWORD 27 | GPS3                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(3,28) | V93U1332C | GPC TO GPS 3 DATA ONE HALFWORD 28 | GPS3                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(3,29) | V93U1333C | GPC TO GPS 3 DATA ONE HALFWORD 29 | GPS3                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(3,3)  | V93M1307P | GPS3 CONTROL WORD 2               | GPS3<br>TLM                                                                                                   |       | HMD       |         | 92067D  |       |
| GPC_TO_GPS_DATA_ONE(3,30) | V93U1334C | GPC TO GPS 3 DATA ONE HALFWORD 30 | GPS3                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(3,31) | V93U1335C | GPC TO GPS 3 DATA ONE HALFWORD 31 | GPS3                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(3,32) | V93U1336C | GPC TO GPS 3 DATA ONE HALFWORD 32 | GPS3                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(3,4)  | V93U1308C | GPC TO GPS 3 DATA ONE HALFWORD 4  | GPS3                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(3,5)  | V93U1309C | GPC TO GPS 3 DATA ONE HALFWORD 5  | GPS3                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(3,6)  | V93U1310C | GPC TO GPS 3 DATA ONE HALFWORD 6  | GPS3                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(3,7)  | V93U1311C | GPC TO GPS 3 DATA ONE HALFWORD 7  | GPS3                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(3,8)  | V93U1312C | GPC TO GPS 3 DATA ONE HALFWORD 8  | GPS3                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_ONE(3,9)  | V93U1313C | GPC TO GPS 3 DATA ONE HALFWORD 9  | GPS3                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,1)  | V93U1337B | GPS1 DATA TWO OUTPUT HEADER       | GPS1<br>TLM                                                                                                   | ND    | BCH       |         | 92067D  |       |
| GPC_TO_GPS_DATA_TWO(1,10) | V93U1346C | GPC TO GPS 1 DATA TWO HALFWORD 10 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,11) | V93U1347C | GPC TO GPS 1 DATA TWO HALFWORD 11 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,12) | V93U1348C | GPC TO GPS 1 DATA TWO HALFWORD 12 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,13) | V93U1349C | GPC TO GPS 1 DATA TWO HALFWORD 13 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,14) | V93U1350C | GPC TO GPS 1 DATA TWO HALFWORD 14 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,15) | V93U1351C | GPC TO GPS 1 DATA TWO HALFWORD 15 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,16) | V93U1352C | GPC TO GPS 1 DATA TWO HALFWORD 16 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,17) | V93U1353C | GPC TO GPS 1 DATA TWO HALFWORD 17 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,18) | V93U1354C | GPC TO GPS 1 DATA TWO HALFWORD 18 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,19) | V93U1355C | GPC TO GPS 1 DATA TWO HALFWORD 19 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,2)  | V93U1338C | GPC TO GPS 1 DATA TWO HALFWORD 2  | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,20) | V93U1356C | GPC TO GPS 1 DATA TWO HALFWORD 20 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,21) | V93U1357C | GPC TO GPS 1 DATA TWO HALFWORD 21 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,22) | V93U1358C | GPC TO GPS 1 DATA TWO HALFWORD 22 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,23) | V93U1359C | GPC TO GPS 1 DATA TWO HALFWORD 23 | GPS1                                                                                                          |       | HMD       |         | 91051K  |       |



TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME                 | M/S ID    | NOMENCLATURE                      | DESTINATION | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|---------------------------|-----------|-----------------------------------|-------------|-------|-----------|---------|---------|-------|
| GPC_TO_GPS_DATA_TWO(1,24) | V93U1360C | GPC TO GPS 1 DATA TWO HALFWORD 24 | GPS1        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,25) | V93U1361C | GPC TO GPS 1 DATA TWO HALFWORD 25 | GPS1        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,26) | V93U1362C | GPC TO GPS 1 DATA TWO HALFWORD 26 | GPS1        |       | HMS       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,27) | V93U1363C | GPC TO GPS 1 DATA TWO HALFWORD 27 | GPS1        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,28) | V93U1364C | GPC TO GPS 1 DATA TWO HALFWORD 28 | GPS1        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,29) | V93U1365C | GPC TO GPS 1 DATA TWO HALFWORD 29 | GPS1        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,3)  | V93U1339C | GPC TO GPS 1 DATA TWO HALFWORD 3  | GPS1        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,30) | V93U1366C | GPC TO GPS 1 DATA TWO HALFWORD 30 | GPS1        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,31) | V93U1367C | GPC TO GPS 1 DATA TWO HALFWORD 31 | GPS1        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,32) | V93U1368C | GPC TO GPS 1 DATA TWO HALFWORD 32 | GPS1        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,4)  | V93U1340C | GPC TO GPS 1 DATA TWO HALFWORD 4  | GPS1        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,5)  | V93U1341C | GPC TO GPS 1 DATA TWO HALFWORD 5  | GPS1        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,6)  | V93U1342C | GPC TO GPS 1 DATA TWO HALFWORD 6  | GPS1        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,7)  | V93U1343C | GPC TO GPS 1 DATA TWO HALFWORD 7  | GPS1        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,8)  | V93U1344C | GPC TO GPS 1 DATA TWO HALFWORD 8  | GPS1        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(1,9)  | V93U1345C | GPC TO GPS 1 DATA TWO HALFWORD 9  | GPS1        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,1)  | V93U1369B | GPS2 DATA TWO OUTPUT HEADER       | GPS2        | ND    | BCH       |         | 92067D  |       |
|                           |           |                                   | TLM         |       |           |         |         |       |
| GPC_TO_GPS_DATA_TWO(2,10) | V93U1378C | GPC TO GPS 2 DATA TWO HALFWORD 10 | GPS2        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,11) | V93U1379C | GPC TO GPS 2 DATA TWO HALFWORD 11 | GPS2        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,12) | V93U1380C | GPC TO GPS 2 DATA TWO HALFWORD 12 | GPS2        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,13) | V93U1381C | GPC TO GPS 2 DATA TWO HALFWORD 13 | GPS2        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,14) | V93U1382C | GPC TO GPS 2 DATA TWO HALFWORD 14 | GPS2        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,15) | V93U1383C | GPC TO GPS 2 DATA TWO HALFWORD 15 | GPS2        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,16) | V93U1384C | GPC TO GPS 2 DATA TWO HALFWORD 16 | GPS2        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,17) | V93U1385C | GPC TO GPS 2 DATA TWO HALFWORD 17 | GPS2        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,18) | V93U1386C | GPC TO GPS 2 DATA TWO HALFWORD 18 | GPS2        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,19) | V93U1387C | GPC TO GPS 2 DATA TWO HALFWORD 19 | GPS2        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,2)  | V93U1370C | GPC TO GPS 2 DATA TWO HALFWORD 2  | GPS2        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,20) | V93U1388C | GPC TO GPS 2 DATA TWO HALFWORD 20 | GPS2        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,21) | V93U1389C | GPC TO GPS 2 DATA TWO HALFWORD 21 | GPS2        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,22) | V93U1390C | GPC TO GPS 2 DATA TWO HALFWORD 22 | GPS2        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,23) | V93U1391C | GPC TO GPS 2 DATA TWO HALFWORD 23 | GPS2        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,24) | V93U1392C | GPC TO GPS 2 DATA TWO HALFWORD 24 | GPS2        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,25) | V93U1393C | GPC TO GPS 2 DATA TWO HALFWORD 25 | GPS2        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,26) | V93U1394C | GPC TO GPS 2 DATA TWO HALFWORD 26 | GPS2        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,27) | V93U1395C | GPC TO GPS 2 DATA TWO HALFWORD 27 | GPS2        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,28) | V93U1396C | GPC TO GPS 2 DATA TWO HALFWORD 28 | GPS2        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,29) | V93U1397C | GPC TO GPS 2 DATA TWO HALFWORD 29 | GPS2        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,3)  | V93U1371C | GPC TO GPS 2 DATA TWO HALFWORD 3  | GPS2        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,30) | V93U1398C | GPC TO GPS 2 DATA TWO HALFWORD 30 | GPS2        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,31) | V93U1399C | GPC TO GPS 2 DATA TWO HALFWORD 31 | GPS2        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,32) | V93U1400C | GPC TO GPS 2 DATA TWO HALFWORD 32 | GPS2        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,4)  | V93U1372C | GPC TO GPS 2 DATA TWO HALFWORD 4  | GPS2        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,5)  | V93U1373C | GPC TO GPS 2 DATA TWO HALFWORD 5  | GPS2        |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,6)  | V93U1374C | GPC TO GPS 2 DATA TWO HALFWORD 6  | GPS2        |       | HMD       |         | 91051K  |       |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME                 | M/S ID    | NOMENCLATURE                      | DESTINATION                                                                                           | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|---------------------------|-----------|-----------------------------------|-------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| GPC_TO_GPS_DATA_TWO(2,7)  | V93U1375C | GPC TO GPS 2 DATA TWO HALFWORD 7  | GPS2                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,8)  | V93U1376C | GPC TO GPS 2 DATA TWO HALFWORD 8  | GPS2                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(2,9)  | V93U1377C | GPC TO GPS 2 DATA TWO HALFWORD 9  | GPS2                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,1)  | V93U1551B | GPS3 DATA TWO OUTPUT HEADER       | GPS3                                                                                                  | ND    | BCH       |         | 92067D  |       |
|                           |           |                                   | TLM                                                                                                   |       |           |         |         |       |
| GPC_TO_GPS_DATA_TWO(3,10) | V93U1560C | GPC TO GPS 3 DATA TWO HALFWORD 10 | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,11) | V93U1561C | GPC TO GPS 3 DATA TWO HALFWORD 11 | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,12) | V93U1562C | GPC TO GPS 3 DATA TWO HALFWORD 12 | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,13) | V93U1563C | GPC TO GPS 3 DATA TWO HALFWORD 13 | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,14) | V93U1564C | GPC TO GPS 3 DATA TWO HALFWORD 14 | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,15) | V93U1565C | GPC TO GPS 3 DATA TWO HALFWORD 15 | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,16) | V93U1566C | GPC TO GPS 3 DATA TWO HALFWORD 16 | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,17) | V93U1567C | GPC TO GPS 3 DATA TWO HALFWORD 17 | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,18) | V93U1568C | GPC TO GPS 3 DATA TWO HALFWORD 18 | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,19) | V93U1569C | GPC TO GPS 3 DATA TWO HALFWORD 19 | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,2)  | V93U1552C | GPC TO GPS 3 DATA TWO HALFWORD 2  | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,20) | V93U1570C | GPC TO GPS 3 DATA TWO HALFWORD 20 | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,21) | V93U1571C | GPC TO GPS 3 DATA TWO HALFWORD 21 | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,22) | V93U1572C | GPC TO GPS 3 DATA TWO HALFWORD 22 | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,23) | V93U1573C | GPC TO GPS 3 DATA TWO HALFWORD 23 | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,24) | V93U1574C | GPC TO GPS 3 DATA TWO HALFWORD 24 | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,25) | V93U1575C | GPC TO GPS 3 DATA TWO HALFWORD 25 | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,26) | V93U1576C | GPC TO GPS 3 DATA TWO HALFWORD 26 | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,27) | V93U1577C | GPC TO GPS 3 DATA TWO HALFWORD 27 | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,28) | V93U1578C | GPC TO GPS 3 DATA TWO HALFWORD 28 | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,29) | V93U1579C | GPC TO GPS 3 DATA TWO HALFWORD 29 | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,3)  | V93U1553C | GPC TO GPS 3 DATA TWO HALFWORD 3  | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,30) | V93U1580C | GPC TO GPS 3 DATA TWO HALFWORD 30 | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,31) | V93U1581C | GPC TO GPS 3 DATA TWO HALFWORD 31 | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,32) | V93U1582C | GPC TO GPS 3 DATA TWO HALFWORD 32 | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,4)  | V93U1554C | GPC TO GPS 3 DATA TWO HALFWORD 4  | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,5)  | V93U1555C | GPC TO GPS 3 DATA TWO HALFWORD 5  | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,6)  | V93U1556C | GPC TO GPS 3 DATA TWO HALFWORD 6  | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,7)  | V93U1557C | GPC TO GPS 3 DATA TWO HALFWORD 7  | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,8)  | V93U1558C | GPC TO GPS 3 DATA TWO HALFWORD 8  | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPC_TO_GPS_DATA_TWO(3,9)  | V93U1559C | GPC TO GPS 3 DATA TWO HALFWORD 9  | GPS3                                                                                                  |       | HMD       |         | 91051K  |       |
| GPS_AIDING_DATA_AGE_DL(1) | V74W3477B | GPS1 AGE OF AIDING DATA           | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 | MS    | HXS       |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME                 | M/S ID     | NOMENCLATURE                  | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|---------------------------|------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| GPS_AIDING_DATA_AGE_DL(2) | V74W3478B  | GPS2 AGE OF AIDING DATA       | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 | MS    | HXS       |         | 93017G  | *     |
| GPS_AIDING_DATA_AGE_DL(3) | V74W3479B  | GPS3 AGE OF AIDING DATA       | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               | MS    | HXS       |         | 93017G  | *     |
| GPS_ANNCNCD_RESET_SET(1)  | V90X3290XB | GPS 1 REF STATE ANNCNCD RESET | GPS REF STATE PROC                                                                                                                  |       | BD        |         | 92067D  |       |
| GPS_ANNCNCD_RESET_SET(2)  | V90X3291XB | GPS 2 REF STATE ANNCNCD RESET | GPS REF STATE PROC                                                                                                                  |       | BD        |         | 92067D  |       |
| GPS_ANNCNCD_RESET_SET(3)  | V90X3292XB | GPS 3 REF STATE ANNCNCD RESET | GPS REF STATE PROC                                                                                                                  |       | BD        |         | 92067D  |       |
| GPS_AOA_SEL               | V90W0435C  | SEL GPS AGE-OF-AIDING DATA    | DL FMT 21/A<br>DL FMT 22/A<br>DL FMT 23/A                                                                                           | MS    | HXS       |         | 93017G  | *     |
| GPS_DG_SOP(1)             | V90X3012X  | GPS 1 DATA GOOD FLAG          | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP                                     |       | BD        |         | 92067D  |       |
| GPS_DG_SOP(2)             | V90X3013X  | GPS 2 DATA GOOD FLAG          | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP                                     |       | BD        |         | 92067D  |       |
| GPS_DG_SOP(3)             | V90X3014X  | GPS 3 DATA GOOD FLAG          | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP                                     |       | BD        |         | 92067D  |       |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME            | M/S ID    | NOMENCLATURE                | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|----------------------|-----------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|------------------|---------|-------------|
| GPS_ECEF_POS_X_DL(1) | V74H4453B | GPS1 WGS 84 ECEF POSITION X | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               | FT    | FXS       |                  | 93017G  | *           |
| GPS_ECEF_POS_X_DL(2) | V74H1453B | GPS2 WGS 84 ECEF POSITION X | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 | FT    | FXS       |                  | 93017G  | *           |
| GPS_ECEF_POS_X_DL(3) | V74H3453B | GPS3 WGS 84 ECEF POSITION X | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               | FT    | FXS       |                  | 93017G  | *           |
| GPS_ECEF_POS_Y_DL(1) | V74H4454B | GPS1 WGS 84 ECEF POSITION Y | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               | FT    | FXS       |                  | 93017G  | *           |
| GPS_ECEF_POS_Y_DL(2) | V74H1454B | GPS2 WGS 84 ECEF POSITION Y | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 | FT    | FXS       |                  | 93017G  | *           |
| GPS_ECEF_POS_Y_DL(3) | V74H3454B | GPS3 WGS 84 ECEF POSITION Y | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               | FT    | FXS       |                  | 93017G  | *           |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME            | M/S ID    | NOMENCLATURE                | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|----------------------|-----------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| GPS_ECEF_POS_Z_DL(1) | V74H4455B | GPS1 WGS 84 ECEF POSITION Z | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               | FT    | FXS       |         | 93017G  | *     |
| GPS_ECEF_POS_Z_DL(2) | V74H1455B | GPS2 WGS 84 ECEF POSITION Z | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 | FT    | FXS       |         | 93017G  | *     |
| GPS_ECEF_POS_Z_DL(3) | V74H3455B | GPS3 WGS 84 ECEF POSITION Z | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               | FT    | FXS       |         | 93017G  | *     |
| GPS_ECEF_VEL_X_DL(1) | V74L4456B | GPS1 WGS 84 ECEF VELOCITY X | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               | FT/S  | FXS       |         | 93017G  | *     |
| GPS_ECEF_VEL_X_DL(2) | V74L1456B | GPS2 WGS 84 ECEF VELOCITY X | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 | FT/S  | FXS       |         | 93017G  | *     |
| GPS_ECEF_VEL_X_DL(3) | V74L3456B | GPS3 WGS 84 ECEF VELOCITY X | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               | FT/S  | FXS       |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME            | M/S ID    | NOMENCLATURE                | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|----------------------|-----------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| GPS_ECEF_VEL_Y_DL(1) | V74L4457B | GPS1 WGS 84 ECEF VELOCITY Y | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               | FT/S  | FXS       |         | 93017G  | *     |
| GPS_ECEF_VEL_Y_DL(2) | V74L1457B | GPS2 WGS 84 ECEF VELOCITY Y | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 | FT/S  | FXS       |         | 93017G  | *     |
| GPS_ECEF_VEL_Y_DL(3) | V74L3457B | GPS3 WGS 84 ECEF VELOCITY Y | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               | FT/S  | FXS       |         | 93017G  | *     |
| GPS_ECEF_VEL_Z_DL(1) | V74L4458B | GPS1 WGS 84 ECEF VELOCITY Z | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               | FT/S  | FXS       |         | 93017G  | *     |
| GPS_ECEF_VEL_Z_DL(2) | V74L1458B | GPS2 WGS 84 ECEF VELOCITY Z | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 | FT/S  | FXS       |         | 93017G  | *     |
| GPS_ECEF_VEL_Z_DL(3) | V74L3458B | GPS3 WGS 84 ECEF VELOCITY Z | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               | FT/S  | FXS       |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME               | M/S ID     | NOMENCLATURE                 | DESTINATION        | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-------------------------|------------|------------------------------|--------------------|-------|-----------|---------|---------|-------|
| GPS_FAIL_FOM_DISP(1)    | V94X1155XB | GPS 1 FAIL FOM DISP          | GPS STATUS DISP    |       | BD        |         | 92067D  |       |
| GPS_FAIL_FOM_DISP(2)    | V94X1156XB | GPS 2 FAIL FOM DISP          | HORIZ SIT DISP     |       | BD        |         | 92067D  |       |
| GPS_FAIL_FOM_DISP(3)    | V94X1157XB | GPS 3 FAIL FOM DISP          | GPS STATUS DISP    |       | BD        |         | 92067D  |       |
| GPS_FAIL_FOM_SOP(1)     | V90X3015X  | GPS 1 FOM THRESH FAIL FLAG   | HORIZ SIT DISP     |       | BD        |         | 92067D  |       |
| GPS_FAIL_FOM_SOP(2)     | V90X3016X  | GPS 2 FOM THRESH FAIL FLAG   | ENT NAV            |       | BD        |         | 92067D  |       |
| GPS_FAIL_FOM_SOP(3)     | V90X3017X  | GPS 3 FOM THRESH FAIL FLAG   | ORB/RND NAV        |       | BD        |         | 92067D  |       |
| GPS_FAIL_ST(1)          | V94J6059C  | GPS 1 FAIL SELF-TEST IND     | PRELAND NAV        |       | VAR       |         | 92067D  |       |
| GPS_FAIL_ST(2)          | V94J6060C  | GPS 2 FAIL SELF-TEST IND     | RTLS NAV           |       | VAR       |         | 92067D  |       |
| GPS_FAIL_ST(3)          | V94J6061C  | GPS 3 FAIL SELF-TEST IND     | ENT NAV            |       | VAR       |         | 92067D  |       |
| GPS_FILT_RESTART(1)     | V90X3269XA | GPS 1 FILTER RESTART FLAG    | ORB/RND NAV        |       | BD        |         | 92049C  |       |
| GPS_FILT_RESTART(2)     | V90X3270XA | GPS 2 FILTER RESTART FLAG    | PRELAND NAV        |       | BD        |         | 92049C  |       |
| GPS_FILT_RESTART(3)     | V90X3271XA | GPS 3 FILTER RESTART FLAG    | RTLS NAV           |       | BD        |         | 92049C  |       |
| GPS_INIT_REQUEST_SOP(1) | V90X3018XB | GPS 1 REQUEST INITIAL STATE  | GPS STATUS DISP    |       | BD        |         | 92067D  |       |
| GPS_INIT_REQUEST_SOP(2) | V90X3019XB | GPS 2 REQUEST INITIAL STATE  | GPS REF STATE PROC |       | BD        |         | 92067D  |       |
| GPS_INIT_REQUEST_SOP(3) | V90X3020XB | GPS 3 REQUEST INITIAL STATE  | GPS STATUS DISP    |       | BD        |         | 92067D  |       |
| GPS_MODE_CMD_RCVD(1)    | V94J0925C  | GPS 1 MODE CMD FDBK          | GPS REF STATE PROC |       | HXS       |         | 91051K  |       |
| GPS_MODE_CMD_RCVD(2)    | V94J0926C  | GPS 2 MODE CMD FDBK          | GPS STATUS DISP    |       | HXS       |         | 91051K  |       |
| GPS_MODE_CMD_RCVD(3)    | V94J0927C  | GPS 3 MODE CMD FDBK          | GPS STATUS DISP    |       | HXS       |         | 91051K  |       |
| GPS_MODE_CURRENT(1)     | V90U3021C  | GPS 1 CURRENT OPERATING MODE | GPS REF STATE PROC |       | VAR       |         | 92132C  |       |
| GPS_MODE_CURRENT(2)     | V90U3022C  | GPS 2 CURRENT OPERATING MODE | GPS STATUS DISP    |       | VAR       |         | 92132C  |       |
| GPS_MODE_CURRENT(3)     | V90U3023C  | GPS 3 CURRENT OPERATING MODE | GPS REF STATE PROC |       | VAR       |         | 92132C  |       |
| GPS_MODE_DISP(1)        | V94J0928C  | GPS 1 MODE                   | GPS STATUS DISP    |       | VAR       |         | 91051K  |       |
| GPS_MODE_DISP(2)        | V94J0929C  | GPS 2 MODE                   | GPS STATUS DISP    |       | VAR       |         | 91051K  |       |
| GPS_MODE_DISP(3)        | V94J0930C  | GPS 3 MODE                   | GPS STATUS DISP    |       | VAR       |         | 91051K  |       |
| GPS_NAV_SUBMODE(1)      | V90U2616C  | GPS 1 NAV SUBMODE INDICATOR  | GPS REF STATE PROC |       | VAR       |         | 91051K  |       |
| GPS_NAV_SUBMODE(2)      | V90U2617C  | GPS 2 NAV SUBMODE INDICATOR  | GPS REF STATE PROC |       | VAR       |         | 91051K  |       |
| GPS_NAV_SUBMODE(3)      | V90U2618C  | GPS 3 NAV SUBMODE INDICATOR  | GPS REF STATE PROC |       | VAR       |         | 91051K  |       |
| GPS_RA_RCVD             | V94X0931X  | GPS RA FLAG FDBK             | HORIZ SIT DISP     |       | BD        |         | 91051K  |       |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME               | M/S ID    | NOMENCLATURE                  | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-------------------------|-----------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| GPS_RCVR_STATUS(1)      | V94J0932C | GPS 1 RCVR STATUS FOR DISPLAY | GPS STATUS DISP<br>HORIZ SIT DISP<br>REL NAV DISP                                                                                   |       | VAR       |         | 92067D  |       |
| GPS_RCVR_STATUS(2)      | V94J0933C | GPS 2 RCVR STATUS FOR DISPLAY | GPS STATUS DISP<br>HORIZ SIT DISP<br>REL NAV DISP                                                                                   |       | VAR       |         | 92067D  |       |
| GPS_RCVR_STATUS(3)      | V94J0934C | GPS 3 RCVR STATUS FOR DISPLAY | GPS STATUS DISP<br>HORIZ SIT DISP<br>REL NAV DISP                                                                                   |       | VAR       |         | 92067D  |       |
| GPS_SEC_DL(1)           | V74W4452B | GPS1 SECONDS                  | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               | S     | BSU       |         | 93017G  | *     |
| GPS_SEC_DL(2)           | V74W1452B | GPS2 SECONDS                  | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 | S     | BSU       |         | 93017G  | *     |
| GPS_SEC_DL(3)           | V74W3452B | GPS3 SECONDS                  | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               | S     | BSU       |         | 93017G  | *     |
| GPS_SOP_COLLECTION_WORD | V93M1151P | GPS SOP COLLECTION WORD       | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |         | 93017G  | *     |



TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME                   | M/S ID    | NOMENCLATURE                | DESTINATION                                                                                                                                            | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------------------------|-----------|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| GPS_SOP_COLLECTION_WORD_TWO | V93M3151P | GPS SOP COLLECTION WORD TWO | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                                  |       | HMD       |         | 93017G  | *     |
| GPS_STATUS_FOM_GDOP(1)      | V74M4461P | GPS1 STATUS FOM GDOP WORD 1 | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                                  |       | HMD       |         | 93017G  | *     |
| GPS_STATUS_FOM_GDOP(2)      | V74M1461P | GPS2 STATUS FOM GDOP WORD 1 | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                    |       | HMD       |         | 93017G  | *     |
| GPS_STATUS_FOM_GDOP(3)      | V74M3461P | GPS3 STATUS FOM GDOP WORD 1 | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                                  |       | HMD       |         | 93017G  | *     |
| GPS_TIME_ADJ_ENBL           | V94X0220X | GPS TIME ADJ CMD RCVD       | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1<br>GPS STATUS DISP | EVENT | BD        |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME          | M/S ID     | NOMENCLATURE                      | DESTINATION                                                                                                                         | UNITS | DATA<br>TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|--------------------|------------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|--------------|------------------|---------|-------------|
| GPS_WEEK_DL(1)     | V74W4451B  | GPS1 WEEKS                        | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1                                              |       | HXU          |                  | 93017G  | *           |
| GPS_WEEK_DL(2)     | V74W1451B  | GPS2 WEEKS                        | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HXU          |                  | 93017G  | *           |
| GPS_WEEK_DL(3)     | V74W3451B  | GPS3 WEEKS                        | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | HXU          |                  | 93017G  | *           |
| INIT_STATE_SET(1)  | V90X3278XB | GPS 1 REFERENCE STATE INITIALIZED | GPS REF STATE PROC                                                                                                                  |       | BD           |                  | 92067D  |             |
| INIT_STATE_SET(2)  | V90X3279XB | GPS 2 REFERENCE STATE INITIALIZED | GPS REF STATE PROC                                                                                                                  |       | BD           |                  | 92067D  |             |
| INIT_STATE_SET(3)  | V90X3280XB | GPS 3 REFERENCE STATE INITIALIZED | GPS REF STATE PROC                                                                                                                  |       | BD           |                  | 92067D  |             |
| NUM_GPS_INSTALLED  | V90U3671C  | NUMBER OF GPS RCVR INSTALLED      | A/L UPP<br>ASC AREA NAV<br>E/L EV AN PROC<br>ENT AREA NAV<br>ENT UPP<br>GPS RCVR STATE PROC<br>RTLS UPP<br>TACAN RM<br>TAEM UPP     |       | HXS          |                  | 92067D  |             |
| PPS_STATUS_WORD(1) | V74M4459P  | GPS1 PPS STATUS                   | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD          |                  | 93017G  | *           |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME           | M/S ID    | NOMENCLATURE                      | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|---------------------|-----------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| PPS_STATUS_WORD(2)  | V74M1459P | GPS2 PPS STATUS                   | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |         | 93017G  | *     |
| PPS_STATUS_WORD(3)  | V74M3459P | GPS3 PPS STATUS                   | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | HMD       |         | 93017G  | *     |
| RCVR_FAIL(1)        | V94X0935X | GPS 1 RCVR FAIL IND               | GAX                                                                                                                                 |       | BD        |         | 92067D  |       |
| RCVR_FAIL(2)        | V94X0936X | GPS 2 RCVR FAIL IND               | GAX                                                                                                                                 |       | BD        |         | 92069B  |       |
| RCVR_FAIL(3)        | V94X0937X | GPS 3 RCVR FAIL IND               | GAX                                                                                                                                 |       | BD        |         | 92067D  |       |
| R_GPS_ECEF_NEW(1,1) | V90H1346C | GPS 1 NEW WGS84 POS VECTOR X-COMP | ASC AREA NAV<br>ENT AREA NAV                                                                                                        | FT    | DPL       |         | 92067D  |       |
| R_GPS_ECEF_NEW(1,2) | V90H1347C | GPS 1 NEW WGS84 POS VECTOR Y-COMP | ASC AREA NAV<br>ENT AREA NAV                                                                                                        | FT    | DPL       |         | 92067D  |       |
| R_GPS_ECEF_NEW(1,3) | V90H1348C | GPS 1 NEW WGS84 POS VECTOR Z-COMP | ASC AREA NAV<br>ENT AREA NAV                                                                                                        | FT    | DPL       |         | 92067D  |       |
| R_GPS_ECEF_NEW(2,1) | V90H1349C | GPS 2 NEW WGS84 POS VECTOR X-COMP | ASC AREA NAV<br>ENT AREA NAV                                                                                                        | FT    | DPL       |         | 92067D  |       |
| R_GPS_ECEF_NEW(2,2) | V90H1350C | GPS 2 NEW WGS84 POS VECTOR Y-COMP | ASC AREA NAV<br>ENT AREA NAV                                                                                                        | FT    | DPL       |         | 92067D  |       |
| R_GPS_ECEF_NEW(2,3) | V90H1351C | GPS 2 NEW WGS84 POS VECTOR Z-COMP | ASC AREA NAV<br>ENT AREA NAV                                                                                                        | FT    | DPL       |         | 92067D  |       |
| R_GPS_ECEF_NEW(3,1) | V90H1352C | GPS 3 NEW WGS84 POS VECTOR X-COMP | ASC AREA NAV<br>ENT AREA NAV                                                                                                        | FT    | DPL       |         | 92067D  |       |
| R_GPS_ECEF_NEW(3,2) | V90H1353C | GPS 3 NEW WGS84 POS VECTOR Y-COMP | ASC AREA NAV<br>ENT AREA NAV                                                                                                        | FT    | DPL       |         | 92067D  |       |
| R_GPS_ECEF_NEW(3,3) | V90H1354C | GPS 3 NEW WGS84 POS VECTOR Z-COMP | ASC AREA NAV<br>ENT AREA NAV                                                                                                        | FT    | DPL       |         | 92067D  |       |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME           | M/S ID    | NOMENCLATURE                  | DESTINATION                                                                                     | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|---------------------|-----------|-------------------------------|-------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| R_GPS_ECEF_SOP(1,1) | V90H3036C | GPS 1 WGS84 POS VECTOR X-COMP | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP | FT    | DPL       |         | 92067D  |       |
| R_GPS_ECEF_SOP(1,2) | V90H3037C | GPS 1 WGS84 POS VECTOR Y-COMP | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP | FT    | DPL       |         | 92067D  |       |
| R_GPS_ECEF_SOP(1,3) | V90H3038C | GPS 1 WGS84 POS VECTOR Z-COMP | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP | FT    | DPL       |         | 92067D  |       |
| R_GPS_ECEF_SOP(2,1) | V90H3039C | GPS 2 WGS84 POS VECTOR X-COMP | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP | FT    | DPL       |         | 92067D  |       |
| R_GPS_ECEF_SOP(2,2) | V90H3040C | GPS 2 WGS84 POS VECTOR Y-COMP | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP | FT    | DPL       |         | 92067D  |       |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME               | M/S ID    | NOMENCLATURE                  | DESTINATION                                                                                     | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-------------------------|-----------|-------------------------------|-------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| R_GPS_ECEF_SOP(2,3)     | V90H3041C | GPS 2 WGS84 POS VECTOR Z-COMP | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP | FT    | DPL       |         | 92067D  |       |
| R_GPS_ECEF_SOP(3,1)     | V90H3042C | GPS 3 WGS84 POS VECTOR X-COMP | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP | FT    | DPL       |         | 92067D  |       |
| R_GPS_ECEF_SOP(3,2)     | V90H3043C | GPS 3 WGS84 POS VECTOR Y-COMP | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP | FT    | DPL       |         | 92067D  |       |
| R_GPS_ECEF_SOP(3,3)     | V90H3044C | GPS 3 WGS84 POS VECTOR Z-COMP | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP | FT    | DPL       |         | 92067D  |       |
| SATS_BLANKING_FLAG(1,1) | V94X0185X | GPS 1 SAT 1 DISP BLANKING     | GPS STATUS DISP                                                                                 |       | BD        |         | 92281D  |       |
| SATS_BLANKING_FLAG(1,2) | V94X0186X | GPS 1 SAT 2 DISP BLANKING     | GPS STATUS DISP                                                                                 |       | BD        |         | 92281D  |       |
| SATS_BLANKING_FLAG(1,3) | V94X0187X | GPS 1 SAT 3 DISP BLANKING     | GPS STATUS DISP                                                                                 |       | BD        |         | 92281D  |       |
| SATS_BLANKING_FLAG(1,4) | V94X0188X | GPS 1 SAT 4 DISP BLANKING     | GPS STATUS DISP                                                                                 |       | BD        |         | 92281D  |       |
| SATS_BLANKING_FLAG(1,5) | V94X0189X | GPS 1 SAT 5 DISP BLANKING     | GPS STATUS DISP                                                                                 |       | BD        |         | 92281D  |       |
| SATS_BLANKING_FLAG(1,6) | V94X0202X | GSP 1 SAT 6 DISP BLANKING     | GPS STATUS DISP                                                                                 |       | BD        |         | 92281D  |       |
| SATS_BLANKING_FLAG(2,1) | V94X0190X | GPS 2 SAT 1 DISP BLANKING     | GPS STATUS DISP                                                                                 |       | BD        |         | 92281D  |       |
| SATS_BLANKING_FLAG(2,2) | V94X0191X | GPS 2 SAT 2 DISP BLANKING     | GPS STATUS DISP                                                                                 |       | BD        |         | 92281D  |       |
| SATS_BLANKING_FLAG(2,3) | V94X0192X | GPS 2 SAT 3 DISP BLANKING     | GPS STATUS DISP                                                                                 |       | BD        |         | 92281D  |       |
| SATS_BLANKING_FLAG(2,4) | V94X0193X | GSP 2 SAT 4 DISP BLANKING     | GPS STATUS DISP                                                                                 |       | BD        |         | 92281D  |       |
| SATS_BLANKING_FLAG(2,5) | V94X0194X | GPS 2 SAT 5 DISP BLANKING     | GPS STATUS DISP                                                                                 |       | BD        |         | 92281D  |       |
| SATS_BLANKING_FLAG(2,6) | V94X0203X | GPS 2 SAT 6 DISP BLANKING     | GPS STATUS DISP                                                                                 |       | BD        |         | 92281D  |       |
| SATS_BLANKING_FLAG(3,1) | V94X0195X | GSP 3 SAT 1 DISP BLANKING     | GPS STATUS DISP                                                                                 |       | BD        |         | 92281D  |       |
| SATS_BLANKING_FLAG(3,2) | V94X0196X | GSP 3 SAT 2 DISP BLANKING     | GPS STATUS DISP                                                                                 |       | BD        |         | 92281D  |       |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME               | M/S ID    | NOMENCLATURE                  | DESTINATION                                                                                     | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-------------------------|-----------|-------------------------------|-------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| SATS_BLANKING_FLAG(3,3) | V94X0197X | GPS 3 SAT 3 DISP BLANKING     | GPS STATUS DISP                                                                                 |       | BD        |         | 92281D  |       |
| SATS_BLANKING_FLAG(3,4) | V94X0198X | GPS 3 SAT 4 DISP BLANKING     | GPS STATUS DISP                                                                                 |       | BD        |         | 92281D  |       |
| SATS_BLANKING_FLAG(3,5) | V94X0199X | GPS 3 SAT 5 DISP BLANKING     | GPS STATUS DISP                                                                                 |       | BD        |         | 92281D  |       |
| SATS_BLANKING_FLAG(3,6) | V94X0204X | GPS 3 SAT 6 DISP BLANKING     | GPS STATUS DISP                                                                                 |       | BD        |         | 92281D  |       |
| SATS_TRACKED(1,1)       | V94U0938C | GPS 1 SAT NO 1 TRACKED        | GPS STATUS DISP                                                                                 |       | HXS       |         | 91051K  |       |
| SATS_TRACKED(1,2)       | V94U0939C | GPS 1 SAT NO 2 TRACKED        | GPS STATUS DISP                                                                                 |       | HXS       |         | 91051K  |       |
| SATS_TRACKED(1,3)       | V94U0940C | GPS 1 SAT NO 3 TRACKED        | GPS STATUS DISP                                                                                 |       | HXS       |         | 91051K  |       |
| SATS_TRACKED(1,4)       | V94U0941C | GPS 1 SAT NO 4 TRACKED        | GPS STATUS DISP                                                                                 |       | HXS       |         | 91051K  |       |
| SATS_TRACKED(1,5)       | V94U0942C | GPS 1 SAT NO 5 TRACKED        | GPS STATUS DISP                                                                                 |       | HXS       |         | 91051K  |       |
| SATS_TRACKED(1,6)       | V94U0943C | GPS 1 SAT NO 6 TRACKED        | GPS STATUS DISP                                                                                 |       | HXS       |         | 91051K  |       |
| SATS_TRACKED(2,1)       | V94U0944C | GPS 2 SAT NO 1 TRACKED        | GPS STATUS DISP                                                                                 |       | HXS       |         | 91051K  |       |
| SATS_TRACKED(2,2)       | V94U0945C | GPS 2 SAT NO 2 TRACKED        | GPS STATUS DISP                                                                                 |       | HXS       |         | 91051K  |       |
| SATS_TRACKED(2,3)       | V94U0946C | GPS 2 SAT NO 3 TRACKED        | GPS STATUS DISP                                                                                 |       | HXS       |         | 91051K  |       |
| SATS_TRACKED(2,4)       | V94U0947C | GPS 2 SAT NO 4 TRACKED        | GPS STATUS DISP                                                                                 |       | HXS       |         | 91051K  |       |
| SATS_TRACKED(2,5)       | V94U0948C | GPS 2 SAT NO 5 TRACKED        | GPS STATUS DISP                                                                                 |       | HXS       |         | 91051K  |       |
| SATS_TRACKED(2,6)       | V94U0949C | GPS 2 SAT NO 6 TRACKED        | GPS STATUS DISP                                                                                 |       | HXS       |         | 91051K  |       |
| SATS_TRACKED(3,1)       | V94U0950C | GPS 3 SAT NO 1 TRACKED        | GPS STATUS DISP                                                                                 |       | HXS       |         | 91051K  |       |
| SATS_TRACKED(3,2)       | V94U0951C | GPS 3 SAT NO 2 TRACKED        | GPS STATUS DISP                                                                                 |       | HXS       |         | 91051K  |       |
| SATS_TRACKED(3,3)       | V94U0952C | GPS 3 SAT NO 3 TRACKED        | GPS STATUS DISP                                                                                 |       | HXS       |         | 91051K  |       |
| SATS_TRACKED(3,4)       | V94U0953C | GPS 3 SAT NO 4 TRACKED        | GPS STATUS DISP                                                                                 |       | HXS       |         | 91051K  |       |
| SATS_TRACKED(3,5)       | V94U0954C | GPS 3 SAT NO 5 TRACKED        | GPS STATUS DISP                                                                                 |       | HXS       |         | 91051K  |       |
| SATS_TRACKED(3,6)       | V94U0955C | GPS 3 SAT NO 6 TRACKED        | GPS STATUS DISP                                                                                 |       | HXS       |         | 91051K  |       |
| T_GPS_NEW(1)            | V90W1355C | GPS 1 NEW STATE TIME TAG(GMT) | ASC AREA NAV<br>ENT AREA NAV                                                                    | S     | DPL       |         | 92067D  |       |
| T_GPS_NEW(2)            | V90W1356C | GPS 2 NEW STATE TIME TAG(GMT) | ASC AREA NAV<br>ENT AREA NAV                                                                    | S     | DPL       |         | 92067D  |       |
| T_GPS_NEW(3)            | V90W1357C | GPS 3 NEW STATE TIME TAG(GMT) | ASC AREA NAV<br>ENT AREA NAV                                                                    | S     | DPL       |         | 92067D  |       |
| T_GPS_OFFSET_SECS       | V91W0029C | GPS OFFSET SECONDS            | D/L NAV SEQ                                                                                     | S     | DPL       |         | 93160B  | *     |
| T_GPS_SOP(1)            | V90W3045C | GPS 1 STATE TIME TAG(GMT)     | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP | S     | DPL       |         | 92067D  |       |
| T_GPS_SOP(2)            | V90W3046C | GPS 2 STATE TIME TAG(GMT)     | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP | S     | DPL       |         | 92067D  |       |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME           | M/S ID    | NOMENCLATURE                       | DESTINATION                                                                                            | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|---------------------|-----------|------------------------------------|--------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| T_GPS_SOP(3)        | V90W3047C | GPS 3 STATE TIME TAG(GMT)          | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP        | S     | DPL       |         | 92067D  |       |
| T_GPS_TIME_ADJ_ACC  | V90W0436C | ACCUM GPC-TO-GPS TIME ADJ          | DL FMT 21/A<br>DL FMT 22/A<br>DL FMT 23/A                                                              | MS    | HXS       |         | 93017G  | *     |
| T_IMU_SAVE_SOP(1)   | V90W3048C | IMU TIME TAG FOR CURNT GPS 1 STATE | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP        | S     | DPL       |         | 92067D  |       |
| T_IMU_SAVE_SOP(2)   | V90W3049C | IMU TIME TAG FOR CURNT GPS 2 STATE | TLM<br>A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP | S     | DPL       |         | 92067D  |       |
| T_IMU_SAVE_SOP(3)   | V90W3050C | IMU TIME TAG FOR CURNT GPS 3 STATE | TLM<br>A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP | S     | DPL       |         | 92067D  |       |
| V_GPS_ECEF_NEW(1,1) | V90L1521C | GPS 1 NEW WGS84 VEL VECTOR X-COMP  | TLM<br>ASC AREA NAV<br>ENT AREA NAV                                                                    | FT/S  | SPL       |         | 92389C  |       |
| V_GPS_ECEF_NEW(1,2) | V90L1522C | GPS 1 NEW WGS84 VEL VECTOR Y-COMP  | ASC AREA NAV<br>ENT AREA NAV                                                                           | FT/S  | SPL       |         | 92389C  |       |
| V_GPS_ECEF_NEW(1,3) | V90L1523C | GPS 1 NEW WGS84 VEL VECTOR Z-COMP  | ASC AREA NAV<br>ENT AREA NAV                                                                           | FT/S  | SPL       |         | 92389C  |       |
| V_GPS_ECEF_NEW(2,1) | V90L1524C | GPS 2 NEW WGS84 VEL VECTOR X-COMP  | ASC AREA NAV<br>ENT AREA NAV                                                                           | FT/S  | SPL       |         | 92389C  |       |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME           | M/S ID    | NOMENCLATURE                      | DESTINATION                                                                                     | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|---------------------|-----------|-----------------------------------|-------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| V_GPS_ECEF_NEW(2,2) | V90L1525C | GPS 2 NEW WGS84 VEL VECTOR Y-COMP | ASC AREA NAV<br>ENT AREA NAV                                                                    | FT/S  | SPL       |         | 92389C  |       |
| V_GPS_ECEF_NEW(2,3) | V90L1526C | GPS 2 NEW WGS84 VEL VECTOR Z-COMP | ASC AREA NAV<br>ENT AREA NAV                                                                    | FT/S  | SPL       |         | 92389C  |       |
| V_GPS_ECEF_NEW(3,1) | V90L1527C | GPS 3 NEW WGS84 VEL VECTOR X-COMP | ASC AREA NAV<br>ENT AREA NAV                                                                    | FT/S  | SPL       |         | 92389C  |       |
| V_GPS_ECEF_NEW(3,2) | V90L1528C | GPS 3 NEW WGS84 VEL VECTOR Y-COMP | ASC AREA NAV<br>ENT AREA NAV                                                                    | FT/S  | SPL       |         | 92389C  |       |
| V_GPS_ECEF_NEW(3,3) | V90L1529C | GPS 3 NEW WGS84 VEL VECTOR Z-COMP | ASC AREA NAV<br>ENT AREA NAV                                                                    | FT/S  | SPL       |         | 92389C  |       |
| V_GPS_ECEF_SOP(1,1) | V90L3051C | GPS 1 WGS84 VEL VECTOR X-COMP     | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP | FT/S  | SPL       |         | 92067D  |       |
| V_GPS_ECEF_SOP(1,2) | V90L3052C | GPS 1 WGS84 VEL VECTOR Y-COMP     | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP | FT/S  | SPL       |         | 92067D  |       |
| V_GPS_ECEF_SOP(1,3) | V90L3053C | GPS 1 WGS84 VEL VECTOR Z-COMP     | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP | FT/S  | SPL       |         | 92067D  |       |
| V_GPS_ECEF_SOP(2,1) | V90L3054C | GPS 2 WGS84 VEL VECTOR X-COMP     | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP | FT/S  | SPL       |         | 92067D  |       |



TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME           | M/S ID    | NOMENCLATURE                  | DESTINATION                                                                                     | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|---------------------|-----------|-------------------------------|-------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| V_GPS_ECEF_SOP(2,2) | V90L3055C | GPS 2 WGS84 VEL VECTOR Y-COMP | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP | FT/S  | SPL       |         | 92067D  |       |
| V_GPS_ECEF_SOP(2,3) | V90L3056C | GPS 2 WGS84 VEL VECTOR Z-COMP | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP | FT/S  | SPL       |         | 92067D  |       |
| V_GPS_ECEF_SOP(3,1) | V90L3057C | GPS 3 WGS84 VEL VECTOR X-COMP | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP | FT/S  | SPL       |         | 92067D  |       |
| V_GPS_ECEF_SOP(3,2) | V90L3058C | GPS 3 WGS84 VEL VECTOR Y-COMP | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP | FT/S  | SPL       |         | 92067D  |       |
| V_GPS_ECEF_SOP(3,3) | V90L3059C | GPS 3 WGS84 VEL VECTOR Z-COMP | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP | FT/S  | SPL       |         | 92067D  |       |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME           | M/S ID    | NOMENCLATURE                      | DESTINATION                                                                                            | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|---------------------|-----------|-----------------------------------|--------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| V_IMU_SAVE_SOP(1,1) | V95L0133C | IMU ACCUM X VEL FOR CURRENT GPS 1 | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP<br>TLM | FT/S  | DPL       |         | 92067D  |       |
| V_IMU_SAVE_SOP(1,2) | V95L0134C | IMU ACCUM Y VEL FOR CURRENT GPS 1 | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP<br>TLM | FT/S  | DPL       |         | 92067D  |       |
| V_IMU_SAVE_SOP(1,3) | V95L0135C | IMU ACCUM Z VEL FOR CURRENT GPS 1 | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP<br>TLM | FT/S  | DPL       |         | 92067D  |       |
| V_IMU_SAVE_SOP(2,1) | V95L0136C | IMU ACCUM X VEL FOR CURRENT GPS 2 | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP<br>TLM | FT/S  | DPL       |         | 92067D  |       |
| V_IMU_SAVE_SOP(2,2) | V95L0137C | IMU ACCUM Y VEL FOR CURRENT GPS 2 | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP<br>TLM | FT/S  | DPL       |         | 92067D  |       |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME           | M/S ID    | NOMENCLATURE                      | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|---------------------|-----------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| V_IMU_SAVE_SOP(2,3) | V95L0138C | IMU ACCUM Z VEL FOR CURRENT GPS 2 | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP<br>TLM                              | FT/S  | DPL       |         | 92067D  |       |
| V_IMU_SAVE_SOP(3,1) | V95L0139C | IMU ACCUM X VEL FOR CURRENT GPS 3 | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP<br>TLM                              | FT/S  | DPL       |         | 92067D  |       |
| V_IMU_SAVE_SOP(3,2) | V95L0140C | IMU ACCUM Y VEL FOR CURRENT GPS 3 | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP<br>TLM                              | FT/S  | DPL       |         | 92067D  |       |
| V_IMU_SAVE_SOP(3,3) | V95L0141C | IMU ACCUM Z VEL FOR CURRENT GPS 3 | A/L UPP<br>ENT NAV<br>ENT UPP<br>ORB/RND NAV<br>PRELAND NAV<br>RTLS NAV<br>RTLS UPP<br>TAEM UPP<br>TLM                              | FT/S  | DPL       |         | 92067D  |       |
|                     | V74E1978B | GPS2 CHAN 1 SIGNAL TO NOISE RATIO | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                      | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74E1980B | GPS2 CHAN 2 SIGNAL TO NOISE RATIO | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74E1989B | GPS2 CHAN 3 SIGNAL TO NOISE RATIO | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74E1991B | GPS2 CHAN 4 SIGNAL TO NOISE RATIO | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74E2080B | GPS2 CHAN 5 SIGNAL TO NOISE RATIO | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74E3080B | GPS3 CHAN 5 SIGNAL TO NOISE RATIO | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | BSU       |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                      | DESTINATION                                                                                           | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|-----------------------------------|-------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74E4978B | GPS1 CHAN 1 SIGNAL TO NOISE RATIO | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74E4980B | GPS1 CHAN 2 SIGNAL TO NOISE RATIO | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74E4989B | GPS1 CHAN 3 SIGNAL TO NOISE RATIO | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74E4991B | GPS1 CHAN 4 SIGNAL TO NOISE RATIO | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74E5978B | GPS3 CHAN 1 SIGNAL TO NOISE RATIO | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74E5980B | GPS3 CHAN 2 SIGNAL TO NOISE RATIO | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                      | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74E5989B | GPS3 CHAN 3 SIGNAL TO NOISE RATIO | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | BSU       |         | 93017G  | *     |
|           | V74E5991B | GPS3 CHAN 4 SIGNAL TO NOISE RATIO | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | BSU       |         | 93017G  | *     |
|           | V74E8080B | GPS1 CHAN 5 SIGNAL TO NOISE RATIO | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | BSU       |         | 93017G  | *     |
|           | V74U1465B | GPS2 GEOMETRIC DILUTION OF PREC   | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U1466B | GPS2 FIGURE OF MERIT              | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                     | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74U1975B | GPS2 CHAN 1 STATE                | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U1976B | GPS2 CHAN 1 HDWARE CHAN NUMBER   | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U1977B | GPS2 CHAN 1 SATELLITE NUMBER     | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U1979B | GPS2 CHAN 1 CODE TRACKING STATUS | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U1981B | GPS2 CHAN 2 CODE TRACKING STATUS | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                     | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74U1986B | GPS2 CHAN 2 STATE                | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U1987B | GPS2 CHAN 2 HDWARE CHAN NUMBER   | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U1988B | GPS2 CHAN 2 SATELLITE NUMBER     | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U1990B | GPS2 CHAN 3 CODE TRACKING STATUS | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U1992B | GPS2 CHAN 4 CODE TRACKING STATUS | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |



TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                     | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74U1997B | GPS2 CHAN 3 STATE                | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U1998B | GPS2 CHAN 3 HDWARE CHAN NUMBER   | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U1999B | GPS2 CHAN 3 SATELLITE NUMBER     | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U2081B | GPS2 CHAN 5 CODE TRACKING STATUS | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U2088B | GPS2 CHAN 4 STATE                | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                   | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74U2089B | GPS2 CHAN 4 HDWARE CHAN NUMBER | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U2090B | GPS2 CHAN 4 SATELLITE NUMBER   | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U2095B | GPS2 CHAN 5 STATE              | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U2096B | GPS2 CHAN 5 HDWARE CHAN NUMBER | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U2097B | GPS2 CHAN 5 SATELLITE NUMBER   | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                     | DESTINATION                                                                                           | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|----------------------------------|-------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74U3081B | GPS3 CHAN 5 CODE TRACKING STATUS | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1                |       | BSU       |         | 93017G  | *     |
|           | V74U3088B | GPS3 CHAN 4 STATE                | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U3089B | GPS3 CHAN 4 HDWARE CHAN NUMBER   | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U3090B | GPS3 CHAN 4 SATELLITE NUMBER     | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U3095B | GPS3 CHAN 5 STATE                | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U3096B | GPS3 CHAN 5 HDWARE CHAN NUMBER   | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                    | DESTINATION                                                                                           | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|---------------------------------|-------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74U3097B | GPS3 CHAN 5 SATELLITE NUMBER    | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U3465B | GPS3 GEOMETRIC DILUTION OF PREC | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U3466B | GPS3 FIGURE OF MERIT            | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U4465B | GPS1 GEOMETRIC DILUTION OF PREC | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U4466B | GPS1 FIGURE OF MERIT            | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U4975B | GPS1 CHAN 1 STATE               | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                     | DESTINATION                                                                                           | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|----------------------------------|-------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74U4976B | GPS1 CHAN 1 HDWARE CHAN NUMBER   | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1                |       | BSU       |         | 93017G  | *     |
|           | V74U4977B | GPS1 CHAN 1 SATELLITE NUMBER     | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U4979B | GPS1 CHAN 1 CODE TRACKING STATUS | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U4981B | GPS1 CHAN 2 CODE TRACKING STATUS | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U4986B | GPS1 CHAN 2 STATE                | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U4987B | GPS1 CHAN 2 HDWARE CHAN NUMBER   | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                     | DESTINATION                                                                                           | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|----------------------------------|-------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74U4988B | GPS1 CHAN 2 SATELLITE NUMBER     | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U4990B | GPS1 CHAN 3 CODE TRACKING STATUS | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U4992B | GPS1 CHAN 4 CODE TRACKING STATUS | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U4997B | GPS1 CHAN 3 STATE                | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U4998B | GPS1 CHAN 3 HDWARE CHAN NUMBER   | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U4999B | GPS1 CHAN 3 SATELLITE NUMBER     | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                     | DESTINATION                                                                                           | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|----------------------------------|-------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74U5975B | GPS3 CHAN 1 STATE                | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U5976B | GPS3 CHAN 1 HDWARE CHAN NUMBER   | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U5977B | GPS3 CHAN 1 SATELLITE NUMBER     | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U5979B | GPS3 CHAN 1 CODE TRACKING STATUS | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U5981B | GPS3 CHAN 2 CODE TRACKING STATUS | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U5986B | GPS3 CHAN 2 STATE                | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                     | DESTINATION                                                                                           | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|----------------------------------|-------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74U5987B | GPS3 CHAN 2 HDWARE CHAN NUMBER   | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U5988B | GPS3 CHAN 2 SATELLITE NUMBER     | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U5990B | GPS3 CHAN 3 CODE TRACKING STATUS | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U5992B | GPS3 CHAN 4 CODE TRACKING STATUS | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U5997B | GPS3 CHAN 3 STATE                | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U5998B | GPS3 CHAN 3 HDWARE CHAN NUMBER   | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |



TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                     | DESTINATION                                                                                           | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|----------------------------------|-------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74U5999B | GPS3 CHAN 3 SATELLITE NUMBER     | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U8081B | GPS1 CHAN 5 CODE TRACKING STATUS | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U8088B | GPS1 CHAN 4 STATE                | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U8089B | GPS1 CHAN 4 HDWARE CHAN NUMBER   | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U8090B | GPS1 CHAN 4 SATELLITE NUMBER     | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V74U8095B | GPS1 CHAN 5 STATE                | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                       | DESTINATION                                                                                                                         | UNITS | DATA<br>TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|-----------|-----------|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|--------------|------------------|---------|-------------|
|           | V74U8096B | GPS1 CHAN 5 HDWARE CHAN NUMBER     | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | BSU          |                  | 93017G  | *           |
|           | V74U8097B | GPS1 CHAN 5 SATELLITE NUMBER       | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | BSU          |                  | 93017G  | *           |
|           | V74W1475B | GPS2 PPS-MISSION DURATION FOR KEYS | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU          |                  | 93017G  | *           |
|           | V74W3475B | GPS3 PPS-MISSION DURATION FOR KEYS | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU          |                  | 93017G  | *           |
|           | V74W4475B | GPS1 PPS-MISSION DURATION FOR KEYS | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU          |                  | 93017G  | *           |
|           | V74X1398B | GPS2 LOG WD18 CHILD                | TLM                                                                                                                                 |       | BD           |                  | 91051K  |             |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                       | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74X1462B | GPS2 INCORP LESS THAN 4 MEAS       | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X1463B | GPS2 RPU FAIL                      | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X1464B | GPS2 BATTERY LOW                   | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X1467B | GPS2 PPS-DAILY KEY IN USE VERIFIED | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X1468B | GPS2 PPS-DAILY KEY IN USE UNVERIF  | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                     | DESTINATION                                                                                                                         | UNITS | DATA<br>TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|-----------|-----------|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|--------------|------------------|---------|-------------|
|           | V74X1469B | GPS2 PPS-DAILY KEY IN USE INCORR | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X1470B | GPS2 PPS-KEY FAILED PARITY       | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X1471B | GPS2 PPS-GUV USER                | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X1472B | GPS2 PPS-2 HOUR ALERT            | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X1473B | GPS2 PPS-INSUFFICIENT KEYS       | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                    | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74X1474B | GPS2 PPS-RECEIVER CONTAINS KEYS | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X1476B | GPS2 PPS-ERASE KEY FAIL         | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 | EVENT | BD        |         | 93017G  | *     |
|           | V74X1971B | GPS2 CHAN 1 FAULT FLAG          | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X1972B | GPS2 CHAN 1 ANTENNA SELECT      | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X1973B | GPS2 CHAN 1 FREQUENCY           | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                    | DESTINATION                                                                                                                         | UNITS | DATA<br>TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|-----------|-----------|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|--------------|------------------|---------|-------------|
|           | V74X1974B | GPS2 CHAN 1 EPHEM DOWNLOAD FLAG | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X1982B | GPS2 CHAN 2 FAULT FLAG          | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X1983B | GPS2 CHAN 2 ANTENNA SELECT      | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X1984B | GPS2 CHAN 2 FREQUENCY           | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X1985B | GPS2 CHAN 2 EPHEM DOWNLOAD FLAG | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                    | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74X1993B | GPS2 CHAN 3 FAULT FLAG          | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X1994B | GPS2 CHAN 3 ANTENNA SELECT      | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X1995B | GPS2 CHAN 3 FREQUENCY           | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X1996B | GPS2 CHAN 3 EPHEM DOWNLOAD FLAG | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X2054B | GPS2 LOG WD1 CHILD              | DL FMT 22/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | BD        |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE       | DESTINATION                                                                            | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|--------------------|----------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74X2055B | GPS2 LOG WD2 CHILD | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X2056B | GPS2 LOG WD3 CHILD | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X2057B | GPS2 LOG WD4 CHILD | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X2058B | GPS2 LOG WD5 CHILD | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X2059B | GPS2 LOG WD6 CHILD | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X2060B | GPS2 LOG WD7 CHILD | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X2061B | GPS2 LOG WD8 CHILD | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |



TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE        | DESTINATION                                                                            | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|---------------------|----------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74X2062B | GPS2 LOG WD9 CHILD  | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X2063B | GPS2 LOG WD10 CHILD | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X2064B | GPS2 LOG WD11 CHILD | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X2065B | GPS2 LOG WD12 CHILD | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X2066B | GPS2 LOG WD13 CHILD | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X2067B | GPS2 LOG WD14 CHILD | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X2068B | GPS2 LOG WD15 CHILD | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE               | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74X2069B | GPS2 LOG WD16 CHILD        | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                              |       | BD        |         | 93017G  | *     |
|           | V74X2070B | GPS2 LOG WD17 CHILD        | DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                              |       | BD        |         | 93017G  | *     |
|           | V74X2084B | GPS2 CHAN 4 FAULT FLAG     | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X2085B | GPS2 CHAN 4 ANTENNA SELECT | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X2086B | GPS2 CHAN 4 FREQUENCY      | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                    | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74X2087B | GPS2 CHAN 4 EPHEM DOWNLOAD FLAG | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X2091B | GPS2 CHAN 5 FAULT FLAG          | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X2092B | GPS2 CHAN 5 ANTENNA SELECT      | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X2093B | GPS2 CHAN 5 FREQUENCY           | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X2094B | GPS2 CHAN 5 EPHEM DOWNLOAD FLAG | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                    | DESTINATION                                                                                           | UNITS | DATA TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|-----------|-----------|---------------------------------|-------------------------------------------------------------------------------------------------------|-------|-----------|------------------|---------|-------------|
|           | V74X3084B | GPS3 CHAN 4 FAULT FLAG          | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |                  | 93017G  | *           |
|           | V74X3085B | GPS3 CHAN 4 ANTENNA SELECT      | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |                  | 93017G  | *           |
|           | V74X3086B | GPS3 CHAN 4 FREQUENCY           | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |                  | 93017G  | *           |
|           | V74X3087B | GPS3 CHAN 4 EPHEM DOWNLOAD FLAG | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |                  | 93017G  | *           |
|           | V74X3091B | GPS3 CHAN 5 FAULT FLAG          | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |                  | 93017G  | *           |
|           | V74X3092B | GPS3 CHAN 5 ANTENNA SELECT      | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |                  | 93017G  | *           |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                       | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74X3093B | GPS3 CHAN 5 FREQUENCY              | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | BD        |         | 93017G  | *     |
|           | V74X3094B | GPS3 CHAN 5 EPHEM DOWNLOAD FLAG    | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | BD        |         | 93017G  | *     |
|           | V74X3099B | GPS1 LOG WD18 CHILD                | TLM                                                                                                                                 |       | BD        |         | 92067D  |       |
|           | V74X3109B | GPS3 LOG WD18 CHILD                | TLM                                                                                                                                 |       | BD        |         | 92067D  |       |
|           | V74X3462B | GPS3 INCORP LESS THAN 4 MEAS       | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | BD        |         | 93017G  | *     |
|           | V74X3463B | GPS3 RPU FAIL                      | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | BD        |         | 93017G  | *     |
|           | V74X3464B | GPS3 BATTERY LOW                   | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | BD        |         | 93017G  | *     |
|           | V74X3467B | GPS3 PPS-DAILY KEY IN USE VERIFIED | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                      | DESTINATION                                                                                                                         | UNITS | DATA<br>TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|-----------|-----------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|--------------|------------------|---------|-------------|
|           | V74X3468B | GPS3 PPS-DAILY KEY IN USE UNVERIF | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X3469B | GPS3 PPS-DAILY KEY IN USE INCORR  | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X3470B | GPS3 PPS-KEY FAILED PARITY        | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X3471B | GPS3 PPS-GUV USER                 | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X3472B | GPS3 PPS-2 HOUR ALERT             | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                      | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74X3473B | GPS3 PPS-INSUFFICIENT KEYS        | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X3474B | GPS3 PPS-RECEIVER CONTAINS KEYS   | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X3476B | GPS3 PPS-ERASE KEY FAIL           | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 | EVENT | BD        |         | 93017G  | *     |
|           | V74X3480X | GPS1 CHAN 1 PSEUDO RANGE EDIT IND | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | BD        |         | 93017G  | *     |
|           | V74X3481X | GPS1 CHAN 2 PSEUDO RANGE EDIT IND | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | BD        |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                      | DESTINATION                                                                                           | UNITS | DATA<br>TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|-----------|-----------|-----------------------------------|-------------------------------------------------------------------------------------------------------|-------|--------------|------------------|---------|-------------|
|           | V74X3482X | GPS1 CHAN 3 PSEUDO RANGE EDIT IND | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X3483X | GPS1 CHAN 4 PSEUDO RANGE EDIT IND | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X3484X | GPS1 CHAN 1 DELTA RANGE EDIT IND  | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X3485X | GPS1 CHAN 2 DELTA RANGE EDIT IND  | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X3486X | GPS1 CHAN 3 DELTA RANGE EDIT IND  | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X3487X | GPS1 CHAN 4 DELTA RANGE EDIT IND  | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |



TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                      | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74X3488X | GPS2 CHAN 1 PSEUDO RANGE EDIT IND | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X3489X | GPS2 CHAN 2 PSEUDO RANGE EDIT IND | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X3490X | GPS2 CHAN 3 PSEUDO RANGE EDIT IND | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X3491X | GPS2 CHAN 4 PSEUDO RANGE EDIT IND | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X3492X | GPS2 CHAN 1 DELTA RANGE EDIT IND  | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                      | DESTINATION                                                                                                                         | UNITS | DATA<br>TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|-----------|-----------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|--------------|------------------|---------|-------------|
|           | V74X3493X | GPS2 CHAN 2 DELTA RANGE EDIT IND  | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X3494X | GPS2 CHAN 3 DELTA RANGE EDIT IND  | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X3495X | GPS2 CHAN 4 DELTA RANGE EDIT IND  | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X3496X | GPS3 CHAN 1 PSEUDO RANGE EDIT IND | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | BD           |                  | 93017G  | *           |
|           | V74X3497X | GPS3 CHAN 2 PSEUDO RANGE EDIT IND | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | BD           |                  | 93017G  | *           |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                      | DESTINATION                                                                                           | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|-----------------------------------|-------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74X3498X | GPS3 CHAN 3 PSEUDO RANGE EDIT IND | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X3499X | GPS3 CHAN 4 PSEUDO RANGE EDIT IND | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X3500X | GPS3 CHAN 1 DELTA RANGE EDIT IND  | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X3501X | GPS3 CHAN 2 DELTA RANGE EDIT IND  | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X3502X | GPS3 CHAN 3 DELTA RANGE EDIT IND  | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X3503X | GPS3 CHAN 4 DELTA RANGE EDIT IND  | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE        | DESTINATION                                                             | UNITS | DATA<br>TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|-----------|-----------|---------------------|-------------------------------------------------------------------------|-------|--------------|------------------|---------|-------------|
|           | V74X4054B | GPS1 LOG WD1 CHILD  | DL FMT 22/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X4055B | GPS1 LOG WD2 CHILD  | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                |       | BD           |                  | 93017G  | *           |
|           | V74X4056B | GPS1 LOG WD3 CHILD  | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                |       | BD           |                  | 93017G  | *           |
|           | V74X4057B | GPS1 LOG WD4 CHILD  | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                |       | BD           |                  | 93017G  | *           |
|           | V74X4058B | GPS1 LOG WD5 CHILD  | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                |       | BD           |                  | 93017G  | *           |
|           | V74X4059B | GPS1 LOG WD6 CHILD  | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                |       | BD           |                  | 93017G  | *           |
|           | V74X4060B | GPS1 LOG WD7 CHILD  | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                |       | BD           |                  | 93017G  | *           |
|           | V74X4061B | GPS1 LOG WD8 CHILD  | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                |       | BD           |                  | 93017G  | *           |
|           | V74X4062B | GPS1 LOG WD9 CHILD  | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                |       | BD           |                  | 93017G  | *           |
|           | V74X4063B | GPS1 LOG WD10 CHILD | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                |       | BD           |                  | 93017G  | *           |
|           | V74X4064B | GPS1 LOG WD11 CHILD | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                |       | BD           |                  | 93017G  | *           |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                 | DESTINATION                                                                                           | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|------------------------------|-------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74X4065B | GPS1 LOG WD12 CHILD          | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                              |       | BD        |         | 93017G  | *     |
|           | V74X4066B | GPS1 LOG WD13 CHILD          | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                              |       | BD        |         | 93017G  | *     |
|           | V74X4067B | GPS1 LOG WD14 CHILD          | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                              |       | BD        |         | 93017G  | *     |
|           | V74X4068B | GPS1 LOG WD15 CHILD          | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                              |       | BD        |         | 93017G  | *     |
|           | V74X4069B | GPS1 LOG WD16 CHILD          | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                              |       | BD        |         | 93017G  | *     |
|           | V74X4070B | GPS1 LOG WD17 CHILD          | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                              |       | BD        |         | 93017G  | *     |
|           | V74X4462B | GPS1 INCORP LESS THAN 4 MEAS | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X4463B | GPS1 RPU FAIL                | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X4464B | GPS1 BATTERY LOW             | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                       | DESTINATION                                                                                                                         | UNITS | DATA<br>TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|-----------|-----------|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|--------------|------------------|---------|-------------|
|           | V74X4467B | GPS1 PPS-DAILY KEY IN USE VERIFIED | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X4468B | GPS1 PPS-DAILY KEY IN USE UNVERIF  | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X4469B | GPS1 PPS-DAILY KEY IN USE INCORR   | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X4470B | GPS1 PPS-KEY FAILED PARITY         | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X4471B | GPS1 PPS-GUV USER                  | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                    | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74X4472B | GPS1 PPS-2 HOUR ALERT           | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X4473B | GPS1 PPS-INSUFFICIENT KEYS      | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X4474B | GPS1 PPS-RECEIVER CONTAINS KEYS | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X4476B | GPS1 PPS-ERASE KEY FAIL         | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 | EVENT | BD        |         | 93017G  | *     |
|           | V74X4971B | GPS1 CHAN 1 FAULT FLAG          | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | BD        |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                    | DESTINATION                                                                                           | UNITS | DATA<br>TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|-----------|-----------|---------------------------------|-------------------------------------------------------------------------------------------------------|-------|--------------|------------------|---------|-------------|
|           | V74X4972B | GPS1 CHAN 1 ANTENNA SELECT      | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X4973B | GPS1 CHAN 1 FREQUENCY           | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X4974B | GPS1 CHAN 1 EPHEM DOWNLOAD FLAG | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X4982B | GPS1 CHAN 2 FAULT FLAG          | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X4983B | GPS1 CHAN 2 ANTENNA SELECT      | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X4984B | GPS1 CHAN 2 FREQUENCY           | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |



TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                    | DESTINATION                                                                                           | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|---------------------------------|-------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74X4985B | GPS1 CHAN 2 EPHEM DOWNLOAD FLAG | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X4993B | GPS1 CHAN 3 FAULT FLAG          | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X4994B | GPS1 CHAN 3 ANTENNA SELECT      | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X4995B | GPS1 CHAN 3 FREQUENCY           | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X4996B | GPS1 CHAN 3 EPHEM DOWNLOAD FLAG | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X5054B | GPS3 LOG WD1 CHILD              | DL FMT 22/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | BD        |         | 93017G  | *     |
|           | V74X5055B | GPS3 LOG WD2 CHILD              | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                                              |       | BD        |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE        | DESTINATION                                              | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|---------------------|----------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74X5056B | GPS3 LOG WD3 CHILD  | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1                |       | BD        |         | 93017G  | *     |
|           | V74X5057B | GPS3 LOG WD4 CHILD  | DL FMT 60/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1 |       | BD        |         | 93017G  | *     |
|           | V74X5058B | GPS3 LOG WD5 CHILD  | DL FMT 60/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1 |       | BD        |         | 93017G  | *     |
|           | V74X5059B | GPS3 LOG WD6 CHILD  | DL FMT 60/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1 |       | BD        |         | 93017G  | *     |
|           | V74X5060B | GPS3 LOG WD7 CHILD  | DL FMT 60/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1 |       | BD        |         | 93017G  | *     |
|           | V74X5061B | GPS3 LOG WD8 CHILD  | DL FMT 60/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1 |       | BD        |         | 93017G  | *     |
|           | V74X5062B | GPS3 LOG WD9 CHILD  | DL FMT 60/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1 |       | BD        |         | 93017G  | *     |
|           | V74X5063B | GPS3 LOG WD10 CHILD | DL FMT 60/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1 |       | BD        |         | 93017G  | *     |
|           | V74X5064B | GPS3 LOG WD11 CHILD | DL FMT 60/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1 |       | BD        |         | 93017G  | *     |
|           | V74X5065B | GPS3 LOG WD12 CHILD | DL FMT 60/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1 |       | BD        |         | 93017G  | *     |
|           | V74X5066B | GPS3 LOG WD13 CHILD | DL FMT 60/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1 |       | BD        |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                    | DESTINATION                                                                                           | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|---------------------------------|-------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74X5067B | GPS3 LOG WD14 CHILD             | DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1                                                             |       | BD        |         | 93017G  | *     |
|           | V74X5068B | GPS3 LOG WD15 CHILD             | DL FMT 60/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1                                              |       | BD        |         | 93017G  | *     |
|           | V74X5069B | GPS3 LOG WD16 CHILD             | DL FMT 60/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1                                              |       | BD        |         | 93017G  | *     |
|           | V74X5070B | GPS3 LOG WD17 CHILD             | DL FMT 60/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1                                              |       | BD        |         | 93017G  | *     |
|           | V74X5971B | GPS3 CHAN 1 FAULT FLAG          | DL FMT 60/1<br>DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1 |       | BD        |         | 93017G  | *     |
|           | V74X5972B | GPS3 CHAN 1 ANTENNA SELECT      | DL FMT 60/1<br>DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1 |       | BD        |         | 93017G  | *     |
|           | V74X5973B | GPS3 CHAN 1 FREQUENCY           | DL FMT 60/1<br>DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1 |       | BD        |         | 93017G  | *     |
|           | V74X5974B | GPS3 CHAN 1 EPHEM DOWNLOAD FLAG | DL FMT 60/1<br>DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1 |       | BD        |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                    | DESTINATION                                                                                           | UNITS | DATA<br>TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|-----------|-----------|---------------------------------|-------------------------------------------------------------------------------------------------------|-------|--------------|------------------|---------|-------------|
|           | V74X5982B | GPS3 CHAN 2 FAULT FLAG          | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X5983B | GPS3 CHAN 2 ANTENNA SELECT      | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X5984B | GPS3 CHAN 2 FREQUENCY           | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X5985B | GPS3 CHAN 2 EPHEM DOWNLOAD FLAG | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X5993B | GPS3 CHAN 3 FAULT FLAG          | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |
|           | V74X5994B | GPS3 CHAN 3 ANTENNA SELECT      | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD           |                  | 93017G  | *           |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                    | DESTINATION                                                                                           | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|---------------------------------|-------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74X5995B | GPS3 CHAN 3 FREQUENCY           | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X5996B | GPS3 CHAN 3 EPHEM DOWNLOAD FLAG | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X8084B | GPS1 CHAN 4 FAULT FLAG          | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X8085B | GPS1 CHAN 4 ANTENNA SELECT      | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X8086B | GPS1 CHAN 4 FREQUENCY           | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V74X8087B | GPS1 CHAN 4 EPHEM DOWNLOAD FLAG | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                    | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|-----------|-----------|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|------------------|---------|-------------|
|           | V74X8091B | GPS1 CHAN 5 FAULT FLAG          | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | BD        |                  | 93017G  | *           |
|           | V74X8092B | GPS1 CHAN 5 ANTENNA SELECT      | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | BD        |                  | 93017G  | *           |
|           | V74X8093B | GPS1 CHAN 5 FREQUENCY           | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | BD        |                  | 93017G  | *           |
|           | V74X8094B | GPS1 CHAN 5 EPHEM DOWNLOAD FLAG | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | BD        |                  | 93017G  | *           |
|           | V93U1001C | GPS2 TIME FIGURE OF MERIT       | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |                  | 93017G  | *           |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE              | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V93U1187C | GPS2 MODE CMD             | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BSU       |         | 93017G  | *     |
|           | V93U1199C | GPS2 MODE CMD CHECK       | GPS2<br>TLM                                                                                                                         |       | BSU       |         | 91051K  |       |
|           | V93U3001C | GPS1 TIME FIGURE OF MERIT | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | BSU       |         | 93017G  | *     |
|           | V93U3187C | GPS1 MODE CMD             | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | BSU       |         | 93017G  | *     |
|           | V93U3199C | GPS1 MODE CMD CHECK       | GPS1<br>TLM                                                                                                                         |       | BSU       |         | 92067D  |       |
|           | V93U9001C | GPS3 TIME FIGURE OF MERIT | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | BSU       |         | 93017G  | *     |
|           | V93U9187C | GPS3 MODE CMD             | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | BSU       |         | 93017G  | *     |
|           | V93U9199C | GPS3 MODE CMD CHECK       | GPS3<br>TLM                                                                                                                         |       | BSU       |         | 92067D  |       |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE              | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V93X1002X | GPS1 BIT IN PROGRESS SOP  | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V93X1003X | GPS2 BIT IN PROGRESS SOP  | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V93X1004X | GPS3 BIT IN PROGRESS SOP  | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V93X1043X | GPS1 SAT DE-SELECT ENABLE | GPS1<br>TLM                                                                                                                         |       | BD        |         | 92276A  |       |
|           | V93X1044X | GPS2 SAT DE-SELECT ENABLE | GPS2<br>TLM                                                                                                                         |       | BD        |         | 92276A  |       |
|           | V93X1045X | GPS3 SAT DE-SELECT ENABLE | GPS3<br>TLM                                                                                                                         |       | BD        |         | 92276A  |       |
|           | V93X1129X | GPS RA FLAG FDBK DL       | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |



TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE          | DESTINATION                                                                                                                                 | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V93X1152X | GPS2 COMMFAULT DL     | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1         |       | BD        |         | 93017G  | *     |
|           | V93X1188X | GPS2 ANNCD RESET CMD  | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1         |       | BD        |         | 93017G  | *     |
|           | V93X1189X | GPS2 BARO AIDING DG   | GPS2<br>DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V93X1190X | GPS2 RADALT AIDING DG | GPS2<br>DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                 | DESTINATION                                                                                                                                 | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V93X1191X | GPS2 DIFFERENTIAL GPS CMD    | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1<br>GPS2 |       | BD        |         | 93017G  | *     |
|           | V93X1192X | GPS2 STATE AIDING DATA VALID | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1<br>GPS2 |       | BD        |         | 93017G  | *     |
|           | V93X1194X | GPS2 INIT STATE AVAIL        | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1<br>GPS2 |       | BD        |         | 93017G  | *     |
|           | V93X1196X | GPS2 LEVER ARM AVAIL         | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1<br>GPS2 |       | BD        |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE            | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V93X1197X | GPS2 FILTER RESTART CMD | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V93X1198X | GPS2 ATT AIDING VALID   | GPS2<br>TLM                                                                                                                         |       | BD        |         | 91051K  |       |
|           | V93X1237X | GPS1 COMMFAULT DL       | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V93X1238X | GPS3 COMMFAULT DL       | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 |       | BD        |         | 93017G  | *     |
|           | V93X3188X | GPS1 ANNCD RESET CMD    | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | BD        |         | 93017G  | *     |
|           | V93X3189X | GPS1 BARO AIDING DG     | GPS1<br>DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                       |       | BD        |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                 | DESTINATION                                                                                                   | UNITS | DATA<br>TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|-----------|-----------|------------------------------|---------------------------------------------------------------------------------------------------------------|-------|--------------|------------------|---------|-------------|
|           | V93X3190X | GPS1 RADALT AIDING DG        | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1<br>GPS1 |       | BD           |                  | 93017G  | *           |
|           | V93X3191X | GPS1 DIFFERENTIAL GPS CMD    | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1<br>GPS1 |       | BD           |                  | 93017G  | *           |
|           | V93X3192X | GPS1 STATE AIDING DATA VALID | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1<br>GPS1 |       | BD           |                  | 93017G  | *           |
|           | V93X3194X | GPS1 INIT STATE AVAIL        | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1<br>GPS1 |       | BD           |                  | 93017G  | *           |
|           | V93X3196X | GPS1 LEVER ARM AVAIL         | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1<br>GPS1 |       | BD           |                  | 93017G  | *           |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE            | DESTINATION                                                                                                                         | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V93X3197X | GPS1 FILTER RESTART CMD | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1                               |       | BD        |         | 93017G  | *     |
|           | V93X3198X | GPS1 ATT AIDING VALID   | GPS1<br>GPS1<br>TLM                                                                                                                 |       | BD        |         | 92067D  |       |
|           | V93X3243X | GPS1 FAIL SELF-TEST DL  | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 | EVENT | BD        |         | 93017G  | *     |
|           | V93X3244X | GPS2 FAIL SELF-TEST DL  | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 | EVENT | BD        |         | 93017G  | *     |
|           | V93X3245X | GPS3 FAIL SELF-TEST DL  | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1 | EVENT | BD        |         | 93017G  | *     |
|           | V93X9188X | GPS3 ANNCD RESET CMD    | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1<br>GPS3                       |       | BD        |         | 93017G  | *     |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE                 | DESTINATION                                                                                                   | UNITS | DATA<br>TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|-----------|-----------|------------------------------|---------------------------------------------------------------------------------------------------------------|-------|--------------|------------------|---------|-------------|
|           | V93X9189X | GPS3 BARO AIDING DG          | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1<br>GPS3 |       | BD           |                  | 93017G  | *           |
|           | V93X9190X | GPS3 RADALT AIDING DG        | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1<br>GPS3 |       | BD           |                  | 93017G  | *           |
|           | V93X9191X | GPS3 DIFFERENTIAL GPS CMD    | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1<br>GPS3 |       | BD           |                  | 93017G  | *           |
|           | V93X9192X | GPS3 STATE AIDING DATA VALID | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1<br>GPS3 |       | BD           |                  | 93017G  | *           |
|           | V93X9194X | GPS3 INIT STATE AVAIL        | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1<br>GPS3 |       | BD           |                  | 93017G  | *           |

TABLE 4.17.6.10-2. OUTPUT FUNCTIONAL PARAMETERS FROM GLOBAL POSITIONING SYSTEM SOP (G4.17)

| FSSR NAME | M/S ID    | NOMENCLATURE            | DESTINATION                                                                                                   | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|-------------------------|---------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V93X9196X | GPS3 LEVER ARM AVAIL    | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1         |       | BD        |         | 93017G  | *     |
|           | V93X9197X | GPS3 FILTER RESTART CMD | DL FMT 21/1<br>DL FMT 22/1<br>DL FMT 23/1<br>DL FMT 32/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 60/1<br>GPS3 |       | BD        |         | 93017G  | *     |
|           | V93X9198X | GPS3 ATT AIDING VALID   | GPS3<br>GPS3<br>TLM                                                                                           |       | BD        |         | 92067D  |       |

**NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.**

**Rate Codes: (HDR Only) 1 = 1 sample/sec 2 = 5 samples/sec 3 = 12.5 samples/sec 4 = 25 samples/sec 5 = 100 samples/sec  
(HDR and LDR) A = 1 sample/sec B = 5 samples/sec C = 12.5 samples/sec D = 25 samples/sec E = 100 samples/sec**

TABLE 4.17.6.10-3. GLOBAL POSITIONING SYSTEM SOP (G4.17) I-LOADS

| FSSR NAME             | MSID      | ENG UNITS | DT | PR | D | S | PR FCTN                                                                                          | MC | CAT | LAST CR | R<br>E<br>V |
|-----------------------|-----------|-----------|----|----|---|---|--------------------------------------------------------------------------------------------------|----|-----|---------|-------------|
| ALT_BARO_CUTOFF_LOW   | V99U8720C | FT        | F  | S  | D | P | G4.127<br>G4.144<br>G4.17<br>G4.205                                                              | 00 | ZFT | 91051K  |             |
| ALT_RA_CUTOFF_HIGH    | V97U2827C | FT        | F  | S  | D | P | G4.17<br>G6.21                                                                                   | 00 | GP3 | 92139   |             |
| ALT_RA_CUTOFF_LOW     | V97U2828C | FT        | F  | S  | D | P | G4.17                                                                                            | 00 | GP3 | 92139   |             |
| DELH_RA_GPS           | V97U2829C | FT        | F  | S  | D | P | G4.17                                                                                            | 00 | GP3 | 92139   |             |
| DT_FR_DISP_REFRESH    | V97U3641C | SEC       | F  | S  | D | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| FOM_GOOD_COUNT_MIN    | V97U2238C | ND        | I  | S  | D | C | G4.17                                                                                            | 00 | GPH | 92430B  |             |
| GPC_GPS_TARGET        | V97U3673C | MSEC      | I  | S  | D | C | G4.17                                                                                            | 00 | GPH | 92817C  |             |
| GPS_DR_EDIT_MAX_HOLD  | V97U2815C | ND        | D  |    | D | P | G4.17                                                                                            | 00 | GPE | 92630A  |             |
| GPS_DR_EDIT_MAX_STEP  | V97U2816C | ND        | I  | S  | D | P | G4.17                                                                                            | 00 | GPE | 92630A  |             |
| GPS_DR_EDIT_STEP_SIZE | V97U2817C | ND        | I  | S  | D | P | G4.17                                                                                            | 00 | GPE | 92630A  |             |
| GPS_DR_EDIT_THRESHOLD | V97U2818C | ND        | I  | S  | D | P | G4.17                                                                                            | 00 | GPE | 92630A  |             |
| GPS_INSTALLED(1)      | V97U2924C | ND        | D  |    | M | X | G4.17<br>G4.20<br>G4.21<br>G4.23<br>G4.24<br>G4.25<br>G6.11<br>G6.21<br>G6.31<br>G6.51<br>V5.1.4 | 00 | GPI | 92292B  |             |
| GPS_INSTALLED(2)      | V97U2831C | ND        | D  |    | M | X | G4.17<br>G4.20<br>G4.21<br>G4.23<br>G4.24<br>G4.25<br>G6.11<br>G6.21<br>G6.31<br>G6.51<br>V5.1.4 | 00 | GPI | 92292B  |             |



TABLE 4.17.6.10-3. GLOBAL POSITIONING SYSTEM SOP (G4.17) I-LOADS

| FSSR NAME                         | MSID      | ENG UNITS | DT | PR | D | S | PR FCTN                                                                                          | MC | CAT | LAST CR | R<br>E<br>V |
|-----------------------------------|-----------|-----------|----|----|---|---|--------------------------------------------------------------------------------------------------|----|-----|---------|-------------|
| GPS_INSTALLED (3)                 | V97U2925C | ND        | D  |    | M | X | G4.17<br>G4.20<br>G4.21<br>G4.23<br>G4.24<br>G4.25<br>G6.11<br>G6.21<br>G6.31<br>G6.51<br>V5.1.4 | 00 | GPI | 92292B  |             |
| GPS_LOWER_ANTENNA_BORESIGHT (1,1) | V97U2832C | ND        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_LOWER_ANTENNA_BORESIGHT (1,2) | V97U2833C | ND        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_LOWER_ANTENNA_BORESIGHT (1,3) | V97U2834C | ND        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_LOWER_ANTENNA_BORESIGHT (2,1) | V97U2835C | ND        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_LOWER_ANTENNA_BORESIGHT (2,2) | V97U2836C | ND        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_LOWER_ANTENNA_BORESIGHT (2,3) | V97U2837C | ND        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_LOWER_ANTENNA_BORESIGHT (3,1) | V97U2838C | ND        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_LOWER_ANTENNA_BORESIGHT (3,2) | V97U2839C | ND        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_LOWER_ANTENNA_BORESIGHT (3,3) | V97U2840C | ND        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_LOWER_ANTENNA_CG (1,1)        | V97U2841C | FT        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_LOWER_ANTENNA_CG (1,2)        | V97U2842C | FT        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_LOWER_ANTENNA_CG (1,3)        | V97U2843C | FT        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_LOWER_ANTENNA_CG (2,1)        | V97U2844C | FT        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_LOWER_ANTENNA_CG (2,2)        | V97U2845C | FT        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_LOWER_ANTENNA_CG (2,3)        | V97U2846C | FT        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_LOWER_ANTENNA_CG (3,1)        | V97U2847C | FT        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_LOWER_ANTENNA_CG (3,2)        | V97U2848C | FT        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_LOWER_ANTENNA_CG (3,3)        | V97U2849C | FT        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_LOWER_ANTENNA_NB (1,1)        | V97U2850C | FT        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_LOWER_ANTENNA_NB (1,2)        | V97U2851C | FT        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_LOWER_ANTENNA_NB (1,3)        | V97U2852C | FT        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_LOWER_ANTENNA_NB (2,1)        | V97U2853C | FT        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_LOWER_ANTENNA_NB (2,2)        | V97U2854C | FT        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_LOWER_ANTENNA_NB (2,3)        | V97U2855C | FT        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_LOWER_ANTENNA_NB (3,1)        | V97U2856C | FT        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_LOWER_ANTENNA_NB (3,2)        | V97U2857C | FT        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_LOWER_ANTENNA_NB (3,3)        | V97U2858C | FT        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_PR_EDIT_MAX_HOLD              | V97U2811C | ND        | D  |    | D | P | G4.17                                                                                            | 00 | GPE | 92630A  |             |
| GPS_PR_EDIT_MAX_STEP              | V97U2812C | ND        | I  | S  | D | P | G4.17                                                                                            | 00 | GPE | 92630A  |             |
| GPS_PR_EDIT_STEP_SIZE             | V97U2813C | ND        | I  | S  | D | P | G4.17                                                                                            | 00 | GPE | 92630A  |             |
| GPS_PR_EDIT_THRESHOLD             | V97U2814C | ND        | I  | S  | D | P | G4.17                                                                                            | 00 | GPE | 92630A  |             |
| GPS_QA_TIME_THRESH                | V97U3573C | SEC       | F  | S  | D | P | G4.17                                                                                            | 00 | GPE | 91051K  |             |
| GPS_UPPER_ANTENNA_BORESIGHT (1,1) | V97U2859C | ND        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_UPPER_ANTENNA_BORESIGHT (1,2) | V97U2860C | ND        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_UPPER_ANTENNA_BORESIGHT (1,3) | V97U2861C | ND        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |
| GPS_UPPER_ANTENNA_BORESIGHT (2,1) | V97U2862C | ND        | F  | S  | M | P | G4.17                                                                                            | 00 | GPH | 92102B  |             |

TABLE 4.17.6.10-3. GLOBAL POSITIONING SYSTEM SOP (G4.17) I-LOADS

| FSSR NAME                        | MSID      | ENG UNITS | DT | PR | D | S | PR FCTN                                                                          | MC | CAT | LAST CR | R<br>E<br>V |
|----------------------------------|-----------|-----------|----|----|---|---|----------------------------------------------------------------------------------|----|-----|---------|-------------|
| GPS_UPPER_ANTENNA_BORESIGHT(2,2) | V97U2863C | ND        | F  | S  | M | P | G4.17                                                                            | 00 | GPH | 92102B  |             |
| GPS_UPPER_ANTENNA_BORESIGHT(2,3) | V97U2864C | ND        | F  | S  | M | P | G4.17                                                                            | 00 | GPH | 92102B  |             |
| GPS_UPPER_ANTENNA_BORESIGHT(3,1) | V97U2865C | ND        | F  | S  | M | P | G4.17                                                                            | 00 | GPH | 92102B  |             |
| GPS_UPPER_ANTENNA_BORESIGHT(3,2) | V97U2866C | ND        | F  | S  | M | P | G4.17                                                                            | 00 | GPH | 92102B  |             |
| GPS_UPPER_ANTENNA_BORESIGHT(3,3) | V97U2867C | ND        | F  | S  | M | P | G4.17                                                                            | 00 | GPH | 92102B  |             |
| GPS_UPPER_ANTENNA_CG(1,1)        | V97U2868C | FT        | F  | S  | M | P | G4.17                                                                            | 00 | GPH | 92102B  |             |
| GPS_UPPER_ANTENNA_CG(1,2)        | V97U2869C | FT        | F  | S  | M | P | G4.17                                                                            | 00 | GPH | 92102B  |             |
| GPS_UPPER_ANTENNA_CG(1,3)        | V97U2870C | FT        | F  | S  | M | P | G4.17                                                                            | 00 | GPH | 92102B  |             |
| GPS_UPPER_ANTENNA_CG(2,1)        | V97U2871C | FT        | F  | S  | M | P | G4.17                                                                            | 00 | GPH | 92102B  |             |
| GPS_UPPER_ANTENNA_CG(2,2)        | V97U2872C | FT        | F  | S  | M | P | G4.17                                                                            | 00 | GPH | 92102B  |             |
| GPS_UPPER_ANTENNA_CG(2,3)        | V97U2873C | FT        | F  | S  | M | P | G4.17                                                                            | 00 | GPH | 92102B  |             |
| GPS_UPPER_ANTENNA_CG(3,1)        | V97U2874C | FT        | F  | S  | M | P | G4.17                                                                            | 00 | GPH | 92102B  |             |
| GPS_UPPER_ANTENNA_CG(3,2)        | V97U2875C | FT        | F  | S  | M | P | G4.17                                                                            | 00 | GPH | 92102B  |             |
| GPS_UPPER_ANTENNA_CG(3,3)        | V97U2876C | FT        | F  | S  | M | P | G4.17                                                                            | 00 | GPH | 92102B  |             |
| GPS_UPPER_ANTENNA_NB(1,1)        | V97U2884C | FT        | F  | S  | M | P | G4.17                                                                            | 00 | GPH | 92102B  |             |
| GPS_UPPER_ANTENNA_NB(1,2)        | V97U2885C | FT        | F  | S  | M | P | G4.17                                                                            | 00 | GPH | 92102B  |             |
| GPS_UPPER_ANTENNA_NB(1,3)        | V97U2886C | FT        | F  | S  | M | P | G4.17                                                                            | 00 | GPH | 92102B  |             |
| GPS_UPPER_ANTENNA_NB(2,1)        | V97U2887C | FT        | F  | S  | M | P | G4.17                                                                            | 00 | GPH | 92102B  |             |
| GPS_UPPER_ANTENNA_NB(2,2)        | V97U2888C | FT        | F  | S  | M | P | G4.17                                                                            | 00 | GPH | 92102B  |             |
| GPS_UPPER_ANTENNA_NB(2,3)        | V97U2889C | FT        | F  | S  | M | P | G4.17                                                                            | 00 | GPH | 92102B  |             |
| GPS_UPPER_ANTENNA_NB(3,1)        | V97U2890C | FT        | F  | S  | M | P | G4.17                                                                            | 00 | GPH | 92102B  |             |
| GPS_UPPER_ANTENNA_NB(3,2)        | V97U2891C | FT        | F  | S  | M | P | G4.17                                                                            | 00 | GPH | 92102B  |             |
| GPS_UPPER_ANTENNA_NB(3,3)        | V97U2892C | FT        | F  | S  | M | P | G4.17                                                                            | 00 | GPH | 92102B  |             |
| LAST_READ_DT_LIM                 | V97U2239C | SEC       | F  | S  | D | P | G4.17                                                                            | 00 | GPH | 92430B  |             |
| LEAP_SEC_CORR                    | V97U2130C | SEC       | I  | S  | M | C | G4.17                                                                            | 00 | GPT | 92102B  |             |
| MAX_FOM_ACCEPT_PFS               | V97U2830C | ND        | I  | S  | D | P | G4.17                                                                            | 02 | GP2 | 92369B  |             |
|                                  |           |           |    |    |   |   |                                                                                  | 03 | GP3 |         |             |
|                                  |           |           |    |    |   |   |                                                                                  | 08 | GP2 |         |             |
|                                  |           |           |    |    |   |   |                                                                                  | 01 | GP3 |         |             |
|                                  |           |           |    |    |   |   |                                                                                  | 09 | GP3 |         |             |
| M_WGS84_TO_EF(1,1)               | V97U2927C | ND        | F  | D  | M | P | G4.17<br>G4.20<br>G4.21<br>G4.220<br>G4.23<br>G4.237<br>G4.24<br>G4.25<br>V5.1.8 | 00 | WGS | 92067D  |             |

TABLE 4.17.6.10-3. GLOBAL POSITIONING SYSTEM SOP (G4.17) I-LOADS

| FSSR NAME          | MSID      | ENG UNITS | DT | PR | D | S | PR FCTN                                                                          | MC | CAT | LAST CR | R<br>E<br>V |
|--------------------|-----------|-----------|----|----|---|---|----------------------------------------------------------------------------------|----|-----|---------|-------------|
| M_WGS84_TO_EF(1,2) | V97U2928C | ND        | F  | D  | M | P | G4.17<br>G4.20<br>G4.21<br>G4.220<br>G4.23<br>G4.237<br>G4.24<br>G4.25<br>V5.1.8 | 00 | WGS | 92067D  |             |
| M_WGS84_TO_EF(1,3) | V97U2929C | ND        | F  | D  | M | P | G4.17<br>G4.20<br>G4.21<br>G4.220<br>G4.23<br>G4.237<br>G4.24<br>G4.25<br>V5.1.8 | 00 | WGS | 92067D  |             |
| M_WGS84_TO_EF(2,1) | V97U2930C | ND        | F  | D  | M | P | G4.17<br>G4.20<br>G4.21<br>G4.220<br>G4.23<br>G4.237<br>G4.24<br>G4.25<br>V5.1.8 | 00 | WGS | 92067D  |             |
| M_WGS84_TO_EF(2,2) | V97U2931C | ND        | F  | D  | M | P | G4.17<br>G4.20<br>G4.21<br>G4.220<br>G4.23<br>G4.237<br>G4.24<br>G4.25<br>V5.1.8 | 00 | WGS | 92067D  |             |
| M_WGS84_TO_EF(2,3) | V97U2932C | ND        | F  | D  | M | P | G4.17<br>G4.20<br>G4.21<br>G4.220<br>G4.23<br>G4.237<br>G4.24<br>G4.25<br>V5.1.8 | 00 | WGS | 92067D  |             |

TABLE 4.17.6.10-3. GLOBAL POSITIONING SYSTEM SOP (G4.17) I-LOADS

| FSSR NAME          | MSID      | ENG UNITS | DT | PR | D | S | PR FCTN                                                                          | MC | CAT | LAST CR | R<br>E<br>V |
|--------------------|-----------|-----------|----|----|---|---|----------------------------------------------------------------------------------|----|-----|---------|-------------|
| M_WGS84_TO_EF(3,1) | V97U2933C | ND        | F  | D  | M | P | G4.17<br>G4.20<br>G4.21<br>G4.220<br>G4.23<br>G4.237<br>G4.24<br>G4.25<br>V5.1.8 | 00 | WGS | 92067D  |             |
| M_WGS84_TO_EF(3,2) | V97U2934C | ND        | F  | D  | M | P | G4.17<br>G4.20<br>G4.21<br>G4.220<br>G4.23<br>G4.237<br>G4.24<br>G4.25<br>V5.1.8 | 00 | WGS | 92067D  |             |
| M_WGS84_TO_EF(3,3) | V97U2935C | ND        | F  | D  | M | P | G4.17<br>G4.20<br>G4.21<br>G4.220<br>G4.23<br>G4.237<br>G4.24<br>G4.25<br>V5.1.8 | 00 | WGS | 92067D  |             |
| RV_MAX             | V99U7596C | FT/SEC    | F  | S  | D | C | G4.15<br>G4.17<br>G4.205                                                         | 00 | ZFT | 92080B  |             |
| SF_ANT             | V97U3549C | ND        | F  | S  | L | P | G4.17                                                                            | 00 | GPH | 92102B  |             |
| SF_ATT             | V97U2911C | DEG       | F  | S  | L | P | G4.17                                                                            | 00 | GPH | 92102B  |             |
| SF_BARO            | V97U2912C | ND        | F  | S  | L | P | G4.17                                                                            | 00 | GPH | 92102B  |             |
| SF_BORE            | V97U3550C | ND        | F  | S  | L | P | G4.17                                                                            | 00 | GPH | 92102B  |             |
| SF_POS             | V97U2914C | ND        | F  | D  | L | P | G4.17<br>G4.21                                                                   | 00 | GPH | 92067D  |             |
| SF_RA              | V97U2915C | ND        | F  | S  | L | P | G4.17                                                                            | 00 | GPH | 92102B  |             |
| SF_TIME            | V97U2918C | ND        | F  | D  | L | P | G4.17                                                                            | 00 | GPH | 92067D  |             |
| SF_VEL             | V97U2919C | ND        | F  | S  | L | P | G4.17<br>G4.21                                                                   | 00 | GPH | 92067D  |             |
| T_GPS_OFFSET_DAYS  | V97U2131C | DAYS      | I  | S  | M | C | G4.17                                                                            | 00 | GPT | 92102B  |             |
| T_RA_GPS_DELAY     | V97U2922C | SEC       | F  | S  | D | P | G4.17                                                                            | 00 | GP3 | 92139   |             |

NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.

TABLE 4.17.6.10-4. GLOBAL POSITIONING SYSTEM SOP (G4.17) K-LOADS

| FSSR NAME<br>DESCRIPTION                                     | MSID      | MC | KLOAD VALUE | ENG UNITS | DT | P<br>R | S   | PR FCTN                                                     | LAST CR | R<br>E<br>V |
|--------------------------------------------------------------|-----------|----|-------------|-----------|----|--------|-----|-------------------------------------------------------------|---------|-------------|
| GPS_SW_CAP<br>MAX NUM OF GPS LRU THAT SOFTWARE<br>CAN HANDLE | V97U2923C | 00 | +3          | ND        | I  |        | S P | G4.17<br>G4.18<br>G4.20<br>G4.21<br>G4.23<br>G4.24<br>G4.25 | 92069B  |             |
| TIME_BIAS_BARO<br>PAD BIAS CORR BARO TIME TAG                | V97U5544C | 00 | +1.790      | E-01 SEC  | F  |        | D C | G4.127<br>G4.144<br>G4.17<br>G4.205                         | 92069B  |             |
| TIME_BIAS_RADALT<br>PAD LOAD CORR RAD ALT TIME               | V97U5546C | 00 | +1.50       | E-02 SEC  | F  |        | D P | G4.17<br>G4.20<br>G4.23<br>G4.24<br>G4.25                   | 92069B  |             |

NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.

TABLE 4.17.6.10-5. GLOBAL POSITIONING SYSTEM SOP (G4.17) CONSTANTS

| FSSR NAME<br>DESCRIPTION              | MSID      | MC | CONSTANT VALUE     | ENG UNITS | DT | P<br>R | S   | PR FCTN                                                                                                                                                               | LAST CR | R<br>E<br>V |
|---------------------------------------|-----------|----|--------------------|-----------|----|--------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------|
| EARTH_RATE<br>EARTH'S ROTATIONAL RATE | V97U4379C | 00 | +7.29211514646E-05 | RAD/SEC   | F  |        | D C | A6.9<br>G4.126<br>G4.127<br>G4.139<br>G4.144<br>G4.148<br>G4.15<br>G4.17<br>G4.19<br>G4.20<br>G4.205<br>G4.21<br>G4.213<br>G4.22<br>G4.236<br>G4.237<br>G4.4<br>G5.26 | 93090E  |             |

**NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.**

## 4.43 TACAN SUBSYSTEM OPERATING PROGRAM

This section defines the detailed functional requirements and formulations for the tactical air navigation (TACAN) subsystem operating program (SOP). The TACAN SOP defines software associated with TACAN range and bearing data processing, auto station command and response processing, upper/lower antenna selection, and self-test processing.

### 4.43.1 TACAN Requirements Overview

#### 4.43.1.1 TACAN Functional Overview

TACAN is a military L-band air navigation system that provides slant range and magnetic bearing information from user aircraft to ground beacon. The desired ground beacon is selected by choosing a channel number (specific frequency). Although each ground beacon can be uniquely identified by its broadcasted Morse code ID tone, channel numbers can be ambiguous. However, the intent of the orbiter design is to use functional or real clear-channel ground beacons. A single TACAN subsystem is depicted in Figure 4.43.1.1-1 along with related interfacing equipment. Six major components are identified that are required for the TACAN function: controls on the panel, an MDM (multiplexer/demultiplexer) that contains the TACAN control register, a receiver-transmitter (R/T), an upper antenna, a lower antenna, and the on-board computer. The keyboard and the display electronics unit are also required for TACAN self-test command and data monitoring.

TACAN Control Head. Ultimate control of the TACAN subsystem is via the control head. The control head has a four-position function switch and four thumbwheels for channel selection. The four positions of the function switch are as follows: OFF, RECEIVE, TRANSMIT/RECEIVE, and GPC.

Power is applied to the R/T when the switch is in any position except OFF. A power-present discrete returns from the R/T to the GPC. When in RECEIVE or TRANSMIT/RECEIVE positions, the channel number is determined by the thumbwheel positions. Channel numbers 1 through 126 are recognized by the R/T. The fourth thumbwheel determines the mode of the ground beacon (X or Y) that completes the channel selection definition. When in RECEIVE mode, the R/T outputs only bearing data. When in TRANSMIT/RECEIVE mode, the R/T outputs both bearing and range data. When the switch is in the GPC position, the channel number, mode, and self-test state are determined by the GPC.

Antenna Control Switch. Antenna selection may be accomplished by allowing the GPC to automatically switch antennas when the antenna switch is in the AUTO position. The auto function may be inhibited by choosing the UPPER or LOWER switch position. The R/T will cause selection of the upper or lower antenna according to switch position.

TACAN Control Word. Mechanization of the command to the R/T, whether it be from the control head or the software, is via the TACAN control register in the MDM. Once every 32 milliseconds, the contents of the TACAN control register are transferred to an output register and are then sent in a serialdigital control word to the TACAN R/T. The format of the control register is shown in Figure 4.43.1.1.2-1. The TACAN discrete input register contains the control head switch settings with one exception, the four-position function switch GPC mode. The format of the discrete input word is shown in Figure 4.43.1.1.2-2.

When the mode switch is set to RECEIVE or TRANSMIT/RECEIVE, the contents of the TACAN discrete input register are converted to control register format and transferred to the TACAN control register. This takes place during the 32-millisecond cycle immediately prior to transfer of the TACAN control register contents to the output register and takes precedence over any control words transmitted from the GPC to the MDM.

When the mode switch is set to GPC, the control register update from the discrete input register does not take place. A control register command sent from the TACAN SOP is then permitted to be transferred to the output register and to command the TACAN T/R.

When read by the TACAN SOP, the contents of the TACAN control register depend upon setting of the mode switch, and upon previous TACAN SOP writes to the control register. When the mode switch is set to GPC, the R/T control word contains the most recent control word update from the TACAN SOP since the start of GPC mode. If the TACAN SOP has not updated the control word since the start of the GPC mode, the R/T control word will contain the last control head switch settings from manual mode. When the mode setting is RECEIVE or TRANSMIT/RECEIVE, the R/T control word read by the TACAN SOP will contain the current control head switch settings unless a control word was written from the TACAN SOP to the MDM in the previous 32 milliseconds. Under this condition, the contents of the R/T control word read by the TACAN SOP will be unpredictable.

TACAN Self-Test. Self-test of the TACAN R/T is initiated through the keyboard or directly by the software. Self-test of the R/T can be executed properly only if the control head mode switch is in GPC position and remains in GPC for the duration of the test. Upon completion of self-test, the TACAN outputs range, bearing, and status discrete to indicate the health of the R/T.

#### **4.43.1.1.1 TACAN Operating Modes**

The TACAN system operating modes are as follows:

- OFF mode
- RECEIVE mode
- TRANSMIT/RECEIVE mode
- GPC mode

OFF mode occurs when the power-on discrete from the TACAN transceiver is in the false or off state.

RECEIVE mode is not used during orbiter operations.

TRANSMIT/RECEIVE mode occurs when the transceiver is in operation as indicated by the power-on discrete and the control switch is in T/R position. The channel selection is controlled by thumbwheels on the control panel.

GPC mode occurs when the transceiver is in operation as indicated by the power-on discrete, and the control switch is in the GPC position. The GPC controls channel selection and self-test operation.



#### 4.43.1.1.2 TACAN Digital Interfaces

The TACAN interfaces with the GPC via the serial digital multiplex/demultiplex input and output data channel. The digital I/O words are 16 bits in size, plus 3 bits for synchronization and 1 bit for odd parity. Throughout the TACAN SOP, the synchronization and parity bits are disregarded, and the most significant data bit in the word is designated as bit zero with the least significant bit being bit 15. The contents, format, and bit values of the TACAN data interfaces are illustrated in:

Figure 4.43.1.1.2-1, TACAN Control Register Format

Figure 4.43.1.1.2-2, TACAN Discrete Word Format

Figure 4.43.1.1.2-3, TACAN to MDM Range Word

Figure 4.43.1.1.2-4, MDM to GPC Range Words

Figure 4.43.1.1.2-5, TACAN to MDM Bearing Word

Figure 4.43.1.1.2-6, MDM to GPC Bearing Word

#### 4.43.1.1.3 TACAN Discrete Interfaces

TACAN provides two discretes to GPC software: power-on discrete and test status monitor discrete.

The power-on discrete is an indication to the GPC that the transceiver power supply is operating. The test status monitor discrete provides an indication of the health of part of the transceiver and is used in conjunction with self-test for fault detection. The test status monitor discrete may change state only when self-test is active.

#### 4.43.1.2 TACAN SOP Functional Overview

The TACAN SOP controls and monitors the operation of the three TACAN systems and processes TACAN data for use by other program elements. The inputs and outputs from the TACAN SOP modules are stored in locations labeled as to parameter and transceiver.

The TACAN SOP is partitioned into four modules which are as follows:

- A. TACAN Self-Test Processing. The TAC\_TEST module initiates TACAN self-test and monitors self-test outputs to determine the health of the TACAN and MDM data link.
- B. TACAN Data Processing. The TAC\_DATA module processes TACAN range, bearing, and channel data.
- C. TACAN Antenna Selection Processing. The TAC\_ANT module performs the processing associated with TACAN upper or lower antenna selection.
- D. TACAN Channel Command Processing. The TAC\_CHAN module generates the TACAN control word in support of navigation-controlled TACAN channel selection.

#### **4.43.1.3 TACAN Functional Module Summary**

The functional modules that constitute the TACAN SOP are identified in Table 4.43.1.3–1. Each of the modules, including functions and formulations are presented in detail in Section 4.43.6.

#### **4.43.1.4 Reference Documents**

MC409–0014 Receiver/Transmitter, Air Navigation Set, Tactical; Rockwell

MC409–0184 Receiver/Transmitter, Air Navigation Set, Tactical; Rockwell

#### **4.43.1.5 Software Protection**

The software implementation of the TACAN SOP shall protect against program checks and error interrupts caused by transient–type errors or bad data inputs. Specifically, the TACAN SOP shall protect against all of the error conditions identified in paragraph 3.6 that are applicable to the TACAN software design and code.

#### **4.43.2 Definitions**

See the glossary in Section 5.1.

#### **4.43.3 Functional Requirements Traceability**

The detailed requirements and formulations contained herein satisfy the GN&C, Level B, CPDS functional requirements for the TACAN SOP.

#### **4.43.4 TACAN SOP Interfaces**

This section defines the interfaces associated with the TACAN SOP. Table 4.43.4–1 contains the TACAN SOP inputs and outputs.

#### **4.43.5 Parameter Initialization**

This section defines the I–load parameters associated with the TACAN SOP. Table 4.43.5–1 contains the I–load parameters and identifies typical I–load values. The actual values will be specified later in the official I–load document. The codes designated in the constant column of Table 4.43.5–1 are to be interpreted as follows: “SX” indicates a soft constant that may change as the software is refined; “MX” indicates a mission/LRU dependent constant that is expected to change from mission to mission; and “X” indicates a hard constant that probably will not change.

#### **4.43.6 Detailed Requirements and Formulations**

This section defines the TACAN SOP functional modules in sufficient detail to create a functional design and generate computer code. Figure 4.43.6–1 presents a flow diagram of the TACAN SOP. Each module defines the functional requirements, interface requirements, detailed requirements and formulations, and special considerations if applicable. A flow diagram is also included for most modules; however, the flow diagrams are supplementary material and are not intended to convey requirements or to place restrictions on functional design or coding.

The TACAN SOP shall function as follows:

1. **TACAN Time Tag.** A homogeneous set of TACAN data shall be read into the GPC prior to each execution of the TAC\_DATA module. These data shall consist of range, bearing, control register data, discrete register data, and the control switch discrete for each of the three TACAN's. The TACAN data shall be time-tagged with a single tag that corresponds to the time associated with the input transaction for the three-TACAN set. Whenever the TAC\_DATA module is executed in support of TACAN RM function (0.25-Hz cycle), the current TACAN time tag shall be stored for use by navigation.
2. **Commfault/Power Check.** For each LRU (1, 2, and 3), determine whether or not a commfault exists. If a commfault does not exist, then set the TACAN power-on signal, TACPON<sub>i</sub>, equal to the TACAN power discrete, TACPOD<sub>i</sub>. If TACPON<sub>i</sub> is false, then set the range and bearing comlocks (TRNG\_CMLK<sub>i</sub> and TBRG\_CMLK<sub>i</sub>) to false; otherwise, continue SOP execution for that LRU.

If a commfault does exist for an LRU, set the range and bearing comlocks for that LRU (TRNG\_CMLK<sub>i</sub> and TBRG\_CMLK<sub>i</sub>) to false and terminate processing on that LRU on that cycle. SOP processing for the remaining LRU or LRU's will continue.

#### 4.43.6.1 TACAN Self-Test Processing (TAC\_TEST)

The purpose of the TAC\_TEST functional module is to initiate TACAN self-test and to monitor the TACAN self-test outputs to determine the health of the TACAN and MDM data link.

A. Functional Requirements. The TAC\_TEST functional module is required to perform the following functions:

1. Set the TACAN self-test bit to the required state in response to a self-test request from the TACAN RM function.
2. Monitor the TACAN range and bearing data on completion of self-test. Limit check the data to detect failures.
3. Monitor the TACAN test status monitor discrettes to detect failures.
4. Provide range and bearing self-test fail flags for use by TACAN RM.
5. Provide a self-test in progress flag for use by TACAN RM.

B. Interface Requirements. The input and output parameters associated with the TAC\_TEST functional modules are contained in Table 4.43.4-1. I-load parameters are contained in Table 4.43.5-1.

C. Detailed Requirements and Formulations. The TAC\_TEST module shall perform the following operations in response to a self-test request from the TACAN RM function. Figure 4.43.6.1-1 presents a flow diagram of the TAC\_TEST functional requirements.

1. Self-Test Initiation. Upon receipt of a self-test request signal from TACAN RM, determine if all TACAN's to be tested are in the GPC mode. If so, set the self-test-in-progress flag to logic 1, set all TACAN self-test failure flags to logic 0, and initiate TACAN self-test on the requested TACAN's by setting bit 15 of the applicable TACAN control words to logic 1 for output to the applicable MDM control registers via the TAC\_CHAN module. Self-test shall be initiated within 1 second of the TACAN RM request for self-test. If any of the requested TACAN's are not in the GPC mode, set the range and bearing fail flags for the requested TACAN's to logic 1 (fail), set the self-test-in-progress flag to logic 0, and set all bits in the self-test request signal to logic 0.
2. Self-Test Monitor. The following operations shall be performed for each TACAN that has been commanded to self-test. After TAC\_STTIM seconds have elapsed, the range and bearing data from the applicable TACAN's shall be read and limit checked to the following I-load limits:

|                | <u>Low Limit</u> | <u>High Limit</u> |
|----------------|------------------|-------------------|
| Range (A    B) | TAC_RNGLO        | TAC_RNGHI         |
| Bearing        | TAC_BEARLO       | TAC_BEARHI        |

In addition, the applicable TACAN test status monitor discrettes shall be checked. If either the TACAN range limit check fails or the test status monitor discrete indicates a failure (logic 0), the applicable range self-test failure flag shall be set to logic 1. If either the TACAN bearing limit check fails or the test status monitor discrete indicates a failure, the applicable bearing self-test failure flag shall be set to logic 1. Note that the TACAN self-test fail flags must be initialized to logic 0 whenever the TACAN SOP is first invoked.

3. Self-Test Completion. Upon completion of self-test, the self-test-in-progress flag shall be set to logic 0, the self-test bits in all TACAN control words shall be set to logic 0, and all bits in the self-test request signal shall be set to logic 0.

D. Special Considerations. The following special considerations are applicable to TACAN self-test operation.

1. In order for the TACAN SOP to initiate TACAN self-test, the TACAN control head switches on the overhead panel in the cockpit must be set to the GPC position. This enables the GPC to output the self-test command word to the TACAN control registers in the MDM.

#### 4.43.6.2 TACAN Data Processing (TAC\_DATA)

The purpose of the TAC\_DATA functional module is to process TACAN input data.

A. Functional Requirements. The TAC\_DATA module is required to perform the following functions:

1. Time tag TACAN input data for use by navigation.
2. Compute the TACAN range values by concatenating the two range words and performing the required scaling and conversion to obtain floating point data in units of feet.

3. Compute the TACAN bearing values by performing the required scaling and conversion to obtain floating point data in units of radians.
4. Set the TACAN range and bearing lock-on flags and commfault/lock-on flags to the correct state.
5. Compute the current TACAN channel identification for use by other software functions.

B. Interface Requirements. The input and output parameters associated with the TAC\_DATA functional module are contained in Table 4.43.4-1. I-load parameters are contained in Table 4.43.5-1.

C. Detailed Requirements and Formulation. The TAC\_DATA module shall perform the following operations whenever the TACAN SOP is active. This module shall be executed prior to TACAN RM processing at a rate of 1.04 Hz. The TAC\_DATA module shall also be executed once every 320 milliseconds (3.125 Hz) prior to area navigation processing if the HSI source and receiver switches (left or right) indicate TACAN. All three TACAN's shall be processed prior to TACAN RM processing. Only the HSI-selected TACAN's are required to be processed in support of area navigation. Figure 4.43.6.2-1 presents a flow diagram of the TAC\_DATA functional requirements.

1. TACAN Range. Compute the TACAN range parameter, TACRANGE<sub>i</sub>, as follows:
  - a. Concatenate input parameters TACRANGA<sub>i</sub> and TACRANGB<sub>i</sub> into a single 32-bit word as shown in Figure 4.43.1.1.2-4. Extract bits 2 through 19 and convert these bits from BCD to fixed-point notation using the following scaling:
    - Bits 2 through 3 = 100's nmi
    - Bits 4 through 7 = 10's nmi
    - Bits 8 through 11 = 1's nmi
    - Bits 12 through 15 = 1/10's nmi
    - Bits 16 through 19 = 1/100's nmi
  - b. Note that input values up to 400 nmi are to be accommodated. The range value shall then be converted from nautical miles to feet using the conversion factor TNM\_FT, changed to floating point, and made available for use by other software.
2. TACAN Range Lock-On and Comlock. If bits 0 and 1 of TACRANGA<sub>i</sub> are both zero; set the TACAN range lock-on flag, TACRANGDG<sub>i</sub>, and TRNG\_CMLK<sub>i</sub> to true; else, set TACRANGDG<sub>i</sub> and TRNG\_CMLK<sub>i</sub> to false.
3. TACAN Bearing. Compute the TACAN bearing parameter, TACBEAR<sub>O</sub><sub>i</sub>, as follows:
  - a. Extract bits 3 through 14 of TACBEARA<sub>i</sub> as shown in Figure 4.43.1.1.2-6. Note that TACBEARA<sub>i</sub> binary data is scaled in degrees with bit 3 (MSB) equal to 90 degrees. If bits 1 and 2 of TACBEARA<sub>i</sub> equal binary "11," then increase the value of the bearing data by 180 degrees.
  - b. The bearing value shall then be converted from degrees to radians, changed to floating point, and made available for use by other software.

4. TACAN Bearing Lock-On and Comlock. If bits 1 and 2 of TACBEARA<sub>i</sub> are either binary “00” or binary “11,” set the TACAN bearing lock-on flag, TACBEARDG<sub>i</sub>, and TBRG\_CMLK<sub>i</sub> to true; otherwise, set TACBEARDG<sub>i</sub> and TBRG\_CMLK<sub>i</sub> to false.
5. TACAN Channel Word. Compute the TACAN channel word, TACCHAN<sub>i</sub>, as follows:
  - a. If in GPC mode (TAC\_GPC<sub>i</sub> = 1), or if GPC input/output design precludes reading of a TACAN transceiver within 34 milliseconds of a write to the same transceiver, then extract bits 7 through 14 of the TACAN control word, TACCFM<sub>i</sub>, and convert bits to fixed-point notation in accordance with the following bit scaling (refer to Figure 4.43.1.1.2-1):
 

Bits 7 through 10 = units (max = 9)

Bits 11 through 14 = tens (max = 120)

Otherwise, proceed to step 6b.
  - b. If in manual mode (TAC\_GPC<sub>i</sub> = 0) and the above input/output constraint is not met, then extract bits 0 and 7 through 14 of the TACAN discrete word, TAC\_DW<sub>i</sub>, and convert these bits to fixed-point notation in accordance with the following bit scaling (refer to FIGURE 4.43.1.1.2-2):
 

Bits 7 through 10 = units (max = 9)

Bits 11 through 14 = tens (max = 90)

Bit 0 = one hundred
  - c. If bit 2 of TACCFM<sub>i</sub> (or TAC\_DW<sub>i</sub>) is true, indicating the TACAN is operating in the Y mode, set TACCHAN<sub>i</sub> negative; otherwise, set TACCHAN<sub>i</sub> positive.
  - d. If TACCHAN<sub>i</sub> has changed since the previous cycle, set the TACAN channel change indicator, TCH\_CHNG<sub>i</sub>, equal to true; otherwise, set TCH\_CHNG<sub>i</sub> equal to false.

#### 4.43.6.3 TACAN Antenna Selection Processing (TAC\_ANT)

The purpose of the TAC\_ANT functional module is to perform the processing associated with TACAN upper or lower antenna selection.

A. Functional Requirements. The TAC\_ANT module is required to perform the following functions for each TACAN:

1. Select lower antenna when a new TACAN channel is commanded and call SITE LOOKUP with appropriate LRU\_ID and NEW\_STATION\_ID.
2. Monitor the range lock-on bits to determine if range lock-on has been achieved.
3. If the TACAN has not achieved range lock-on, delay several seconds and then switch to the opposite antenna in an attempt to obtain range lock-on.

4. Set the antenna selection discrettes and the antenna inhibit discrettes to the proper state, and output these discrettes to the TACAN.

B. Interface Requirements. The input and output parameters associated with the TAC\_ANT functional module are contained in Table 4.43.4-1. I-load parameters are contained in Table 4.43.5-1.

C. Detailed Requirements and Formulation. The following operations shall be performed by the TAC\_ANT module whenever the TACAN SOP is active. Figure 4.43.6.3-1 presents a flow diagram of the TAC\_ANT functional requirements.

1. Perform the following operations for each TACAN at a rate of once per second:
  - a. If TACCHAN<sub>i</sub> has changed since the last cycle, set the TACANSEL<sub>i</sub> discrete to logic 0 (lower) for TACAN<sub>i</sub>; also set the range lock on timer, RL\_TIMER<sub>i</sub>, to zero for TACAN<sub>i</sub>. Then perform steps e and g.
  - b. If TACAN<sub>i</sub> currently has range lock-on (TACRANGA<sub>i</sub> bits 0 and 1 are both zero), reset the TACAN range lock-on timer, RL\_TIMER<sub>i</sub>, to 0; otherwise continue with step c
  - c. Increment the range lock-on timer, RL\_TIMER<sub>i</sub>, by 1 second.
  - d. If the range lock-on timer, RL\_TIMER<sub>i</sub>, is greater than or equal to TAC\_RLTIM seconds, change the state of the upper/lower antenna discrete, TACANTSEL<sub>i</sub>, from 1 to 0 (lower) or 0 to 1 (upper) as applicable.
  - e. Set the TACAN antenna selection inhibit discrete, TACANTINH<sub>i</sub>, to logic 1. Note that this discrete can be initialized to logic 1 when the TACAN SOP is first invoked and maintained at logic 1 for all TACAN SOP processing.
  - f. Set the range lock-on timer, RL\_TIMER<sub>i</sub>, to 0.
  - g. Output the TACANTSEL<sub>i</sub> and TACANTINH<sub>i</sub> discrettes within 0.5 second.
2. TACAN<sub>i</sub> antenna selection processing is not required during TACAN<sub>i</sub> self-test (TAC\_TEST) processing.

D. Special Considerations. The following special considerations are applicable to TACAN SOP antenna selection.

1. During normal utilization of the TACAN's, the TACAN SOP will determine the proper selection of either the upper or lower antenna based upon achieving range lock-on within a predefined time interval. In order for the SOP to actually control the antenna selection, the TACAN antenna control switches on the overhead panel in the cockpit must be set at the auto position. This enables the GPC to control the antenna inhibit discrettes and the upper/lower selection discrettes.
2. The crew can override the TACAN SOP auto antenna selection by manually placing the TACAN antenna control switches in either the upper or lower antenna position. The SOP antenna selection processing will continue; however, the outputs from the GPC will be inhibited, and antenna selection will be in accordance with the antenna control switch position.

#### 4.43.6.4 TACAN Channel Command Processing (TAC\_CHAN)

The purpose of the TAC\_CHAN functional module is to generate the control word output to the TACAN's in support of GPC-controlled TACAN channel selection. Note that TACAN channel selection is performed by the navigation function.

A. Functional Requirements. The TAC\_CHAN functional module is required to perform the following functions:

1. Convert the TACAN channel number selected by navigation into the required format for output to the TACAN control registers.
2. Format the TACAN control word to specify the proper channel, mode, and test condition and output the control word to the TACAN control registers.

B. Interface Requirements. The input and output parameters associated with the TAC\_CHAN functional module are contained in Table 4.43.4-1.

C. Detailed Requirements and Formulations. The following operations shall be performed by the TAC\_CHAN module whenever the TACAN SOP is active. Figure 4.43.6.4-1 presents a flow diagram of the TAC\_CHAN functional requirements.

1. Perform the following operations for each TACAN that is in GPC mode at a rate of once per second:
  - a. To command TACAN channel selection from the GPC, a 16-bit control word shall be generated and output to the MDM control register associated with the respective TACAN LRU. As defined in Figure 4.43.1.1.2-1, the bit configuration of the control word shall be as follows:

(Bit 0) 1 OMO 100 XXX XYY YYZ (Bit 15)

Where M is a mode select bit (X/Y), XXXX (units) and YYYYY (tens) represent the desired channel number requested by the navigation function, and Z represents the self-test command bit (logic state controlled by the TAC\_TEST module). Note that the Y-mode channels are represented by negative channel numbers in the navigation and display functions. Other bits in the control word correspond to the following:

Function = T/R

- b. Output the control word to the MDM within 0.5 second.
2. TAC\_CHAN processing shall follow the channel selection processing in navigation.

D. Special Considerations. The following special considerations are applicable to GPC-controlled TACAN channel selection.

1. During normal utilization of the TACAN's, the navigation function and the TACAN SOP will select the TACAN channels based upon factors such as available stations, current state vector, flight path geometry, etc. In order for the SOP to actually control the channel section, the TACAN control head switches on the overhead panel in the cockpit must be set to the GPC



position. This enables the GPC to output the selected channel number to the TACAN control register in the MDM.

2. The crew can override the GPC-controlled TACAN channel selection by placing the TACAN control head switches in the T/R positions. This enables the crew to manually select the TACAN channel via the thumb-wheel switches. It should be noted that manual channel selection may be incompatible with TACAN selection filter processing and redundancy management.

#### 4.43.6.5 Applicable Tables for TACAN SOP

The IDD inputs and outputs are listed in Tables 4.43.6.5-1 and 4.43.6.5-2. Values for the I-loads are contained in the I-loads requirements document (JSC-19350); however, I-load definitions applicable to this principal function are listed in Table 4.43.6.5-3. K-loads are listed in Table 4.43.6.5-4. Constants are listed in Table 4.43.6.5-5.

| Table 4.43.1.3-1. TACAN SOP Functional Modules |                      |                         |
|------------------------------------------------|----------------------|-------------------------|
| Module Name                                    | Applicable Paragraph | Module Description      |
| TAC_TEST                                       | 4.43.6.1             | TACAN self-test         |
| TAC_DATA                                       | 4.43.6.2             | TACAN data processing   |
| TAC_ANT                                        | 4.43.6.3             | TACAN antenna selection |
| TAC_CHAN                                       | 4.43.6.4             | TACAN channel command   |

Table 4.43.4-1.(1) TACAN SOP Interface Table

| INPUT          |           |                                                  |                              |             |         |       |           |
|----------------|-----------|--------------------------------------------------|------------------------------|-------------|---------|-------|-----------|
| Name           | MSID      | Description                                      | Source                       | Signal Type | Range   | Units | Rate (Hz) |
| TACRANGA(1)*** | V74M1550P | TACAN NO. 1 RANGE WORD A                         | TACAN 1                      | FIXED PT    | 0 – 400 | NM    | 3.125     |
| TACRANGA(2)*** | V74M1650P | TACAN NO. 2 RANGE WORD A                         | TACAN 2                      | FIXED PT    | 0 – 400 | NM    | 3.125     |
| TACRANGA(3)*** | V74M1750P | TACAN NO. 3 RANGE WORD A                         | TACAN 3                      | FIXED PT    | 0 – 400 | NM    | 3.125     |
| TACRANGB(1)*** | V74M1551P | TACAN NO. 1 RANGE WORD B                         | TACAN 1                      | FIXED PT    | 0 – 400 | NM    | 3.125     |
| TACRANGB(2)*** | V74M1651P | TACAN NO. 2 RANGE WORD B                         | TACAN 2                      | FIXED PT    | 0 – 400 | NM    | 3.125     |
| TACRANGB(3)*** | V74M1751P | TACAN NO. 3 RANGE WORD B                         | TACAN 3                      | FIXED PT    | 0 – 400 | NM    | 3.125     |
| TACBEARA(1)*** | V74M1530P | TACAN NO. 1 BEARING WORD A                       | TACAN 1                      | FIXED PT    | 0 – 360 | DEG   | 3.125     |
| TACBEARA(2)*** | V74M1630P | TACAN NO. 2 BEARING WORD A                       | TACAN 2                      | FIXED PT    | 0 – 360 | DEG   | 3.125     |
| TACBEARA(3)*** | V74M1730P | TACAN NO. 3 BEARING WORD A                       | TACAN 3                      | FIXED PT    | 0 – 360 | DEG   | 3.125     |
| TACBEARB(1)*** | V74M1531P | TACAN NO. 1 BEARING WORD B                       | TACAN 1                      | FIXED PT    | 0 – 360 | DEG   | 3.125     |
| TACBEARB(2)*** | V74M1631P | TACAN NO. 2 BEARING WORD B                       | TACAN 2                      | FIXED PT    | 0 – 360 | DEG   | 3.125     |
| TACBEARB(3)*** | V74M1731P | TACAN NO. 3 BEARING WORD B                       | TACAN 3                      | FIXED PT    | 0 – 360 | DEG   | 3.125     |
| TACCFM(1)      | V72M6598P | MDM FF01 DSCR IN CD00 CH6                        | HWDR<br>CONT<br>REG<br>NO. 1 | FIXED PT    | NA      | NA    | 3.125     |
| TACCFM(2)      | V72M6648P | MDM FF02 DSCR IN CD00 CH6                        | HWDR<br>CONT<br>REG<br>NO. 2 | FIXED PT    | NA      | NA    | 3.125     |
| TACCFM(3)      | V72M6698P | MDM FF03 DSCR IN CD00 CH6                        | HWDR<br>CONT<br>REG<br>NO. 3 | FIXED PT    | NA      | NA    | 3.125     |
| TAC_TSM(1)     | V74X0070X | TACAN NO. 1 TEST STATUS<br>MONITOR               | TACAN 1                      | DISCRETE    | 0,1     | NA    | 3.125     |
| TAC_TSM(2)     | V74X0080X | TACAN NO. 2 TEST STATUS<br>MONITOR               | TACAN 2                      | DISCRETE    | 0,1     | NA    | 3.125     |
| TAC_TSM(3)     | V74X0090X | TACAN NO. 3 TEST STATUS<br>MONITOR               | TACAN 3                      | DISCRETE    | 0,1     | NA    | 3.125     |
| TAC_GPC(1)     | V72K8410X | TACAN NO. 1 AUTO DISCRETE<br>(CMPTR GPC=LOGIC 1) | TACAN 1<br>D&C/<br>MDM       | DISCRETE    | 0,1     | NA    | 3.125     |
| TAC_GPC(2)     | V72K8430X | TACAN NO. 2 AUTO DISCRETE<br>(CMPTR GPC=LOGIC 1) | TACAN 2<br>D&C/<br>MDM       | DISCRETE    | 0,1     | NA    | 3.125     |
| TAC_GPC(3)     | V72K8450X | TACAN NO. 3 AUTO DISCRETE<br>(CMPTR GPC=LOGIC 1) | TACAN 3<br>D&C/<br>MDM       | DISCRETE    | 0,1     | NA    | 3.125     |
| TACPOD(1)      | V74X0071X | TACAN NO. 1 POWER STATUS                         | TACAN 1                      | DISCRETE    | 0,1     | NA    | 3.125     |
| TACPOD(2)      | V74X0081X | TACAN NO. 2 POWER STATUS                         | TACAN 2                      | DISCRETE    | 0,1     | NA    | 3.125     |
| TACPOD(3)      | V74X0091X | TACAN NO. 3 POWER STATUS                         | TACAN 3                      | DISCRETE    | 0,1     | NA    | 3.125     |

Table 4.43.4-1.(1) TACAN SOP Interface Table

| INPUT           |           |                           |                                                      |             |         |       |           |
|-----------------|-----------|---------------------------|------------------------------------------------------|-------------|---------|-------|-----------|
| Name            | MSID      | Description               | Source                                               | Signal Type | Range   | Units | Rate (Hz) |
| TAC_DW(1)       | V72M6599P | MDM FF01 DSCR IN CD00 CH5 | HWDR<br>DISC<br>REG<br>NO. 1                         | FIXED PT    | NA      | NA    | 3.125     |
| TAC_DW(2)       | V72M6649P | MDM FF02 DSCR IN CD00 CH5 | HWDR<br>DISC<br>REG<br>NO. 2                         | FIXED PT    | NA      | NA    | 3.125     |
| TAC_DW(3)       | V72M6699P | MDM FF03 DSCR IN CD00 CH5 | HWDR<br>DISC<br>REG<br>NO. 3                         | FIXED PT    | NA      | NA    | 3.125     |
| RCVR_LEFT*      | V96J2105C | LH HSI RECEIVER SELECT    | SW RM<br>4.180                                       | INTEGER     | 1, 2, 3 | NA    | 3.125     |
| RCVR_RIGHT*     | V96J2205C | RH HSI RECEIVER SELECT    | SW RM<br>4.180                                       | INTEGER     | 1, 2, 3 | NA    | 3.125     |
| SOURCE_LEFT*    | V96X2111X | LH HSI SOURCE SELECT      | SW RM<br>4.180                                       | LOGICAL     | 0,1     | NA    | 3.125     |
| SOURCE_RIGHT*   | V96X2211X | RH HSI SOURCE SELECT      | SW RM<br>4.180                                       | LOGICAL     | 0,1     | NA    | 3.125     |
| AUTO_CHANNEL_ID | V95J5022C | TACAN CHANNEL SELECTION   | ASCENT<br>ENTRY<br>SITE<br>LOOKUP<br>4.124/<br>4.238 | FIXED PT    | +/-126  | NA    | 1.04      |
| TAC_STREQ       | V90J3602C | TACAN SELF TEST REQUEST   | TACAN<br>RM 4.77                                     | BITS        | 3 BITS  | NA    | OD        |
| TAC_CF(1)       | V91X3500X | TACAN 1 COMMFAULT         | FCOS                                                 | LOGICAL     | 0,1     | NA    | 3.125     |
| TAC_CF(2)       | V91X3510X | TACAN 2 COMMFAULT         | FCOS                                                 | LOGICAL     | 0,1     | NA    | 3.125     |
| TAC_CF(3)       | V91X3520X | TACAN 3 COMMFAULT         | FCOS                                                 | LOGICAL     | 0,1     | NA    | 3.125     |
| CLOCK           | V91W5000C | CLOCK-COMPUTER (GMT)      | FCOS                                                 | FLOAT PT    | NA      | SEC   | 3.125     |

\* These parameters are not directly used in TACAN SOP.

\*\* This time tag is not used anywhere in TACAN SOP.

\*\*\*See Figure 4.43.1.1.2-3 and 4.43.1.1.2-5 for contents of this parent word.

Table 4.43.4-1.(2) TACAN SOP Interface Table

| OUTPUT       |           |                               |                                              |             |          |       |           |
|--------------|-----------|-------------------------------|----------------------------------------------|-------------|----------|-------|-----------|
| Name         | MSID      | Description                   | Destination                                  | Signal Type | Range    | Units | Rate (Hz) |
| TACRANGE0(1) | V95H5102C | TACAN NO. 1 RANGE OUT         | AREA NAV<br>4.220<br>TLM<br>TACAN RM<br>4.77 | FLOAT PT    | 0-2432K  | FEET  | 1.04      |
| TACRANGE0(2) | V95H5202C | TACAN NO. 2 RANGE OUT         | AREA NAV<br>4.220<br>TLM<br>TACAN RM<br>4.77 | FLOAT PT    | 0-2432K  | FEET  | 1.04      |
| TACRANGE0(3) | V95H5302C | TACAN NO. 3 RANGE OUT         | AREA NAV<br>4.220<br>TLM<br>TACAN RM<br>4.77 | FLOAT PT    | 0-2432K  | FEET  | 1.04      |
| TACBEARO(1)  | V95H5122C | TACAN NO. 1 BEARING OUT       | AREA NAV<br>4.220<br>TLM<br>TACAN RM<br>4.77 | FLOAT PT    | 0 - 6.28 | RAD   | 1.04      |
| TACBEARO(2)  | V95H5222C | TACAN NO. 2 BEARING OUT       | AREA NAV<br>4.220<br>TLM<br>TACAN RM<br>4.77 | FLOAT PT    | 0 - 6.28 | RAD   | 1.04      |
| TACBEARO(3)  | V95H5322C | TACAN NO. 3 BEARING OUT       | AREA NAV<br>4.220<br>TLM<br>TACAN RM<br>4.77 | FLOAT PT    | 0 - 6.28 | RAD   | 1.04      |
| TACRANGDG(1) | V95X5104X | TACAN NO. 1 RANGE LOCKED ON   | TACAN RM<br>4.77 GAX<br>4.110 TLM            | LOGICAL     | 0,1      | NA    | 1.04      |
| TACRANGDG(2) | V95X5204X | TACAN NO. 2 RANGE LOCKED ON   | TACAN RM<br>4.77<br>GAX 4.110<br>TLM         | LOGICAL     | 0,1      | NA    | 1.04      |
| TACRANGDG(3) | V95X5304X | TACAN NO. 3 RANGE LOCKED ON   | TACAN RM<br>4.77<br>GAX 4.110<br>TLM         | LOGICAL     | 0,1      | NA    | 1.04      |
| TACBEARDG(1) | V95X5124X | TACAN NO. 1 BEARING LOCKED ON | TACAN RM<br>GAX 4.110<br>TLM                 | LOGICAL     | 0,1      | NA    | 1.04      |
| TACBEARDG(2) | V95X5224X | TACAN NO. 2 BEARING LOCKED ON | TACAN RM<br>GAX 4.110<br>TLM                 | LOGICAL     | 0,1      | NA    | 1.04      |

Table 4.43.4-1.(2) TACAN SOP Interface Table

| OUTPUT        |           |                                     |                         |             |        |       |              |
|---------------|-----------|-------------------------------------|-------------------------|-------------|--------|-------|--------------|
| Name          | MSID      | Description                         | Destination             | Signal Type | Range  | Units | Rate (Hz)    |
| TACBEARDG(3)  | V95X5324X | TACAN NO. 3 BEARING LOCKED ON       | TACAN RM GAX 4.110 TLM  | LOGICAL     | 0,1    | NA    | 1.04         |
| TACPON(1)     | V95X5145X | TACAN NO. 1 BUFFERED POWER STATUS   | TACAN RM                | LOGICAL     | 0,1    | NA    | 1.04         |
| TACPON(2)     | V95X5245X | TACAN NO. 2 BUFFERED POWER STATUS   | TACAN RM                | LOGICAL     | 0,1    | NA    | 1.04         |
| TACPON(3)     | V95X5345X | TACAN NO. 3 BUFFERED POWER STATUS   | TACAN RM                | LOGICAL     | 0,1    | NA    | 1.04         |
| TRNG_CMLK(1)  | V95X5140X | TACAN 1 RANGE COMMFAULT/LOCKON FLAG | AREA NAV 4.220, GAX TLM | LOGICAL     | 0,1    | NA    | 1.04         |
| TRNG_CMLK(2)  | V95X5240X | TACAN 2 RANGE COMMFAULT/LOCKON FLAG | AREA NAV 4.220, GAX TLM | LOGICAL     | 0,1    | NA    | 1.04         |
| TRNG_CMLK(3)  | V95X5340X | TACAN 3 RANGE COMMFAULT/LOCKON FLAG | AREA NAV 4.220, GAX TLM | LOGICAL     | 0,1    | NA    | 1.04         |
| TBRG_CMLK(1)  | V95X5141X | TACAN 1 BEAR COMMFAULT/LOCKON FLAG  | AREA NAV 4.220, GAX TLM | LOGICAL     | 0,1    | NA    | 1.04         |
| TBRG_CMLK(2)  | V95X5241X | TACAN 2 BEAR COMMFAULT/LOCKON FLAG  | AREA NAV 4.220, GAX TLM | LOGICAL     | 0,1    | NA    | 1.04         |
| TBRG_CMLK(3)  | V95X5341X | TACAN 3 BEAR COMMFAULT/LOCKON FLAG  | AREA NAV 4.220, GAX TLM | LOGICAL     | 0,1    | NA    | 1.04         |
| TACCHAN(1)    | V95J5130C | TACAN NO. 1 CHANNEL W/MODE          | TACAN RM 4.77 4.220 TLM | FIXED PT    | +/-126 | NA    | 1.04<br>1.04 |
| TACCHAN(2)    | V95J5230C | TACAN NO. 2 CHANNEL W/MODE          | TACAN RM 4.77 4.220 TLM | FIXED PT    | +/-126 | NA    | 1.04<br>1.04 |
| TACCHAN(3)    | V95J5330C | TACAN NO. 3 CHANNEL W/MODE          | TACAN RM 4.77 4.220 TLM | FIXED PT    | +/-126 | NA    | 1.04<br>1.04 |
| TAC_TIM_TAG** | V95W5001C | TACAN TIME TAG                      | TLM                     | FLOAT PT    | NA     | SEC   | 1.04         |
| TAC_CNTRL(1)  | V74M1510P | TACAN 1 CONTROL WORD                | TACAN 1, TLM            | FIXED PT    | NA     | NA    | O.D.         |
| TAC_CNTRL(2)  | V74M1610P | TACAN 2 CONTROL WORD                | TACAN 2, TLM            | FIXED PT    | NA     | NA    | O.D.         |
| TAC_CNTRL(3)  | V74M1710P | TACAN 3 CONTROL WORD                | TACAN 3, TLM            | FIXED PT    | NA     | NA    | O.D.         |

Table 4.43.4-1.(2) TACAN SOP Interface Table

| OUTPUT         |           |                                             |                   |             |        |       |           |
|----------------|-----------|---------------------------------------------|-------------------|-------------|--------|-------|-----------|
| Name           | MSID      | Description                                 | Destination       | Signal Type | Range  | Units | Rate (Hz) |
| TACANTSEL(1)   | V74K0178X | TACAN 1 ANTENNA SELECTION                   | TACAN 1, TLM      | DISCRETE    | 0,1    | NA    | O.D       |
| TACANTSEL(2)   | V74K0188X | TACAN 2 ANTENNA SELECTION                   | TACAN 2, TLM      | DISCRETE    | 0,1    | NA    | O.D       |
| TACANTSEL(3)   | V74K0198X | TACAN 3 ANTENNA SELECTION                   | TACAN 3, TLM      | DISCRETE    | 0,1    | NA    | O.D       |
| TACANTINH(1)   | V74K0141X | TACAN 1 ANTENNA SWITCH INHIBIT              | TACAN 1           | DISCRETE    | 0,1    | NA    | O.D       |
| TACANTINH(2)   | V74K0151X | TACAN 2 ANTENNA SWITCH INHIBIT              | TACAN 2           | DISCRETE    | 0,1    | NA    | O.D.      |
| TACANTINH(3)   | V74K0161X | TACAN 3 ANTENNA SWITCH INHIBIT              | TACAN 3           | DISCRETE    | 0,1    | NA    | O.D.      |
| TAC_STIP       | V95X5006X | TACAN SELF TEST IN PROGRESS                 | TACAN RM 4.77 GAX | LOGICAL     | 0,1    | NA    | O.D.      |
| TAC_BRGFL(1)   | V95X5143X | TACAN NO. 1 BEARING SELF-TEST FAIL          | TACAN RM 4.77     | LOGICAL     | 0,1    | NA    | O.D.      |
| TAC_BRGFL(2)   | V95X5243X | TACAN NO. 2 BEARING SELF-TEST FAIL          | TACAN RM 4.77     | LOGICAL     | 0,1    | NA    | O.D.      |
| TAC_BRGFL(3)   | V95X5343X | TACAN NO. 3 BEARING SELF-TEST FAIL          | TACAN RM 4.77     | LOGICAL     | 0,1    | NA    | O.D.      |
| TAC_RNGFL(1)   | V95X5144X | TACAN NO. 1 RANGE SELF-TEST FAIL            | TACAN RM 4.77     | LOGICAL     | 0,1    | NA    | O.D.      |
| TAC_RNGFL(2)   | V95X5244X | TACAN NO. 2 RANGE SELF-TEST FAIL            | TACAN RM 4.77     | LOGICAL     | 0,1    | NA    | O.D.      |
| TAC_RNGFL(3)   | V95X5344X | TACAN NO. 3 RANGE SELF-TEST FAIL            | TACAN RM 4.77     | LOGICAL     | 0,1    | NA    | O.D.      |
| TCH_CHNG(1)    | V95X5146X | TACAN 1 CHANNEL CHANGE INDICATOR            | TACAN RM 4.77     | LOGICAL     | 0,1    | NA    | 1.04      |
| TCH_CHNG(2)    | V95X5246X | TACAN 2 CHANNEL CHANGE INDICATOR            | TACAN RM 4.77     | LOGICAL     | 0,1    | NA    | 1.04      |
| TCH_CHNG(3)    | V95X5346X | TACAN 3 CHANNEL CHANGE INDICATOR            | TACAN RM 4.77     | LOGICAL     | 0,1    | NA    | 1.04      |
| NEW_STATION_ID | V95J5020C | TACAN 1, 2, OR 3 NEW STATION CHANNEL NUMBER | SITE LOOK UP      | FIXED PT    | +/-126 | NA    | 1.04      |
| LRU_ID         | V95J5021C | TACAN LRU NUMBER                            | SITE LOOK UP      | FIXED PT    | 1,2,3  | NA    | 1.04      |

Table 4.43.4-1.(2) TACAN SOP Interface Table

| OUTPUT                                                                                                                                                                                                                        |           |                |                                                               |             |       |       |           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|----------------|---------------------------------------------------------------|-------------|-------|-------|-----------|
| Name                                                                                                                                                                                                                          | MSID      | Description    | Destination                                                   | Signal Type | Range | Units | Rate (Hz) |
| T_TACAN                                                                                                                                                                                                                       | V90W3596C | TACAN TIME TAG | ENT NAV<br>4.127<br>PRELAND<br>NAV 4.144<br>RTLS NAV<br>4.205 |             |       |       |           |
| <p>* These parameters are not directly used in TACAN SOP.<br/>           ** This time tag is not used anywhere in TACAN SOP.<br/>           ***See Figure 4.43.1.1.2-3 and 4.43.1.1.2-5 for contents of this parent word.</p> |           |                |                                                               |             |       |       |           |

| Table 4.43.5-1. TACAN SOP I-Load Parameters |           |                               |       |        |       |        |
|---------------------------------------------|-----------|-------------------------------|-------|--------|-------|--------|
| Name                                        | MSID      | Description                   | Const | Type   | Value | Units  |
| TAC_RNGLO                                   | V99U5718C | TACAN RANGE LOW LIMIT         | SX    | SCALAR | *     | NMI    |
| TAC_RNGHI                                   | V99U5717C | TACAN RANGE HI LIMIT          | SX    | SCALAR | *     | NMI    |
| TAC_BEARHI                                  | V99U5715C | TACAN BEARING HI LIMIT        | SX    | SCALAR | *     | DEG    |
| TAC_BEARLO                                  | V99U5716C | TACAN BEARING LOW LIMIT       | SX    | SCALAR | *     | DEG    |
| TNMFT                                       | V99U5522C | TACAN NMI TO FEET CONV FACTOR | X     | SCALAR | *     | FT/NMI |
| TAC_RLTIM                                   | V99U5520C | TACAN RANGE LOCK TIME LIMIT   | SX    | SCALAR | *     | SEC    |
| TAC_STTIM                                   | V99U5521C | TACAN SELF-TEST               | SX    | SCALAR | *     | SEC    |

\* These values found in JSC 19350.



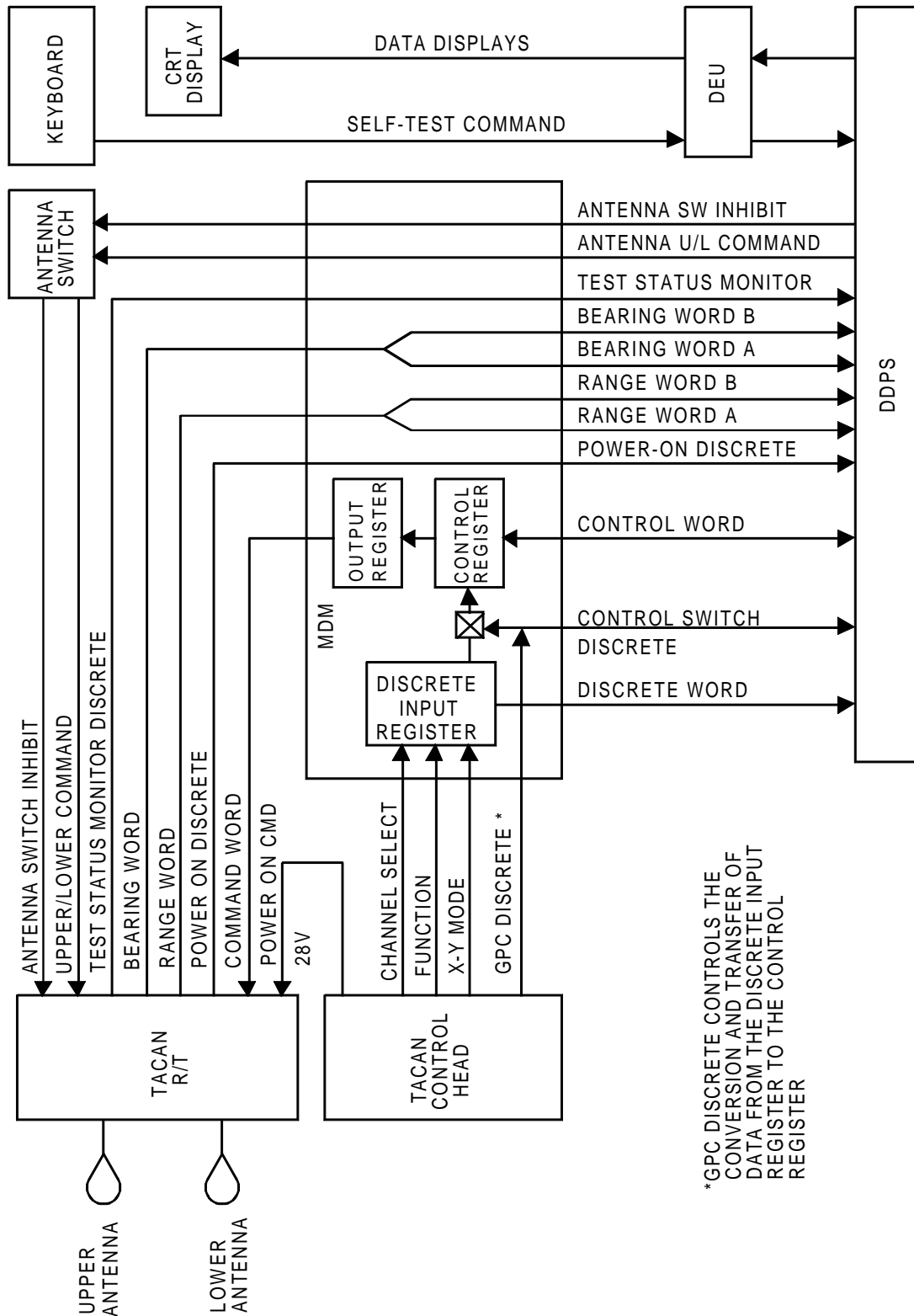


FIGURE 4.43.1.1-1. TACAN Subsystem Block Diagram

| <u>BIT NO.</u> | <u>FUNCTION</u>   | <u>COMMENT</u>     |
|----------------|-------------------|--------------------|
| 0              | SYNC              | ALWAYS 1           |
| 1              | SPARE             | *                  |
| 2              | X/Y MODE          | 1 = Y, 0 = X       |
| 3              | A/A               | 0 = NOT AIR TO AIR |
| 4              | T/R, R            | 1 = T/R, 0 = R     |
| 5              | SPARE             | *                  |
| 6              | SPARE             | *                  |
| 7              | CHANNEL SELECTION | 1 UNITS            |
| 8              | CHANNEL SELECTION | 2 UNITS            |
| 9              | CHANNEL SELECTION | 4 UNITS            |
| 10             | CHANNEL SELECTION | 8 UNITS            |
| 11             | CHANNEL SELECTION | 10 TENS            |
| 12             | CHANNEL SELECTION | 20 TENS            |
| 13             | CHANNEL SELECTION | 40 TENS            |
| 14             | CHANNEL SELECTION | 80 TENS            |
| 15             | SELF TEST         | 1 = TEST           |
| 16-31          | SET TO 0 BY MDM   |                    |

\* DON'T CARE BITS IN HARDWARE

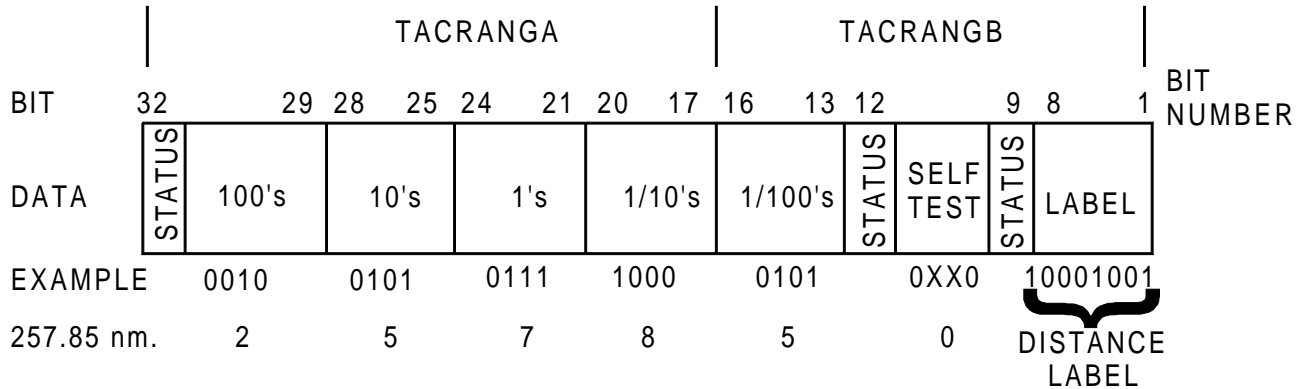
FIGURE 4.43.1.1.2-1. TACAN Control Register Format

| <u>BIT NO.</u> | <u>FUNCTION</u>     | <u>COMMENT</u> |
|----------------|---------------------|----------------|
| 0              | CHANNEL SELECTION   | 100 HUNDREDS   |
| 1              | POWER ON DISCRETE   | 1 = PWR ON     |
| 2              | X/Y MODE            | 1 = Y, 0 = X   |
| 3              | TEST STATUS MONITOR | 1 = GOOD       |
| 4              | T/R, R              | 1 = T/R, 0 = R |
| 5              | RADAR ALTIMETER     |                |
| 6              | RADAR ALTIMETER     |                |
| 7              | CHANNEL SELECTION   | 1 UNITS        |
| 8              | CHANNEL SELECTION   | 2 UNITS        |
| 9              | CHANNEL SELECTION   | 4 UNITS        |
| 10             | CHANNEL SELECTION   | 8 UNITS        |
| 11             | CHANNEL SELECTION   | 10 TENS        |
| 12             | CHANNEL SELECTION   | 20 TENS        |
| 13             | CHANNEL SELECTION   | 40 TENS        |
| 14             | CHANNEL SELECTION   | 80 TENS        |
| 15             | SPARE               |                |

NOTE: FOR TACAN CHANNEL NUMBERS ≥100, BITS 11-14 OF THE CONTROL DIFFER FROM BITS 11-14 AND 0 OF THE DISCRETE WORD

FIGURE 4.43.1.1.2-2. TACAN Discrete Word Format

RANGWORD



| 32 | 31 | 12 | 11 | 10 | 9 | BIT                                           |
|----|----|----|----|----|---|-----------------------------------------------|
| 0  | 0  | -  | -  | -  | - | VALID DATA (TRACK OR SHORT-TERM MEMORY)       |
| 0  | 1  | -  | -  | -  | - | SELF-TEST FAILURE                             |
| 1  | 0  | -  | -  | -  | - | NO COMPUTED DATA (SEARCH OR LONG-TERM MEMORY) |
| 1  | 1  | -  | -  | -  | - | NOT USED                                      |
| -  | -  | -  | 0  | 0  | - | NOT IN SELF-TEST                              |
| -  | -  | -  | 1  | 1  | - | IN SELF-TEST                                  |
| -  | -  | -  | 0  | 1  | - | NOT DEFINED                                   |
| -  | -  | -  | 1  | 0  | - | NOT DEFINED                                   |
| -  | -  | 0  | -  | -  | - | PASSED AUTO BITE TEST *                       |
| -  | -  | 1  | -  | -  | - | FAILED AUTO BITE TEST *                       |
| -  | -  | -  | -  | -  | 0 | SUPPRESSION PULSE NOT PRESENT *               |
| -  | -  | -  | -  | -  | 1 | SUPPRESSION PULSE PRESENT *                   |

\* APPLIES TO MC409-0184 TACAN ONLY

FIGURE 4.43.1.1.2-3. TACAN-to-MDM Range Word

RANGEWORD

TACRANGA



0

15

TACRANGB



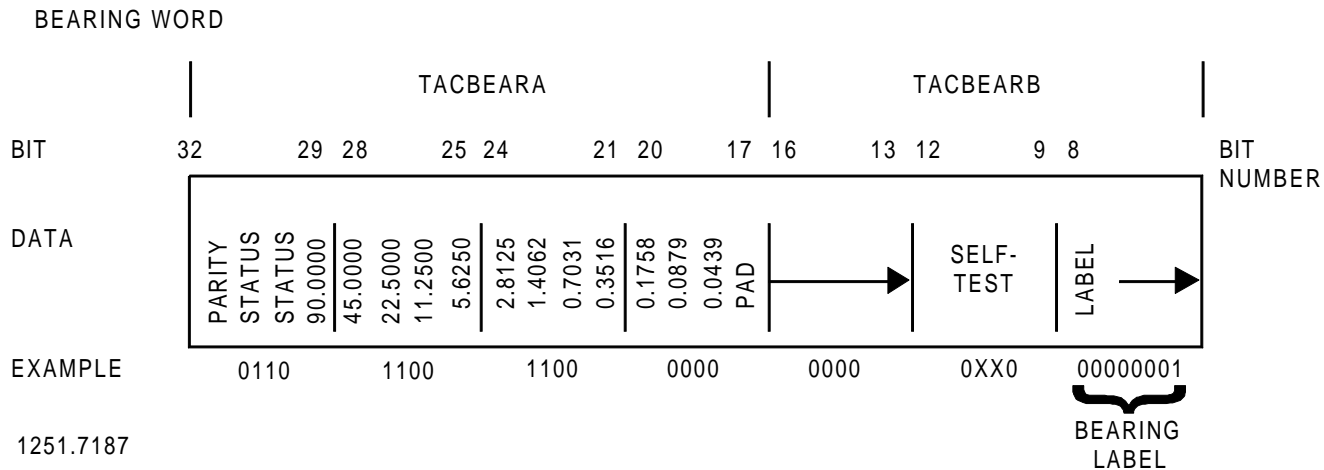
16

31

| BITS          |                                                                                             |
|---------------|---------------------------------------------------------------------------------------------|
| 0 AND 1       | = "00" VALID DATA<br>= "01" SELF-TEST FAILURE<br>= "10" NO COMPUTED DATA<br>= "11" NOT USED |
| 2 AND 3       | 100'S N. MILES                                                                              |
| 4 THROUGH 7   | 10'S N. MILES                                                                               |
| 8 THROUGH 11  | 1'S N. MILES                                                                                |
| 12 THROUGH 15 | 1/10'S N. MILES                                                                             |
| 16 THROUGH 19 | 1/100'S N. MILES                                                                            |
| 20            | *AUTO BITE TEST STATUS<br>= "0" PASS<br>= "1" FAIL                                          |
| 21 AND 22     | = "00" NOT IN SELF-TEST<br>= "11" IN SELF-TEST<br>= "10" NOT USED<br>= "01" NOT USED        |
| 23            | *SUPPRESSION PULSE PRESENT<br>= "0" PULSE NOT PRESENT<br>= "1" PULSE PRESENT                |
| 24 THROUGH 31 | LABEL = 10001001                                                                            |

\* APPLIES TO MC409-0184 TACAN ONLY

FIGURE 4.43.1.1.2-4. MDM-to-GPC Range Words



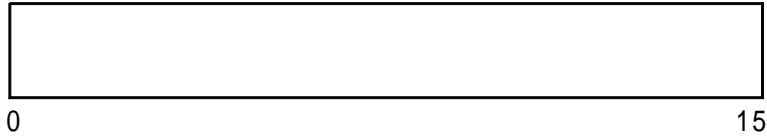
| 31 | 30 | 11 | 10 | BIT                                                 |
|----|----|----|----|-----------------------------------------------------|
| 0  | 0  | -  | -  | LESS THAN 180 DEGREES (TRACK OR SHORT-TERM MEMORY)  |
| 0  | 1  | -  | -  | SELF-TEST FAILURE                                   |
| 1  | 0  | -  | -  | NO COMPUTED DATA (NO OR UNUSEABLE SIGNAL)           |
| 1  | 1  | -  | -  | 180 DEGREES OR GREATER (TRACK OR SHORT-TERM MEMORY) |
| -  | -  | 0  | 0  | NOT IN SELF-TEST                                    |
| -  | -  | 1  | 1  | IN SELF-TEST                                        |
| -  | -  | 0  | 1  | NOT DEFINED                                         |
| -  | -  | 1  | 0  | NOT DEFINED                                         |

NOTE: BIT 32 IS ALWAYS SET FOR ODD PARITY  
BINARY VALUES ROUNDED.

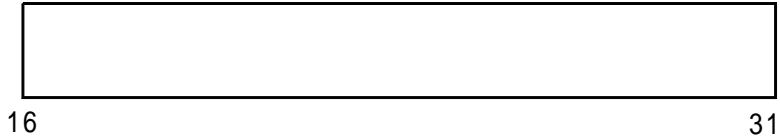
FIGURE 4.43.1.1.2-5. TACAN-to-MDM Bearing Word

BEARING WORD

TACBEARA



TACBEARB



BITS

|               |   |            |                        |
|---------------|---|------------|------------------------|
| 0             | = | PARITY     |                        |
| 1 and 2       | = | '00'       | LESS THAN 180 DEGREES  |
|               | = | '01'       | SELF-TEST FAILURE      |
|               | = | '10'       | NO COMPUTED DATA       |
|               | = | '≥11'      | 180 DEGREES OR GREATER |
| 3             | = | 90.0000°   |                        |
| 4             | = | 45.0000°   |                        |
| 5             | = | 22.5000°   |                        |
| 6             | = | 11.2500°   |                        |
| 7             | = | 5.6250°    |                        |
| 8             | = | 2.8125°    |                        |
| 9             | = | 1.40625°   |                        |
| 10            | = | 0.703125°  |                        |
| 11            | = | 0.3515625° |                        |
| 12            | = | 0.1757812° |                        |
| 13            | = | 0.0878956° |                        |
| 14            | = | 0.0439453° |                        |
| 15 through 20 | * |            |                        |
| 21 and 22     | = | '00'       | NOT IN SELF TEST       |
|               | = | '11'       | IN SELF TEST           |
|               | = | '10'       | NOT USED               |
|               | = | '01'       | NOT USED               |
| 23            | * |            |                        |
| 24 through 31 |   | LABEL      | = 0000 0001            |

\* DON'T CARE BITS IN H/W

FIGURE 4.43.1.1.2-6. MDM-to-GPC Bearing Word

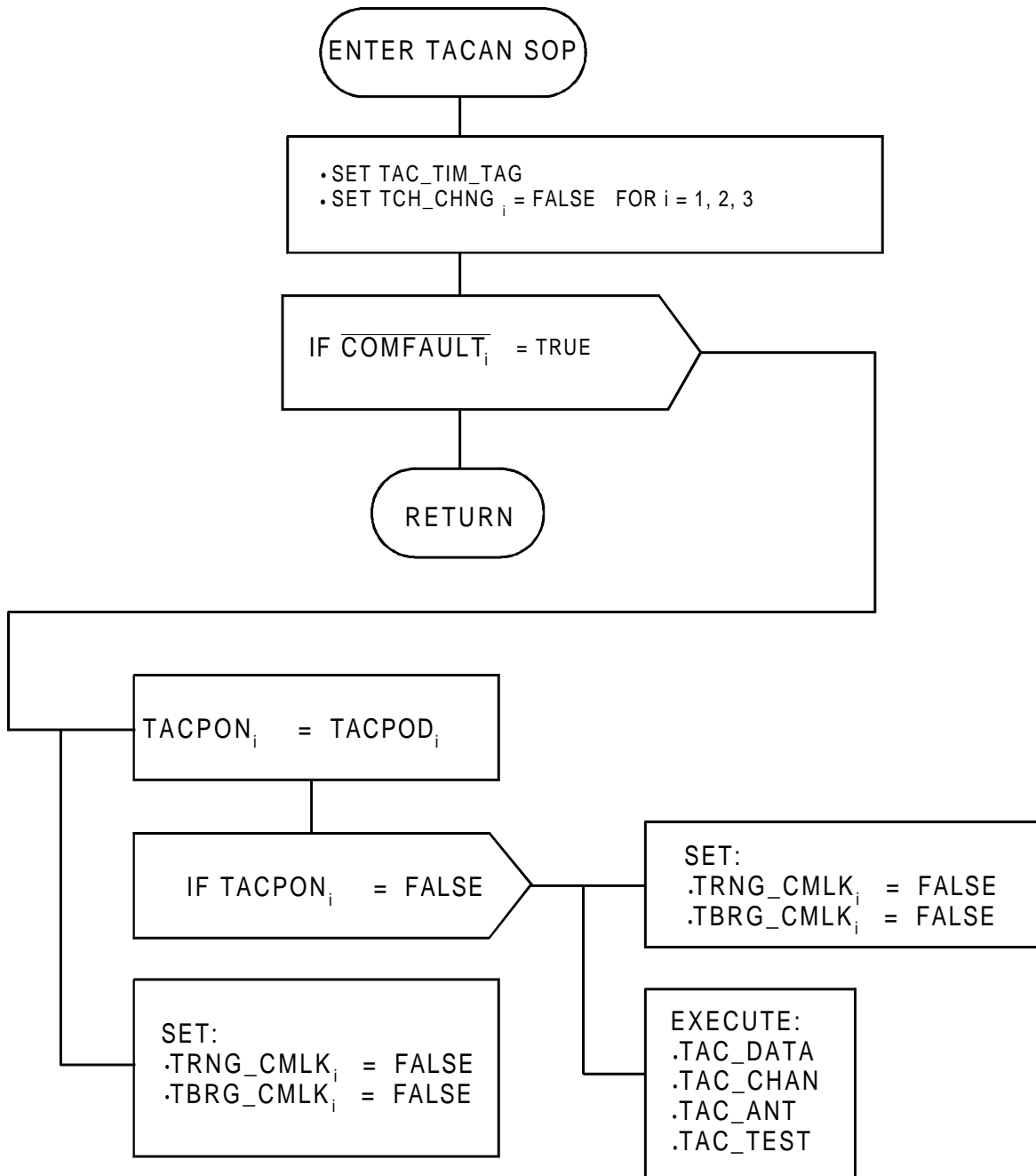


FIGURE 4.43.6-1.TACAN SOP

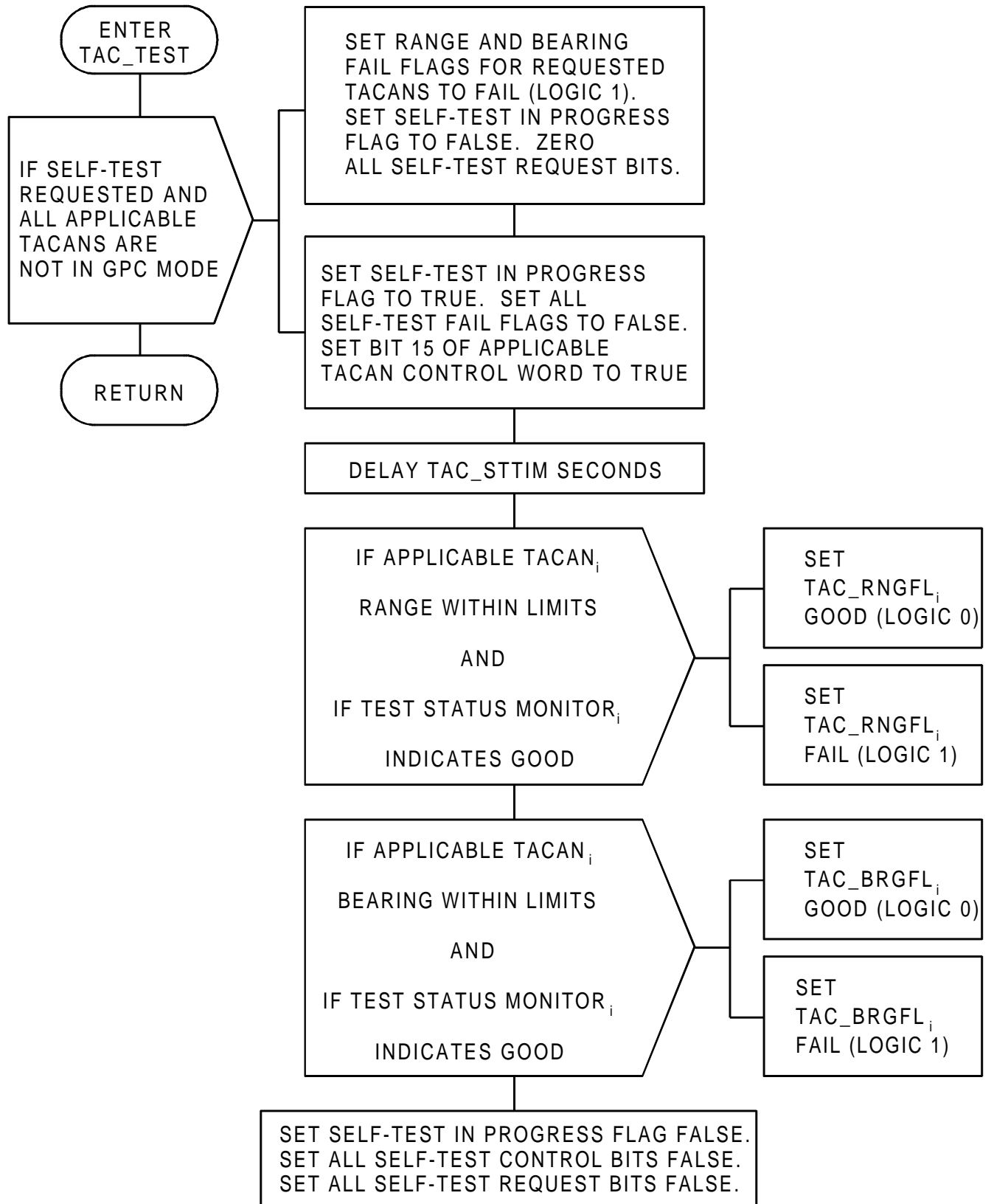


FIGURE 4.43.6.1-1. TAC\_TEST Flow Diagram



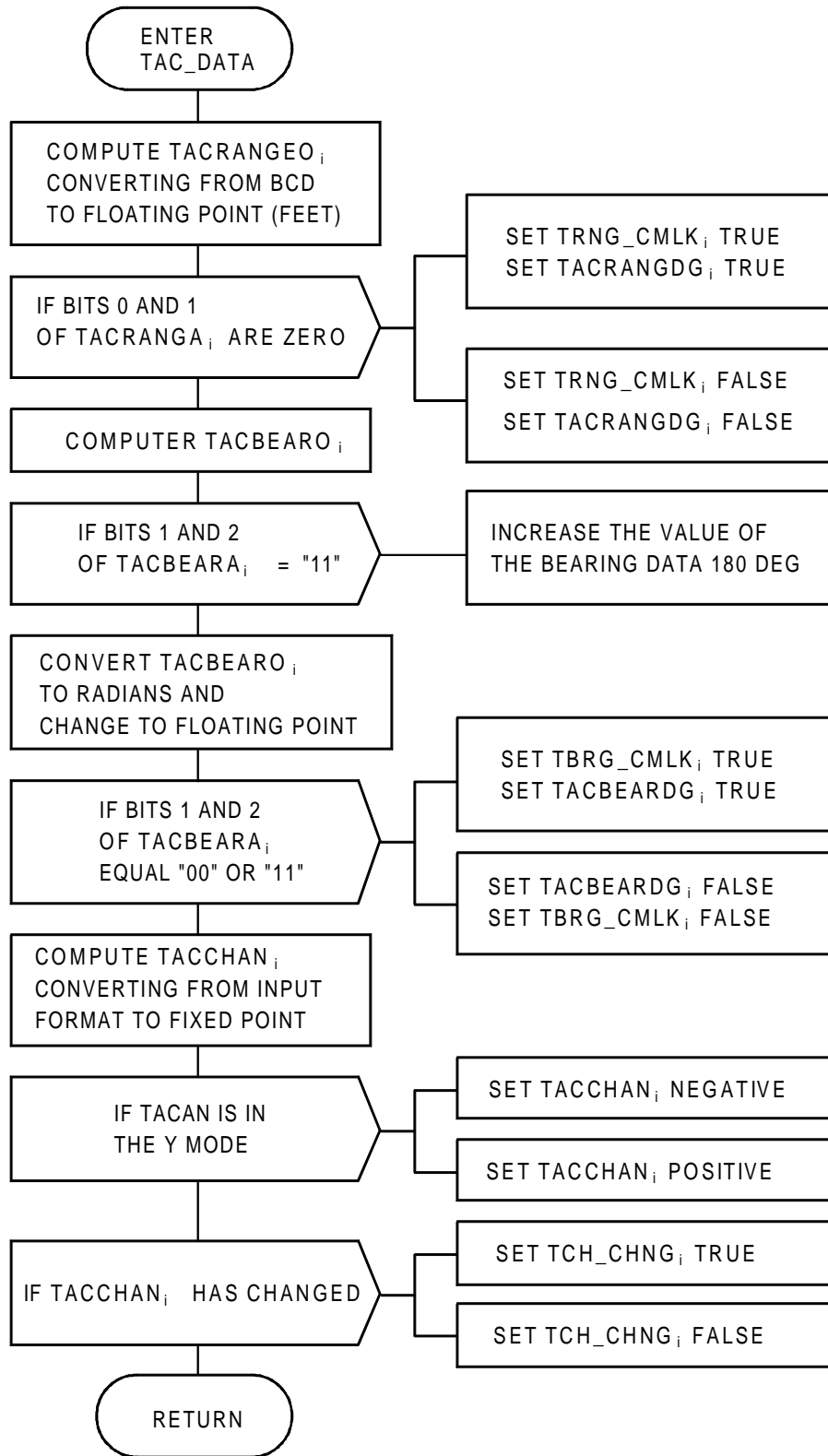


FIGURE 4.43.6.2-1. TAC\_DATA Flow Diagram

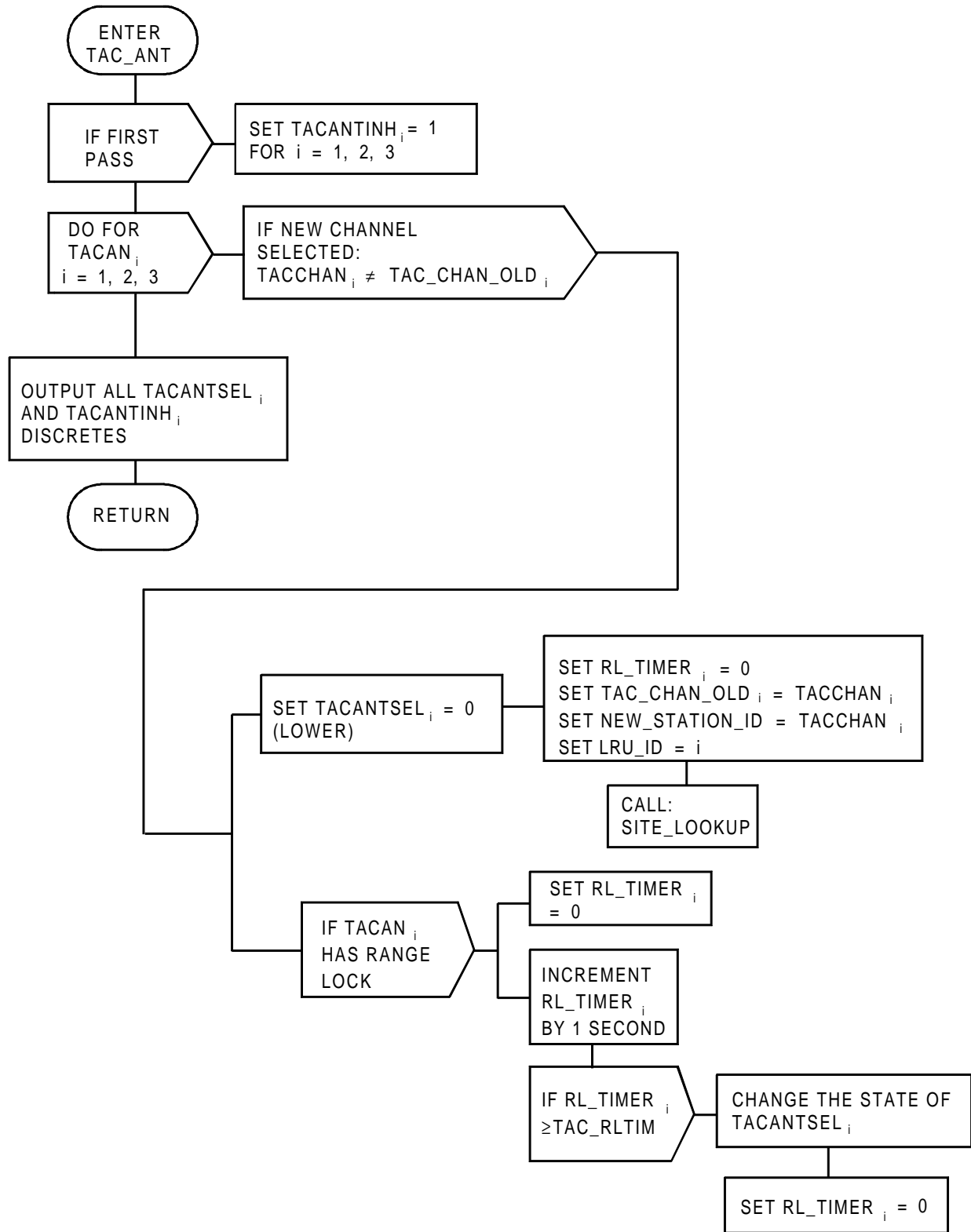


FIGURE 4.43.6.3-1. TAC\_ANT Flow Diagram

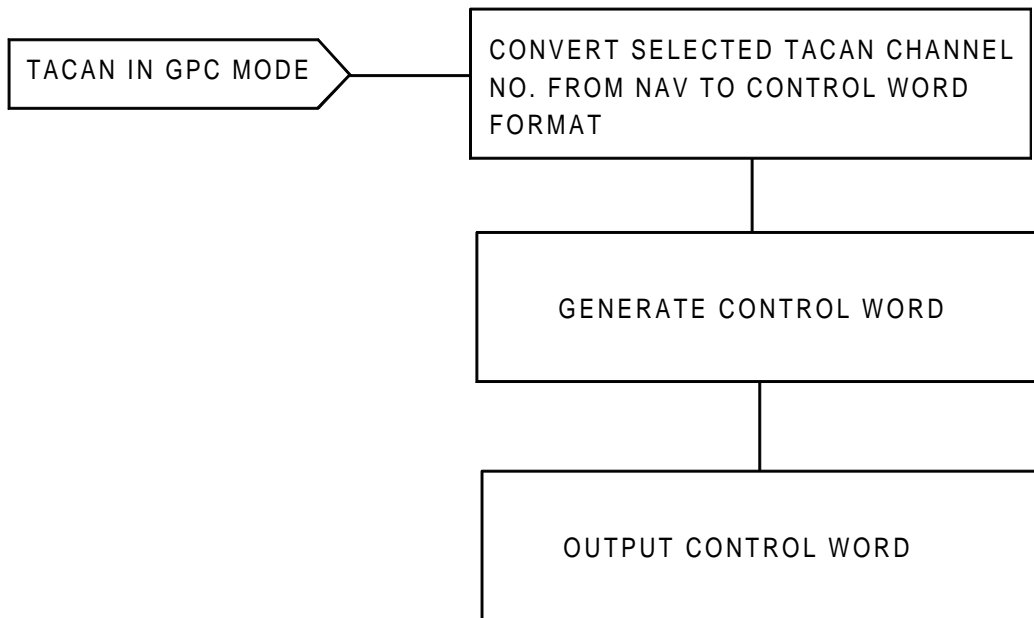


FIGURE 4.43.6.4-1. TAC\_CHAN Flow Diagram

TABLE 4.43.6.5-1. INPUT FUNCTIONAL PARAMETERS FOR TACTICAL AIR NAVIGATION SOP (G4.43)

| FSSR NAME        | M/S ID     | NOMENCLATURE                  | SOURCE          | UNITS | DATA<br>TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|------------------|------------|-------------------------------|-----------------|-------|--------------|------------------|---------|-------------|
| AUTO_CHANNEL_ID  | V95J5022CA | AUTO TACAN CHANNEL SELECTION  | ENT SITE LOOKUP |       |              |                  |         |             |
| AUTO_CHANNEL_ID  | V95J5022CB | AUTO TACAN CHANNEL SELECTION  | ASC SITE LOOKUP |       |              |                  |         |             |
| CLOCK/CLOCKTIME  | V91W5000C  | CLOCK-COMPUTER (GMT)          | FCOS            | S     |              |                  | 93160B  |             |
| RCVR_LEFT        | V96J2105C  | LH HSI RECEIVER SELECT        | GN&C SW RM      |       |              |                  |         |             |
| RCVR_RIGHT       | V96J2205C  | RH HSI RECEIVER SELECT        | GN&C SW RM      |       |              |                  |         |             |
| SOURCE_LEFT      | V96X2111X  | LH HSI SOURCE SELECT          | GN&C SW RM      |       |              |                  |         |             |
| SOURCE_RIGHT     | V96X2211X  | RH HSI SOURCE SELECT          | GN&C SW RM      |       |              |                  |         |             |
| TACBEAR (1)      | V74M1529P  | TACAN 1 BEARING 32 BITS       | TACAN 1         |       | FMD          |                  | 92297B  |             |
| TACBEAR (2)      | V74M1629P  | TACAN 2 BEARING 32 BITS       | TACAN 2         |       | FMD          |                  | 92297B  |             |
| TACBEAR (3)      | V74M1729P  | TACAN 3 BEARING 32 BITS       | TACAN 3         |       | FMD          |                  | 92297B  |             |
| TACBEARA (1)     | V74M1530P  | TACAN 1 BEARING WORD 1        | WD1 TACAN 1     | DEG   | HMD          |                  | 93017G  | *           |
| TACBEARA (2)     | V74M1630P  | TACAN 2 BEARING WORD 1        | WD1 TACAN 2     | DEG   | HMD          |                  | 93017G  | *           |
| TACBEARA (3)     | V74M1730P  | TACAN 3 BEARING WORD 1        | WD1 TACAN 3     | DEG   | HMD          |                  | 93017G  | *           |
| TACBEARB (1)     | V74M1531P  | TACAN 1 BEARING WORD 2        | WD2 TACAN 1     | DEG   | HMD          |                  | 93017G  | *           |
| TACBEARB (2)     | V74M1631P  | TACAN 2 BEARING WORD 2        | WD2 TACAN 2     | DEG   | HMD          |                  | 93017G  | *           |
| TACBEARB (3)     | V74M1731P  | TACAN 3 BEARING WORD 2        | WD2 TACAN 3     | DEG   | HMD          |                  | 93017G  | *           |
| TACCFM (1)       | V72M6598P  | MDM FF01 DSCR IN CD 00 CH 6   | HDWR            |       | HMD          |                  | 92025B  |             |
| TACCFM (2)       | V72M6648P  | MDM FF02 DSCR IN CD 00 CH 6   | HDWR            |       | HMD          |                  | 92025B  |             |
| TACCFM (3)       | V72M6698P  | MDM FF03 DSCR IN CD 00 CH 6   | HDWR            |       | HMD          |                  | 92025B  |             |
| TACPOD (1)       | V74X0071X  | TACAN NO 1 POWER STATUS       | TACAN 1         |       | BD           |                  | 93017G  | *           |
| TACPOD (2)       | V74X0081X  | TACAN NO 2 POWER STATUS       | TACAN 2         |       | BD           |                  | 93017G  | *           |
| TACPOD (3)       | V74X0091X  | TACAN NO 3 POWER STATUS       | TACAN 3         |       | BD           |                  | 93017G  | *           |
| TACRANG (1)      | V74M1549P  | TACAN 1 RANGE 32 BITS         | TACAN 1         |       | FMD          |                  | 93017G  | *           |
| TACRANG (2)      | V74M1649P  | TACAN 2 RANGE 32 BITS         | TACAN 2         |       | FMD          |                  | 93017G  | *           |
| TACRANG (3)      | V74M1749P  | TACAN 3 RANGE 32 BITS         | TACAN 3         |       | FMD          |                  | 93017G  | *           |
| TACRANGA (1)     | V74M1550P  | TACAN 1 RANGE WORD A          | WD1 TACAN 1     | NM    | HMD          |                  | 92297B  |             |
| TACRANGA (2)     | V74M1650P  | TACAN 2 RANGE WORD A          | WD1 TACAN 2     | NM    | HMD          |                  | 92297B  |             |
| TACRANGA (3)     | V74M1750P  | TACAN 3 RANGE WORD A          | WD1 TACAN 3     | NM    | HMD          |                  | 92297B  |             |
| TACRANGB (1)     | V74M1551P  | TACAN 1 RANGE WORD B          | WD2 TACAN 1     | NM    | HMD          |                  | 92297B  |             |
| TACRANGB (2)     | V74M1651P  | TACAN 2 RANGE WORD B          | WD2 TACAN 2     | NM    | HMD          |                  | 92297B  |             |
| TACRANGB (3)     | V74M1751P  | TACAN 3 RANGE WORD B          | WD2 TACAN 3     | NM    | HMD          |                  | 92297B  |             |
| TAC_CF (1)       | V91X3500X  | TACAN 1 COMMFAULT             | FCOS            |       |              |                  | 92025B  |             |
| TAC_CF (2)       | V91X3510X  | TACAN 2 COMMFAULT             | FCOS            |       |              |                  | 92025B  |             |
| TAC_CF (3)       | V91X3520X  | TACAN 3 COMMFAULT             | FCOS            |       |              |                  | 92025B  |             |
| TAC_CHAN_OLD (1) | V95U5023CA | PREV VALUE TAC CHAN FOR LRU 1 | ENT SITE LOOKUP |       |              |                  |         |             |
| TAC_CHAN_OLD (1) | V95U5023CB | PREV VALUE TAC CHAN FOR LRU 1 | ASC SITE LOOKUP |       |              |                  |         |             |
| TAC_CHAN_OLD (2) | V95U5024CA | PREV VALUE TAC CHAN FOR LRU 2 | ENT SITE LOOKUP |       |              |                  |         |             |
| TAC_CHAN_OLD (2) | V95U5024CB | PREV VALUE TAC CHAN FOR LRU 2 | ASC SITE LOOKUP |       |              |                  |         |             |
| TAC_CHAN_OLD (3) | V95U5025CA | PREV VALUE TAC CHAN FOR LRU 3 | ENT SITE LOOKUP |       |              |                  |         |             |
| TAC_CHAN_OLD (3) | V95U5025CB | PREV VALUE TAC CHAN FOR LRU 3 | ASC SITE LOOKUP |       |              |                  |         |             |
| TAC_CNTRL (1)    | V74M1510PA | TACAN NO 1 CONTROL WORD       | D&C PNL         |       |              |                  | 92025B  |             |
| TAC_CNTRL (2)    | V74M1610PA | TACAN NO 2 CONTROL WORD       | D&C PNL         |       |              |                  | 92025B  |             |
| TAC_CNTRL (3)    | V74M1710PA | TACAN NO 3 CONTROL WORD       | D&C PNL         |       |              |                  | 92025B  |             |
| TAC_DW (1)       | V72M6599P  | MDM FF01 DSCR IN CD 00 CH 5   | HDWR            |       | HMD          |                  | 93017G  | *           |
| TAC_DW (2)       | V72M6649P  | MDM FF02 DSCR IN CD 00 CH 5   | HDWR            |       | HMD          |                  | 93017G  | *           |
| TAC_DW (3)       | V72M6699P  | MDM FF03 DSCR IN CD 00 CH 5   | HDWR            |       | HMD          |                  | 93017G  | *           |

TABLE 4.43.6.5-1. INPUT FUNCTIONAL PARAMETERS FOR TACTICAL AIR NAVIGATION SOP (G4.43)

| FSSR NAME  | M/S ID    | NOMENCLATURE                       | SOURCE            | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|------------|-----------|------------------------------------|-------------------|-------|-----------|---------|---------|-------|
| TAC_GPC(1) | V72K8410X | TACAN NO 1 AUTO DISCRETE(COMPUTER) | HDWR              |       | BD        |         | 93017G  | *     |
| TAC_GPC(2) | V72K8430X | TACAN NO 2 AUTO DISCRETE(COMPUTER) | HDWR              |       | BD        |         | 93017G  | *     |
| TAC_GPC(3) | V72K8450X | TACAN NO 3 AUTO DISCRETE(COMPUTER) | HDWR              |       | BD        |         | 93017G  | *     |
| TAC_STREQ  | V90J3602C | TACAN SELF TEST REQUEST            | TACAN RM          | BITS  |           |         | 92025B  |       |
| TAC_TSM(1) | V74X0070X | TACAN NO 1 TEST STATUS MONITOR-GO  | TACAN 1           |       | BD        |         | 93017G  | *     |
| TAC_TSM(2) | V74X0080X | TACAN NO 2 TEST STATUS MONITOR-GO  | TACAN 2           |       | BD        |         | 93017G  | *     |
| TAC_TSM(3) | V74X0090X | TACAN NO 3 TEST STATUS MONITOR-GO  | TACAN 3           |       | BD        |         | 93017G  | *     |
|            | V72M6597P | MDM FF01 DSCR IN CD 09 CH 02       | HDWR              |       | HMD       |         | 93017G  | *     |
|            | V72M6647P | MDM FF02 DSCR IN CD 09 CH 02       | HDWR              |       | HMD       |         | 93017G  | *     |
|            | V72M6697P | MDM FF03 DSCR IN CD 09 CH 02       | HDWR              |       | HMD       |         | 93017G  | *     |
|            | V74H1534B | TACAN 1 BEARING/STATUS             | WD1B01-02 TACAN 1 | DEG   | BMD       |         | 93017G  | *     |
|            | V74H1535B | TACAN 1 BEARING DATA               | WD1B03-14 TACAN 1 | DEG   | BSU       |         | 93017G  | *     |
|            | V74H1554B | TACAN 1 RANGE (WD-A)               | WD1B02-15 TACAN 1 | NM    | BCD       |         | 92297B  |       |
|            | V74H1555B | TACAN 1 RANGE (WD-B)               | WD2B00-03 TACAN 1 | NM    | BCD       |         | 92297B  |       |
|            | V74H1634B | TACAN 2 BEARING/STATUS             | WD1B01-02 TACAN 2 | DEG   | BMD       |         | 93017G  | *     |
|            | V74H1635B | TACAN 2 BEARING DATA               | WD1B03-14 TACAN 2 | DEG   | BSU       |         | 93017G  | *     |
|            | V74H1654B | TACAN 2 RANGE (WD-A)               | WD1B02-15 TACAN 2 | NM    | BCD       |         | 92297B  |       |
|            | V74H1655B | TACAN 2 RANGE (WD-B)               | WD2B00-03 TACAN 2 | NM    | BCD       |         | 92297B  |       |
|            | V74H1734B | TACAN 3 BEARING/STATUS             | WD1B01-02 TACAN 3 | DEG   | BMD       |         | 93017G  | *     |
|            | V74H1735B | TACAN 3 BEARING DATA               | WD1B03-14 TACAN 3 | DEG   | BSU       |         | 93017G  | *     |
|            | V74H1754B | TACAN 3 RANGE (WD-A)               | WD1B02-15 TACAN 3 | NM    | BCD       |         | 92297B  |       |
|            | V74H1755B | TACAN 3 RANGE (WD-B)               | WD2B00-03 TACAN 3 | NM    | BCD       |         | 92297B  |       |
|            | V74J1536B | TACAN 1 BEARING SELF TEST          | WD2B04-07 TACAN 1 |       | BMD       |         | 93017G  | *     |
|            | V74J1537B | TACAN 1 BEARING LABEL              | WD2B08-15 TACAN 1 |       | BSU       |         | 92297B  |       |
|            | V74J1552B | TACAN 1 RANGE STATUS               | WD1B00-01 TACAN 1 |       | BMD       |         | 93017G  | *     |
|            | V74J1557B | TACAN 1 RANGE LABEL                | WD2B08-15 TACAN 1 |       | BSU       |         | 92297B  |       |
|            | V74J1559B | TACAN 1 RANGE SELF TEST            | WD2B05-06 TACAN 1 |       | BMD       |         | 93017G  | *     |
|            | V74J1636B | TACAN 2 BEARING SELF TEST          | WD2B04-07 TACAN 2 |       | BMD       |         | 93017G  | *     |
|            | V74J1637B | TACAN 2 BEARING LABEL              | WD2B08-15 TACAN 2 |       | BSU       |         | 92297B  |       |
|            | V74J1652B | TACAN 2 RANGE STATUS               | WD1B00-01 TACAN 2 |       | BMD       |         | 93017G  | *     |
|            | V74J1657B | TACAN 2 RANGE LABEL                | WD2B08-15 TACAN 2 |       | BSU       |         | 92297B  |       |
|            | V74J1659B | TACAN 2 RANGE SELF TEST            | WD2B05-06 TACAN 2 |       | BMD       |         | 93017G  | *     |
|            | V74J1736B | TACAN 3 BEARING SELF TEST          | WD2B04-07 TACAN 3 |       | BMD       |         | 93017G  | *     |
|            | V74J1737B | TACAN 3 BEARING LABEL              | WD2B08-15 TACAN 3 |       | BSU       |         | 92297B  |       |
|            | V74J1752B | TACAN 3 RANGE STATUS               | WD1B00-01 TACAN 3 |       | BMD       |         | 93017G  | *     |
|            | V74J1757B | TACAN 3 RANGE LABEL                | WD2B08-15 TACAN 3 |       | BSU       |         | 92297B  |       |
|            | V74J1759B | TACAN 3 RANGE SELF TEST            | WD2B05-06 TACAN 3 |       | BMD       |         | 93017G  | *     |
|            | V74U1533B | TACAN 1 BEARING 14 BITS            | TACAN 1           |       | BSS       |         | 92297B  |       |
|            | V74U1553B | TACAN 1 RANGE 18 BITS              | TACAN 1           | NM    | BCD       |         | 93017G  | *     |
|            | V74U1633B | TACAN 2 BEARING 14 BITS            | TACAN 2           |       | BSS       |         | 92297B  |       |
|            | V74U1653B | TACAN 2 RANGE 18 BITS              | TACAN 2           | NM    | BCD       |         | 93017G  | *     |
|            | V74U1733B | TACAN 3 BEARING 14 BITS            | TACAN 3           |       | BSS       |         | 92297B  |       |
|            | V74U1753B | TACAN 3 RANGE 18 BITS              | TACAN 3           | NM    | BCD       |         | 93017G  | *     |
|            | V74X1532B | TACAN 1 BEARING DATA PARITY        | WD1B00 TACAN 1    |       | BD        |         | 93017G  | *     |
|            | V74X1558B | TACAN 1 RNG BLT-IN TST STAT        | WD2B04 TACAN 1    |       | BD        |         | 93017G  | *     |
|            | V74X1560B | TACAN 1 RNG SUPR PULS PRST         | WD2B07 TACAN 1    |       | BD        |         | 93017G  | *     |

TABLE 4.43.6.5-1. INPUT FUNCTIONAL PARAMETERS FOR TACTICAL AIR NAVIGATION SOP (G4.43)

| FSSR NAME | M/S ID    | NOMENCLATURE                | SOURCE | UNITS   | DATA<br>TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|-----------|-----------|-----------------------------|--------|---------|--------------|------------------|---------|-------------|
|           | V74X1632B | TACAN 2 BEARING DATA PARITY | WD1B00 | TACAN 2 | BD           |                  | 93017G  | *           |
|           | V74X1658B | TACAN 2 RNG BLT-IN TST STAT | WD2B04 | TACAN 2 | BD           |                  | 93017G  | *           |
|           | V74X1660B | TACAN 2 RNG SUPR PULS PRST  | WD2B07 | TACAN 2 | BD           |                  | 93017G  | *           |
|           | V74X1732B | TACAN 3 BEARING DATA PARITY | WD1B00 | TACAN 3 | BD           |                  | 93017G  | *           |
|           | V74X1758B | TACAN 3 RNG BLT-IN TST STAT | WD2B04 | TACAN 3 | BD           |                  | 93017G  | *           |
|           | V74X1760B | TACAN 3 RNG SUPR PULS PRST  | WD2B07 | TACAN 3 | BD           |                  | 93017G  | *           |

**NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.**

TABLE 4.43.6.5-2. OUTPUT FUNCTIONAL PARAMETERS FROM TACTICAL AIR NAVIGATION SOP (G4.43)

| FSSR NAME      | M/S ID     | NOMENCLATURE                       | DESTINATION                                                                                   | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|----------------|------------|------------------------------------|-----------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| LRU_ID         | V95J5021C  | TACAN LRU NUMBER                   | ASC SITE LOOKUP                                                                               |       |           |         |         |       |
| NEW_STATION_ID | V95J5020CA | TACAN 1,2,OR 3 NEW STATION CHAN NO | ENT SITE LOOKUP                                                                               |       |           |         |         |       |
| TACANTINH(1)   | V74K0141XA | TACAN NO 1 ANTENNA SELECT INHIBIT  | ASC SITE LOOKUP<br>ENT SITE LOOKUP                                                            |       |           |         | 93017G  | *     |
|                |            |                                    | DL FMT 21/1<br>DL FMT 23/1<br>DL FMT 32/1<br>TACAN 1                                          |       |           |         |         |       |
| TACANTINH(2)   | V74K0151XA | TACAN NO 2 ANTENNA SELECT INHIBIT  | DL FMT 21/1<br>DL FMT 23/1<br>DL FMT 32/1<br>TACAN 2                                          |       |           |         | 93017G  | *     |
| TACANTINH(3)   | V74K0161XA | TACAN NO 3 ANTENNA SELECT INHIBIT  | DL FMT 21/1<br>DL FMT 23/1<br>TACAN 3                                                         |       |           |         | 93017G  | *     |
| TACANTSEL(1)   | V74K0178XA | TACAN NO 1 UPPER/LOWER ANT LOCK    | DL FMT 21/1<br>DL FMT 23/1<br>DL FMT 32/1<br>TACAN 1                                          |       |           |         | 93017G  | *     |
| TACANTSEL(2)   | V74K0188XA | TACAN NO 2 UPPER/LOWER ANT LOCK    | DL FMT 21/1<br>DL FMT 23/1<br>DL FMT 32/1<br>TACAN 2                                          |       |           |         | 93017G  | *     |
| TACANTSEL(3)   | V74K0198XA | TACAN NO 3 UPPER/LOWER ANT LOCK    | DL FMT 21/1<br>DL FMT 23/1<br>TACAN 3                                                         |       |           |         | 93017G  | *     |
| TACBEARDG(1)   | V95X5124XA | TACAN NO 1 BEARING LOCKED ON       | TACAN RM<br>TLM                                                                               |       |           |         |         |       |
| TACBEARDG(2)   | V95X5224XA | TACAN NO 2 BEARING LOCKED ON       | TACAN RM<br>TLM                                                                               |       |           |         |         |       |
| TACBEARDG(3)   | V95X5324XA | TACAN NO 3 BEARING LOCKED ON       | TACAN RM<br>TLM                                                                               |       |           |         |         |       |
| TACBEARO(1)    | V95H5122CA | TACAN NO 1 BEARING OUT             | A/L UPP<br>ASC AREA NAV<br>ENT AREA NAV<br>ENT UPP<br>RTLS UPP<br>TACAN RM<br>TAEM UPP<br>TLM | RAD   |           |         |         |       |

TABLE 4.43.6.5-2. OUTPUT FUNCTIONAL PARAMETERS FROM TACTICAL AIR NAVIGATION SOP (G4.43)

| FSSR NAME    | M/S ID     | NOMENCLATURE                     | DESTINATION                                                                                   | UNITS | DATA<br>TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|--------------|------------|----------------------------------|-----------------------------------------------------------------------------------------------|-------|--------------|------------------|---------|-------------|
| TACBEARO(2)  | V95H5222CA | TACAN NO 2 BEARING OUT           | A/L UPP<br>ASC AREA NAV<br>ENT AREA NAV<br>ENT UPP<br>RTLS UPP<br>TACAN RM<br>TAEM UPP<br>TLM | RAD   |              |                  |         |             |
| TACBEARO(3)  | V95H5322CA | TACAN NO 3 BEARING OUT           | A/L UPP<br>ASC AREA NAV<br>ENT AREA NAV<br>ENT UPP<br>RTLS UPP<br>TACAN RM<br>TAEM UPP<br>TLM | RAD   |              |                  |         |             |
| TACCHAN(1)   | V95J5130CA | TACAN NO 1 CHANNEL W/MODE        | TACAN RM<br>TLM                                                                               |       |              |                  |         |             |
| TACCHAN(2)   | V95J5230CA | TACAN NO 2 CHANNEL W/MODE        | TACAN RM<br>TLM                                                                               |       |              |                  |         |             |
| TACCHAN(3)   | V95J5330CA | TACAN NO 3 CHANNEL W/MODE        | TACAN RM<br>TLM                                                                               |       |              |                  |         |             |
| TACPON(1)    | V95X5145XA | TACAN NO 1 BUFFERED POWER STATUS | TACAN RM                                                                                      |       |              |                  | 90182   |             |
| TACPON(2)    | V95X5245XA | TACAN NO 2 BUFFERED POWER STATUS | TACAN RM                                                                                      |       |              |                  | 90182   |             |
| TACPON(3)    | V95X5345XA | TACAN NO 3 BUFFERED POWER STATUS | TACAN RM                                                                                      |       |              |                  | 90182   |             |
| TACRANGDG(1) | V95X5104XA | TACAN NO 1 RANGE LOCKED ON       | TACAN RM<br>TLM                                                                               |       |              |                  |         |             |
| TACRANGDG(2) | V95X5204XA | TACAN NO 2 RANGE LOCKED ON       | TACAN RM<br>TLM                                                                               |       |              |                  |         |             |
| TACRANGDG(3) | V95X5304XA | TACAN NO 3 RANGE LOCKED ON       | TACAN RM<br>TLM                                                                               |       |              |                  |         |             |
| TACRANGE0(1) | V95H5102CA | TACAN NO 1 RANGE OUT             | A/L UPP<br>ASC AREA NAV<br>ENT AREA NAV<br>ENT UPP<br>RTLS UPP<br>TACAN RM<br>TAEM UPP<br>TLM | FT    |              |                  |         |             |



TABLE 4.43.6.5-2. OUTPUT FUNCTIONAL PARAMETERS FROM TACTICAL AIR NAVIGATION SOP (G4.43)

| FSSR NAME    | M/S ID     | NOMENCLATURE                      | DESTINATION                                                                                                                                                   | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|--------------|------------|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| TACRANGE0(2) | V95H5202CA | TACAN NO 2 RANGE OUT              | A/L UPP<br>ASC AREA NAV<br>ENT AREA NAV<br>ENT UPP<br>RTLS UPP<br>TACAN RM<br>TAEM UPP                                                                        | FT    |           |         |         |       |
| TACRANGE0(3) | V95H5302CA | TACAN NO 3 RANGE OUT              | TLM<br>A/L UPP<br>ASC AREA NAV<br>ENT AREA NAV<br>ENT UPP<br>RTLS UPP<br>TACAN RM<br>TAEM UPP                                                                 | FT    |           |         |         |       |
| TAC_BRGFL(1) | V95X5143X  | TACAN NO 1 BEARING SELF TEST FAIL | TACAN RM                                                                                                                                                      |       |           |         |         |       |
| TAC_BRGFL(2) | V95X5243X  | TACAN NO 2 BEARING SELF TEST FAIL | TACAN RM                                                                                                                                                      |       |           |         |         |       |
| TAC_BRGFL(3) | V95X5343X  | TACAN NO 3 BEARING SELF TEST FAIL | TACAN RM                                                                                                                                                      |       |           |         |         |       |
| TAC_CHAN(1)  | V74K1514BA | TACAN NO 1 CHANNEL SELECT         | DL FMT 21/1<br>DL FMT 23/A<br>DL FMT 32/A<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 52/1<br>DL FMT 53/1<br>DL FMT 60/1<br>TACAN 1 |       |           |         | 93017G  | *     |
| TAC_CHAN(2)  | V74K1614BA | TACAN NO 2 CHANNEL SELECT         | DL FMT 21/1<br>DL FMT 23/A<br>DL FMT 32/A<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 52/1<br>DL FMT 53/1<br>DL FMT 60/1<br>TACAN 2 |       |           |         | 93017G  | *     |

TABLE 4.43.6.5-2. OUTPUT FUNCTIONAL PARAMETERS FROM TACTICAL AIR NAVIGATION SOP (G4.43)

| FSSR NAME    | M/S ID     | NOMENCLATURE                    | DESTINATION                                                                                                                                                   | UNITS | DATA<br>TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|--------------|------------|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------------|------------------|---------|-------------|
| TAC_CHAN(3)  | V74K1714BA | TACAN NO 3 CHANNEL SELECT       | DL FMT 21/1<br>DL FMT 23/A<br>DL FMT 32/A<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 52/1<br>DL FMT 53/1<br>DL FMT 60/1            |       |              |                  | 93017G  | *           |
| TAC_CNTRL(1) | V74M1510PB | TACAN NO 1 CONTROL WORD AUTO    | TACAN 3<br>DL FMT 21/1<br>DL FMT 23/A<br>DL FMT 32/A<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 52/1<br>DL FMT 53/1<br>DL FMT 60/1 |       |              |                  | 93017G  | *           |
| TAC_CNTRL(2) | V74M1610PB | TACAN NO 2 CONTROL WORD AUTO    | TACAN 1<br>DL FMT 21/1<br>DL FMT 23/A<br>DL FMT 32/A<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 52/1<br>DL FMT 53/1<br>DL FMT 60/1 |       |              |                  | 93017G  | *           |
| TAC_CNTRL(3) | V74M1710PB | TACAN NO 3 CONTROL WORD AUTO    | TACAN 2<br>DL FMT 21/1<br>DL FMT 23/A<br>DL FMT 32/A<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 52/1<br>DL FMT 53/1<br>DL FMT 60/1 |       |              |                  | 93017G  | *           |
| TAC_RNGFL(1) | V95X5144X  | TACAN NO 1 RANGE SELF TEST FAIL | TACAN 3                                                                                                                                                       |       |              |                  |         |             |
| TAC_RNGFL(2) | V95X5244X  | TACAN NO 2 RANGE SELF TEST FAIL | TACAN RM                                                                                                                                                      |       |              |                  |         |             |

TABLE 4.43.6.5-2. OUTPUT FUNCTIONAL PARAMETERS FROM TACTICAL AIR NAVIGATION SOP (G4.43)

| FSSR NAME                                                 | M/S ID                                            | NOMENCLATURE                                                                                                                                   | DESTINATION                                                                                           | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------------------------------------------------------|---------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| TAC_RNGFL(3)<br>TAC_STIP                                  | V95X5344X<br>V95X5006X                            | TACAN NO 3 RANGE SELF TEST FAIL<br>TACAN SELF TEST IN PROGRESS                                                                                 | TACAN RM<br>GAX                                                                                       |       | BD        |         |         |       |
| TAC_TIM_TAG                                               | V95W5001CA                                        | TACAN TIME TAG                                                                                                                                 | HORIZ SIT DISP<br>TACAN RM<br>DL FMT 21/1<br>DL FMT 23/A                                              | S     |           |         | 93017G  | *     |
| TBRG_CMLK(1)                                              | V95X5141XA                                        | TACAN 1 BEAR COMFAULT/LOCKON FLAG                                                                                                              | TACAN RM<br>ASC AREA NAV<br>DL FMT 21/1<br>DL FMT 23/A<br>ENT AREA NAV<br>GAX                         |       |           |         | 93017G  | *     |
| TBRG_CMLK(2)                                              | V95X5241XA                                        | TACAN 2 BEAR COMFAULT/LOCKON FLAG                                                                                                              | HORIZ SIT SPEC<br>ASC AREA NAV<br>DL FMT 21/1<br>DL FMT 23/A<br>ENT AREA NAV<br>GAX                   |       |           |         | 93017G  | *     |
| TBRG_CMLK(3)                                              | V95X5341XA                                        | TACAN 3 BEAR COMFAULT/LOCKON FLAG                                                                                                              | HORIZ SIT SPEC<br>ASC AREA NAV<br>DL FMT 21/1<br>DL FMT 23/A<br>ENT AREA NAV<br>GAX                   |       |           |         | 93017G  | *     |
| TCH_CHNG(1)<br>TCH_CHNG(2)<br>TCH_CHNG(3)<br>TRNG_CMLK(1) | V95X5146X<br>V95X5246X<br>V95X5346X<br>V95X5140XA | TACAN 1 CHANNEL CHANGE INDICATOR<br>TACAN 2 CHANNEL CHANGE INDICATOR<br>TACAN 3 CHANNEL CHANGE INDICATOR<br>TACAN 1 RANGE COMFAULT/LOCKON FLAG | TACAN RM<br>TACAN RM<br>TACAN RM<br>ASC AREA NAV<br>DL FMT 21/1<br>DL FMT 23/A<br>ENT AREA NAV<br>GAX |       |           |         | 93017G  | *     |
| TRNG_CMLK(2)                                              | V95X5240XA                                        | TACAN 2 RANGE COMFAULT/LOCKON FLAG                                                                                                             | HORIZ SIT SPEC<br>ASC AREA NAV<br>DL FMT 21/1<br>DL FMT 23/A<br>ENT AREA NAV<br>GAX                   |       |           |         | 93017G  | *     |
| TRNG_CMLK(3)                                              | V95X5340XA                                        | TACAN 3 RANGE COMFAULT/LOCKON FLAG                                                                                                             | HORIZ SIT SPEC<br>ASC AREA NAV<br>DL FMT 21/1<br>DL FMT 23/A<br>ENT AREA NAV<br>GAX                   |       |           |         | 93017G  | *     |

TABLE 4.43.6.5-2. OUTPUT FUNCTIONAL PARAMETERS FROM TACTICAL AIR NAVIGATION SOP (G4.43)

| FSSR NAME | M/S ID     | NOMENCLATURE          | DESTINATION                                                                                                                                                   | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
| T_TACAN   | V90W3596CB | TACAN TIME TAG        | ENT NAV<br>PRELAND NAV<br>RTLS NAV                                                                                                                            | S     |           |         |         |       |
|           | V72M6636PA | MDM FF01 DSCR OUT SET | CD 00 CH 7<br>DL FMT 21/1<br>DL FMT 23/1<br>DL FMT 32/1<br>TACAN 1                                                                                            |       |           |         | 93017G  | *     |
|           | V72M6686PA | MDM FF02 DSCR OUT SET | CD 00 CH 7<br>DL FMT 21/1<br>DL FMT 23/1<br>DL FMT 32/1<br>TACAN 2                                                                                            |       |           |         | 93017G  | *     |
|           | V72M6736PA | MDM FF03 DSCR OUT SET | CD 00 CH 7<br>DL FMT 21/1<br>DL FMT 23/1<br>TACAN 3                                                                                                           |       |           |         | 93017G  | *     |
|           | V74K1511BA | TACAN NO 1 MODE X/Y   | DL FMT 21/1<br>DL FMT 23/A<br>DL FMT 32/A<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 52/1<br>DL FMT 53/1<br>DL FMT 60/1<br>TACAN 1 |       |           |         | 93017G  | *     |
|           | V74K1512BA | TACAN NO 1 A/A        | DL FMT 21/1<br>DL FMT 23/A<br>DL FMT 32/A<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 52/1<br>DL FMT 53/1<br>DL FMT 60/1<br>TACAN 1 |       |           |         | 93017G  | *     |

TABLE 4.43.6.5-2. OUTPUT FUNCTIONAL PARAMETERS FROM TACTICAL AIR NAVIGATION SOP (G4.43)

| FSSR NAME | M/S ID     | NOMENCLATURE            | DESTINATION                                                                                                                                                   | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|------------|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|---------|---------|-------|
|           | V74K1513BA | TACAN NO 1 T/R+RCV ONLY | DL FMT 21/1<br>DL FMT 23/A<br>DL FMT 32/A<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 52/1<br>DL FMT 53/1<br>DL FMT 60/1            |       |           |         | 93017G  | *     |
|           | V74K1611BA | TACAN NO 2 MODE X/Y     | TACAN 1<br>DL FMT 21/1<br>DL FMT 23/A<br>DL FMT 32/A<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 52/1<br>DL FMT 53/1<br>DL FMT 60/1 |       |           |         | 93017G  | *     |
|           | V74K1612BA | TACAN NO 2 A/A          | TACAN 2<br>DL FMT 21/1<br>DL FMT 23/A<br>DL FMT 32/A<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 52/1<br>DL FMT 53/1<br>DL FMT 60/1 |       |           |         | 93017G  | *     |
|           | V74K1613BA | TACAN NO 2 T/R+RCV ONLY | TACAN 2<br>DL FMT 21/1<br>DL FMT 23/A<br>DL FMT 32/A<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 52/1<br>DL FMT 53/1<br>DL FMT 60/1 |       |           |         | 93017G  | *     |

TABLE 4.43.6.5-2. OUTPUT FUNCTIONAL PARAMETERS FROM TACTICAL AIR NAVIGATION SOP (G4.43)

| FSSR NAME | M/S ID     | NOMENCLATURE            | DESTINATION                                                                                                                                                   | UNITS | DATA<br>TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|-----------|------------|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------------|------------------|---------|-------------|
|           | V74K1711BA | TACAN NO 3 MODE X/Y     | DL FMT 21/1<br>DL FMT 23/A<br>DL FMT 32/A<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 52/1<br>DL FMT 53/1<br>DL FMT 60/1            |       |              |                  | 93017G  | *           |
|           | V74K1712BA | TACAN NO 3 A/A          | TACAN 3<br>DL FMT 21/1<br>DL FMT 23/A<br>DL FMT 32/A<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 52/1<br>DL FMT 53/1<br>DL FMT 60/1 |       |              |                  | 93017G  | *           |
|           | V74K1713BA | TACAN NO 3 T/R+RCV ONLY | TACAN 3<br>DL FMT 21/1<br>DL FMT 23/A<br>DL FMT 32/A<br>DL FMT 42/1<br>DL FMT 43/1<br>DL FMT 44/1<br>DL FMT 45/1<br>DL FMT 52/1<br>DL FMT 53/1<br>DL FMT 60/1 |       |              |                  | 93017G  | *           |
|           | V95M2864P  | CGYB_TBRG_CMLK\$(1:)    | TACAN 3<br>DL FMT 21/1<br>DL FMT 23/A                                                                                                                         |       |              |                  | 93017G  | *           |
|           | V95M2865P  | CGYB_TBRG_CMLK\$(2:)    | DL FMT 21/1<br>DL FMT 23/A                                                                                                                                    |       |              |                  | 93017G  | *           |
|           | V95M2866P  | CGYB_TBRG_CMLK\$(3:)    | DL FMT 21/1<br>DL FMT 23/A                                                                                                                                    |       |              |                  | 93017G  | *           |
|           | V95M2867P  | CGYB_TRNG_CMLK\$(1:)    | DL FMT 21/1<br>DL FMT 23/A                                                                                                                                    |       |              |                  | 93017G  | *           |
|           | V95M2868P  | CGYB_TRNG_CMLK\$(2:)    | DL FMT 21/1<br>DL FMT 23/A                                                                                                                                    |       |              |                  | 93017G  | *           |
|           | V95M2869P  | CGYB_TRNG_CMLK\$(3:)    | DL FMT 21/1<br>DL FMT 23/A                                                                                                                                    |       |              |                  | 93017G  | *           |

TABLE 4.43.6.5-2. OUTPUT FUNCTIONAL PARAMETERS FROM TACTICAL AIR NAVIGATION SOP (G4.43)

| FSSR NAME | M/S ID | NOMENCLATURE | DESTINATION | UNITS | DATA TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|-----------|--------|--------------|-------------|-------|-----------|------------------|---------|-------------|
|-----------|--------|--------------|-------------|-------|-----------|------------------|---------|-------------|

**NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.**

**Rate Codes: (HDR Only) 1 = 1 sample/sec 2 = 5 samples/sec 3 = 12.5 samples/sec 4 = 25 samples/sec 5 = 100 samples/sec  
(HDR and LDR) A = 1 sample/sec B = 5 samples/sec C = 12.5 samples/sec D = 25 samples/sec E = 100 samples/sec**

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TABLE 4.43.6.5-3. TACTICAL AIR NAVIGATION SOP (G4.43) I-LOADS

| FSSR NAME  | MSID      | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R<br>E<br>V |
|------------|-----------|-----------|----|----|---|---|---------|----|-----|---------|-------------|
| TAC_BEARHI | V99U5715C | DEG       | F  | S  | D | P | G4.43   | 00 | TSI | DC0755  |             |
| TAC_BEARLO | V99U5716C | DEG       | F  | S  | D | P | G4.43   | 00 | TSI | DC0755  |             |
| TAC_RLTIM  | V99U5520C | SEC       | F  | S  | L | X | G4.43   | 00 | TSI | DC0755  |             |
| TAC_RNGHI  | V99U5717C | NMI       | F  | S  | L | P | G4.43   | 00 | TSI | DC0755  |             |
| TAC_RNGLO  | V99U5718C | NMI       | F  | S  | L | P | G4.43   | 00 | TSI | DC0755  |             |
| TAC_STTIM  | V99U5521C | SEC       | F  | S  | L | P | G4.43   | 00 | TSI | DC0755  |             |
| TNMFT      | V99U5522C | FT/NMI    | F  | S  | L | P | G4.43   | 00 | TSI | 92025B  |             |

NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.

TABLE 4.43.6.5-4. TACTICAL AIR NAVIGATION SOP (G4.43) K-LOADS

| FSSR NAME<br>DESCRIPTION | MSID | MC | KLOAD VALUE | ENG UNITS | DT | P<br>R | S | PR FCTN | LAST CR | R<br>E<br>V |
|--------------------------|------|----|-------------|-----------|----|--------|---|---------|---------|-------------|
|--------------------------|------|----|-------------|-----------|----|--------|---|---------|---------|-------------|

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NO REQUIREMENTS

**NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.**

TABLE 4.43.6.5-5. TACTICAL AIR NAVIGATION SOP (G4.43) CONSTANTS

| FSSR NAME<br>DESCRIPTION | MSID | MC | CONSTANT VALUE | ENG UNITS | DT | P<br>R | S | PR FCTN | LAST CR | R<br>E<br>V |
|--------------------------|------|----|----------------|-----------|----|--------|---|---------|---------|-------------|
|--------------------------|------|----|----------------|-----------|----|--------|---|---------|---------|-------------|

NO REQUIREMENTS

**NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.**

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## 4.44 MICROWAVE SCAN BEAM LANDING SYSTEM SOP

This section defines the detailed functional requirements and formulations for the microwave scan beam landing system (MSBLS) subsystem operating program (SOP). The MSBLS SOP defines software associated with MSBLS azimuth, elevation, and range data processing.

### 4.44.1 MSBLS Requirements Overview

#### 4.44.1.1 MSBLS Functional Overview.

The MSBLS is a military Ku-band precision landing navigation aid that is used by the orbiter during final approach and landing. This flight phase is nominally from 12,000 feet altitude through touchdown and roll-out. By manual selection of the channel number (specific frequency) associated with the targeted runway approach, the orbiter will receive the range, azimuth, and elevation data that are provided by the MSBLS ground stations. The orbiter is equipped with three MSBLS transceivers for redundancy purposes. A single MSBLS subsystem is depicted in Figure 4.44.1.1-1, along with related interfacing equipment. Five major components are identified that are required for the MSBLS function: a control head, an antenna, a transceiver, a multiplexer/demultiplexer (MDM), and the on-board computer. The keyboard and the display electronics unit are also required for the crew to initiate self-test of the MSBLS transceiver.

Control of the MSBLS is via the control head two-position function switch and channel select thumbwheel. The two positions of the function switch are ON and OFF. When the function switch is placed in the ON position, power is applied to the transceiver and a power-present discrete returns from the transceiver to the MDM and then to the computer. Channel selection can be implemented only by the control head thumbwheel, and selection verification can only be accomplished via a visual check of the thumbwheel position by the crew (no channel number is available to the computer). Channel numbers of 1 to 10 are recognized by the transceiver. One thumbwheel per transceiver is provided, and the three thumbwheels are operated independently of each other.

The only software control of the MSBLS subsystem is the self-test of the transceiver. The software for the MSBLS self-test is defined in VU requirements.

MSBLS Data Processing (MSB\_DATA). The MSBLS data processing module performs bit-stripping of the flag bits in the MSBLS input words. The module also performs fixed-point to floating-point conversion of the azimuth, elevation, and range data and scaling of azimuth and elevation data to radians and range data from nautical miles to feet.

MSBLS data for use in navigation shall be processed by the MSBLS SOP at a 320-millisecond interval during the same 160-millisecond period as the selection filter. The MSBLS SOP processing shall precede the selection filter processing.

MSBLS data for use in area navigation shall be processed by the MSBLS SOP at a 320-millisecond interval during the same 160-millisecond period as area navigation is executed. The MSBLS SOP processing shall precede the area navigation execution.

#### 4.44.1.1.1 MSBLS Operating Modes.

The MSBLS operating modes are as follows:

- OFF mode
- ON mode
- SELF-TEST mode

The OFF mode occurs when the power-on discrete from the MSBLS transceiver is in the false or off state. The ON mode occurs when the transceiver is in operation as indicated by the power-on discrete. The self-test mode occurs when the transceiver is ON and is commanded to self-test by VU software.

#### 4.44.1.1.2 MSBLS Digital Interfaces.

The MSBLS interfaces with the GPC via the serial digital multiplex/demultiplex input and output data channel. The digital I/O words are 16 bits in size, plus 3 bits for synchronization and 1 bit for odd parity. Throughout the MSBLS SOP the synchronization and parity bits are disregarded, and the most significant data bit in the word is designated bit 0, with the least significant bit being bit 15. The contents, format, and bit values of the azimuth, elevation, and range data words transmitted from the MSBLS to the MDM are illustrated in Figure 4.44.1.1.2-1. The MSBLS data words transmitted from the MDM to GPC are illustrated in Figures 4.44.1.1.2-2, -3, and -4.

Azimuth Angle Data Word. The 16 bits of the azimuth data word passed on to the computer are divided among three functions: (1) azimuth data, (2) self-test status, and (3) data validity. The first bit (bit 0) of the 14-bit azimuth data is the sign bit. As the orbiter approaches the runway, a positive azimuth signal indicates that the orbiter is positioned to the right of the runway centerline. Conversely, a negative value indicates that the orbiter is to the left of the centerline. The value of the azimuth data (in degrees) is relative to the centerline and is referenced to the azimuth ground scanner location. Bit 1 is the most significant bit (16 degrees) of the binary-coded data.

Bit 14 of the data word indicates whether the transceiver is in self-test or not. Bit 15 indicates the validity of the azimuth data whether the transceiver is in self-test or not.

Elevation Angle Data Word. The 16 bits of the elevation angle data word are divided among four functions: (1) Bit 0 represents the status of the automatic gain control (AGC) and the mixer crystal current, (2) bits 1 through 13 are the elevation angle data, (3) bit 14 is the self-test mode indicator, and (4) bit 15 is the elevation angle data validity. Bit 0 can change from zero to one during self-test if an AGC failure is indicated by built-in test equipment or at any time if the mixer crystal current monitor indicates a failure. The elevation angle data (in degrees) are relative to the horizontal with the elevation ground scanner as reference point. Bit 1 (16 degrees) is the most significant bit in this binary-coded word.

Range Data Word. The 16 bits of the range data word are divided among four functions: (1) Bit 0 represents the status of AGC and the mixer crystal current, (2) bits 1 through 13 are the range data, (3) bit 14 is the self-test mode indicator, and (4) bit 15 is range data validity. Range word bit 0 provides an identical function to elevation word bit 0. The range data (in nautical miles) are relative to the ground distance measuring equipment antenna. Bit 1 (10.36 nmi) is the most significant bit in the binary-coded data word.

#### 4.44.1.1.3 Other MSBLS Interfaces.

The MSBLS transceiver requires the following interfaces:

- Power-on discrete
- Self-test command

The power-on discrete is generated by the MSBLS and indicates the transceiver is in operation.

The self-test command is generated by the VU software and causes the transceiver to perform self-test. The self-test condition is triggered in the transceiver anytime a serial digital word is output to the MSBLS transceiver.

#### 4.44.1.2 MSBLS SOP Overview.

The MSBLS SOP processes MSBLS data for use by other program elements. The inputs and outputs for the MSBLS SOP modules are stored in locations labeled as to parameter and transceiver.

The MSBLS SOP processing is performed at the highest rate required by the user: selection filter at 3.125 Hz, area navigation at 3.125 Hz, and FDIR at 0.25 Hz. The MSBLS SOP examines the dedicated display source selection signals to determine execution of the MSBLS SOP. Refer to Figure 4.44.1.2-1 for a MSBLS SOP signal flow diagram.

MSBLS Input Processing (MSB\_IN). The MSBLS input processing module identifies and accepts new inputs and controls execution or nonexecution of the MSBLS data processing module. The MSBLS input processing functional module shall input the range, azimuth, and elevation. If the input data from one or more of the LRU's are changed by one or more bits, the transaction time shall be stored as the time tag for those parameters; and on the next cycle, the input data shall be made available to the user and also stored as old data. (Azimuth shall be updated after 320 milliseconds but no more than 480 milliseconds with or without a detectable change.)

#### 4.44.1.3 MSBLS SOP Functional Module Summary.

The functional modules that constitute the MSBLS SOP are identified in Table 4.44.1.3-1. Each of the modules, including functions and formulation, are presented in detail in Section 4.44.6.

#### 4.44.1.4 Reference Documents.

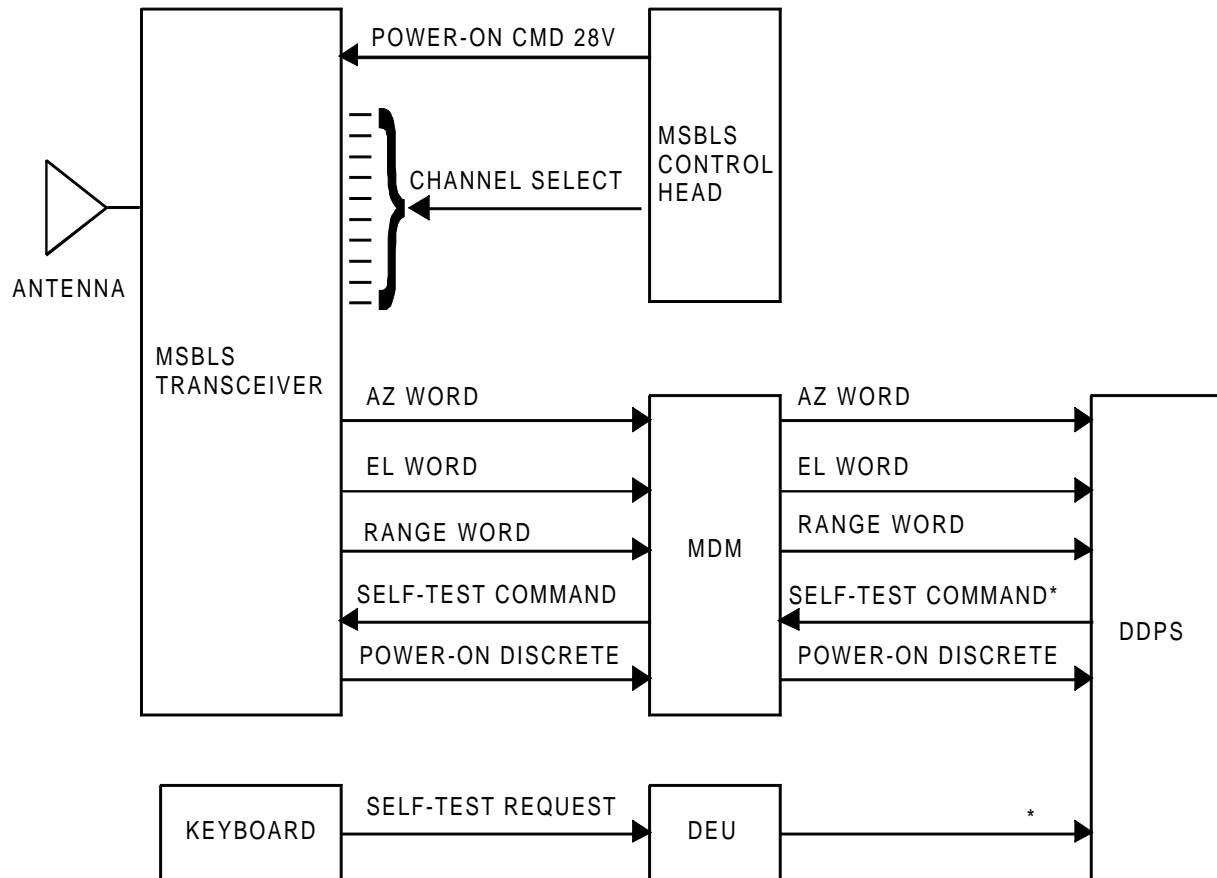
MC409-0017 Navigation Set, Microwave Scan Beam Landing System.

#### 4.44.1.5 Software Protection.

The software implementation of the MSBLS SOP shall protect against program checks and error interrupts caused by transient-type errors or bad data inputs. Specifically, the MSBLS SOP shall protect against all of the error conditions identified in paragraph 3.6 that are applicable to the MSBLS software design and code.

| Table 4.44.1.3-1. MSBLS SOP Functional Modules |                      |                        |
|------------------------------------------------|----------------------|------------------------|
| Module Name                                    | Applicable Paragraph | Module Description     |
| MSB_IN                                         | 4.44.6.1             | MSBLS Input Processing |
| MSB_DATA                                       | 4.44.6.2             | MSBLS Data Processing  |



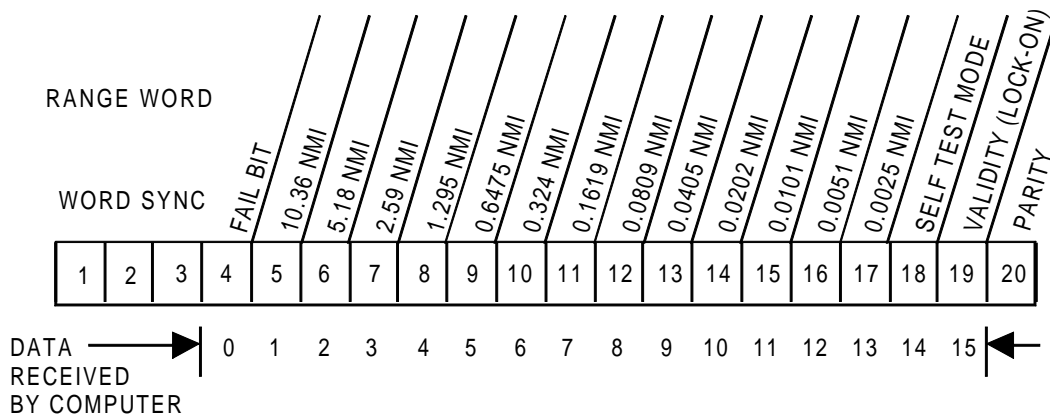
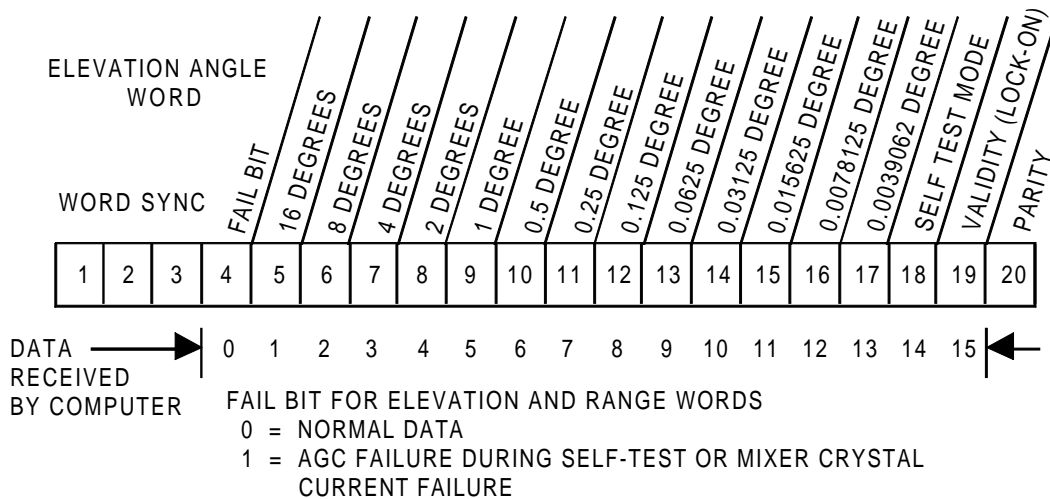
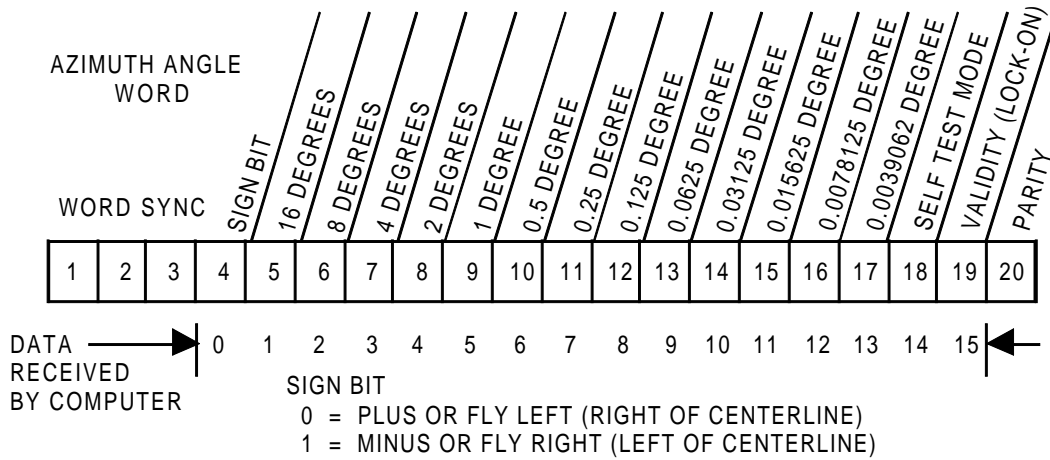


\* SOFTWARE REQUIREMENTS FOR SELF-TEST ARE SPECIFIED IN THE VU CPDS.

FIGURE 4.44.1.1-1. Microwave Scanning Beam Landing System, Single-String Diagram

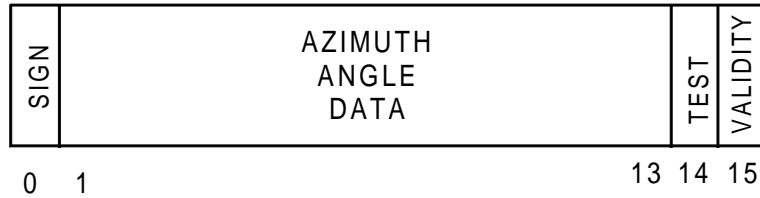
SELF-TEST STATUS BITS (ALL)  
0 = NOT IN SELF-TEST  
1 = PERFORMING SELF-TEST

VALIDITY BITS (ALL)  
0 = VALID DATA  
1 = NONVALID DATA



NOTE: BINARY VALUES ARE ROUNDED

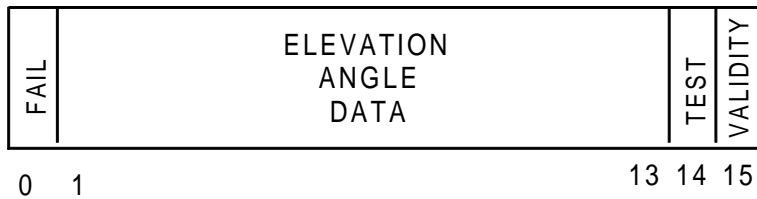
FIGURE 4.44.1.1.2-1. MSBLS Serial Data Words (MSBLS to MDM)



BIT 0    SIGN 0 = PLUS OR FLY LEFT  
                   1 = MINUS OR FLY RIGHT

|    |                                                      |
|----|------------------------------------------------------|
| 1  | 16 DEG                                               |
| 2  | 8 DEG                                                |
| 3  | 4 DEG                                                |
| 4  | 2 DEG                                                |
| 5  | 1 DEG                                                |
| 6  | 0.5 DEG                                              |
| 7  | 0.25 DEG                                             |
| 8  | 0.125 DEG                                            |
| 9  | 0.0625 DEG                                           |
| 10 | 0.03125 DEG                                          |
| 11 | 0.015625 DEG                                         |
| 12 | 0.0078125 DEG                                        |
| 13 | 0.0039062 DEG                                        |
| 14 | TEST        0 = NOT IN SELF-TEST<br>1 = IN SELF-TEST |
| 15 | VALIDITY    0 = VALID DATA<br>1 = INVALID DATA       |

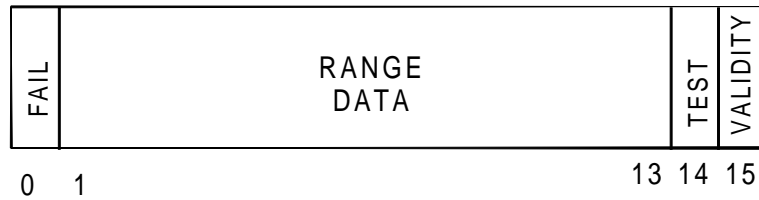
FIGURE 4.44.1.1.2-2. MSBLS Azimuth Angle Word Format (MDM to GPC)



BIT 0 FAIL 0 = NORMAL DATA  
 1 = AGC FAILURE (DURING SELF-TEST) OR MIXER  
 CRYSTAL CURRENT FAILURE

|    |                                             |
|----|---------------------------------------------|
| 1  | 16 DEG                                      |
| 2  | 8 DEG                                       |
| 3  | 4 DEG                                       |
| 4  | 2 DEG                                       |
| 5  | 1 DEG                                       |
| 6  | 0.5 DEG                                     |
| 7  | 0.25 DEG                                    |
| 8  | 0.125 DEG                                   |
| 9  | 0.0625 DEG                                  |
| 10 | 0.03125 DEG                                 |
| 11 | 0.015625 DEG                                |
| 12 | 0.0078125 DEG                               |
| 13 | 0.0039062 DEG                               |
| 14 | TEST 0 = NOT IN TEST<br>1 = IN SELF-TEST    |
| 15 | VALIDITY 0 = VALID DATA<br>1 = INVALID DATA |

FIGURE 4.44.1.1.2-3. MSBLS Elevation Angle Word Format (MDM to GPC)



BIT 0 FAIL 0 = NORMAL DATA  
 1 = AGC FAILURE (DURING SELF-TEST) OR  
 MIXER CRYSTAL CURRENT FAILURE

1 10.36 NMI  
 2 5.18 NMI  
 3 2.59 NMI  
 4 1.295 NMI  
 5 0.6475 NMI  
 6 0.324 NMI  
 7 0.1619 NMI  
 8 0.0809 NMI  
 9 0.0405 NMI  
 10 0.0202 NMI  
 11 0.0101 NMI  
 12 0.0051 NMI  
 13 0.0025 NMI

14 TEST STATUS 0 = NOT IN SELF-TEST  
 1 = IN SELF-TEST

15 VALIDITY 0 = VALID DATA  
 1 = INVALID DATA

FIGURE 4.44.1.1.2-4. MSBLS Range Word Format (MDM to GPC)

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#### 4.44.2 Definitions.

This section is not applicable to the MSBLS SOP.

#### 4.44.3 Functional Requirements Traceability.

The detailed requirements and formulations contained herein satisfy the GN&C, Level B, CPDS functional requirements for the MSBLS SOP.

#### 4.44.4 Interface Parameters.

The interface parameters required to properly execute the MSBLS functional module are given in Table 4.44.4-1.

#### 4.44.5 Parameter Initialization.

Table 4.44.5-1 presents the conversion factor for nautical miles to feet taken from the Level A document.

This section defines the I-load parameters associated with the MSBLS SOP. Table 4.44.5-2 contains the I-load parameters and identifies typical I-load values. The actual values will be specified later in the official I-load document. The codes designated in the constant column of Table 4.44.5-2 are to be interpreted as follows: "SX" indicates a soft constant that may change as the software is refined; "MX" indicates a mission/LRU dependent constant that is expected to change from mission to mission; and "X" indicates a hard constant that probably will not change.

#### 4.44.6 Detailed Requirements and Formulation.

This section defines the MSBLS SOP functional modules in sufficient detail to create a software design and generate computer code. Each module defines the functional requirements, interface requirements, detailed requirements and formulations, and special considerations if applicable. A flow diagram is also included for most modules. However, the flow diagrams are supplementary material and are not intended to convey requirements or to place restrictions on software design or coding.

##### 4.44.6.1 MSBLS Input Processing (MSB\_IN).

The purpose of the MSB\_IN functional module is to input data and control execution or nonexecution of the MSB\_DATA functional module.

A. Functional Requirements. The MSB\_IN module is required to perform the following function for each MSBLS:

Evaluate input data words for any change of value as compared to the last sampling. If a change has occurred, the transaction time tag will be stored as the measurement time tag, and on the next cycle, the input data will be stored and made available to the user. Since the azimuth data are changing slowly when the vehicle is lining up with the runway center line, the azimuth data will be accepted without a change if the last accepted input data are over 320 milliseconds old, but no more than 480 milliseconds.

B. Interface Requirements. The input and output parameters associated with the MSB\_IN functional module are contained in Table 4.44.4-1.



C. Detailed Requirements and Formulations. The following sequence of operations shall be performed for each MSBLS transceiver at a rate of 6.25 times per second:

1. If this is not a range update cycle (RANGE\_UPDATE=OFF), then compare each MSBLS input range word (MSBRANGIN) to the range word (MSBRANGE). If the input range word differs from the range word, store CLOCKTIME as the range time (RANGE\_TIME) and set the range update flag to on. However, if this is a range update cycle (RANGE\_UPDATE=ON), then update MSBRANGE with MSBRANGIN, MSBRANGTIM with RANGE\_TIME and set the range update flag to off.
2. If this is not an elevation update cycle (ELEVATION\_UPDATE = OFF), then compare each MSBLS input elevation word (MSBELEVIN) to the elevation word (MSBELEV). If the input elevation word differs from the elevation word, store CLOCKTIME as the elevation time (ELEVATION\_TIME) and set the elevation update flag to on. However, if this is an elevation update cycle (ELEVATION\_UPDATE=ON), then update MSBELEV with MSBELEVIN, MSBELEVTIM with ELEVATION\_TIME and set the elevation update flag to off.
3. If this is not an azimuth update cycle (AZIMUTH\_UPDATE = OFF), then compare each MSBLS input azimuth word (MSBAZIMIN) to the azimuth word (MSBAZIM) and perform the test on AZIMUTH\_PASS flag. If the input azimuth word differs from the azimuth word or this is a second cycle since the last update (AZIMUTH\_PASS = ON), then store CLOCKTIME as the azimuth time (AZIMUTH\_TIME), set the azimuth update flag to on and set AZIMUTH\_PASS to off, else set AZIMUTH\_PASS to on. However, if this is an azimuth update cycle (AZIMUTH\_UPDATE=ON), then update MSBAZIM with MSBAZIMIN, MSBAZIMTIM with AZIMUTH\_TIME and set the azimuth update flag to off.

Figure 4.44.6.1-1 presents a flow diagram for the MSB\_IN functional module.

#### 4.44.6.2 MSBLS Data Processing (MSB\_DATA).

The purpose of this MSB\_DATA functional module is to process the MSBLS input data.

A. Functional Requirements. The MSB\_DATA module is required to perform the following functions for each MSBLS:

1. Process the data words provided by the MSB\_IN functional module and remove the flag bits, using these bits to drive flags for other functional modules.
2. Check the values of the range, heading, azimuth, and elevation for validity and magnitude within the specified limits.

Set the validity flags on words going to the selection filter and area nav.

3. Compute the MSBLS range, azimuth, and elevation values by performing the required scaling and conversion to obtain floating point data in required units.

B. Interface Requirements. The input and output parameters associated with the MSB\_DATA functional module are contained in Table 4.44.4-1.

C. Detailed Requirements and Formulations. The following operations shall be performed for each applicable MSBLS transceiver at a rate of 3.125 Hz:

1. MSBLS Range Out. The MSBLS range data (MSBRANGE<sub>O</sub>) are contained in the MSBLS range word (MSBRANGIN) as a 13-bit binary word (Figure 4.44.1.1.2-4). The most significant bit is bit 1 with a value of 10.36 nmi. Compute MSBRANGE<sub>O</sub> in floating point and scale the value in feet using the conversion factor ft-per-nmi (MLSNMI\_FT). Set MSBLS range lock-on and MSBLS range commfault flags to false.
2. MSBLS Range Lock-On and Comlock. The MSBLS range lock-on (MSBRANGDG) is driven by bit 15 of the MSBLS range word (MSBRANGE). MSBRANGDG is a two-state flag indicating data good or bad. True indicates data good. If MSBRANGE<sub>i</sub> bit 15 is zero, then first test to determine if there is no range commfault and set MRNG\_CMLK<sub>i</sub> flag to true; else leave MRNG\_CMLK<sub>i</sub> false. Then set MSBRANGDG<sub>i</sub> to true; else leave MSBRANGDG false.
3. MSBLS Elevation Out. The MSBLS elevation data (MSBELEVO) are contained in the MSBLS elevation word (MSBELEV) as a 13-bit binary word (Figure 4.44.1.1.2-3). The most significant bit is bit 1 with a value of 16 degrees. Compute MSBELEVO<sub>i</sub> in floating point and scale in radians. Set MSBLS elevation lock-on and MSBLS elevation commfault flags to false.
4. MSBLS Elevation Lock-On and Comlock. The MSBLS elevation lock-on (MSBELEVDG) is driven by bit 15 of the MSBLS elevation word (MSBELEV). MSBELEVDG is a two-state flag indicating data good or bad. True indicates data good.

If MSBELEV bit 15 is zero, then first test to determine if there is no elevation COMFAULT<sub>i</sub> and set MELV\_CMLK<sub>i</sub> to true; otherwise leave false. Next, test to determine if the absolute course with respect to the runway | COURSE\_WRT\_RW adjusted to the range -180 to +180 | is less than COURSE\_WRT\_RW\_LIM, the desired limit; test to determine if MRNG\_CMLK<sub>i</sub> is true; and finally test whether the elevation is within the desired minimum MSBELMIN\_LIM and desired maximum MSBELMAX\_LIM.

If all these conditions are met, set MSBELEVDG<sub>i</sub> to true.

5. MSBLS Fail Flag.

If MSBELV<sub>i</sub> bit 0 = 1

Then set MSBELVSTB<sub>i</sub> to true;

else set MSBELVSTB<sub>i</sub> to false

The MSBLS failure flag (MSBELVSTB) is driven by crystal current failure or AGC failure during self-test

6. MSBLS Azimuth Out. The MSBLS azimuth data (MSBAZIMO) are contained in the MSBLS azimuth word (MSBAZIM) as a 13-bit binary word plus sign (Figure 4.44.1.1.2-2). The most significant bit is bit 1 with a value of 16 degrees. The sign is in bit 0 with + = 0 and - = 1. Plus indicates fly left (i.e., orbiter to the right of the centerline), and minus indicates fly right (i.e., orbiter to the left of the centerline). Compute MSBAZIMO<sub>i</sub> in floating point and scale in radians. Set MSBLS azimuth lock-on and MSBLS azimuth commfault flags to false.
7. MSBLS Azimuth Lock-On and Comlock. The MSBLS azimuth lock-on (MSBAZIMDG) is driven by bit 15 of the MSBLS azimuth word (MSBAZIM). MSBAZIMDG is a two-state flag indicating data good or bad. True indicates data good.

If MSBAZIM bit 15 is zero, then first test to determine if there is no azimuth COMMFAULT<sub>i</sub> and set MAZM\_CMLK<sub>i</sub> to true; otherwise leave false. Next, test to determine if the absolute course with respect to the runway | COURSE\_WRT\_RW adjusted to the range -180 to +180 | is less than COURSE\_WRT\_RW\_LIM, the desired limit. If the range comlock MRNG\_CMK<sub>i</sub> is true and if the range is less than a maximum limit MSBRNG\_LIM and if the absolute value of the azimuth is less than a desired maximum MSBAZ\_LIM, set azimuth lock-on MSBAZIMDG<sub>i</sub> to true.

Note that comlock processing is only required on area navigation cycles. Figure 4.44.6.2-1 presents a flow diagram for the MSB\_DATA functional module.

#### **4.44.6.3 Applicable Tables for MSBLS SOP.**

The IDD inputs and outputs are listed in Tables 4.44.6.3-1 and 4.44.6.3-2. Values for the I-loads are contained in the I-loads requirements document (JSC-19350); however, I-load definitions applicable to this principal function are listed in Table 4.44.6.3-3. K-loads are listed in Table 4.44.6.3-4. Constants are listed in Table 4.44.6.3-5.

| Table 4.44.4-1. MSBLS SOP Interface Table |                     |                                                 |                 |                       |                |        |       |              |
|-------------------------------------------|---------------------|-------------------------------------------------|-----------------|-----------------------|----------------|--------|-------|--------------|
| Name                                      | MSID/<br>Mnemonic   | Description                                     | Input<br>Source | Output<br>Destination | Signal<br>Type | Range  | Units | Rate<br>(Hz) |
| MSBRANGIN(1)                              | V74M1050P<br>G08206 | MSBLS NO 1<br>RANGE WORD<br>(16 BIT PARENT)     | MSBLS 1         |                       | HMD            |        | NA    | 6.25         |
|                                           | V74X1051B           | MSBLS NO 1 RNG<br>AGC-XTAL CUR FAIL             | MSBLS 1         |                       | LOGICAL        | 0, 1   | NA    | 6.25         |
|                                           | V74H1052B           | MSBLS NO 1 RANGE<br>DATA                        | MSBLS 1         |                       | FIXED PT       | 0-20.7 | NM    | 6.25         |
|                                           | V74X1053B           | MSBLS NO 1 RANGE<br>TEST                        | MSBLS 1         |                       | LOGICAL        | 0, 1   | NA    | 6.25         |
|                                           | V74X1054B           | MSBLS NO 1 RANGE<br>VALIDITY                    | MSBLS 1         |                       | LOGICAL        | 0, 1   | NA    | 6.25         |
| MSBRANGIN(2)                              | V74M1150P<br>G08207 | MSBLS NO 2<br>RANGE WORD<br>(16 BIT PARENT)     | MSBLS 2         |                       | HMD            |        | NA    | 6.25         |
|                                           | V74X1151B           | MSBLS NO 2 RNG<br>AGC-XTAL CUR FAIL             | MSBLS 2         |                       | LOGICAL        | 0, 1   | NA    | 6.25         |
|                                           | V74H1152B           | MSBLS NO 2 RANGE<br>DATA                        | MSBLS 2         |                       | FIXED PT       | 0-20.7 | NM    | 6.25         |
|                                           | V74X1153B           | MSBLS NO 2 RANGE<br>TEST                        | MSBLS 2         |                       | LOGICAL        | 0, 1   | NA    | 6.25         |
|                                           | V74X1154B           | MSBLS NO 2 RANGE<br>VALIDITY                    | MSBLS 2         |                       | LOGICAL        | 0, 1   | NA    | 6.25         |
| MSBRANGIN(3)                              | V74M1250P<br>G08208 | MSBLS NO 3<br>RANGE WORD<br>(16 BIT PARENT)     | MSBLS 3         |                       | HMD            |        | NA    | 6.25         |
|                                           | V74X1251B           | MSBLS NO 3 RNG<br>AGC-XTAL CUR FAIL             | MSBLS 3         |                       | LOGICAL        | 0, 1   | NA    | 6.25         |
|                                           | V74H1252B           | MSBLS NO 3 RANGE<br>DATA                        | MSBLS 3         |                       | FIXED PT       | 0-20.7 | NM    | 6.25         |
|                                           | V74X1253B           | MSBLS NO 3 RANGE<br>TEST                        | MSBLS 3         |                       | LOGICAL        | 0, 1   | NA    | 6.25         |
|                                           | V74X1254B           | MSBLS NO 3 RANGE<br>VALIDITY                    | MSBLS 3         |                       | LOGICAL        | 0, 1   | NA    | 6.25         |
| MSBELEVIN(1)                              | V74M1030P<br>G08203 | MSBLS NO 1<br>ELEVATION WORD<br>(16 BIT PARENT) | MSBLS 1         |                       | HMD            |        | NA    | 6.25         |
|                                           | V74X1031B           | MSBLS NO 1 EL<br>AGC-XTAL CUR FAIL              | MSBLS 1         |                       | LOGICAL        | 0, 1   | NA    | 6.25         |
|                                           | V74H1032B           | MSBLS NO 1<br>ELEVATION DATA                    | MSBLS 1         |                       | FIXED PT       | 0-30   | DEG   | 6.25         |
|                                           | V74X1033B           | MSBLS NO 1<br>ELEVATION TEST                    | MSBLS 1         |                       | LOGICAL        | 0, 1   | NA    | 6.25         |
|                                           | V74X1034B           | MSBLS NO 1<br>ELEVATION<br>VALIDITY             | MSBLS 1         |                       | LOGICAL        | 0, 1   | NA    | 6.25         |

Table 4.44.4-1. MSBLS SOP Interface Table

| Name         | MSID/<br>Mnemonic   | Description                                     | Input<br>Source | Output<br>Destination | Signal<br>Type | Range  | Units | Rate<br>(Hz) |
|--------------|---------------------|-------------------------------------------------|-----------------|-----------------------|----------------|--------|-------|--------------|
| MSBELEVIN(2) | V74M1130P<br>G08204 | MSBLS NO 2<br>ELEVATION WORD<br>(16 BIT PARENT) | MSBLS 2         |                       | HMD            |        | NA    | 6.25         |
|              | V74X1131B           | MSBLS NO 2 EL<br>AGC-XTAL CUR FAIL              | MSBLS 2         |                       | LOGICAL        | 0, 1   | NA    | 6.25         |
|              | V74H1132B           | MSBLS NO 2<br>ELEVATION DATA                    | MSBLS 2         |                       | FIXED PT       | 0-30   | DEG   | 6.25         |
|              | V74X1133B           | MSBLS NO 2<br>ELEVATION TEST                    | MSBLS 2         |                       | LOGICAL        | 0, 1   | NA    | 6.25         |
|              | V74X1134B           | MSBLS NO 2<br>ELEVATION<br>VALIDITY             | MSBLS 2         |                       | LOGICAL        | 0, 1   | NA    | 6.25         |
| MSBELEVIN(3) | V74M1230P<br>G08205 | MSBLS NO 3<br>ELEVATION WORD<br>(16 BIT PARENT) | MSBLS 3         |                       | HMD            |        | NA    | 6.25         |
|              | V74X1231B           | MSBLS NO 3 EL<br>AGC-XTAL CUR FAIL              | MSBLS 3         |                       | LOGICAL        | 0, 1   | NA    | 6.25         |
|              | V74H1232B           | MSBLS NO 3<br>ELEVATION DATA                    | MSBLS 3         |                       | FIXED PT       | 0-30   | DEG   | 6.25         |
|              | V74X1233B           | MSBLS NO 3<br>ELEVATION TEST                    | MSBLS 3         |                       | LOGICAL        | 0, 1   | NA    | 6.25         |
|              | V74X1234B           | MSBLS NO 3<br>ELEVATION<br>VALIDITY             | MSBLS 3         |                       | LOGICAL        | 0, 1   | NA    | 6.25         |
| MSBAZIMIN(1) | V74M1010P<br>G08200 | MSBLS NO. 1<br>AZIMUTH WORD<br>(16 BIT PARENT)  | MSBLS 1         |                       | HMD            |        | NA    | 6.25         |
|              | V74H1012B           | MSBLS NO 1<br>AZIMUTH DATA                      | MSBLS 1         |                       | FIXED PT       | 0-31.2 | DEG   | 6.25         |
|              | V74X1013B           | MSBLS NO 1<br>AZIMUTH TEST                      | MSBLS 1         |                       | LOGICAL        | 0, 1   | NA    | 6.25         |
|              | V74X1014B           | MSBLS NO 1<br>AZIMUTH VALIDITY                  | MSBLS 1         |                       | LOGICAL        | 0, 1   | NA    | 6.25         |
| MSBAZIMIN(2) | V74M1110P<br>G08201 | MSBLS NO 2<br>AZIMUTH WORD<br>(16 BIT PARENT)   | MSBLS 2         |                       | HMD            |        | NA    | 6.25         |
|              | V74H1112B           | MSBLS NO 2<br>AZIMUTH DATA                      | MSBLS 2         |                       | FIXED PT       | 0-31.2 | DEG   | 6.25         |
|              | V74X1113B           | MSBLS NO 2<br>AZIMUTH TEST                      | MSBLS 2         |                       | LOGICAL        | 0, 1   | NA    | 6.25         |
|              | V74X1114B           | MSBLS NO 2<br>AZIMUTH VALIDITY                  | MSBLS 2         |                       | LOGICAL        | 0, 1   | NA    | 6.25         |

| Table 4.44.4-1. MSBLS SOP Interface Table |                     |                                               |                 |                                 |                |             |       |              |
|-------------------------------------------|---------------------|-----------------------------------------------|-----------------|---------------------------------|----------------|-------------|-------|--------------|
| Name                                      | MSID/<br>Mnemonic   | Description                                   | Input<br>Source | Output<br>Destination           | Signal<br>Type | Range       | Units | Rate<br>(Hz) |
| MSBAZIMIN(3)                              | V74M1210P<br>G08202 | MSBLS NO 3<br>AZIMUTH WORD<br>(16 BIT PARENT) | MSBLS 3         |                                 | HMD            |             | NA    | 6.25         |
|                                           | V74H1212B           | MSBLS NO 3<br>AZIMUTH DATA                    | MSBLS 3         |                                 | FIXED PT       | 0-31.2      | DEG   | 6.25         |
|                                           | V74X1213B           | MSBLS NO 3<br>AZIMUTH TEST                    | MSBLS 3         |                                 | LOGICAL        | 0, 1        | NA    | 6.25         |
|                                           | V74X1214B           | MSBLS NO 3<br>AZIMUTH VALIDITY                | MSBLS 3         |                                 | LOGICAL        | 0, 1        | NA    | 6.25         |
| MSBLS_CF(1)                               | V91X3550X<br>G46263 | MSBLS 1<br>COMMFAULT                          | FCOS            |                                 | LOGICAL        | 0, 1        | NA    | 3.125        |
| MSBLS_CF(2)                               | V91X3560X<br>G46264 | MSBLS 2<br>COMMFAULT                          | FCOS            |                                 | LOGICAL        | 0, 1        | NA    | 3.125        |
| MSBLS_CF(3)                               | V91X3570X<br>G46265 | MSBLS 3<br>COMMFAULT                          | FCOS            |                                 | LOGICAL        | 0, 1        | NA    | 3.125        |
| CLOCK TIME                                | V91W5000C<br>G07829 | CLOCK COMPUTER<br>(GMT)                       | FCOS            |                                 | FLOAT<br>PT    | NA          | SEC   | 6.25         |
| MSBRANGE0(1)                              | V95H6102C<br>G08119 | MSBLS 1 RANGE<br>OUT                          |                 | SF (4.71)                       | FLOAT          | 0 –<br>125K | FEET  | 3.125        |
|                                           |                     |                                               |                 | MSBLS FDIR<br>(4.78)            | PT             |             |       | 0.26         |
|                                           |                     |                                               |                 | ASC AREA<br>NAV PROC<br>(4.237) |                |             |       | 1.04         |
|                                           |                     |                                               |                 | ENT AREA<br>NAV PROC<br>(4.220) |                |             |       | 1.04         |
| MSBRANGE0(2)                              | V95H6202C<br>G08120 | MSBLS 2 RANGE<br>OUT                          |                 | SF (4.71)                       | FLOAT          | 0 –<br>125K | FEET  | 3.125        |
|                                           |                     |                                               |                 | MSBLS FDIR<br>(4.78)            | PT             |             |       | 0.26         |
|                                           |                     |                                               |                 | ASC AREA<br>NAV PROC<br>(4.237) |                |             |       | 1.04         |
|                                           |                     |                                               |                 | ENT AREA<br>NAV PROC<br>(4.220) |                |             |       | 1.04         |
| MSBRANGE0(3)                              | V95H6302C<br>G08121 | MSBLS 3 RANGE<br>OUT                          |                 | SF (4.71)                       | FLOAT          | 0 –<br>125K | FEET  | 3.125        |
|                                           |                     |                                               |                 | MSBLS FDIR<br>(4.78)            | PT             |             |       | 0.26         |
|                                           |                     |                                               |                 | ASC AREA<br>NAV PROC<br>(4.237) |                |             |       | 1.04         |
|                                           |                     |                                               |                 | ENT AREA<br>NAV PROC<br>(4.220) |                |             |       | 1.04         |

Table 4.44.4-1. MSBLS SOP Interface Table

| Name        | MSID/<br>Mnemonic   | Description              | Input<br>Source | Output<br>Destination           | Signal<br>Type | Range   | Units | Rate<br>(Hz) |
|-------------|---------------------|--------------------------|-----------------|---------------------------------|----------------|---------|-------|--------------|
| MSBELEVO(1) | V95H6142C<br>G08116 | MSBLS 1 ELEVATION<br>OUT |                 | SF (4.71)                       | FLOAT          | 0 – 0.6 | RAD   | 3.125        |
|             |                     |                          |                 | MSBLS FDIR<br>(4.78)            | PT             |         |       | 0.26         |
|             |                     |                          |                 | ASC AREA<br>NAV PROC<br>(4.237) |                |         |       | 1.04         |
|             |                     |                          |                 | ENT AREA<br>NAV PROC<br>(4.220) |                |         |       | 1.04         |
| MSBELEVO(2) | V95H6242C<br>G08117 | MSBLS 2 ELEVATION<br>OUT |                 | SF (4.71)                       | FLOAT          | 0 – 0.6 | RAD   | 3.125        |
|             |                     |                          |                 | MSBLS FDIR<br>(4.78)            | PT             |         |       | 0.26         |
|             |                     |                          |                 | ASC AREA<br>NAV PROC<br>(4.237) |                |         |       | 1.04         |
|             |                     |                          |                 | ENT AREA<br>NAV PROC<br>(4.220) |                |         |       | 1.04         |
| MSBELEVO(3) | V95H6342C<br>G08118 | MSBLS 3 ELEVATION<br>OUT |                 | SF (4.71)                       | FLOAT          | 0 – 0.6 | RAD   | 3.125        |
|             |                     |                          |                 | MSBLS FDIR<br>(4.78)            | PT             |         |       | 0.26         |
|             |                     |                          |                 | ASC AREA<br>NAV PROC<br>(4.237) |                |         |       | 1.04         |
|             |                     |                          |                 | ENT AREA<br>NAV PROC<br>(4.220) |                |         |       | 1.04         |
| MSBAZIMO(1) | V95H6122C<br>G08113 | MSBLS 1 AZIMUTH<br>OUT   |                 | SF (4.71)                       | FLOAT          | +/-0.6  | RAD   | 3.125        |
|             |                     |                          |                 | MSBLS FDIR<br>(4.78)            | PT             |         |       | 0.26         |
|             |                     |                          |                 | ASC AREA<br>NAV PROC<br>(4.237) |                |         |       | 1.04         |
|             |                     |                          |                 | ENT AREA<br>NAV PROC<br>(4.220) |                |         |       | 1.04         |
| MSBAZIMO(2) | V95H6222C<br>G08114 | MSBLS 2 AZIMUTH<br>OUT   |                 | SF (4.71)                       | FLOAT          | +/-0.6  | RAD   | 3.125        |
|             |                     |                          |                 | MSBLS FDIR<br>(4.78)            | PT             |         |       | 0.26         |
|             |                     |                          |                 | ASC AREA<br>NAV PROC<br>(4.237) |                |         |       | 1.04         |
|             |                     |                          |                 | ENT AREA<br>NAV PROC<br>(4.220) |                |         |       | 1.04         |

| Table 4.44.4-1. MSBLS SOP Interface Table |                     |                                           |                 |                                          |                |        |       |                       |
|-------------------------------------------|---------------------|-------------------------------------------|-----------------|------------------------------------------|----------------|--------|-------|-----------------------|
| Name                                      | MSID/<br>Mnemonic   | Description                               | Input<br>Source | Output<br>Destination                    | Signal<br>Type | Range  | Units | Rate<br>(Hz)          |
| MSBAZIMO(3)                               | V95H6322C<br>G08115 | MSBLS 3 AZIMUTH<br>OUT                    |                 | SF (4.71)                                | FLOAT          | +/-0.6 | RAD   | 3.125                 |
|                                           |                     |                                           |                 | MSBLS FDIR<br>(4.78)                     | PT             |        |       | 0.26                  |
|                                           |                     |                                           |                 | ASC AREA<br>NAV PROC<br>(4.237)          |                |        |       | 1.04                  |
|                                           |                     |                                           |                 | ENT AREA<br>NAV PROC<br>(4.220)          |                |        |       | 1.04                  |
| MSBRANGDG(1)                              | V95X6104X<br>G08110 | MSBLS 1 RANGE<br>LOCKED ON                |                 | SF 4.71<br>GAX 4.110<br>MSB FDIR<br>4.78 | LOGICAL        | 0, 1   | NA    | 3.125<br>1.04<br>0.26 |
| MSBRANGDG(2)                              | V95X6204X<br>G08111 | MSBLS 2 RANGE<br>LOCKED ON                |                 | SF 4.71<br>GAX 4.110<br>MSB FDIR<br>4.78 | LOGICAL        | 0, 1   | NA    | 3.125<br>1.04<br>0.26 |
| MSBRANGDG(3)                              | V95X6304X<br>G08112 | MSBLS 3 RANGE<br>LOCKED ON                |                 | SF 4.71<br>GAX 4.110<br>MSB FDIR<br>4.78 | LOGICAL        | 0, 1   | NA    | 3.125<br>1.04<br>0.26 |
| MSBELEVDG(1)                              | V95X6144X<br>G08107 | MSBLS 1 ELEVATION<br>LOCKED ON            |                 | SF 4.71<br>GAX 4.110<br>MSB FDIR<br>4.78 | LOGICAL        | 0, 1   | NA    | 3.125<br>1.04<br>0.26 |
| MSBELEVDG(2)                              | V95X6244X<br>G08108 | MSBLS 2 ELEVATION<br>LOCKED ON            |                 | SF 4.71<br>GAX 4.110<br>MSB FDIR<br>4.78 | LOGICAL        | 0, 1   | NA    | 3.125<br>1.04<br>0.26 |
| MSBELEVDG(3)                              | V95X6344X<br>G08109 | MSBLS 3 ELEVATION<br>LOCKED ON            |                 | SF 4.71<br>GAX 4.110<br>MSB FDIR<br>4.78 | LOGICAL        | 0, 1   | NA    | 3.125<br>1.04<br>0.26 |
| MSBAZIMDG(1)                              | V95X6124X<br>G08104 | MSBLS 1 AZIMUTH<br>LOCKED ON              |                 | SF 4.71<br>GAX 4.110<br>MSB FDIR<br>4.78 | LOGICAL        | 0, 1   | NA    | 3.125<br>1.04<br>0.26 |
| MSBAZIMDG(2)                              | V95X6224X<br>G08105 | MSBLS 2 AZIMUTH<br>LOCKED ON              |                 | SF 4.71<br>GAX 4.110<br>MSB FDIR<br>4.78 | LOGICAL        | 0, 1   | NA    | 3.125<br>1.04<br>0.26 |
| MSBAZIMDG(3)                              | V95X6324X<br>G08106 | MSBLS 3 AZIMUTH<br>LOCKED ON              |                 | SF 4.71<br>GAX 4.110<br>MSB FDIR<br>4.78 | LOGICAL        | 0, 1   | NA    | 3.125<br>1.04<br>0.26 |
| MSBELVSTB(1)                              | V95X6148X<br>G46260 | MSBLS NO. 1<br>ELEVATION<br>SELF-TEST BAD |                 | MSBLS FDIR<br>4.78                       | LOGICAL        | 0, 1   | NA    | 0.26                  |



Table 4.44.4-1. MSBLS SOP Interface Table

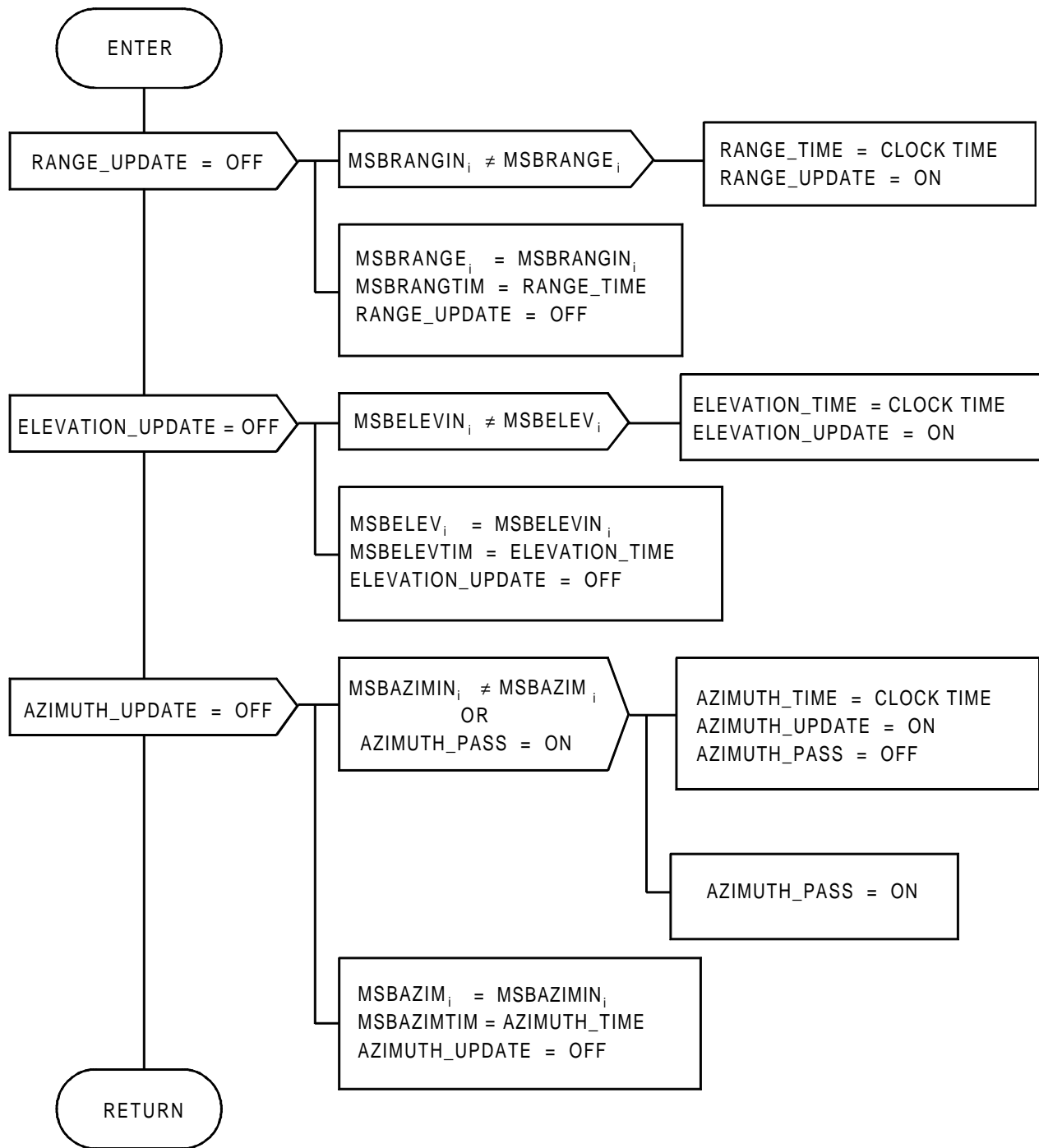
| Name         | MSID/<br>Mnemonic   | Description                                    | Input<br>Source | Output<br>Destination                                              | Signal<br>Type | Range | Units | Rate<br>(Hz) |
|--------------|---------------------|------------------------------------------------|-----------------|--------------------------------------------------------------------|----------------|-------|-------|--------------|
| MSBELVSTB(2) | V95X6248X<br>G46261 | MSBLS NO. 2<br>ELEVATION<br>SELF-TEST BAD      |                 | MSBLS FDIR<br>4.78                                                 | LOGICAL        | 0, 1  | NA    | 0.26         |
| MSBELVSTB(3) | V95X6348X<br>G46262 | MSBLS NO. 3<br>ELEVATION<br>SELF-TEST BAD      |                 | MSBLS FDIR<br>4.78                                                 | LOGICAL        | 0, 1  | NA    | 0.26         |
| MSBRANTIM    | V95W6000C<br>G08122 | MSBLS RANGE<br>MEASUREMENT<br>TIME             |                 | PRELAND<br>NAV 4.144<br>TLM<br>RTLS NAV<br>4.205                   | FLOAT<br>PT    | NA    | SEC   | 3.125        |
| MSBELEVTIM   | V95W6020C<br>G08124 | MSBLS ELEVATION<br>MEASUREMENT<br>TIME         |                 | PRELAND<br>NAV 4.144<br>TLM<br>RTLS NAV<br>4.205                   | FLOAT<br>PT    | NA    | SEC   | 3.125        |
| MSBAZIMTIM   | V95W6010C<br>G08123 | MSBLS AZIMUTH<br>MEASUREMENT<br>TIME           |                 | PRELAND<br>NAV 4.144<br>TLM<br>RTLS NAV<br>4.205                   | FLOAT<br>PT    | NA    | SEC   | 3.125        |
| MRNG_CMLK(1) | V95X6056X<br>G50729 | MSBLS 1 RANGE<br>COMMFAULT/<br>LOCKON FLAG     |                 | ASC AREA<br>NAV PROC<br>(4.237)<br>ENT AREA<br>NAV PROC<br>(4.220) | LOGICAL        | 0, 1  | NA    | 1.04<br>1.04 |
| MRNG_CMLK(2) | V95X6062X<br>G50730 | MSBLS 2 RANGE<br>COMMFAULT/<br>LOCKON FLAG     |                 | ASC AREA<br>NAV PROC<br>(4.237)<br>ENT AREA<br>NAV PROC<br>(4.220) | LOGICAL        | 0, 1  | NA    | 1.04<br>1.04 |
| MRGN_CMLK(3) | V95X6067X<br>G50731 | MSBLS 3 RANGE<br>COMMFAULT/<br>LOCKON FLAG     |                 | ASC AREA<br>NAV PROC<br>(4.237)<br>ENT AREA<br>NAV PROC<br>(4.220) | LOGICAL        | 0, 1  | NA    | 1.04<br>1.04 |
| MELV_CMLK(1) | V95X6057X<br>G50723 | MSBLS 1 ELEVATION<br>COMMFAULT/<br>LOCKON FLAG |                 | ASC AREA<br>NAV PROC<br>(4.237)<br>ENT AREA<br>NAV PROC<br>(4.220) | LOGICAL        | 0, 1  | NA    | 1.04<br>1.04 |

| Table 4.44.4-1. MSBLS SOP Interface Table |                     |                                                |                 |                                           |                |              |       |              |
|-------------------------------------------|---------------------|------------------------------------------------|-----------------|-------------------------------------------|----------------|--------------|-------|--------------|
| Name                                      | MSID/<br>Mnemonic   | Description                                    | Input<br>Source | Output<br>Destination                     | Signal<br>Type | Range        | Units | Rate<br>(Hz) |
| MELV_CMLK(2)                              | V95X6063X<br>G50724 | MSBLS 2 ELEVATION<br>COMMFAULT/<br>LOCKON FLAG |                 | ASC AREA<br>NAV PROC<br>(4.237)           | LOGICAL        | 0, 1         | NA    | 1.04         |
|                                           |                     |                                                |                 | ENT AREA<br>NAV PROC<br>(4.220)           |                |              |       | 1.04         |
| MELV_CMLK(3)                              | V95X6068X<br>G50725 | MSBLS 3 ELEVATION<br>COMMFAULT/<br>LOCKON FLAG |                 | ASC AREA<br>NAV PROC<br>(4.237)           | LOGICAL        | 0, 1         | NA    | 1.04         |
|                                           |                     |                                                |                 | ENT AREA<br>NAV PROC<br>(4.220)           |                |              |       | 1.04         |
| MAZM_CMLK(1)                              | V95X6058X<br>G50726 | MSBLS 1 AZIMUTH<br>COMMFAULT/<br>LOCKON FLAG   |                 | ASC AREA<br>NAV PROC<br>(4.237)           | LOGICAL        | 0, 1         | NA    | 1.04         |
|                                           |                     |                                                |                 | ENT AREA<br>NAV PROC<br>(4.220)           |                |              |       | 1.04         |
| MAZM_CMLK(2)                              | V95X6064X<br>G50727 | MSBLS 2 AZIMUTH<br>COMMFAULT/<br>LOCKON FLAG   |                 | ASC AREA<br>NAV PROC<br>(4.237)           | LOGICAL        | 0, 1         | NA    | 1.04         |
|                                           |                     |                                                |                 | ENT AREA<br>NAV PROC<br>(4.220)           |                |              |       | 1.04         |
| MAZM_CMLK(3)                              | V95X6069X<br>G50728 | MSBLS 3 AZIMUTH<br>COMMFAULT/<br>LOCKON FLAG   |                 | ASC AREA<br>NAV PROC<br>(4.237)           | LOGICAL        | 0, 1         | NA    | 1.04         |
|                                           |                     |                                                |                 | ENT AREA<br>NAV PROC<br>(4.220)           |                |              |       | 1.04         |
| SQ_AZMLS                                  | V95H6021C<br>G19901 | SELECTED MSBLS<br>AZIMUTH_SCLD                 |                 | PRELAND<br>NAV 4.144<br>RTLS NAV<br>4.205 | FLOAT<br>PT    | +/-0.6       | RAD   |              |
| SQ_ELMLS                                  | V95H6022C<br>G14402 | SELECTED MSBLS<br>ELEVATION_SCLD               |                 | PRELAND<br>NAV 4.144<br>RTLS NAV<br>4.205 | FLOAT<br>PT    | 0, 6         | RAD   |              |
| SQ_RANGE                                  | V95H6023C<br>G14403 | SELECTED MSBLS<br>RANGE_SCLD                   |                 | PRELAND<br>NAV 4.144<br>RTLS NAV<br>4.205 | FLOAT<br>PT    | 0,<br>125000 | FT    |              |

| Table 4.44.5-1. MSBLS SOP Conversion Parameters |                                     |           |        |          |
|-------------------------------------------------|-------------------------------------|-----------|--------|----------|
| Name                                            | Description                         |           |        | Constant |
| MLSNMI_FT                                       | MSBLS nmi to feet conversion factor |           |        | X        |
| V97U6791C                                       | Type                                | Value     | Units  |          |
|                                                 | Scalar                              | 6076.1155 | ft/nmi |          |

| Table 4.44.5-2. MSBLS SOP I-Load Parameters |           |                             |          |        |       |         |
|---------------------------------------------|-----------|-----------------------------|----------|--------|-------|---------|
| Name                                        | MML No.   | MSID Description            | Constant | Type   | Value | Units   |
| MSBAZ_LIM                                   | V99U5719C | MSBLS azimuth limit         | X        | Scalar | *     | Radians |
| MSBELMAX_LIM                                | V99U5720C | MSBLS upper elevation limit | X        | Scalar | *     | Radians |
| MSBELMIN_LIM                                | V99U5721C | MSBLS lower elevation limit | X        | Scalar | *     | Radians |
| MSBRNG_LIM                                  | V99U5722C | MSBLS range limit           | X        | Scalar | *     | NMI     |
| COURSE_WRT_<br>RW_LIM                       | V99U5723C | MSBLS heading limit         | X        | Scalar | *     | Radians |

\* These values found in JSC 19350.



INITIALIZE RANGE\_UPDATE, AZIMUTH\_UPDATE, AZIMUTH\_PASS, AND  
 ELEVATION\_UPDATE TO OFF

FIGURE 4.44.6.1-1. MSB\_IN Flow Diagram

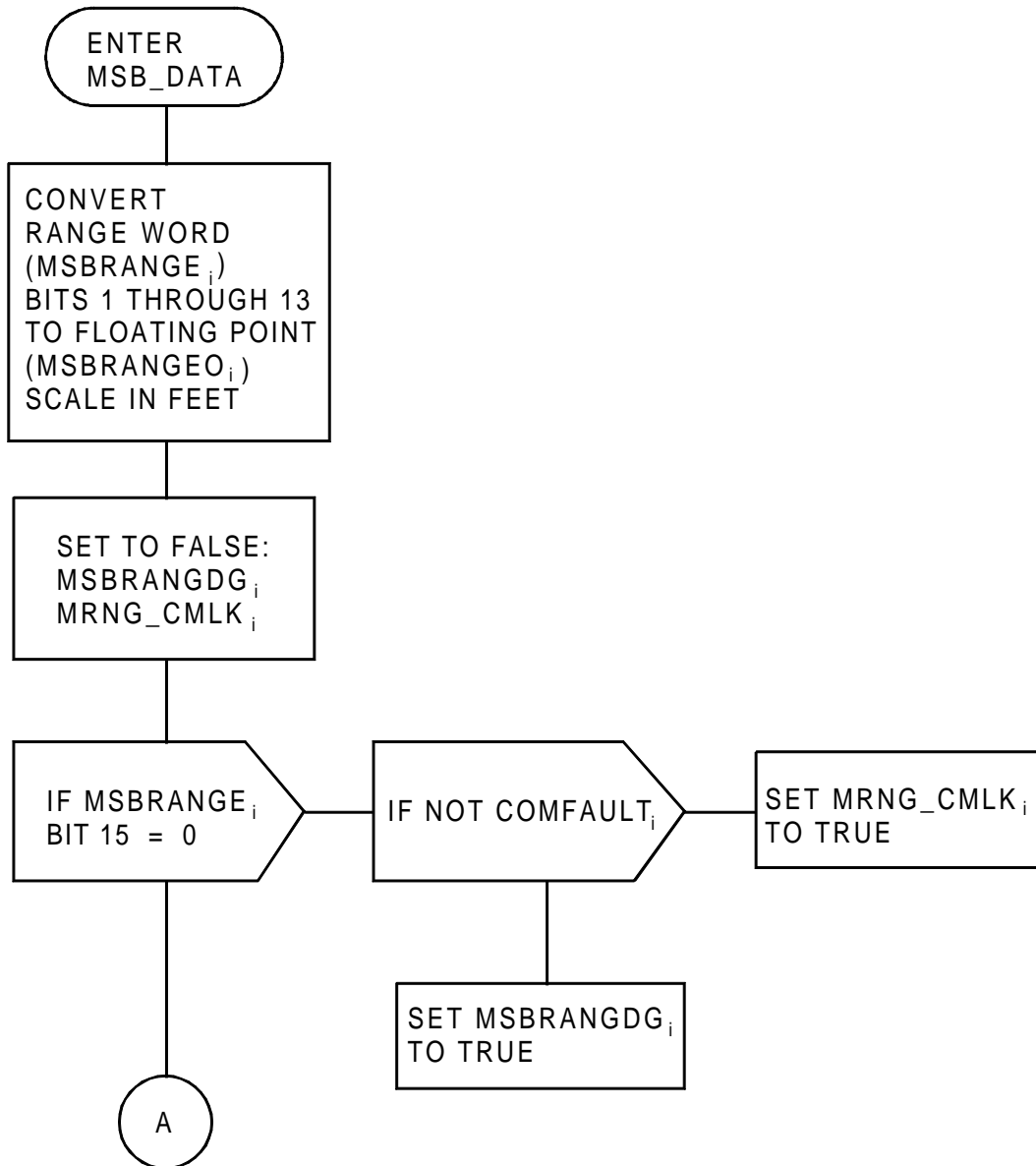


FIGURE 4.44.6.2-1.(1) MSB\_DATA Flow Diagram (Sheet 1 of 3)

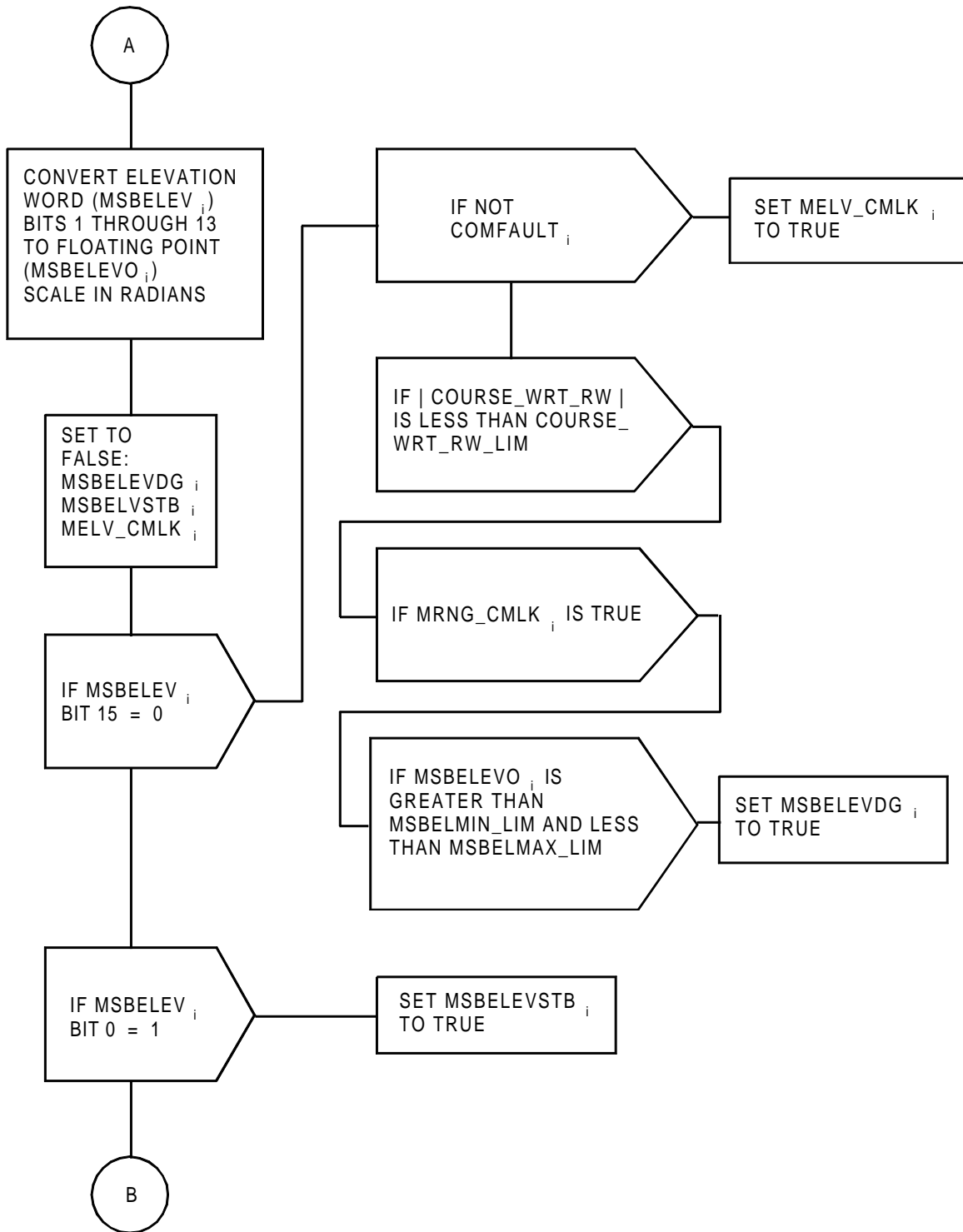


FIGURE 4.44.6.2-1.(2) MSB\_DATA Flow Diagram (Sheet 2 of 3)

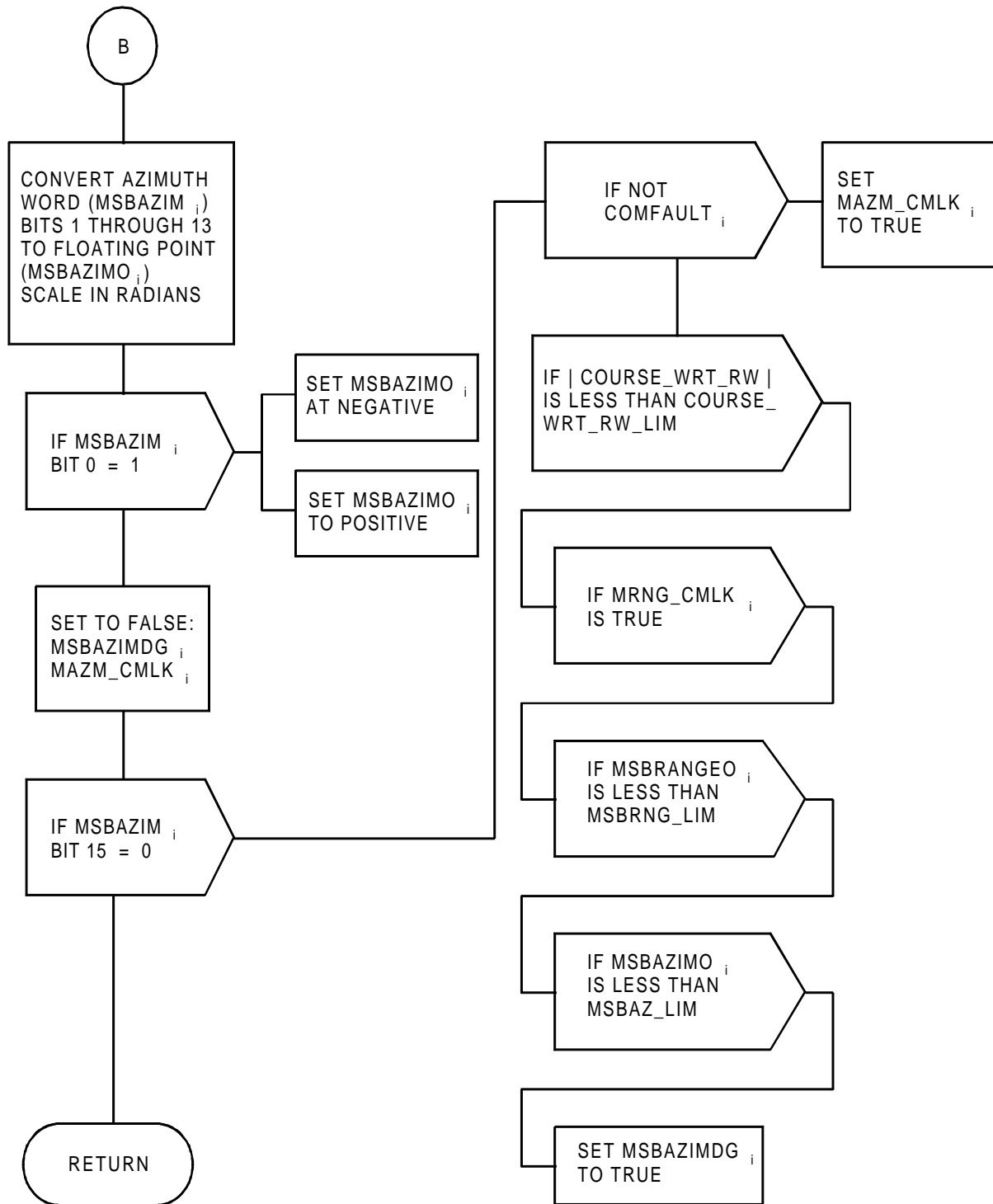


FIGURE 4.44.6.2-1.(3) MSB\_DATA Flow Diagram (Sheet 3 of 3)

TABLE 4.44.6.3-1. INPUT FUNCTIONAL PARAMETERS FOR MICROWAVE SCAN BEAM LANDING SYSTEM SOP (G4.44)

| FSSR NAME         | M/S ID     | NOMENCLATURE                     | SOURCE   | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-------------------|------------|----------------------------------|----------|-------|-----------|---------|---------|-------|
| CLOCK/CLOCKTIME   | V91W5000C  | CLOCK-COMPUTER(GMT)              | FCOS     | S     |           |         | 93160B  | *     |
| COURSE_WRT_RW/PSD | V95H0225CB | COURSE WRT RW CENTERLINE         | TAEM UPP | DEG   |           |         | 93017G  | *     |
| COURSE_WRT_RW/PSD | V95H0225CC | COURSE WRT RW CENTERLINE         | A/L UPP  | DEG   |           |         | 93017G  | *     |
| COURSE_WRT_RW/PSD | V95H0225CD | COURSE WRT RW CENTERLINE         | RTLS UPP | DEG   |           |         | 93017G  | *     |
| MSBAZIMIN(1)      | V74M1010P  | MSBLS NO 1 AZIMUTH WORD          | MSBLS 1  |       | HMD       |         | 93017G  | *     |
| MSBAZIMIN(2)      | V74M1110P  | MSBLS NO 2 AZIMUTH WORD          | MSBLS 2  |       | HMD       |         | 93017G  | *     |
| MSBAZIMIN(3)      | V74M1210P  | MSBLS NO 3 AZIMUTH WORD          | MSBLS 3  |       | HMD       |         | 93017G  | *     |
| MSBELEVIN(1)      | V74M1030P  | MSBLS NO 1 ELEVATION WORD        | MSBLS 1  |       | HMD       |         | 93017G  | *     |
| MSBELEVIN(2)      | V74M1130P  | MSBLS NO 2 ELEVATION WORD        | MSBLS 2  |       | HMD       |         | 93017G  | *     |
| MSBELEVIN(3)      | V74M1230P  | MSBLS NO 3 ELEVATION WORD        | MSBLS 3  |       | HMD       |         | 93017G  | *     |
| MSBLS_CF(1)       | V91X3550X  | MSBLS 1 COMMFAULT                | FCOS     |       |           |         |         |       |
| MSBLS_CF(2)       | V91X3560X  | MSBLS 2 COMMFAULT                | FCOS     |       |           |         |         |       |
| MSBLS_CF(3)       | V91X3570X  | MSBLS 3 COMMFAULT                | FCOS     |       |           |         |         |       |
| MSBPOD(1)         | V74X0110X  | MSBLS NO 1 POWER STATUS          | MSBLS 1  |       | BD        |         | 93017G  | *     |
| MSBPOD(2)         | V74X0120X  | MSBLS NO 2 POWER STATUS          | MSBLS 2  |       | BD        |         | 93017G  | *     |
| MSBPOD(3)         | V74X0130X  | MSBLS NO 3 POWER STATUS          | MSBLS 3  |       | BD        |         | 93017G  | *     |
| MSBRANGIN(1)      | V74M1050P  | MSBLS NO 1 RANGE WORD            | MSBLS 1  |       | HMD       |         | 93017G  | *     |
| MSBRANGIN(2)      | V74M1150P  | MSBLS NO 2 RANGE WORD            | MSBLS 2  |       | HMD       |         | 93017G  | *     |
| MSBRANGIN(3)      | V74M1250P  | MSBLS NO 3 RANGE WORD            | MSBLS 3  |       | HMD       |         | 93017G  | *     |
| Q_AZMLS           | V90H3002C  | SELECTED MSBLS AZIMUTH-RAW       | SF       | DEG   | SPL       |         | 93017G  | *     |
| Q_ELMLS           | V90H3032C  | SELECTED MSBLS ELEVATION-RAW     | SF       | DEG   | SPL       |         | 93017G  | *     |
| Q_RANGE           | V90H3062C  | SELECTED MSBLS RANGE-RAW         | SF       | NM    | SPL       |         | 93017G  | *     |
|                   | V72M6597P  | MDM FF01 DSCR IN CD 09 CH 02     | HDWR     |       | HMD       |         | 93017G  | *     |
|                   | V72M6647P  | MDM FF02 DSCR IN CD 09 CH 02     | HDWR     |       | HMD       |         | 93017G  | *     |
|                   | V72M6697P  | MDM FF03 DSCR IN CD 09 CH 02     | HDWR     |       | HMD       |         | 93017G  | *     |
|                   | V74H1012B  | MSBLS NO 1 AZIMUTH DATA          | MSBLS 1  | DEG   | BMS       |         | 93017G  | *     |
|                   | V74H1032B  | MSBLS NO 1 ELEVATION DATA        | MSBLS 1  | DEG   | BSU       |         | 93017G  | *     |
|                   | V74H1052B  | MSBLS NO 1 RANGE DATA            | MSBLS 1  | NM    | BSU       |         | 93017G  | *     |
|                   | V74H1112B  | MSBLS NO 2 AZIMUTH DATA          | MSBLS 2  | DEG   | BMS       |         | 93017G  | *     |
|                   | V74H1132B  | MSBLS NO 2 ELEVATION DATA        | MSBLS 2  | DEG   | BSU       |         | 93017G  | *     |
|                   | V74H1152B  | MSBLS NO 2 RANGE DATA            | MSBLS 2  | NM    | BSU       |         | 93017G  | *     |
|                   | V74H1212B  | MSBLS NO 3 AZIMUTH DATA          | MSBLS 3  | DEG   | BMS       |         | 93017G  | *     |
|                   | V74H1232B  | MSBLS NO 3 ELEVATION DATA        | MSBLS 3  | DEG   | BSU       |         | 93017G  | *     |
|                   | V74H1252B  | MSBLS NO 3 RANGE DATA            | MSBLS 3  | NM    | BSU       |         | 93017G  | *     |
|                   | V74X1013B  | MSBLS NO 1 AZIMUTH TEST          | MSBLS 1  |       | BD        |         | 93017G  | *     |
|                   | V74X1014B  | MSBLS NO 1 AZIMUTH VALIDITY      | MSBLS 1  |       | BD        |         | 93017G  | *     |
|                   | V74X1031B  | MSBLS NO 1 EL AGC-XTAL CUR FAIL  | MSBLS 1  |       | BD        |         | 93017G  | *     |
|                   | V74X1033B  | MSBLS NO 1 ELEVATION TEST        | MSBLS 1  |       | BD        |         | 93017G  | *     |
|                   | V74X1034B  | MSBLS NO 1 ELEVATION VALIDITY    | MSBLS 1  |       | BD        |         | 93017G  | *     |
|                   | V74X1051B  | MSBLS NO 1 RNG AGC-XTAL CUR FAIL | MSBLS 1  |       | BD        |         | 93017G  | *     |
|                   | V74X1053B  | MSBLS NO 1 RANGE TEST            | MSBLS 1  |       | BD        |         | 93017G  | *     |
|                   | V74X1054B  | MSBLS NO 1 RANGE VALIDITY        | MSBLS 1  |       | BD        |         | 93017G  | *     |
|                   | V74X1113B  | MSBLS NO 2 AZIMUTH TEST          | MSBLS 2  |       | BD        |         | 93017G  | *     |
|                   | V74X1114B  | MSBLS NO 2 AZIMUTH VALIDITY      | MSBLS 2  |       | BD        |         | 93017G  | *     |
|                   | V74X1131B  | MSBLS NO 2 EL AGC-XTAL CUR FAIL  | MSBLS 2  |       | BD        |         | 93017G  | *     |
|                   | V74X1133B  | MSBLS NO 2 ELEVATION TEST        | MSBLS 2  |       | BD        |         | 93017G  | *     |



TABLE 4.44.6.3-1. INPUT FUNCTIONAL PARAMETERS FOR MICROWAVE SCAN BEAM LANDING SYSTEM SOP (G4.44)

| FSSR NAME | M/S ID    | NOMENCLATURE                     | SOURCE  | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|-----------|----------------------------------|---------|-------|-----------|---------|---------|-------|
|           | V74X1134B | MSBLS NO 2 ELEVATION VALIDITY    | MSBLS 2 |       | BD        |         | 93017G  | *     |
|           | V74X1151B | MSBLS NO 2 RNG AGC-XTAL CUR FAIL | MSBLS 2 |       | BD        |         | 93017G  | *     |
|           | V74X1153B | MSBLS NO 2 RANGE TEST            | MSBLS 2 |       | BD        |         | 93017G  | *     |
|           | V74X1154B | MSBLS NO 2 RANGE VALIDITY        | MSBLS 2 |       | BD        |         | 93017G  | *     |
|           | V74X1213B | MSBLS NO 3 AZIMUTH TEST          | MSBLS 3 |       | BD        |         | 93017G  | *     |
|           | V74X1214B | MSBLS NO 3 AZIMUTH VALIDITY      | MSBLS 3 |       | BD        |         | 93017G  | *     |
|           | V74X1231B | MSBLS NO 3 EL AGC-XTAL CUR FAIL  | MSBLS 3 |       | BD        |         | 93017G  | *     |
|           | V74X1233B | MSBLS NO 3 ELEVATION TEST        | MSBLS 3 |       | BD        |         | 93017G  | *     |
|           | V74X1234B | MSBLS NO 3 ELEVATION VALIDITY    | MSBLS 3 |       | BD        |         | 93017G  | *     |
|           | V74X1251B | MSBLS NO 3 RNG AGC-XTAL CUR FAIL | MSBLS 3 |       | BD        |         | 93017G  | *     |
|           | V74X1253B | MSBLS NO 3 RANGE TEST            | MSBLS 3 |       | BD        |         | 93017G  | *     |
|           | V74X1254B | MSBLS NO 3 RANGE VALIDITY        | MSBLS 3 |       | BD        |         | 93017G  | *     |

**NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.**

TABLE 4.44.6.3-2. OUTPUT FUNCTIONAL PARAMETERS FROM MICROWAVE SCAN BEAM LANDING SYSTEM SOP (G4.44)

| FSSR NAME    | M/S ID    | NOMENCLATURE                       | DESTINATION                                      | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|--------------|-----------|------------------------------------|--------------------------------------------------|-------|-----------|---------|---------|-------|
| MAZM_CMLK(1) | V95X6058X | MSBLS 1 AZ COMFAULT/LOCKON FLAG    | ASC AREA NAV<br>ENT AREA NAV                     |       |           |         | 92297B  |       |
| MAZM_CMLK(2) | V95X6064X | MSBLS 2 AZ COMFAULT/LOCKON FLAG    | ASC AREA NAV<br>ENT AREA NAV                     |       |           |         | 92297B  |       |
| MAZM_CMLK(3) | V95X6069X | MSBLS 3 AZ COMFAULT/LOCKON FLAG    | ASC AREA NAV<br>ENT AREA NAV                     |       |           |         | 92297B  |       |
| MELV_CMLK(1) | V95X6057X | MSBLS 1 EL COMFAULT/LOCKON FLAG    | ASC AREA NAV<br>ENT AREA NAV                     |       |           |         | 92297B  |       |
| MELV_CMLK(2) | V95X6063X | MSBLS 2 EL COMFAULT/LOCKON FLAG    | ASC AREA NAV<br>ENT AREA NAV                     |       |           |         | 92297B  |       |
| MELV_CMLK(3) | V95X6068X | MSBLS 3 EL COMFAULT/LOCKON FLAG    | ASC AREA NAV<br>ENT AREA NAV                     |       |           |         | 92297B  |       |
| MRNG_CMLK(1) | V95X6056X | MSBLS 1 RANGE COMFAULT/LOCKON FLAG | ASC AREA NAV<br>ENT AREA NAV                     |       |           |         | 92297B  |       |
| MRNG_CMLK(2) | V95X6062X | MSBLS 2 RANGE COMFAULT/LOCKON FLAG | ASC AREA NAV<br>ENT AREA NAV                     |       |           |         | 92297B  |       |
| MRNG_CMLK(3) | V95X6067X | MSBLS 3 RANGE COMFAULT/LOCKON FLAG | ASC AREA NAV<br>ENT AREA NAV                     |       |           |         | 92297B  |       |
| MSBAZIMDG(1) | V95X6124X | MSBLS 1 AZIMUTH LOCKED ON          | GAX<br>MSBLS FDIR<br>SF                          |       |           |         | 92297B  |       |
| MSBAZIMDG(2) | V95X6224X | MSBLS 2 AZIMUTH LOCKED ON          | GAX<br>MSBLS FDIR<br>SF                          |       |           |         | 92297B  |       |
| MSBAZIMDG(3) | V95X6324X | MSBLS 3 AZIMUTH LOCKED ON          | GAX<br>MSBLS FDIR<br>SF                          |       |           |         | 92297B  |       |
| MSBAZIMO(1)  | V95H6122C | MSBLS 1 AZIMUTH OUT                | ASC AREA NAV<br>ENT AREA NAV<br>MSBLS FDIR<br>SF | RAD   |           |         | 90278D  |       |
| MSBAZIMO(2)  | V95H6222C | MSBLS 2 AZIMUTH OUT                | ASC AREA NAV<br>ENT AREA NAV<br>MSBLS FDIR<br>SF | RAD   |           |         | 90278D  |       |
| MSBAZIMO(3)  | V95H6322C | MSBLS 3 AZIMUTH OUT                | ASC AREA NAV<br>ENT AREA NAV<br>MSBLS FDIR<br>SF | RAD   |           |         | 90278D  |       |
| MSBAZIMTIM   | V95W6010C | MSBLS AZIMUTH MEASUREMENT TIME     | DL FMT 23/1<br>PRELAND NAV<br>RTL NAV            | S     | DPL       |         | 93017G  | *     |
| MSBELEVDG(1) | V95X6144X | MSBLS 1 ELEVATION LOCKED ON        | GAX<br>MSBLS FDIR<br>SF                          |       |           |         | 92297B  |       |

TABLE 4.44.6.3-2. OUTPUT FUNCTIONAL PARAMETERS FROM MICROWAVE SCAN BEAM LANDING SYSTEM SOP (G4.44)

| FSSR NAME    | M/S ID    | NOMENCLATURE                       | DESTINATION                                      | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|--------------|-----------|------------------------------------|--------------------------------------------------|-------|-----------|---------|---------|-------|
| MSBELEVDG(2) | V95X6244X | MSBLS 2 ELEVATION LOCKED ON        | GAX<br>MSBLS FDIR<br>SF                          |       |           |         | 92297B  |       |
| MSBELEVDG(3) | V95X6344X | MSBLS 3 ELEVATION LOCKED ON        | GAX<br>MSBLS FDIR<br>SF                          |       |           |         | 92297B  |       |
| MSBELEVO(1)  | V95H6142C | MSBLS 1 ELEVATION OUT              | ASC AREA NAV<br>ENT AREA NAV<br>MSBLS FDIR<br>SF | RAD   |           |         | 90278D  |       |
| MSBELEVO(2)  | V95H6242C | MSBLS 2 ELEVATION OUT              | ASC AREA NAV<br>ENT AREA NAV<br>MSBLS FDIR<br>SF | RAD   |           |         | 90278D  |       |
| MSBELEVO(3)  | V95H6342C | MSBLS 3 ELEVATION OUT              | ASC AREA NAV<br>ENT AREA NAV<br>MSBLS FDIR<br>SF | RAD   |           |         | 90278D  |       |
| MSBELEVTIM   | V95W6020C | MSBLS ELEVATION MEASUREMENT TIME   | DL FMT 23/1<br>PRELAND NAV<br>RTLS NAV           | S     | DPL       |         | 93017G  | *     |
| MSBELVSTB(1) | V95X6148X | MSBLS NO 1 ELEVATION SELF TEST BAD | MSBLS FDIR                                       |       |           |         |         |       |
| MSBELVSTB(2) | V95X6248X | MSBLS NO 2 ELEVATION SELF TEST BAD | MSBLS FDIR                                       |       |           |         |         |       |
| MSBELVSTB(3) | V95X6348X | MSBLS NO 3 ELEVATION SELF TEST BAD | MSBLS FDIR                                       |       |           |         |         |       |
| MSBRANGDG(1) | V95X6104X | MSBLS 1 RANGE LOCKED ON            | GAX<br>MSBLS FDIR<br>SF                          |       |           |         | 92297B  |       |
| MSBRANGDG(2) | V95X6204X | MSBLS 2 RANGE LOCKED ON            | GAX<br>MSBLS FDIR<br>SF                          |       |           |         | 92297B  |       |
| MSBRANGDG(3) | V95X6304X | MSBLS 3 RANGE LOCKED ON            | GAX<br>MSBLS FDIR<br>SF                          |       |           |         | 92297B  |       |
| MSBRANGE0(1) | V95H6102C | MSBLS 1 RANGE OUT                  | ASC AREA NAV<br>ENT AREA NAV<br>MSBLS FDIR<br>SF | FT    |           |         | 90278D  |       |
| MSBRANGE0(2) | V95H6202C | MSBLS 2 RANGE OUT                  | ASC AREA NAV<br>ENT AREA NAV<br>MSBLS FDIR<br>SF | FT    |           |         | 90278D  |       |
| MSBRANGE0(3) | V95H6302C | MSBLS 3 RANGE OUT                  | ASC AREA NAV<br>ENT AREA NAV<br>MSBLS FDIR<br>SF | FT    |           |         | 90278D  |       |

TABLE 4.44.6.3-2. OUTPUT FUNCTIONAL PARAMETERS FROM MICROWAVE SCAN BEAM LANDING SYSTEM SOP (G4.44)

| FSSR NAME  | M/S ID    | NOMENCLATURE                  | DESTINATION                            | UNITS | DATA TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|------------|-----------|-------------------------------|----------------------------------------|-------|-----------|------------------|---------|-------------|
| MSBRANGTIM | V95W6000C | MSBLS RANGE MEASUREMENT TIME  | DL FMT 23/1<br>PRELAND NAV<br>RTLS NAV | S     | DPL       |                  | 93017G  | *           |
| SQ_AZMLS   | V95H6021C | SELECTED MSBLS AZIMUTH-SCLD   | PRELAND NAV<br>RTLS NAV                | RAD   |           |                  | 89137C  |             |
| SQ_ELMLS   | V95H6022C | SELECTED MSBLS ELEVATION-SCLD | PRELAND NAV<br>RTLS NAV                | RAD   |           |                  | 89137C  |             |
| SQ_RANGE   | V95H6023C | SELECTED MSBLS RANGE-SCLD     | PRELAND NAV<br>RTLS NAV                | FT    |           |                  | 89137C  |             |

**NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.**

**Rate Codes: (HDR Only) 1 = 1 sample/sec 2 = 5 samples/sec 3 = 12.5 samples/sec 4 = 25 samples/sec 5 = 100 samples/sec  
(HDR and LDR) A = 1 sample/sec B = 5 samples/sec C = 12.5 samples/sec D = 25 samples/sec E = 100 samples/sec**

TABLE 4.44.6.3-3. MICROWAVE SCAN BEAM LANDING SYSTEM SOP (G4.44) I-LOADS

| FSSR NAME         | MSID      | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R<br>E<br>V |
|-------------------|-----------|-----------|----|----|---|---|---------|----|-----|---------|-------------|
| COURSE_WRT_RW_LIM | V99U5723C | RAD       | F  | S  | D | P | G4.44   | 00 | MSI | DC0755  |             |
| MSBAZ_LIM         | V99U5719C | RAD       | F  | S  | D | P | G4.44   | 00 | MSI | DC0755  |             |
| MSBELMAX_LIM      | V99U5720C | RAD       | F  | S  | D | P | G4.44   | 00 | MSI | DC0755  |             |
| MSBELMIN_LIM      | V99U5721C | RAD       | F  | S  | D | P | G4.44   | 00 | MSI | DC0755  |             |
| MSBRNG_LIM        | V99U5722C | NMI       | F  | S  | D | P | G4.44   | 00 | MSI | DC0755  |             |

**NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.**

TABLE 4.44.6.3-4. MICROWAVE SCAN BEAM LANDING SYSTEM SOP (G4.44) K-LOADS

| FSSR NAME<br>DESCRIPTION | MSID | MC | KLOAD VALUE | ENG UNITS | DT | P<br>R | S | PR FCTN | LAST CR | R<br>E<br>V |
|--------------------------|------|----|-------------|-----------|----|--------|---|---------|---------|-------------|
|--------------------------|------|----|-------------|-----------|----|--------|---|---------|---------|-------------|

NO REQUIREMENTS

**NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.**

TABLE 4.44.6.3-5. MICROWAVE SCAN BEAM LANDING SYSTEM SOP (G4.44) CONSTANTS

| FSSR NAME<br>DESCRIPTION                       | MSID      | MC | CONSTANT VALUE | ENG UNITS   | DT | P<br>R | S   | PR FCTN                 | LAST CR | R<br>E<br>V |
|------------------------------------------------|-----------|----|----------------|-------------|----|--------|-----|-------------------------|---------|-------------|
| FT_PER_NMI<br>NAUTICAL MILE TO FEET CONVERSION | V97U6791C | 00 | +6.0761155     | E+03 FT/NMI | F  |        | S P | A6.9<br>G4.213<br>G4.44 | 90374C  |             |

**NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.**

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## **4.45 RADAR ALTIMETER SUBSYSTEM OPERATING PROGRAM.**

This section defines the detailed functional requirements and formulations for the radar altimeter (RA) subsystem operating program (SOP). The RA SOP defines software associated with radar altimeter altitude (height above terrain) data processing.

### **4.45.1 Radar Altimeter Requirements Overview.**

#### **4.45.1.1 Radar Altimeter Functional Overview.**

The RA is a C-band altimeter system that provides an indication of the orbiter altitude from 5000 feet to touchdown. The RA requires no ground station information as is the case with the other navigation sensors. The RA system provides altitude from the antenna to the nearest point on the terrain. The orbiter design contains two identical independent RA subsystems for redundancy purposes. A single RA subsystem is depicted in Figure 4.45.1.1-1 along with related interfacing equipment. Six major components are identified that are required for the RA function: a control head, an MDM (multiplexer/demultiplexer), a receiver-transmitter (R/T), a transmitting antenna, a receiving antenna, and the onboard computer. The keyboard and the display electronics unit are also required for the crew to initiate self-test command of the RA R/T.

The RA control head (panel switch) has a two-position function switch. The two positions of the function switch are ON and OFF. When the switch is in the ON position, power is applied to the R/T and a power-present discrete returns from the R/T to the MDM. Software control of the RA is limited to processing the self-test command. The RA self-test requirements are documented in the VU requirements.

##### **4.45.1.1.1 Radar Altimeter Operating Modes.**

The radar altimeter operating modes are as follows:

- OFF mode
- ON mode
- SELF-TEST mode

The OFF mode is indicated when the power-on discrete from the RA is in the false or off state.

The ON mode occurs when the power-on discrete from the RA is in the true or on state.

The SELF-TEST mode occurs when the power-on discrete is on and self-test is commanded from the keyboard. In this mode the transceiver tests the internal circuits and provides output data that indicates the health of the transceiver.

#### **4.45.1.1.2 Radar Altimeter Digital Interfaces.**

The radar altimeter interfaces with the GPC via the serial digital multiplex/demultiplex input and output data channels. The digital I/O words are 16 bits in size, plus 3 bits for synchronization and 1 bit for odd parity. Throughout the RA SOP, the synchronization and parity bits are disregarded and the most significant data bit in the word is designated as bit 0 with the least significant bit being bit 15. The contents, format, and bit values of the RA data words are illustrated in Figure 4.45.1.1.2-1 and Figure 4.45.1.1.2-2.

#### **4.45.1.1.3 Radar Altimeter Discrete Interfaces.**

The radar altimeter requires the following discrete interfaces: power-on discrete and self-test command.

The power-on discrete is generated by the RA and is true when power is applied and the RA is operating. The self-test command is generated by VU software. The self-test command causes the RA to perform self-test.

#### **4.45.1.2 RA SOP Overview.**

The RA SOP controls and monitors the operation of the two RA systems and processes RA data for other program elements. The inputs and outputs from the RA SOP modules are stored in locations labeled as to parameter and transceiver.

Each RA transceiver is serviced in sequence, and the altitude data and data good signals are made available to the selection filter and the AVVI processor. The time tag for radar altimeter data is made available to user parameter processing.

Refer to Figure 4.45.1.2-1 for a block diagram depicting the signal flow.

RA data processing is performed on each transceiver at a rate of 6.25 Hz. The RA\_DATA functional module accepts RA outputs and removes the flag bits for use by other program elements and converts altitude from fixed-point to floating-point data.

#### **4.45.1.3 Radar Altimeter SOP Functional Module Summary.**

The functional modules that constitute the RA SOP are identified in Table 4.45.1.3-1. Each of the modules, including functions and formulations, are presented in detail in Section 4.45.6.

#### **4.45.1.4 Reference Documents.**

MC409-0015 Altimeter, Radar; Rockwell.

#### **4.45.1.5 Software Protection.**

The software implementation of the RA SOP shall protect against program checks and error interrupts caused by the transient-type errors or bad data inputs. Specifically, the RA SOP shall protect against all of the error conditions identified in paragraph 3.6 that are applicable to the RA software design and code.

#### **4.45.2 Definitions.**

This section is not applicable to the RA SOP.

#### 4.45.3 Functional Requirements Traceability.

The detailed requirements and formulations contained herein satisfy the GN&C, Level B, CPDS functional requirements for the RA SOP.

#### 4.45.4 Interface Parameters.

The interface parameters required to properly execute the RA SOP functional module are shown in Table 4.45.4-1.

#### 4.45.5 Radar Altimeter Initialization.

No I-load parameters are required for RA data processing.

#### 4.45.6 Detailed Requirements and Formulations.

This section defines the RA SOP functional module in sufficient detail to create a software design and to generate computer code. The module defines the functional requirements, interface requirements, detailed requirements and formulations, and special considerations if applicable. A flow diagram is also included; however, the flow diagram is supplementary material and is not intended to convey requirements or to place restrictions on software design or coding.

##### 4.45.6.1 RA Data Processing (RA\_DATA).

The purpose of the RA\_DATA functional module is to process the RA input data from a powered RA.

A. Functional Requirements. The RA\_DATA module is required to perform the following functions for each RA.

1. Accept the data words input from the RA and strip off the flag bits. Test data word input for odd parity and set RAPODD flag.
2. Generate the data good and comlock flags.
3. Convert altitude data from fixed point to floating point.

B. Interface Requirements. The input and output parameters associated with the RA\_DATA functional module are contained in Table 4.45.4-1.

C. Functional Requirements and Formulations. The following operations shall be performed for each RA transceiver at a rate of 6.25 Hz.

1. RA Altitude Out. RA altitude out (RA\_ALTO) is contained in the RA parent word, RA\_ALTIN, as a 13-bit binary word (Figure 4.45.1.1.2-2). The most significant bit is bit 1. The least significant bit is bit 13 with a value of 1 foot. Extract bits 1 through 13 of the RA input word (RA\_ALTIN<sub>i</sub>) and form RA\_ALTO<sub>i</sub> in floating point in units of feet.

The RA parent word will be tested for odd parity. The 16 binary stages of the RA parent word will be summed and will be said to be true if the sum is an odd number. RAPODD will be set true if the sum is odd.

2. RA Altitude Lock-On and Comlock. The RA altitude lock-on, RALT\_DG, is driven by bit 14 of the RA parent word (RA\_ALTIN). RALT\_DG is a two-state flag indicating data good or bad. True indicates good data. If RAPODD is true and if RA\_ALTIN<sub>i</sub> bit 14 = true, then set RALT\_DG<sub>i</sub> to true; else set RALT\_DG<sub>i</sub> to false.

If RA<sub>i</sub> altitude is locked on and if there is no commfault, set RALT\_CMLK<sub>i</sub> flag to true; else set RALT\_CMLK<sub>i</sub> flag false.

Note that the RALT\_CMLK<sub>i</sub> flag status is only required to be computed for the AVVI processor at a rate of 1.04 Hz

3. RA Time Tag. Set the RA time tag parameter, RA\_TIME, equal to the computer clock time, CLOCK, corresponding to the current RA input read transaction time.

Figure 4.45.6.1-1 nresents a flow diagram for the RA\_DATA functional module.

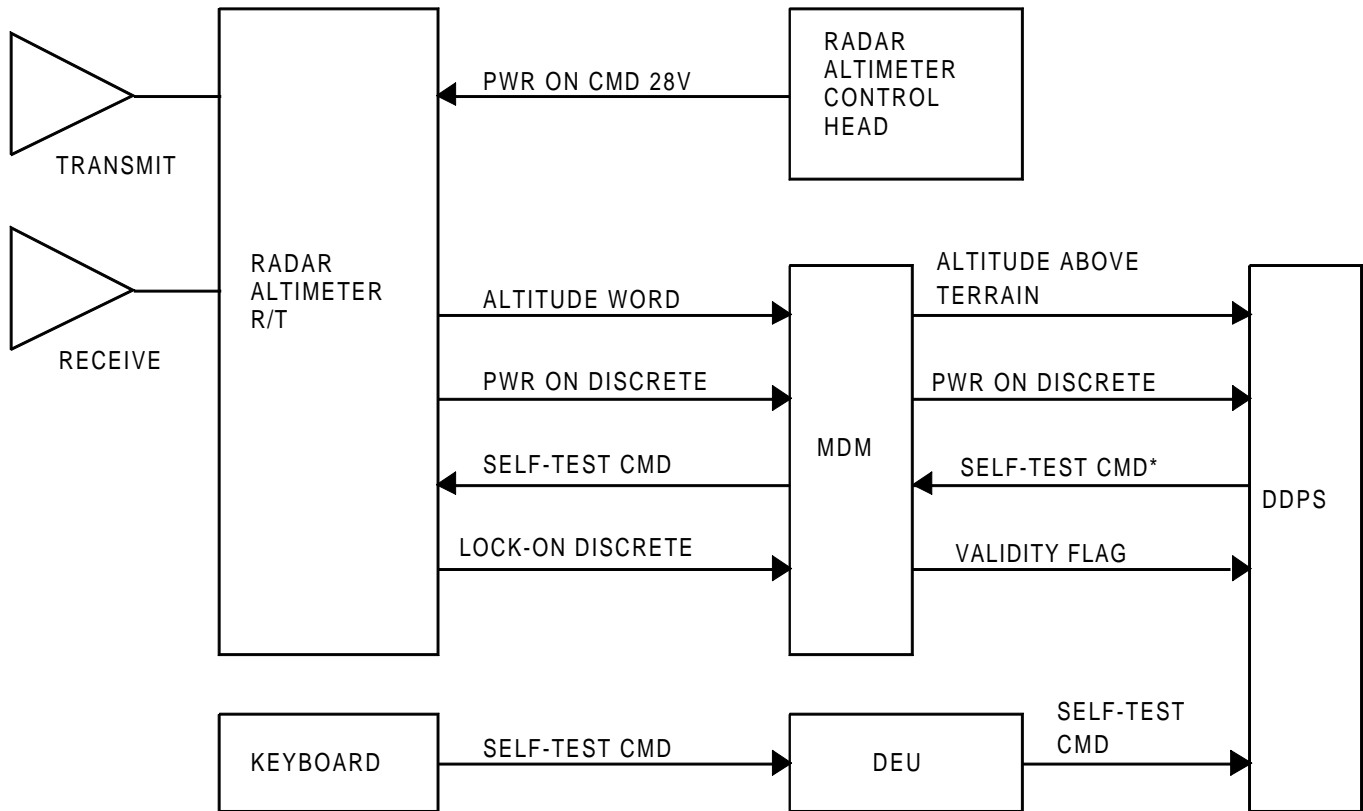
#### 4.45.6.2 Applicable Tables for RA SOP.

The IDD inputs and outputs are listed in Tables 4.45.6.2-1. and 4.45.6.2-2 Values for the I-loads are contained in the I-loads requirements document (JSC-19350); however, I-load definitions applicable to this principal function are listed in Table 4.45.6.2-3. K-loads are listed in Table 4.45.6.2-4. Constants are listed in Table 4.45.6.2-5.

| Table 4.45.1.3-1. RA SOP Functional Modules |                      |                                 |
|---------------------------------------------|----------------------|---------------------------------|
| Module Name                                 | Applicable Paragraph | Module Description              |
| RA_DATA                                     | 4.45.6.1             | Radar Altimeter Data Processing |

Table 4.45.4-1. Radar Altimeter Interface Table

| Name         | MSID                | Description                        | Input Source | Output Destination                                  | Signal Type | Range   | Units   | Rate (Hz)    |
|--------------|---------------------|------------------------------------|--------------|-----------------------------------------------------|-------------|---------|---------|--------------|
| RA_ALTIN(1)  | V74M1801P<br>G08500 | RADAR ALT NO. 1<br>PARENT WORD     | RA1          |                                                     | FIXED PT    | 0, 8200 | FEET    | 6.25         |
| RA_ALTIN(2)  | V74M1851P<br>G08501 | RADAR ALT NO. 2<br>PARENT WORD     | RA2          |                                                     | FIXED PT    | 0, 8200 | FEET    | 6.25         |
| CLOCK        | V91W5000C<br>G07829 | CLOCK-COMPUTER<br>(GMT)            | FCOS         |                                                     | FLOAT PT    | NA      | D:H:M:S | 6.25         |
| RA_ALTO(1)   | V95H7100C<br>G08405 | RADAR ALTIMETER<br>NO. 1 ALTITUDE  |              | SF 4.71<br>AVVI PROC<br>4.106<br>TLM                | FLOAT PT    | 0, 8200 | FEET    | 6.25<br>6.25 |
| RA_ALTO(2)   | V95H7200C<br>G08406 | RADAR ALTIMETER<br>NO. 2 ALTITUDE  |              | SF 4.71<br>AVVI PROC<br>4.106<br>TLM                | FLOAT PT    | 0, 8200 | FEET    | 6.25<br>6.25 |
| RALT_DG(1)   | V95X7110X<br>G08403 | RADAR ALTIMETER<br>NO. 1 LOCKED ON |              | SF 4.71<br>TLM                                      | LOGICAL     | 0, 1    | NA      | 6.25         |
| RALT_DG(2)   | V95X7210X<br>G08404 | RADAR ALTIMETER<br>NO. 2 LOCKED ON |              | SF 4.71<br>TLM                                      | LOGICAL     | 0, 1    | NA      | 6.25         |
| RALT_CF(1)   | V91X3600X<br>G16502 | RADAR ALTIMETER 1<br>COMMFAULT     | FCOS         |                                                     | LOGICAL     | 0, 1    | NA      | 6.25         |
| RALT_CF(2)   | V91X3620X<br>G16503 | RADAR ALTIMETER 2<br>COMMFAULT     | FCOS         |                                                     | LOGICAL     | 0, 1    | NA      | 6.25         |
| RA_TIME      | V95W7000C<br>G08407 | RADAR ALTIMETER<br>TIME            |              | TAEM UPP<br>4.24<br>A/L UPP<br>4.25 RTLS<br>UPP TLM | FLOAT PT    | NA      | SEC     | 6.25<br>6.25 |
| RALT_CMLK(1) | V95X7130X           | RA 1 COMMFAULT/<br>LOCKON FLAG     |              | AVVI PROC<br>4.106                                  | LOGICAL     | 0, 1    | NA      | 1.04         |
| RALT_CMLK(2) | V95X7230X           | RA 2<br>COMMFAULT/<br>LOCKON FLAG  |              | AVVI PROC<br>4.106                                  | LOGICAL     | 0, 1    | NA      | 1.04         |
| RA_PWR_ON(1) | V74S0175E           | RADAR ALTIMETER<br>NO. 1 READY     | RA1          | —                                                   | DISCRETE    | 0, 1    | NA      | 6.25         |
| RA_PWR_ON(2) | V74S0185E           | RADAR ALTIMETER<br>NO. 2 READY     | RA2          | —                                                   | DISCRETE    | 0, 1    | NA      | 6.25         |



\*SOFTWARE REQUIREMENTS ARE SPECIFIED IN THE VU CPDS.

FIGURE 4.45.1.1-1. Radar Altimeter Subsystem Diagram

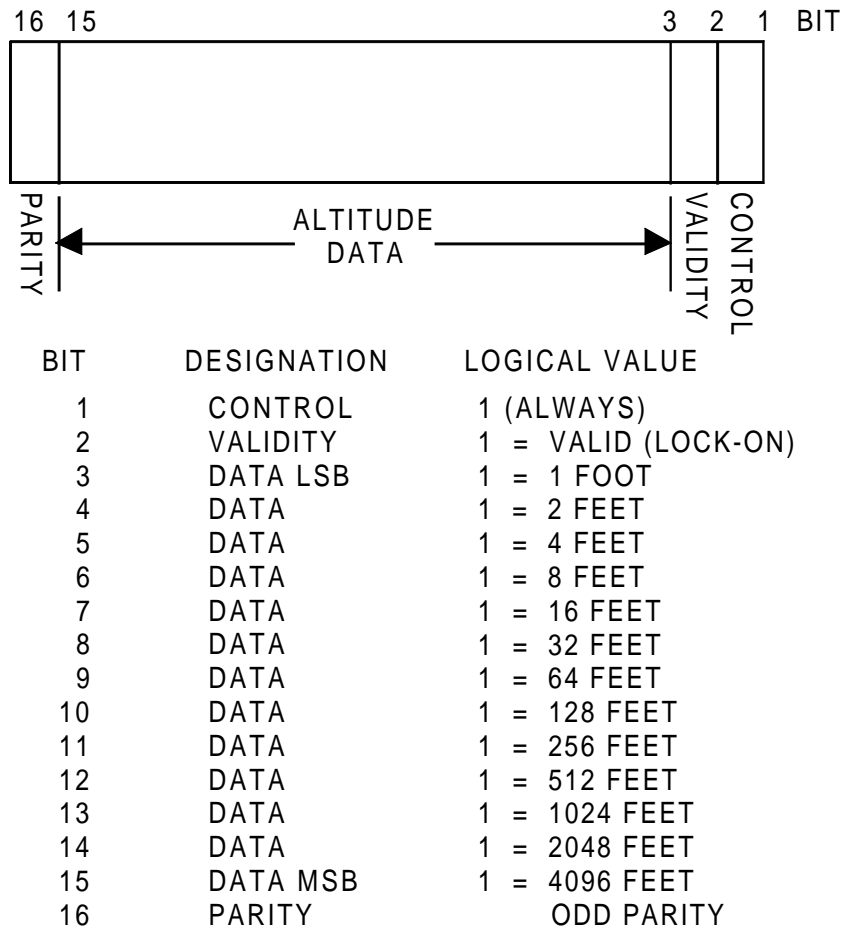
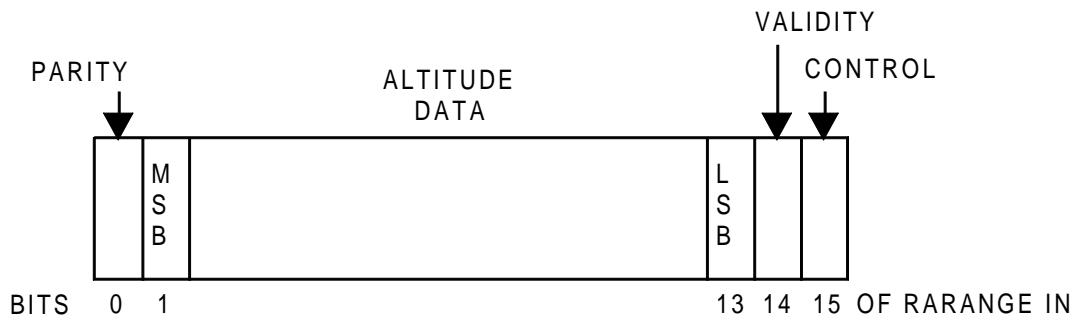


FIGURE 4.45.1.1.2-1. RA Altitude Data Word (From RA to MDM)



| BIT | DESIGNATION | VALUE               |
|-----|-------------|---------------------|
| 0   | PARITY      | ODD PARITY          |
| 1   | DATA MSB    | 1 = 4096 FT         |
| 2   | DATA        | 1 = 2048 FT         |
| 3   | DATA        | 1 = 1024 FT         |
| 4   | DATA        | 1 = 512 FT          |
| 5   | DATA        | 1 = 256 FT          |
| 6   | DATA        | 1 = 128 FT          |
| 7   | DATA        | 1 = 64 FT           |
| 8   | DATA        | 1 = 32 FT           |
| 9   | DATA        | 1 = 16 FT           |
| 10  | DATA        | 1 = 8 FT            |
| 11  | DATA        | 1 = 4 FT            |
| 12  | DATA        | 1 = 2 FT            |
| 13  | DATA LSB    | 1 = 1 FT            |
| 14  | VALIDITY    | 1 = VALID (LOCK ON) |
| 15  | CONTROL     | 1 (ALWAYS)          |

FIGURE 4.45.1.1.2-2. RA Altitude Data Word (From MDM to GPC)



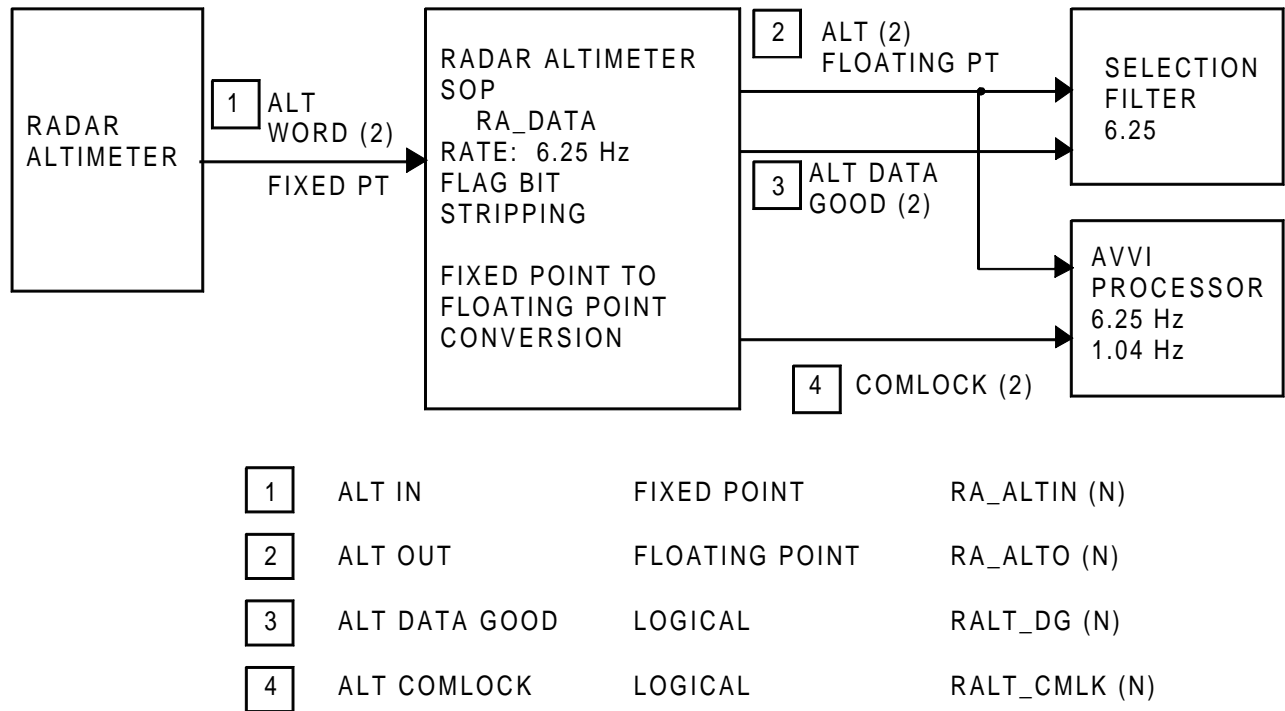


FIGURE 4.45.1.2-1. Radar Altimeter Data Signal Flow

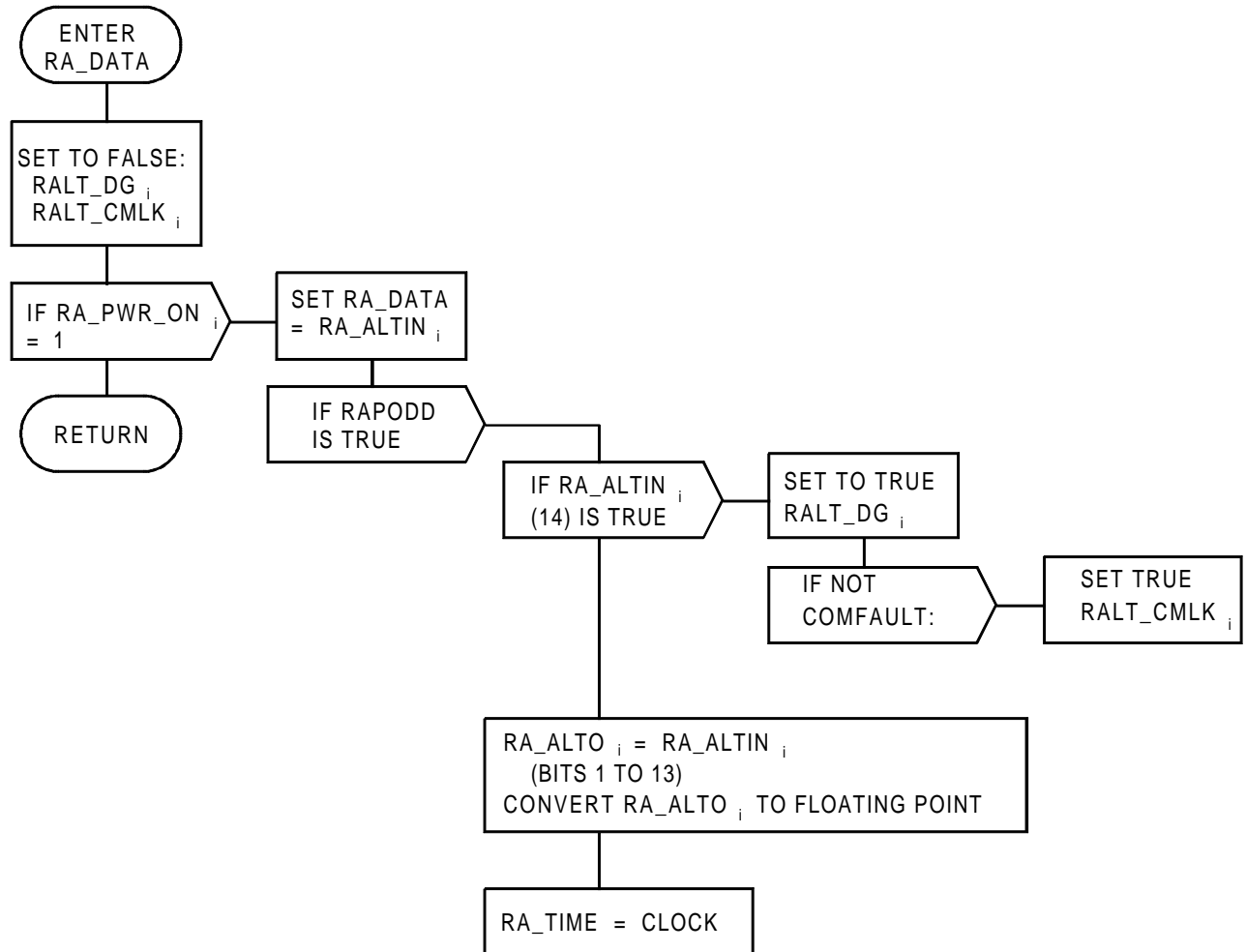


FIGURE 4.45.6.1-1. RA\_DATA Flow Diagram

TABLE 4.45.6.2-1. INPUT FUNCTIONAL PARAMETERS FOR RADAR ALTIMETER SUBSYSTEM OPERATING PROGRAM (G4.45)

| FSSR NAME       | M/S ID    | NOMENCLATURE                | SOURCE | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------------|-----------|-----------------------------|--------|-------|-----------|---------|---------|-------|
| CLOCK/CLOCKTIME | V91W5000C | CLOCK-COMPUTER(GMT)         | FCOS   | S     |           |         | 93160B  | *     |
| RALT_CF(1)      | V91X3600X | RADAR ALTIMETER 1 COMMFAULT | FCOS   |       |           |         |         |       |
| RALT_CF(2)      | V91X3620X | RADAR ALTIMETER 2 COMMFAULT | FCOS   |       |           |         |         |       |
| RA_ALTIN(1)     | V74M1801P | RADAR ALT NO 1 PARENT WORD  | RA 1   | FT    | HMD       |         | 93017G  | *     |
| RA_ALTIN(2)     | V74M1851P | RADAR ALT NO 2 PARENT WORD  | RA 2   | FT    | HMD       |         | 93017G  | *     |

**NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.**

TABLE 4.45.6.2-2. OUTPUT FUNCTIONAL PARAMETERS FROM RADAR ALTIMETER SUBSYSTEM OPERATING PROGRAM  
(G4.45)

| FSSR NAME    | M/S ID    | NOMENCLATURE                   | DESTINATION                                               | UNITS | DATA<br>TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|--------------|-----------|--------------------------------|-----------------------------------------------------------|-------|--------------|------------------|---------|-------------|
| RALT_CMLK(1) | V95X7130X | RA 1 COMMFault/LOCKON FLAG     | AVVI PROC                                                 |       |              |                  |         |             |
| RALT_CMLK(2) | V95X7230X | RA 2 COMMFault/LOCKON FLAG     | AVVI PROC                                                 |       |              |                  |         |             |
| RALT_DG(1)   | V95X7110X | RADAR ALTIMETER NO 1 LOCKED ON | SF<br>TLM                                                 |       |              |                  |         |             |
| RALT_DG(2)   | V95X7210X | RADAR ALTIMETER NO 2 LOCKED ON | SF<br>TLM                                                 |       |              |                  |         |             |
| RA_ALTO(1)   | V95H7100C | RADAR ALTIMETER NO 1 ALTITUDE  | AVVI PROC<br>SF<br>TLM                                    | FT    |              |                  |         |             |
| RA_ALTO(2)   | V95H7200C | RADAR ALTIMETER NO 2 ALTITUDE  | AVVI PROC<br>SF<br>TLM                                    | FT    |              |                  |         |             |
| RA_TIME      | V95W7000C | RADAR ALTIMETER TIME           | A/L UPP<br>DL FMT 23/2<br>GPS SOP<br>RTLS UPP<br>TAEM UPP | S     | DPL          |                  | 93017G  | *           |

**NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.**

**Rate Codes: (HDR Only) 1 = 1 sample/sec 2 = 5 samples/sec 3 = 12.5 samples/sec 4 = 25 samples/sec 5 = 100 samples/sec  
(HDR and LDR) A = 1 sample/sec B = 5 samples/sec C = 12.5 samples/sec D = 25 samples/sec E = 100 samples/sec**

TABLE 4.45.6.2-3. RADAR ALTIMETER SUBSYSTEM OPERATING PROGRAM (G4.45) I-LOADS

| FSSR NAME | MSID | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R<br>E<br>V |
|-----------|------|-----------|----|----|---|---|---------|----|-----|---------|-------------|
|-----------|------|-----------|----|----|---|---|---------|----|-----|---------|-------------|

NO REQUIREMENTS

**NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.**

TABLE 4.45.6.2-4. RADAR ALTIMETER SUBSYSTEM OPERATING PROGRAM (G4.45) K-LOADS

| FSSR NAME<br>DESCRIPTION | MSID | MC | KLOAD VALUE | ENG UNITS | DT | P<br>R | S | PR FCTN | LAST CR | R<br>E<br>V |
|--------------------------|------|----|-------------|-----------|----|--------|---|---------|---------|-------------|
|--------------------------|------|----|-------------|-----------|----|--------|---|---------|---------|-------------|

---

NO REQUIREMENTS

**NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.**

TABLE 4.45.6.2-5. RADAR ALTIMETER SUBSYSTEM OPERATING PROGRAM (G4.45) CONSTANTS

| FSSR NAME<br>DESCRIPTION | MSID | MC | CONSTANT VALUE | ENG UNITS | DT | P<br>R | S | PR FCTN | LAST CR | R<br>E<br>V |
|--------------------------|------|----|----------------|-----------|----|--------|---|---------|---------|-------------|
|--------------------------|------|----|----------------|-----------|----|--------|---|---------|---------|-------------|

NO REQUIREMENTS

**NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.**

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## **4.122 NAVIGATION-DERIVED AIR DATA SOP.**

This section documents the detailed level requirements for the navigation–derived air data (NAVDAD) SOP principal function.

### **4.122.1 Overview.**

The purpose of the NAVDAD SOP is to calculate certain air data parameters based on navigation–supplied data. The navigation–derived air data parameters provided by the NAVDAD SOP are as follows:

- Dynamic pressure
- Equivalent airspeed
- Mach number

These parameters are calculated at the 1.04 Hz rate prior to the NAVDAD/ADS transition processing specified in the ADTA SOP.

These parameters are sent to the ADTA SOP to provide a central location for transitioning between NAVDAD and ADS air data parameters. It should be noted that the navigation–derived angle of attack (from attitude processing) and ground relative velocity magnitude (from the user parameter processing functions) are sent directly to the ADTA SOP for transitioning. The remaining navigation–derived air data parameters (altitude, altitude rate, drag acceleration, and sideslip angle) are calculated by navigation, attitude processing, or UPP.

The navigation–derived air data are needed during entry to drive guidance and flight control and the dedicated displays. After the crew has manually transferred to ADS air data, the navigation–derived air data are used as a backup source.

#### **4.122.1.1 Functional Requirements Traceability.**

The detailed requirements and formulations contained herein satisfy the GN&C, Level B, CPDS functional requirements for the NAVDAD SOP.

#### **4.122.2 NAVDAD SOP Detail Level Requirements.**

The NAVDAD SOP shall compute the following air data parameters based on nav–supplied data:

- Dynamic pressure
- Equivalent airspeed
- Mach number

These parameters shall be computed at the 1.04 Hz rate whenever the NAVDAD/ AUTO SPEC function indicates NAVDAD.

These parameters shall be computed prior to the NAVDAD/ADS transition function specified by the ADTA SOP. In addition, execution of this function shall occur in the computational cycle corresponding to the beginning of the AMI and AVVI principal functions' first-order hold periods. This is required to minimize the staleness of the AMI/AVVI data when NAVDAD data is being utilized and either air data source select switch is in the COMPUTER position.

The detailed requirements required to compute the above parameters are discussed in the following paragraphs. A functional block diagram of the NAVDAD SOP is shown in Figure 4.122-1. The functional modules are shown in Figures 4.122-2 through 4.122-5. A restriction of the execution sequence within the NAVDAD SOP is that the navigation-derived dynamic pressure shall be computed before the navigation-derived equivalent airspeed. In addition, at ground relative speeds less than 2000 feet per second, static air temperature shall be computed before the dynamic pressure subfunction.

The input/output parameters are shown in Tables 4.122-1 and 4.122-2, respectively. The initialization requirements are shown in Table 4.122-3 and the I-load parameters are shown in Table 4.122-4.

#### **4.122.2.1 Navigation Derived Dynamic Pressure (DYPRS\_N).**

The purpose of the DYPRS\_N subfunction shall be to compute dynamic pressure as a function of navigation-data. The vehicle's ground relative speed shall provide the basis for the dynamic pressure equations given below.

- A. For  $REL\_VEL\_MAG \geq V\_NAVDAD$  (NAVDAD velocity switching point), the subfunction shall first compute the drag coefficient as a function of navigation derived angle of attack and ground relative speed as follows:

$$C\_D = KCD1 + KCD2 \exp - \left( \frac{REL\_VEL\_MAG - KCD3}{KCD4} \right) \\ + KCD5 ALPHA\_NAVDAD + KCD6 ALPHA\_NAVDAD^2$$

where

$C\_D$  = Drag coefficient (nd)

$REL\_VEL\_MAG$  = Ground relative velocity magnitude (ft/sec)

$ALPHA\_NAVDAD$  = navigation derived angle of attack (deg)

KCD1 through KCD6 = Constants

Next, the dynamic pressure shall be computed as

$$QBAR\_N = \frac{ACC\_DRAG M}{C\_D REF\_AREA}$$

where

QBAR\_N = navigation derived dynamic pressure (lb/sq ft)

ACC\_DRAG = Drag acceleration (ft/sec<sup>2</sup>) from the appropriate user parameter processing (UPP) function

M = Current vehicle mass (slugs)

REF\_AREA = Reference area (sq ft) for the vehicle associated with the model for C\_D mentioned earlier

For OPS-3, the current vehicle mass is obtained from the DEORB GUID principal function (4.209), while for OPS 6 it is obtained from a premission value defined by GRTLS TAEM guidance.

B. For REL\_VEL\_MAG < V\_NAVDAD: First, the air density shall be computed depending on the lapse rate for the Ith layer as follows:

1. For LM(I) = 0,

$$RHO\_N = RHO\_B(I) \exp - \left( G\_OVR\_R \frac{ALT - ALT\_B(I)}{TMB(I)} \right)$$

where

LM(I) = Lapse rate in Ith layer (°K/ft)

RHO\_N = Navigation-derived air density (slugs/ft<sup>3</sup>)

RHO\_B(I) = Air density at the base of the Ith layer (slugs/ft<sup>3</sup>)

G\_OVR\_R = Sea level gravity divided by the universal gas constant of air (°K/ft)

ALT = Altitude above mean sea level (ft)

ALT\_B(I) = Altitude at the base of the Ith layer (ft)

TMB(I) = Temperature at the base of the Ith layer (°K)

2. For LM(I) ≠ 0,

$$RHO\_N = RHO\_B(I) \left( \frac{TMB(I)}{SAT\_N} \right)^{\left[ \frac{G\_OVR\_R}{LM(I)} + 1 \right]}$$

where SAT\_N is the navigation-derived static air temperature (°K) and other parameters are as defined earlier. The values of I and SAT\_N are to be determined by the MACH\_N subfunction of paragraph 4.122.2.3, and are based on a two-layered atmospheric model.

Next, QBAR\_N shall be computed as follows:

$$QBAR\_N = 0.5 RHO\_N REL\_VEL\_MAG^2$$

#### 4.122.2.2 Navigation-Derived Equivalent Airspeed (EQAS\_N).

The purpose of the EQAS\_N subfunction shall be to compute equivalent airspeed as a function of navigation-derived dynamic pressure. This subfunction shall not be executed until the DYPRS\_N subfunction has been executed. The navigation derived equivalent airspeed shall be computed as follows:

$$EAS\_N = \sqrt{\frac{2 QBAR\_N}{RHO\_SEA\_LEVEL}}$$

where

EAS\_N = Navigation-derived equivalent airspeed (ft/sec)

QBAR\_N = Navigation-derived dynamic pressure (lb/ft<sup>2</sup>)

RHO\_SEA\_LEVEL = Sea level atmospheric density (slugs/ft<sup>3</sup>) (identical to RHO\_B(1))

#### 4.122.2.3 Navigation-Derived Mach Number (MACH\_N).

The purpose of the MACH\_N subfunction shall be to compute Mach number as a function of navigation-supplied altitude and velocity data. The ground relative speed shall provide the basis for the Mach equations as follows:

- A. For  $REL\_VEL\_MAG \geq V\_NAVDAD$

$$M\_N = \frac{REL\_VEL\_MAG}{1000 \text{ ft / sec}}$$

where

M\_N = Navigation-derived Mach number

REL\_NAV\_MAG = Ground relative velocity magnitude (ft/sec)

- B. For  $REL\_VEL\_MAG < V\_NAVDAD$ , Mach shall be computed as a function of static air temperature and ground relative velocity. Static air temperature shall be determined by modeling the atmosphere into two layers. Within each layer a constant lapse rate with respect to altitude is assumed. This function shall first determine the layer, I, by comparing the vehicle altitude above mean sea level to the layer altitude boundaries. Then the constants describing that layer shall be used to compute static air temperature as follows:

$$SAT\_N = TMB(I) + LM(I) (ALT - ALT\_B(I)),$$

where

SAT\_N = Navigation-derived static air temperature (°K)

TMB(I) = Temperature at base of layer (°K)

LM(I) = Lapse rate in layer (°K/ft)

ALT\_B(I) = Altitude at the base of layer (ft)

ALT = Vehicle altitude above mean sea level (ft)

I = Layer identifier

The values of I and SAT\_N are also provided to the dynamic pressure subfunction.

The Mach number shall then be computed as follows:

$$M\_N = \frac{REL\_VEL\_MAG}{SPD\_SND\_CON \sqrt{SAT\_N}}$$

where

M\_N = Navigation-derived Mach number

REL\_VEL\_MAG = Ground relative velocity magnitude (ft/sec)

SAT\_N = Navigation-derived static air temperature (°K)

SPD\_SND\_CON = Speed of sound constant for air (ft/sec/°K<sup>1/2</sup>)

#### 4.122.2.4 Applicable Tables for NAVDAD SOP.

The IDD inputs and outputs are listed in Tables 4.122.2.4-1 and 4.122.2.4-2. Values for the I-loads are contained in the I-loads requirements document (JSC-19350); however, I-load definitions applicable to this principal function are listed in Table 4.122.2.4-3. K-loads are listed in Table 4.122.2.4-4. Constants are listed in Table 4.122.2.4-5.

| Table 4.122-1. NAVDAD SOP Inputs |                      |                                          |                                               |              |                 |                |           |
|----------------------------------|----------------------|------------------------------------------|-----------------------------------------------|--------------|-----------------|----------------|-----------|
| Name                             | MSID                 | Description                              | Input Source                                  | Signal Type  | Range           | Units          | Rate (Hz) |
| NAV_DAD                          | G70317               | NAVDAD/AUTO SELECT<br>(0=NAVDAD)         | HORZ SIT                                      | DISCR<br>ETE | 0,1             |                | 1.04      |
| REL_VEL_MAG                      | V95L0151C<br>G03902  | GND REL MAGNITUDE IN M50<br>SYS          | ENTRY UPP<br>TAEM UPP<br>A/L UPP              |              | 0, 27K          | FT/SEC         |           |
| ALT                              | V95H0175C<br>G04207  | CURR ORB ALTITUDE ABOVE<br>REF ELLIPSOID | ENTRY UPP<br>TAEM UPP<br>A/L UPP,<br>RTLS UPP | FLOAT<br>PT  | -10,<br>+10,000 | KFT            | 1.04      |
| ALPHA_NAVDAD                     | V95H0233C            | NAV DERIVED ANGLE OF<br>ATTACK           | RTLS,<br>ENTRY,<br>TAEM,<br>A/L UPP           | FLOAT<br>PT  |                 | DEG            | 1.04      |
| ACC_DRAG                         | V95A0160C<br>G04205  | DRAG DECEL                               | ENTRY UPP<br>TAEM UPP<br>RTLS UPP             | FLOAT<br>PT  |                 | FT/SEC<br>/SEC | 1.04      |
| M*                               | V90U1961CC<br>G48797 | CURRENT VEHICLE MASS                     | DEORBIT<br>GUID                               | FLOAT<br>PT  |                 | SLUGS          |           |

\*Current vehicle mass obtained from DEORBGUID during OPS 3 only

| Table 4.122-2. NAVDAD SOP Outputs |                     |                                 |                                                  |             |       |             |           |
|-----------------------------------|---------------------|---------------------------------|--------------------------------------------------|-------------|-------|-------------|-----------|
| Name                              | MSID                | Description                     | Output Destination                               | Signal Type | Range | Units       | Rate (Hz) |
| QBAR_N                            | V95P3170C<br>G25207 | NAV DERIVED DYNAMIC PRESSURE    | ADTA SOP,<br>TAEM GUID<br>GRTLS TAEM<br>GUID TLM | FLOAT PT    | 0,500 | LB/SQ<br>FT | 1.04      |
| EAS_N                             | V95L3175C<br>G25203 | NAV DERIVED EQUIVALENT AIRSPEED | ADTA SOP<br>TLM                                  | FLOAT PT    | 0,600 | FT/SEC      | 1.04      |
| M_N                               | V90L0847C<br>G25202 | NAV DERIVED MACH NUMBER         | ADTA SOP<br>TLM                                  | FLOAT PT    | 0,27  | ND          | 1.04      |

Table 4.122-3. NAVDAD SOP Initialization Parameters

| Name        | MSID      | Description                                             | Const | Type     | Value           | Units                |
|-------------|-----------|---------------------------------------------------------|-------|----------|-----------------|----------------------|
| SPD_SND_CON |           | SPEED OF SOUND CONSTANT                                 | X     | FLOAT PT | 65.77018        | FT/SEC/DEG K         |
| G_OVR_R     |           | SEA LEVEL GRAVITY DIVIDED BY THE UNIVERSAL GAS CONSTANT | X     | FLOAT PT | 1.044300444E-02 | DEG K/FT             |
| M*          | V97U0443C | WEIGHT RTLS                                             |       | FLOAT PT | **              | SLUGS                |
|             |           |                                                         | MX    |          |                 |                      |
| REF_AREA    | V99U5625C | VEHICLE REFERENCE AREA FOR DRAG COEFFICIENT             | X     | FLOAT PT | 2690.           | SQ FT                |
| KCD1        | V99U5616C | DRAG COEFFICIENT CONSTANT 1                             | X     | FLOAT PT | ***             | ND                   |
| KCD2        | V99U5617C | DRAG COEFFICIENT CONSTANT 2                             | X     | FLOAT PT | ***             | ND                   |
| KCD3        | V99U5618C | DRAG COEFFICIENT CONSTANT 3                             | X     | FLOAT PT | ***             | FT/SEC               |
| KCD4        | V99U5619C | DRAG COEFFICIENT CONSTANT 4                             | X     | FLOAT PT | ***             | FT/SEC               |
| KCD5        | V99U5620C | DRAG COEFFICIENT CONSTANT 5                             | X     | FLOAT PT | ***             | 1/DEG                |
| KCD6        | V99U5621C | DRAG COEFFICIENT CONSTANT 6                             | X     | FLOAT PT | ***             | 1/DEG/DEG            |
| ALT_B(1)    | V99U5601C | ALTITUDE BASE OF 1ST LAYER                              | X     | FLOAT PT | ***             | FT                   |
| ALT_B(2)    | V99U5602C | ALTITUDE BASE OF 2ND LAYER (MC01)                       | X     | FLOAT PT | ***             | FT                   |
| TMB(1)      | V99U5695C | TEMPERATURE AT BASE OF 1ST LAYER                        | X     | FLOAT PT | ***             | DEG K                |
| TMB(2)      | V99U5696C | TEMPERATURE AT BASE OF 2ND LAYER                        | X     | FLOAT PT | ***             | DEG K                |
| LM(1)       | V99U5622C | LAPSE RATE IN 1ST LAYER                                 | X     | FLOAT PT | ***             | DEG K/FT             |
| LM(2)       | V99U5623C | LAPSE RATE IN 2ND LAYER                                 | X     | FLOAT PT | ***             | DEG K/FT             |
| RHO_B_ND(1) | V99U5626C | DENSITY AT BASE OF 1ST LAYER                            | X     | FLOAT PT | ***             | SLUG/FT <sup>3</sup> |
| RHO_B_ND(2) | V99U5627C | DENSITY AT BASE OF 2ND LAYER                            | X     | FLOAT PT | ***             | SLUG/FT <sup>3</sup> |
| V_NAVDAD    | V99U5710C | NAVDAD VELOCITY SWITCHING POINT                         | X     | FLOAT PT | 1400.           | FT/SEC               |

\*Current vehicle mass I-load parameter for OPS 6 only  
 \*\*Value to be obtained from GRTLS TAEM guidance I-load  
 \*\*\*Henceforth, the current values shall be taken from JSC 19350.

Table 4.122-4. NAVDAD SOP I-Load Parameters

| Name        | MSID      | Description                  | Const | Type     | Value | Units                |
|-------------|-----------|------------------------------|-------|----------|-------|----------------------|
| RHO_B_ND(1) | V99U5626C | DENSITY AT BASE OF 1ST LAYER | X     | FLOAT PT | *     | SLUG/FT <sup>3</sup> |
| RHO_B_ND(2) | V99U5627C | DENSITY AT BASE OF 2ND LAYER | X     | FLOAT PT | *     | SLUG/FT <sup>3</sup> |

†

\*Henceforth, the current values shall be taken from JSC 19350



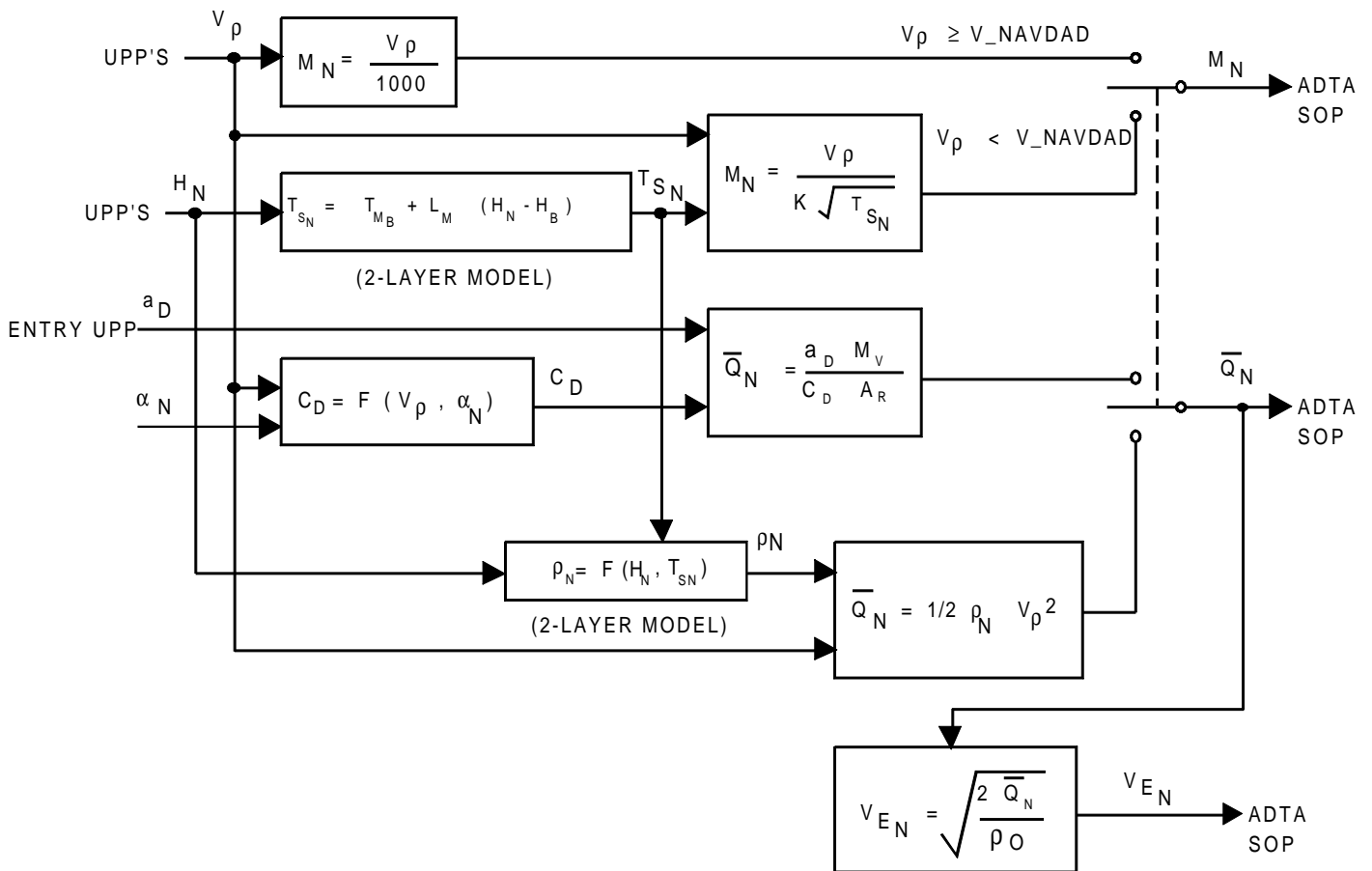


FIGURE 4.122-1. NAVDAD SOP Funtional Block Diagram

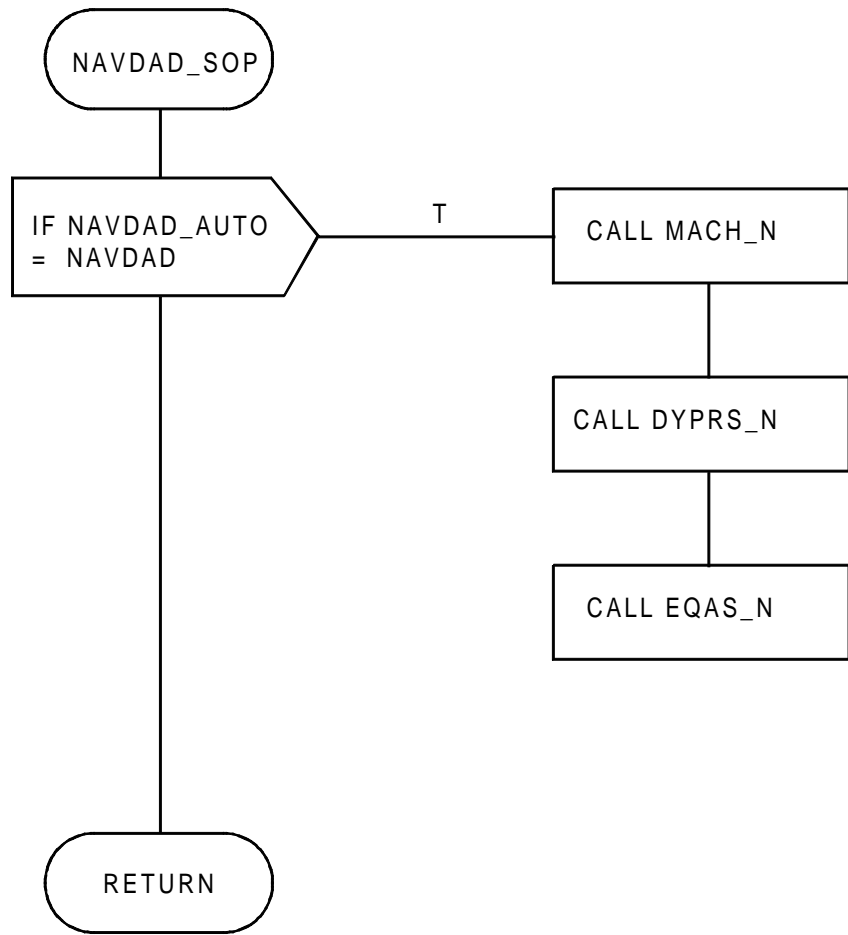


FIGURE 4.122-2. NAVDAD\_SOP Functional Module

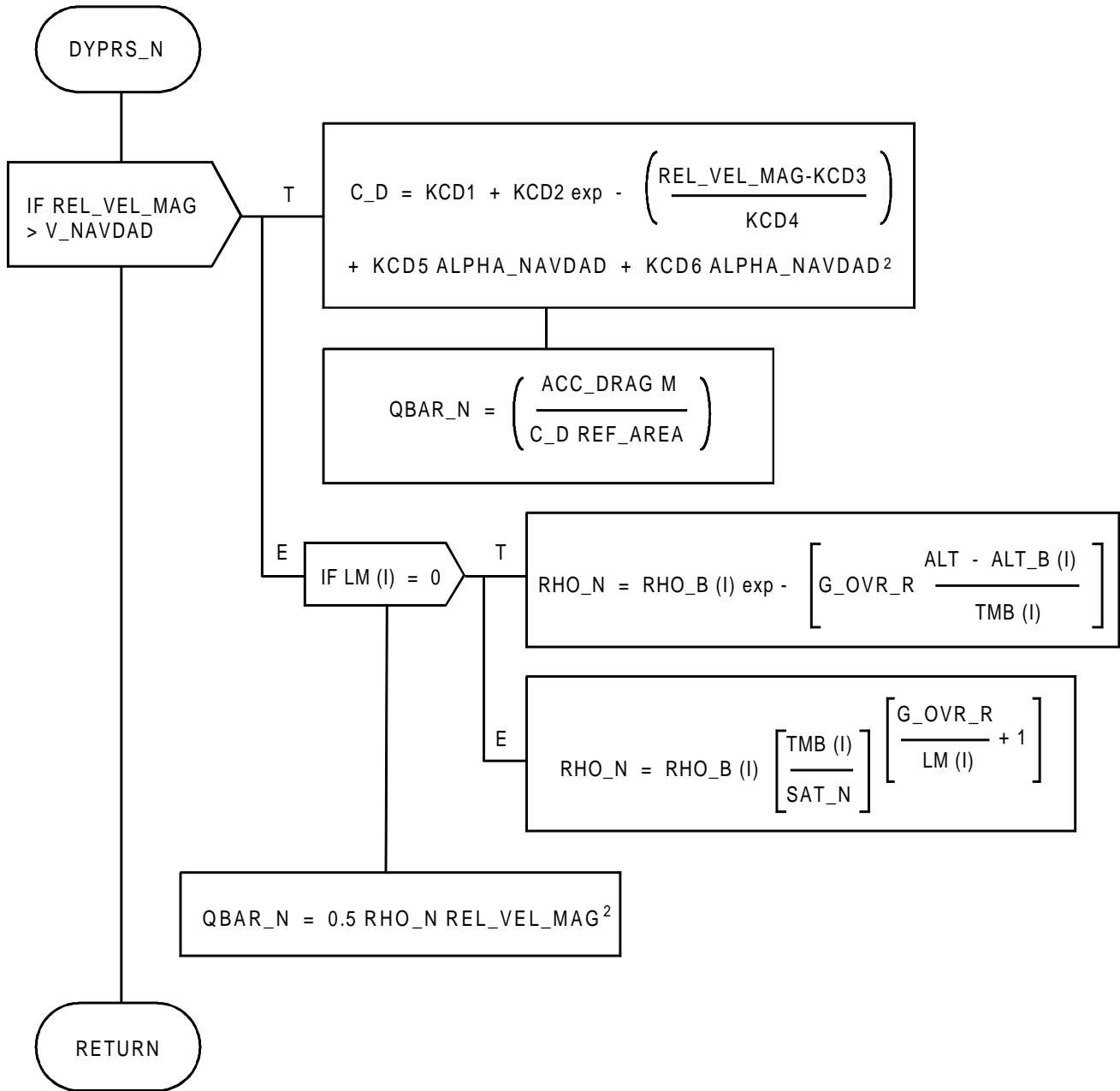


FIGURE 4.122-3. DYPRS\_N Functional Module

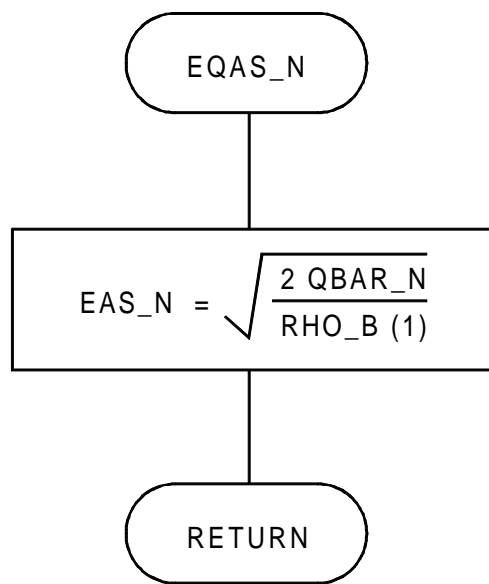


FIGURE 4.122-4. EQAS\_N Functional Module

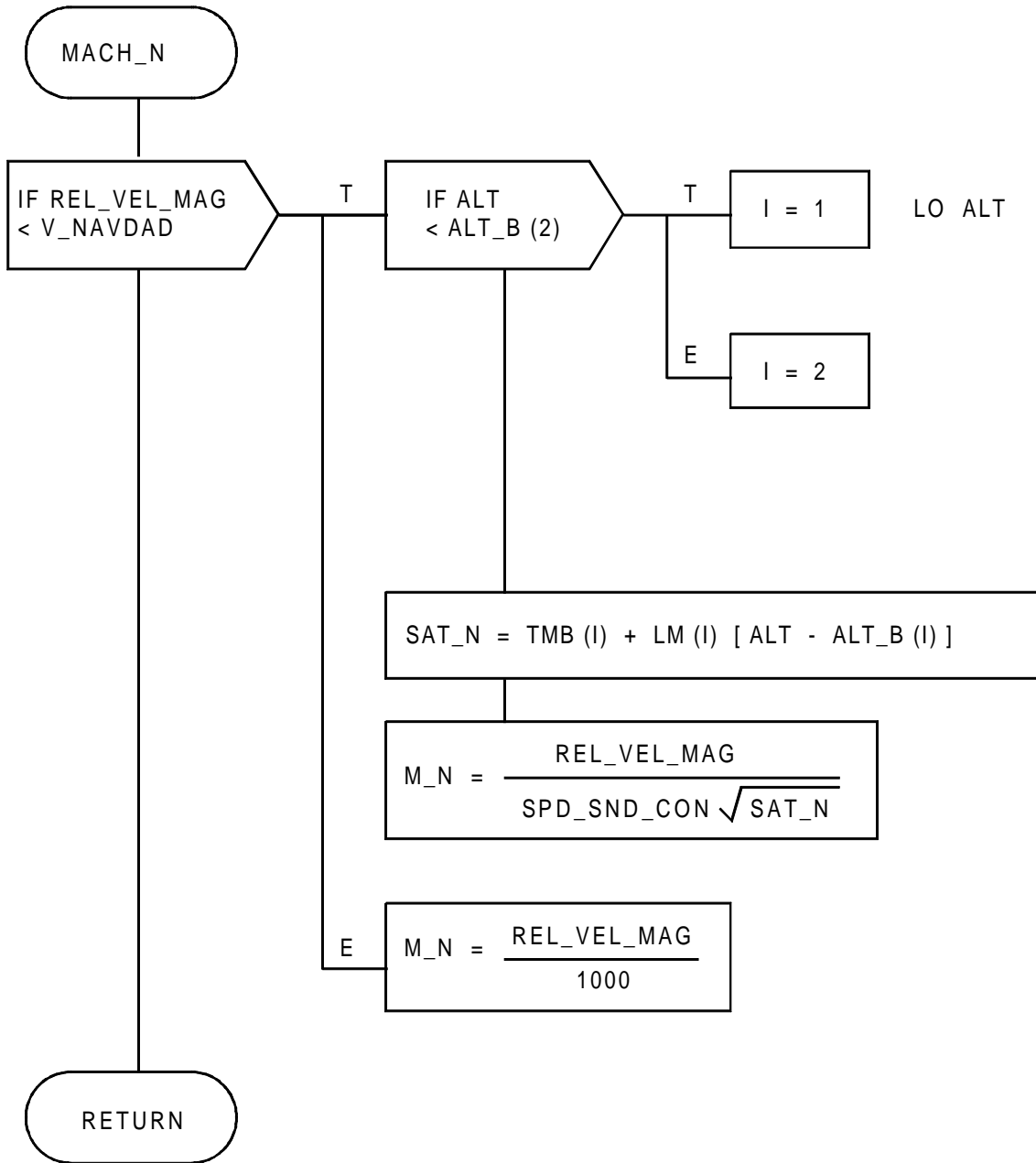


FIGURE 4.122-5. MACH\_N Functional Module

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TABLE 4.122.2.4-1. INPUT FUNCTIONAL PARAMETERS FOR NAVIGATIONALY-DERIVED AIR DATA SOP (G4.122)

| FSSR NAME            | M/S ID     | NOMENCLATURE                     | SOURCE     | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|----------------------|------------|----------------------------------|------------|-------|-----------|---------|---------|-------|
| ACC_DRAG             | V95A0160CA | DRAG DECEL                       | RTLS UPP   |       |           |         | 89979F  |       |
| ACC_DRAG             | V95A0160CB | DRAG DECEL                       | ENT UPP    | FT/S2 |           |         | 93017G  | *     |
| ACC_DRAG             | V95A0160CC | DRAG DECEL                       | TAEM UPP   | FT/S2 |           |         | 93017G  | *     |
| ALPHA_NAVDAD         | V95H0233CA | AVG NAVDAD ANGLE OF ATTACK       | ENT UPP    | DEG   |           |         |         |       |
| ALPHA_NAVDAD         | V95H0233CB | AVG NAVDAD ANGLE OF ATTACK       | TAEM UPP   | DEG   |           |         |         |       |
| ALPHA_NAVDAD         | V95H0233CC | AVG NAVDAD ANGLE OF ATTACK       | A/L UPP    | DEG   |           |         |         |       |
| ALPHA_NAVDAD         | V95H0233CD | AVG NAVDAD ANGLE OF ATTACK       | RTLS UPP   | DEG   |           |         |         |       |
| ALT                  | V95H0175CA | CURR ORB ALT ABOVE REF ELLIPSOID | RTLS UPP   | FT    | SPL       |         | 93017G  | *     |
| ALT                  | V95H0175CC | CURR ORB ALT ABOVE REF ELLIPSOID | ENT UPP    | FT    | SPL       |         | 93017G  | *     |
| ALT                  | V95H0175CD | CURR ORB ALT ABOVE REF ELLIPSOID | TAEM UPP   | FT    | SPL       |         | 93017G  | *     |
| ALT                  | V95H0175CE | CURR ORB ALT ABOVE REF ELLIPSOID | A/L UPP    | FT    | SPL       |         | 93017G  | *     |
| M/CURR_ORB_MASS/MASS | V90U1961CC | CURRENT VEHICLE MASS             | DEORB GUID | SLUGS |           |         | 93090E  |       |
| REL_VEL_MAG          | V95L0151CA | GND REL VEL MAGNITUDE IN M50 SYS | RTLS UPP   | FT/S  | SPL       |         | 93017G  | *     |
| REL_VEL_MAG/V        | V95L0151CB | GND REL VEL MAGNITUDE IN M50 SYS | A/L UPP    | FT/S  | SPL       |         | 93017G  | *     |
| REL_VEL_MAG/V        | V95L0151CC | GND REL VEL MAGNITUDE IN M50 SYS | ENT UPP    | FT/S  | SPL       |         | 93017G  | *     |
| REL_VEL_MAG/V        | V95L0151CD | GND REL VEL MAGNITUDE IN M50 SYS | TAEM UPP   | FT/S  | SPL       |         | 93017G  | *     |

**NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.**

TABLE 4.122.2.4-2. OUTPUT FUNCTIONAL PARAMETERS FROM NAVIGATIONALY-DERIVED AIR DATA SOP (G4.122)

| FSSR NAME | M/S ID    | NOMENCLATURE                    | DESTINATION                                                            | UNITS  | DATA TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|-----------|-----------|---------------------------------|------------------------------------------------------------------------|--------|-----------|------------------|---------|-------------|
| EAS_N     | V95L3175C | NAV DERIVED EQUIVALENT AIRSPEED | ADTA SOP<br>DL FMT 21/1<br>DL FMT 23/1                                 | FT/S   | SPL       |                  | 93017G  | *           |
| M_N       | V90L0847C | NAV DERIVED MACH NUMBER         | ADTA SOP<br>DL FMT 21/1<br>DL FMT 23/1                                 |        | SPL       |                  | 93017G  | *           |
| QBAR_N    | V95P3170C | NAV DERIVED DYNAMIC PRESSURE    | ADTA SOP<br>DL FMT 21/1<br>DL FMT 23/1<br>GRTLS TAEM GUID<br>TAEM GUID | LB/FT2 | SPL       |                  | 93017G  | *           |

**NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.**

**Rate Codes: (HDR Only) 1 = 1 sample/sec 2 = 5 samples/sec 3 = 12.5 samples/sec 4 = 25 samples/sec 5 = 100 samples/sec  
(HDR and LDR) A = 1 sample/sec B = 5 samples/sec C = 12.5 samples/sec D = 25 samples/sec E = 100 samples/sec**



TABLE 4.122.2.4-3. NAVIGATIONALY-DERIVED AIR DATA SOP (G4.122) I-LOADS

| FSSR NAME   | MSID      | ENG UNITS   | DT | PR | D | S | PR FCTN                    | MC | CAT | LAST CR | R<br>E<br>V |
|-------------|-----------|-------------|----|----|---|---|----------------------------|----|-----|---------|-------------|
| ALT_B(1)    | V99U5601C | FT          | F  | S  | D | C | G4.122                     | 01 | PR2 | DC0599  |             |
|             |           |             |    |    |   |   |                            | 03 | PE2 |         |             |
| ALT_B(2)    | V99U5602C | FT          | F  | S  | D | C | G4.122                     | 01 | PR2 | DC0599  |             |
|             |           |             |    |    |   |   |                            | 03 | PE2 |         |             |
| KCD(1)      | V99U5616C | ND          | F  | S  | D | C | G4.122                     | 01 | DN1 | DC0599  |             |
|             |           |             |    |    |   |   |                            | 03 | DN3 |         |             |
| KCD(2)      | V99U5617C | ND          | F  | S  | D | C | G4.122                     | 01 | DN1 | DC0599  |             |
|             |           |             |    |    |   |   |                            | 03 | DN3 |         |             |
| KCD(3)      | V99U5618C | FT/SEC      | F  | S  | D | C | G4.122                     | 01 | DN1 | DC0599  |             |
|             |           |             |    |    |   |   |                            | 03 | DN3 |         |             |
| KCD(4)      | V99U5619C | FT/SEC      | F  | S  | D | C | G4.122                     | 01 | DN1 | DC0599  |             |
|             |           |             |    |    |   |   |                            | 03 | DN3 |         |             |
| KCD(5)      | V99U5620C | DEG** -1    | F  | S  | D | C | G4.122                     | 01 | DN1 | DC0599  |             |
|             |           |             |    |    |   |   |                            | 03 | DN3 |         |             |
| KCD(6)      | V99U5621C | DEG** -2    | F  | S  | D | C | G4.122                     | 01 | DN1 | DC0599  |             |
|             |           |             |    |    |   |   |                            | 03 | DN3 |         |             |
| LM(1)       | V99U5622C | DEG K/FT    | F  | S  | D | C | G4.122                     | 01 | PR2 | DC0599  |             |
|             |           |             |    |    |   |   |                            | 03 | PE2 |         |             |
| LM(2)       | V99U5623C | DEG K/FT    | F  | S  | D | C | G4.122                     | 01 | PR2 | DC0599  |             |
|             |           |             |    |    |   |   |                            | 03 | PE2 |         |             |
| RHO_B_ND(1) | V99U5626C | SLUGS/FT**3 | F  | S  | D | C | G4.122                     | 01 | PR2 | DC0599  |             |
|             |           |             |    |    |   |   |                            | 03 | PE2 |         |             |
| RHO_B_ND(2) | V99U5627C | SLUGS/FT**3 | F  | S  | D | C | G4.122                     | 01 | PR2 | DC0599  |             |
|             |           |             |    |    |   |   |                            | 03 | PE2 |         |             |
| TMB(1)      | V99U5695C | DEG K       | F  | S  | D | C | G4.122                     | 01 | PR2 | DC0599  |             |
|             |           |             |    |    |   |   |                            | 03 | PE2 |         |             |
| TMB(2)      | V99U5696C | DEG K       | F  | S  | D | C | G4.122                     | 01 | PR2 | DC0599  |             |
|             |           |             |    |    |   |   |                            | 03 | PE2 |         |             |
| WEIGHT_RTLS | V97U0443C | SLUGS       | F  | S  | M | C | G4.122<br>G4.204<br>G4.234 | 00 | GWT | 89979F  |             |

NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.

TABLE 4.122.2.4-4. NAVIGATIONALY-DERIVED AIR DATA SOP (G4.122) K-LOADS

| FSSR NAME<br>DESCRIPTION   | MSID      | MC | KLOAD VALUE | ENG UNITS | DT     | P<br>R | S | PR FCTN  | LAST CR | R<br>E<br>V |
|----------------------------|-----------|----|-------------|-----------|--------|--------|---|----------|---------|-------------|
| REF_AREA                   | V99U5625C | 00 | +2.6900000  | E+03      | FT**2  | F      | S | C G4.122 | 89792E  |             |
| VEH REF AREA FOR DRAG COEF |           |    |             |           |        |        |   | G4.123   |         |             |
| V_NAVDAD                   | V99U5710C | 00 | +1.400      | E+03      | FT/SEC | F      | S | C G4.122 | 59972   |             |
| NAVDAD VEL SWITCHING POINT |           |    |             |           |        |        |   |          |         |             |

**NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.**

TABLE 4.122.2.4-5. NAVIGATIONALY-DERIVED AIR DATA SOP (G4.122) CONSTANTS

| FSSR NAME<br>DESCRIPTION                   | MSID      | MC | CONSTANT VALUE | ENG UNITS | DT                  | P<br>R | S | PR FCTN          | LAST CR | R<br>E<br>V |
|--------------------------------------------|-----------|----|----------------|-----------|---------------------|--------|---|------------------|---------|-------------|
| G_OVR_R<br>QUOTIENT MSL G/UNIV GAS CONST R | V99U5605C | 00 | +1.04129       | E-02      | DEG K/FT            | F      | S | C A6.9<br>G4.122 | 90374C  |             |
| SPD_SND_CON<br>SPEED OF SOUND CONSTANT     | V99U5628C | 00 | +6.577035      | E+01      | FT/SEC/(DEG K)**1/2 | F      | S | C A6.9<br>G4.122 | 90374C  |             |

**NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.**

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## **4.229 RENDEZVOUS RADAR SOP.**

This section defines the detailed functional requirements and formulations for the rendezvous radar (RR) subsystem operating program (SOP). The RR SOP specifies the software requirements associated with RR data input, data conversion, and with display processing. Note that requirements for RR control and antenna pointing are specified by the SM antenna management function and are supported by the GN&C Rendezvous Navigation function.

### **4.229.1 Rendezvous Radar Requirements Overview.**

#### **4.229.1.1 Rendezvous Radar Functional Overview.**

The Ku-band Radar/ Communication system is a dual-purpose orbiter subsystem that is used during orbital operations. It functions as either a wide-band communications system for data interchange with the ground or as a rendezvous radar to detect and track detached payloads or other spacecraft before or during rendezvous maneuvers. The functions of communications and radar are not available simultaneously.

The rendezvous radar provides automatic target detection, acquisition, and tracking. It is a target-location and parameter-estimation device that assists in reducing target location uncertainties during rendezvous maneuvers. The targets are earth-orbiting satellites that are stabilized in three axes. The radar tracks a target automatically to determine range, range rate, roll, and pitch angle relative to the orbiter, as well as inertial target angle rates. All output parameters are provided simultaneously during the tracking phase. External assistance and operator intervention are normally required only for functions that initiate radar operation. To restrict search volume to target location uncertainties, angle search is performed about a direction (vector) furnished to the radar by the GPC.

Upon the initiation of search, the radar performs automatic search and indicates that search is in progress for a maximum of 1 minute. If target detection occurs, the search program stops, the search indication is removed, and the radar indicates that detection has occurred. The search indication and detection indication are provided in the status words. Figure 4.229.1.1-1 depicts a single RR subsystem block diagram.

##### **4.229.1.1.1 Rendezvous Radar Digital Interfaces.**

The rendezvous radar interfaces with the GPC's via the serial digital multiplex/demultiplex input and output data channels. The digital input words are 16 bits in size, plus 3 bits for synchronization and 1 bit for odd parity. Throughout the rendezvous radar SOP, the synchronization and parity bits are disregarded, and the most significant data bit in the word is designated as bit 0 with the least significant bit being bit 15.

Parameters that are transmitted from the RR to the GPC's are listed below.

- Status Word 1
- Status Word 2
- Roll Angle
- Pitch Angle
- Range Rate (2 words)
- Range (2 words)
- Roll Angle Rate
- Pitch Angle Rate

The contents, format, and bit values of the data words are illustrated in Figures 4.229.1.1.1–1 through 4.229.1.1.1–8.

#### **4.229.1.2 Rendezvous Radar SOP Overview.**

The rendezvous radar SOP receives the RR words input to the GN&C GPC and processes the data in preparation for navigation and CRT displays. The processing of range and angle data and rates is controlled by the state of certain status bits. Data good flags indicate the goodness of the RR data. Figure 4.229.1.2–1 illustrates a signal flow.

#### **4.229.1.3 Reference Documents.**

MC409–0025, Integrated Communications and Radar Equipment, Ku–Band.

#### **4.229.2 Definitions.**

This section is not applicable to the rendezvous radar SOP.

#### **4.229.3 Functional Requirements Traceability.**

The detailed requirements and formulations contained herein satisfy the GN&C, Level B, CPDS functional requirements for the rendezvous radar SOP.

#### **4.229.4 Interface Requirements.**

The interface parameters required to properly execute the RR SOP functional module are specified in Table 4.229.4–1.

#### **4.229.5 Parameter Initialization.**

No I–load parameters are required for the RR SOP.

#### **4.229.6 Detailed Requirements and Formulations.**

This section defines the RR SOP functional modules in sufficient detail to create a functional design and generate computer code. Each module defines the functional requirements, interface requirements, detailed requirements and formulations, and special considerations if applicable. A flow diagram is also included in Figure 4.229.6.1-1; however, the flow diagram is supplementary material and is not intended to convey requirements or to place restrictions on functional design or coding.

#### 4.229.6.1 RR SOP.

The purpose of the RR SOP is to process range, range rate, line of sight (LOS) angle, and inertial LOS angle rate data and associated flags for navigation and displays.

A. Functional Requirements. The RR\_SOP module is required to perform the following functions.

1. Acquire the RR digital data words, input data time tag, RR comfault flag, and Mean-of-50 to body quaternion from COMPOOL.
2. Monitor the RR commfault flag and status words to determine whether to process RR input data.
3. Perform RR data time tag processing.
4. Scale the range, range rate, roll, roll rate, pitch, and pitch rate data and convert from fixed point to floating point format.
5. Store the Mean-of-50 to body quaternion for use by navigation.
6. Identify self-test data, as such, for navigation.
7. Monitor the RR status words and process the RR range, range rate, and angle data good flags; the range, range rate, angle, and angle rate status words; the radar mode status word; and the RR VALID flag.

B. Interface Requirements. The input and output parameters associated with the RR\_SOP module are contained in Table 4.229.4-1.

C. Detailed Requirements. The following operations are required for performance of the RR\_SOP functional module.

1. Initialization. Before the RR SOP is first executed, the TRK\_LAST\_CYCLE flag should be set false, RR\_STAT\_DISP should be set equal to six and the RR\_VALID flag should set to TRUE.
2. Data Acquisition. RR data shall be acquired from the radar electronics assembly (EA-1) via MDM FF3 at a rate of 6-1/4 Hz and made available to the RR SOP along with the RR commfault flag and input data time tag at a rate of 1.04 Hz. GN&C requests for data from the Ku-band system shall be nominally spaced with respect to each other and the SM requests for data from the Ku-band system so that a minimum of 122  $\mu$  seconds elapses after the last data word of a message and the first data word of the next response message at the MDM output(s) to the Ku-band system.

(NOTE: If the two requests for data from the Ku-band system occur such that the Ku-band system must respond via both SIO channels concurrently, then the Ku-band system may not respond properly to one or both data requests. The software contractor shall insure that the software will continue to execute properly when this occurs.)

Reference paragraph 6.3.3 of SS-P-0002-580, Level B SM CPDS and paragraph 20.3.1.2.4.2.1 of MC409-0025, Ku-band for more detail. The RR SOP shall also acquire the quaternion, M50 to measured body, from the ATT\_PROC principal function at a rate of 1.04 Hz.

3. Data Processing. Set the RR\_SELF\_TEST flag false. Set the RR range, range rate, and angle data good flags false. Set the RR range, range rate, angle, and angle rate status words equal to 1. Monitor the RR\_COM\_FLT flag. If the flag is set true, discontinue processing. If the RR\_COM\_FLT flag is set false, monitor the radar on bit (bit 0 of status word 1). If the radar on bit is false, set RR\_STAT\_DISP to 0 (COMM mode) and discontinue processing. If the radar on bit is true, perform steps 3a through 3h and proceed to step 4:
  - a. Set the RR data time tag, RR\_TIM, equal to the computer clock time, CLOCK, corresponding to the current RR data input transaction time.
  - b. Form the radar range output word, RR\_RANGE\_O, by combining RR\_RANGE\_A (16 bits) with the seven most significant bits of RR\_RANGE\_B and scaling to form a floating point word in units of feet.
  - c. Form the radar range rate output word RR\_RANGRO, by using RR\_RNGRTE\_A (15 bits plus sign) and scaling to form a floating point word (with correct sign) in units of feet per second.
  - d. Form the radar roll angle output word, RR\_ROLLO, by scaling and converting RR\_ROLL\_IN (12 bits plus sign) to floating point (with correct sign) in units of degrees.
  - e. Form the radar roll rate output word, RR\_RRTEO, by scaling and converting RR\_RRTE\_IN (14 bits plus sign) to floating point (with correct sign) in units of milliradians per second.
  - f. Form the radar pitch angle output word, RR\_PITCHO, by scaling and converting RR\_PITCH\_IN (11 bits plus sign) to floating point (with correct sign) in units of degrees.
  - g. Form the radar pitch rate output word, RR\_PRTEO, by scaling and converting RR\_PRTE\_IN (14 bits plus sign) to floating point (with correct sign) in units of milliradians per second.
  - h. Update Q\_M50BODY\_RR (i)(i=1,4) with the currently acquired quaternion, M50 to measured body.
4. Mode Status. Examine the RR Status Word 1, (RR\_STAT1), and set the RR mode status word, RR\_STAT\_DISP, in the following order.
  - a. If bit 9 of RR\_STAT1 is true, set RR\_STAT\_DISP to 5 (self-test in progress), set RR\_SELF\_TEST true, and proceed to step 6; otherwise continue with step 4b.
  - b. If bit 3 of RR\_STAT1 is true, set the RR\_STAT\_DISP to 3 (GPC acquisition mode) and proceed to step 5. Otherwise set TRK\_LAST\_CYCLE false and continue with step 4c.
  - c. If bit 2 of RR\_STAT1 is true, set RR\_STAT\_DISP to 2 (GPC designate mode) and proceed to step 6; otherwise continue with step 4d.



- d. If bit 1 of RR\_STAT1 is true, set RR\_STAT\_DISP to 1 (auto-track mode) and proceed to step 6. Otherwise set RR\_STAT\_DISP to 4 (manual mode) and proceed to step 6.
5. GAX Processing. Processing of the RR\_VALID flag occurs only if the RR is in the GPC acquisition mode and proceeds as follows:
  - a. Monitor the RR track flag—bit 2 in the RR status word 2, RR\_STAT2. If bit 2 of RR\_STAT2 is true, set the RR\_VALID flag true and proceed to step 5b. If bit 2 of RR\_STAT2 is false, examine the flag indicating the status of tracking last cycle, TRK\_LAST\_CYCLE. If TRK\_LAST\_CYCLE is true, set the RR\_VALID flag false and proceed to step 5b. If TRK\_LAST\_CYCLE is false, proceed to step 5b.
  - b. Set the TRK\_LAST\_CYCLE flag equal to bit 2 of RR\_STAT2 and proceed to step 6.
6. RR Data Status and Data Good Processing. Perform steps 6a through 6d, then discontinue processing. (Note that all data goods are set false in paragraph 4.229.6.1.C3.)
  - a. If bit 7 of RR\_STAT1 is true, set RR\_ANG\_DG true and ANG\_STATUS to 0; otherwise, set ANG\_STATUS to 2.
  - b. If bit 8 of RR\_STAT1 is true, set RR\_ANGR\_DG true and ANGRT\_STATUS to 0; otherwise set ANGRT\_STATUS to 2.
  - c. If bit 14 of RR\_STAT2 is true, set RNG\_STATUS to 0; otherwise set RNG\_STATUS to 2.
  - d. If bit 15 of RR\_STAT2 is true, set RR\_RNGR\_DG true, and RNGRT\_STATUS to 0; otherwise, set RNGRT\_STATUS to 2.

D. Special Considerations. The following special considerations are applicable to the RR SOP software design and operational utilization.

1. The software implementation of the RR SOP shall protect against program checks and error interrupts caused by transient type errors or ad data inputs. Specifically, the RR SOP shall protect against all of the error conditions identified in paragraph 3.6 which are applicable to the RR software design and code.
2. The requirement for the data good flags could be satisfied by utilizing the range, range rate, angle, and angle rate status words. The only difference is that zero is used to indicate good data (true), and 1 and 2 values drive different displays both of which are flags of missing or bad data (false).

3. The integers associated with the range, range rate, angle, and angle rate status words are intended to convey the following information to the REL NAV display.

| <u>Integer</u> | <u>REL NAV Response</u>                                   |
|----------------|-----------------------------------------------------------|
| 0              | Normal data – display                                     |
| 1              | Blank data and display an “M” (commfault or in COMM mode) |
| 2              | Display data with a “↓”                                   |

4. The purpose of the requirements in paragraph 4.229.6.1C5, GAX processing, is to generate an alarm only in the case where a loss of track occurs in the GPC acquisition mode after the RR has initially acquired and tracked the target. GAX sets off a Class 3 alert when it receives an RR\_VALID flag set to the false state.
5. The integer associated with the radar mode status word (RR\_STAT\_DISP) is intended to convey the following information to the REL NAV:

| <u>Integer</u> | <u>REL NAV Response</u> |
|----------------|-------------------------|
| 0              | COMM mode               |
| 1              | AUTO_TRACK mode         |
| 2              | GPC_DES mode            |
| 3              | GPC_ACQ mode            |
| 4              | MANUAL mode             |
| 5              | SELF_TEST mode          |
| 6              | INITIALIZATION          |

6. The RR\_SELF\_TEST flag is intended to notify rendezvous navigation not to use the radar data regardless of the states of the individual data good discretets when the RR is in the self-test mode.
7. Referring to paragraphs 4.229.6.1.C.3.b–g, several of the radar serial data words do not use a full 16 bits for transmission of numerical data. These bits are reserved for use by the radar hardware and should be ignored when converting data to GPC floating point words.

**4.229.7 Applicable Tables for Rendezvous Radar SOP.**

The IDD inputs and outputs are listed in Tables 4.229.7-1 and 4.229.7-2. Values for the I-loads are contained in the I-loads requirements document (JSC-19350); however, I-load definitions applicable to this principal function are listed in Table 4.229.7-3. K-loads are listed in Table 4.229.7-4. Constants are listed in Table 4.229.7-5.

Table 4.229.4-1. Rendezvous Radar SOP Interface Table

| Name         | MSID                 | Description                               | Input Source     | Output Destination          | Signal Type | Range           | Units       | Rate (Hz) |
|--------------|----------------------|-------------------------------------------|------------------|-----------------------------|-------------|-----------------|-------------|-----------|
| RR_PITCH_IN  | V74H2920B<br>G33318  | KU BAND A CH 2<br>PITCH WORD 4<br>WD 4    | RR               | TLM                         | FIXED PT    | +/-180          | DEG         | 6.25      |
| RR_RNGRTE_A  | V74R2921B<br>G33314  | KU BAND A CH 2<br>RANGE RATE<br>WD 5      | RR               | TLM                         | FIXED PT    | +/-1638         | FT/<br>SEC  | 6.25      |
| RR_RANGE_A   | V74H2924B<br>G33312  | KU BAND A CH 2<br>RANGE WORD 7<br>WD 7    | RR               | TLM                         | FIXED PT    | 40.0<br>2.6 E+6 | FEET        | 6.25      |
| RR_RANGE_B   | V74H2925B<br>G33313  | KU BAND A CH 2<br>RANGWORD 8<br>WD 8      | RR               | TLM                         | FIXED PT    | 0.31-<br>39.7   | FEET        | 6.25      |
| RR_PRTE_IN   | V74R2927B<br>G33319  | KU BAND A CH 2<br>PITCH RATE WD 10        | RR               | TLM                         | FIXED PT    | +/-16.4         | DEG/<br>SEC | 6.25      |
| RR_ROLL_IN   | V74R2918B<br>G33316  | KU BAND A CH 2<br>ROLL WORD 3<br>WD 3     | RR               | TLM                         | FIXED PT    | +/-360          | DEG         | 6.25      |
| RR_RRTE_IN   | V74R2926B<br>G33317  | KU BAND A CH 2<br>ROLL RATE<br>WD 9       | RR               | TLM                         | FIXED PT    | +/-16.4         | DEG/<br>SEC | 6.25      |
| RR_STAT1     | V74M2882P<br>G33324  | KU-A CH 2 STATUS<br>WORD 1<br>WD 1        | RR               | TLM                         | FIXED PT    | NA              | NA          | 6.25      |
| RR_STAT2     | V74M2900P<br>G33325  | KU-A CH 2 STATUS<br>WORD 2<br>WD 2        | RR               | TLM                         | FIXED PT    | NA              | NA          | 6.25      |
| RR_COM_FLT   | V91X2467X            | R RADAR<br>COMMFault                      | FCOS             |                             | LOGICAL     | 0,1             | NA          | 1.04      |
| CLOCK        | V91W5000C<br>G07829  | CLOCK-COMPUTER<br>(GMT)                   | FCOS             |                             | FLOAT PT    | NA              | D:H:M:<br>S | 1.04      |
| Q_BOD_M50(1) | V90U2240CB<br>G19849 | M50 TO BODY<br>QUAT MEASURED<br>ELEMENT 1 | ATT_PROC<br>4.97 |                             | FLOAT PT    | NA              | NA          | 1.04      |
| Q_BOD_M50(2) | V90U2241CB<br>G19850 | M50 TO BODY<br>QUAT MEASURED<br>ELEMENT 2 | ATT_PROC<br>4.97 |                             | FLOAT PT    | NA              | NA          | 1.04      |
| Q_BOD_M50(3) | V90U2242CB<br>G19851 | M50 TO BODY<br>QUAT MEASURED<br>ELEMENT 3 | ATT_PROC<br>4.97 |                             | FLOAT PT    | NA              | NA          | 1.04      |
| Q_BOD_M50(4) | V90U2243CB<br>G19852 | M50 TO BODY<br>QUAT MEASURED<br>ELEMENT 4 | ATT_PROC<br>4.97 |                             | FLOAT PT    | NA              | NA          | 1.04      |
| RR_RNG_DG    | V95X4293X<br>G33310  | R RADAR RANGE<br>DATA GOOD                |                  | ORB/RND<br>NAV 4.126<br>TLM | LOGICAL     | 0,1             | NA          | O.D.      |

Table 4.229.4-1. Rendezvous Radar SOP Interface Table

| Name                | MSID                | Description                          | Input Source | Output Destination                      | Signal Type | Range            | Units                | Rate (Hz)        |
|---------------------|---------------------|--------------------------------------|--------------|-----------------------------------------|-------------|------------------|----------------------|------------------|
| RR_ENGR_DG          | V95X4294X<br>G33311 | R RADAR RANGE<br>RATE DATA GOOD      |              | ORB/RND<br>NAV 4.126<br>TLM             | LOGICAL     | 0,1              | NA                   | O.D.             |
| RR_ANG_DG           | V95X4295X<br>G33326 | R RADAR ANGLE<br>DATA GOOD           |              | ORB/RND<br>NAV 4.126<br>TLM             | LOGICAL     | 0,1              | NA                   | O.D.             |
| RR_RANGE0           | V95H4287C<br>G33305 | R RADAR RANGE<br>OUT                 |              | ORB/RND<br>NAV 4.126<br>REL NAV<br>6.11 | FLOAT PT    | 0-2.8 X<br>10**6 | FEET                 | O.D.<br><br>1.04 |
| RR_RNGRO            | V95R4288C<br>G33306 | R RADAR RANGE<br>RATE OUT            |              | ORB/RND<br>NAV 4.126<br>REL NAV<br>6.11 | FLOAT PT    | +/-2800          | FT/SEC               | O.D.<br><br>1.04 |
| RR_PITCHO           | V95H4281C<br>G33301 | R RADAR PITCH<br>ANGLE OUT           |              | ORB/RND<br>NAV 4.126<br>REL NAV<br>6.11 | FLOAT PT    | +/-180           | DEG                  | O.D.<br><br>1.04 |
| RR_PRTEO            | V95R4282C<br>G33302 | R RADAR PITCH<br>RATE OUT            |              | REL NAV<br>6.11                         | FLOAT PT    | +/-286.2         | MILLI<br>RAD/<br>SEC | 1.04<br>O.D.     |
| RR_ROLLO            | V95H4284C<br>G33303 | R RADAR ROLL<br>ANGLE OUT            |              | ORB/RND<br>NAV 4.126<br>REL NAV<br>6.11 | FLOAT PT    | +/-360           | DEG                  | O.D.<br><br>1.04 |
| RR_RRTEO            | V95R4285C<br>G33304 | R RADAR ROLL<br>RATE OUT             |              | REL NAV<br>6.11                         | FLOAT PT    | +/-286.2         | MILLI<br>RAD/<br>SEC | 1.04<br>O.D.     |
| RR_TIM              | V95W4292C<br>G50298 | R RADAR TIME                         |              | ORB/RND<br>NAV 4.126                    | FLOAT PT    | NA               | SEC                  | O.D.             |
| RR_VALID            | V95X4283X<br>G50297 | R RADAR DATA<br>VALID                |              | GAX 4.110                               | LOGICAL     | 0,1              | NA                   | 1.04             |
| RR_SELF_TEST        | V95X4309X<br>G50380 | R RADAR SELF<br>TEST PROGRESS        |              | ORB/RND<br>NAV 4.126                    | LOGICAL     | 0,1              | NA                   | O.D.             |
| RNG_STATUS          | V95J4298C<br>G50293 | R RADAR RANGE<br>STATUS WORD         |              | REL NAV<br>6.11                         | INTEGER     | 0,1,2            | NA                   | 1.04             |
| RNGRT_STATUS        | V95J4299C<br>G50294 | R RADAR RANGE<br>RATE STATUS<br>WORD |              | REL NAV<br>6.11                         | INTEGER     | 0,1,2            | NA                   | 1.04             |
| ANG_STATUS          | V95J4300C<br>G50295 | R RADAR ANGLE<br>STATUS WORD         |              | REL NAV<br>6.11                         | INTEGER     | 0,1,2            | NA                   | 1.04             |
| ANGRT_STATUS        | V95J4302C<br>G50296 | R RADAR ANGLE<br>RATE STATUS<br>WORD |              | REL NAV<br>6.11                         | INTEGER     | 0,1,2            | NA                   | 1.04             |
| RR_STAT_DISP        | V95J4303C<br>G50948 | RADAR MODE<br>STATUS WORD            |              | REL NAV<br>6.11                         | INTEGER     | 0-6              | NA                   | 1.04             |
| Q_M50BODY_<br>RR(1) | V95U4312C<br>G50376 | M50 TO BODY RR<br>ELEMENT 1          |              | ORB/RND<br>NAV 4.126                    | FLOAT PT    | NA               | NA                   | O.D.             |

Table 4.229.4-1. Rendezvous Radar SOP Interface Table

| Name            | MSID                | Description                 | Input Source | Output Destination   | Signal Type | Range | Units | Rate (Hz) |
|-----------------|---------------------|-----------------------------|--------------|----------------------|-------------|-------|-------|-----------|
| Q_M50BODY_RR(2) | V95U4313C<br>G50377 | M50 TO BODY RR<br>ELEMENT 2 |              | ORB/RND<br>NAV 4.126 | FLOAT PT    | NA    | NA    | O.D.      |
| Q_M50BODY_RR(3) | V95U4314C<br>G50378 | M50 TO BODY RR<br>ELEMENT 3 |              | ORB/RND<br>NAV 4.126 | FLOAT PT    | NA    | NA    | O.D.      |
| Q_M50BODY_RR(4) | V95U4315C<br>G50379 | M50 TO BODY RR<br>ELEMENT 4 |              | ORB/RND<br>NAV 4.126 | FLOAT PT    | NA    | NA    | O.D.      |

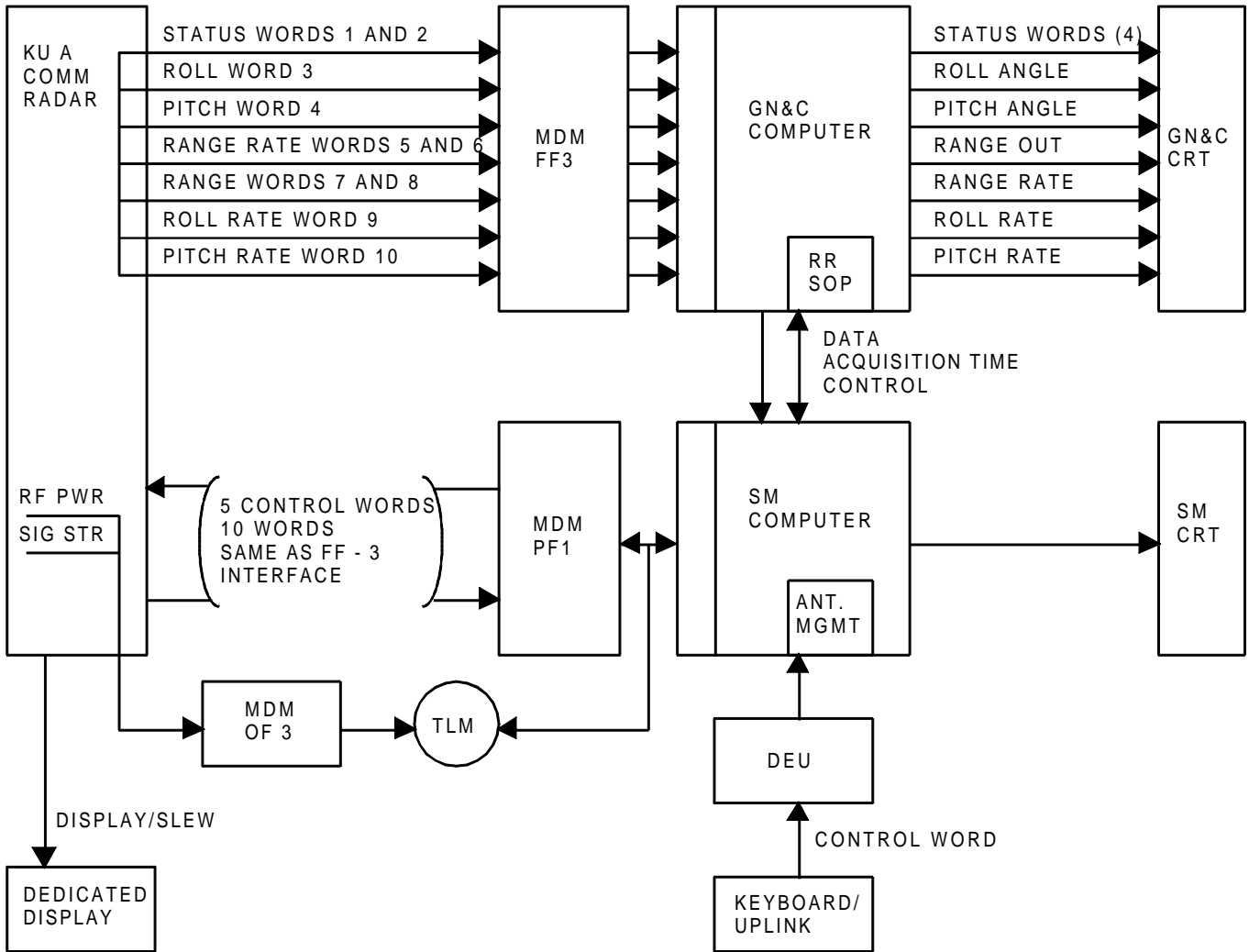


FIGURE 4.229.1.1-1. RR Subsystem Block Diagram

| <u>BIT NO.</u> | <u>RR_RANGE_A (WORD 1)</u> | <u>VALUE (FT)</u> |
|----------------|----------------------------|-------------------|
| 0              |                            | 1,310,720         |
| 1              |                            | 655,360           |
| 2              |                            | 327,680           |
| 3              |                            | 163,840           |
| 4              |                            | 81,920            |
| 5              |                            | 40,960            |
| 6              |                            | 20,480            |
| 7              |                            | 10,240            |
| 8              |                            | 5,120             |
| 9              |                            | 2,560             |
| 10             |                            | 1,280             |
| 11             |                            | 640               |
| 12             |                            | 320               |
| 13             |                            | 160               |
| 14             |                            | 80                |
| 15             | <u>RR_RANGE_B (WORD 2)</u> | 40                |
| 0              |                            | 20                |
| 1              |                            | 10                |
| 2              |                            | 5                 |
| 3              |                            | 5/2               |
| 4              |                            | 5/4               |
| 5              |                            | 5/8               |
| 6              |                            | 5/16              |

FIGURE 4.229.1.1.1-1. RR Range Words

| <u>BIT NO.</u> | <u>EXACT VALUE</u>         | <u>ROUNDED VALUE</u> |
|----------------|----------------------------|----------------------|
| 0              | +/- (0/1)                  |                      |
| 1              | $180^\circ \times 2^0$     | 180.0                |
| 2              | $180^\circ \times 2^{-1}$  | 90.0                 |
| 3              | $180^\circ \times 2^{-2}$  | 45.0                 |
| 4              | $180^\circ \times 2^{-3}$  | 22.5                 |
| 5              | $180^\circ \times 2^{-4}$  | 11.25                |
| 6              | $180^\circ \times 2^{-5}$  | 5.625                |
| 7              | $180^\circ \times 2^{-6}$  | 2.8125               |
| 8              | $180^\circ \times 2^{-7}$  | 1.40625              |
| 9              | $180^\circ \times 2^{-8}$  | 0.703125             |
| 10             | $180^\circ \times 2^{-9}$  | 0.3515625            |
| 11             | $180^\circ \times 2^{-10}$ | 0.1757812            |
| 12             | $180^\circ \times 2^{-11}$ | 0.0878906            |
| 13             | NOT USED                   |                      |
| 14             | NOT USED                   |                      |
| 15             | NOT USED                   |                      |

FIGURE 4.229.1.1.1-2. RR Roll Angle Word

| <u>BIT NO.</u> | <u>EXACT VALUE</u>        | <u>ROUNDED VALUE</u> |
|----------------|---------------------------|----------------------|
| 0              | +/- (0/1)                 |                      |
| 1              | $90^\circ \times 2^0$     | 90.0                 |
| 2              | $90^\circ \times 2^{-1}$  | 45.0                 |
| 3              | $90^\circ \times 2^{-2}$  | 22.5                 |
| 4              | $90^\circ \times 2^{-3}$  | 11.25                |
| 5              | $90^\circ \times 2^{-4}$  | 5.625                |
| 6              | $90^\circ \times 2^{-5}$  | 2.8125               |
| 7              | $90^\circ \times 2^{-6}$  | 1.40625              |
| 8              | $90^\circ \times 2^{-7}$  | 0.703125             |
| 9              | $90^\circ \times 2^{-8}$  | 0.3515625            |
| 10             | $90^\circ \times 2^{-9}$  | 0.1757812            |
| 11             | $90^\circ \times 2^{-10}$ | 0.0878906            |
| 12             | NOT USED                  |                      |
| 13             | NOT USED                  |                      |
| 14             | NOT USED                  |                      |
| 15             | NOT USED                  |                      |

FIGURE 4.229.1.1.1-3. RR Pitch Angle Word

| <u>BIT NO.</u> |                      | <u>VALUE (FT/SEC)</u> |
|----------------|----------------------|-----------------------|
|                | RR_RNGRTE_A (WORD 1) |                       |
| 0              |                      | +/- (0/1)             |
| 1              |                      | 819.2                 |
| 2              |                      | 409.6                 |
| 3              |                      | 204.8                 |
| 4              |                      | 102.4                 |
| 5              |                      | 51.2                  |
| 6              |                      | 25.6                  |
| 7              |                      | 12.8                  |
| 8              |                      | 6.4                   |
| 9              |                      | 3.2                   |
| 10             |                      | 1.6                   |
| 11             |                      | 0.8                   |
| 12             |                      | 0.4                   |
| 13             |                      | 0.2                   |
| 14             |                      | 0.1                   |
| 15             |                      | 0.05                  |
|                | RR_RNGRTE_B (WORD 2) |                       |
| 0              |                      | NOT USED              |
| 1              |                      | NOT USED              |
| 2              |                      | NOT USED              |

FIGURE 4.229.1.1.1-4. RR Range Rate Words



| <u>BIT NO.</u> | <u>VALUE_(°/SEC)</u> |
|----------------|----------------------|
| 0              | +/- (0/1)            |
| 1              | 8.192                |
| 2              | 4.096                |
| 3              | 2.048                |
| 4              | 1.024                |
| 5              | 0.512                |
| 6              | 0.256                |
| 7              | 0.128                |
| 8              | 0.064                |
| 9              | 0.032                |
| 10             | 0.016                |
| 11             | 0.008                |
| 12             | 0.004                |
| 13             | 0.002                |
| 14             | 0.001                |
| 15             | NOT USED             |

FIGURE 4.229.1.1.1-5. RR Roll Angle Rate Word

| <u>BIT NO.</u> | <u>VALUE_(°/SEC)</u> |
|----------------|----------------------|
| 0              | +/- (0/1)            |
| 1              | 8.192                |
| 2              | 4.096                |
| 3              | 2.048                |
| 4              | 1.024                |
| 5              | 0.512                |
| 6              | 0.256                |
| 7              | 0.128                |
| 8              | 0.064                |
| 9              | 0.032                |
| 10             | 0.016                |
| 11             | 0.008                |
| 12             | 0.004                |
| 13             | 0.002                |
| 14             | 0.001                |
| 15             | NOT USED             |

FIGURE 4.229.1.1.1-6. RR Pitch Angle Rate Word

| <u>BIT NO.</u> | <u>PARAMETER</u>                         |
|----------------|------------------------------------------|
| 0              | COMM A/RADAR ON (CR)                     |
| 1              | ANTENNA STEERING AUTO MODE (CR)          |
| 2              | ANTENNA STEERING GPC DESIGNATE MODE (CR) |
| 3              | ANTENNA STEERING GPC ACQ MODE (CR)       |
| 4              | PARITY ERROR (CR)                        |
| 5              | SYNC ERROR (CR)                          |
| 6              | VALIDITY ERROR (CR)                      |
| 7              | RADAR ANGLE DATA GOOD (R)                |
| 8              | RADAR ANGLE RATE DATA GOOD (R)           |
| 9              | RADAR SELF-TEST IN PROGRESS (R)          |
| 10             | Ku A/B SELECT (C)                        |
| 11             | RDR THLD VAR/FIX (R)                     |
| 12             | OBSC INTLK OVRD (CR)                     |
| 13             | SPARE                                    |
| 14             | SPARE                                    |
| 15             | SPARE                                    |
|                | (C) COMMUNICATION FUNCTION               |
|                | (CR) COMMUNICATION AND RADAR FUNCTION    |
|                | (R) RADAR FUNCTION                       |

FIGURE 4.229.1.1.1-7. RR Status Word 1

| <u>BIT NO.</u> | <u>PARAMETER</u>                      |
|----------------|---------------------------------------|
| 0              | SEARCH (CR)                           |
| 1              | DETECT (CR)                           |
| 2              | TRACK (CR)                            |
| 3              | OPERATE (CR)                          |
| 4              | EA-1 RADAR TEST STATUS (R)            |
| 5              | DA RADAR TEST STATUS (R)              |
| 6              | EA-2 RADAR TEST STATUS (CR)           |
| 7              | SYSTEM TEST STATUS (R)                |
| 8              | TDRS WEST (C)                         |
| 9              | TDRS EAST (C)                         |
| 10             | SPARE                                 |
| 11             | FWD LINK DATA FRAME SYNC (C)          |
| 12             | DATA PRESENT (C)                      |
| 13             | SCAN WARN LIMIT (CR)                  |
| 14             | RADAR RANGE DATA GOOD (R)             |
| 15             | RADAR RANGE RATE DATA GOOD (R)        |
|                | (C) COMMUNICATION FUNCTION            |
|                | (CR) COMMUNICATION AND RADAR FUNCTION |
|                | (R) RADAR FUNCTION                    |

FIGURE 4.229.1.1.1-8. RR Status Word 2

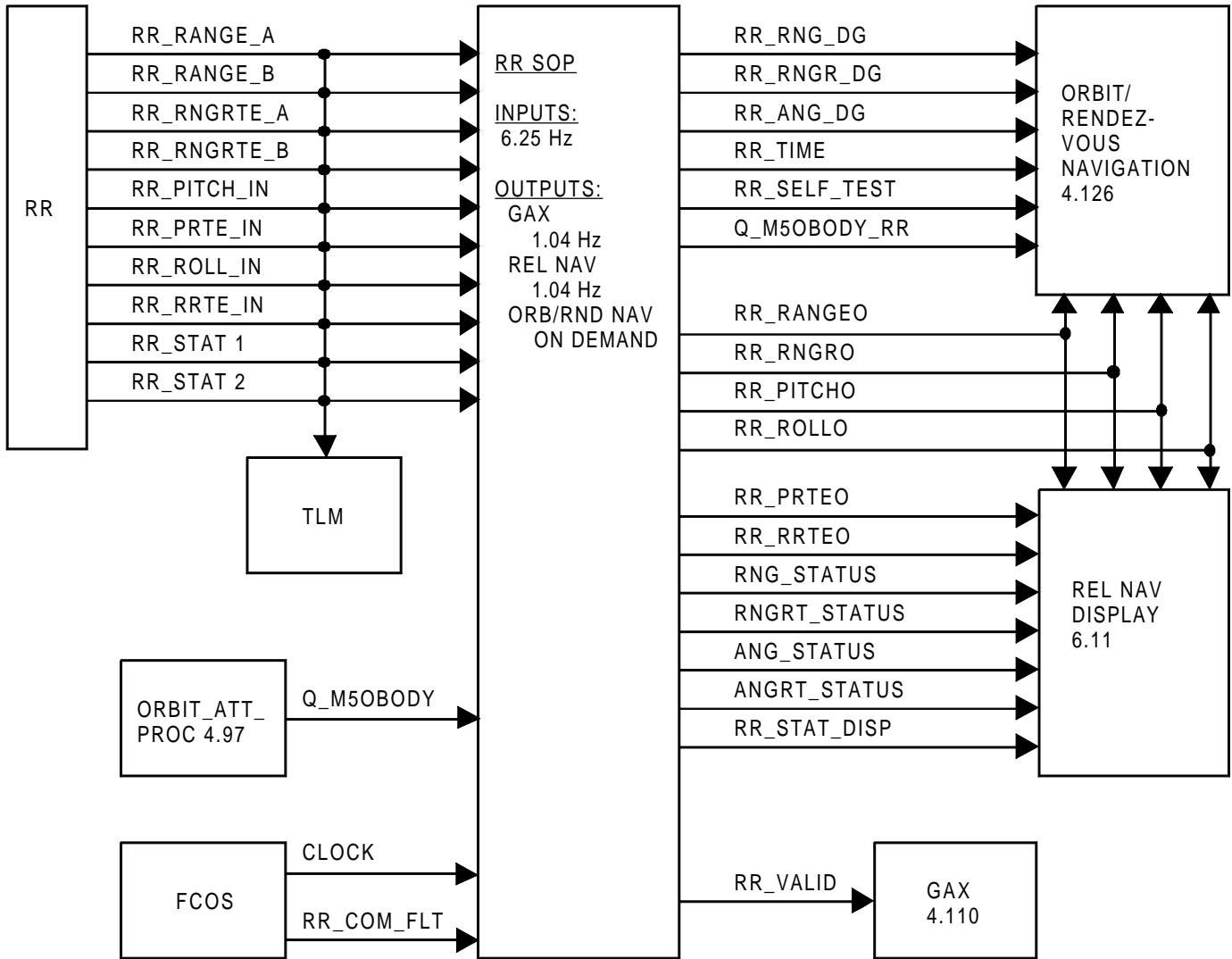


FIGURE 4.229.1.2-1. RR SOP Signal Flow Diagram

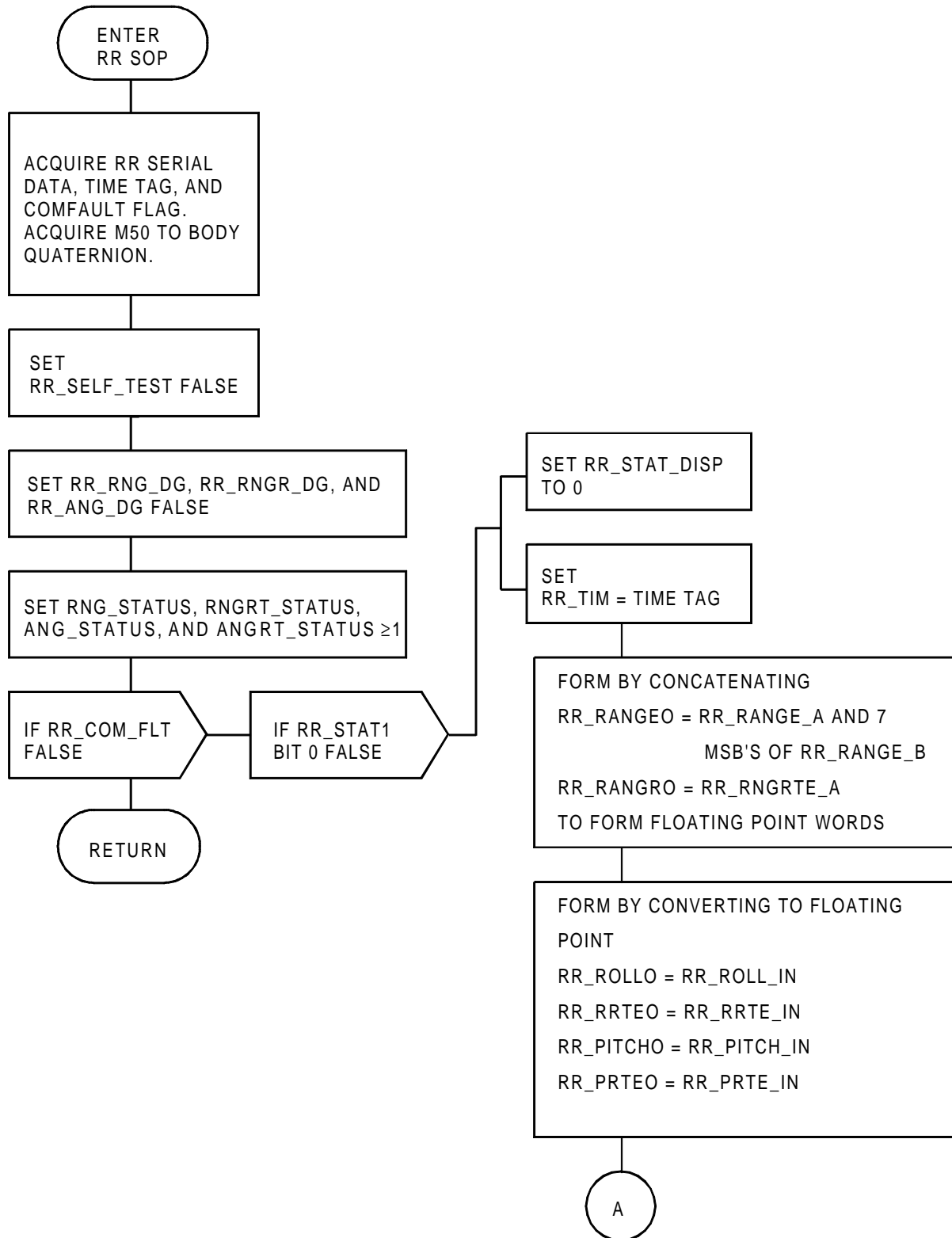


FIGURE 4.229.6.1-1.(1) RR SOP Flow Diagram (Sheet 1 of 3)

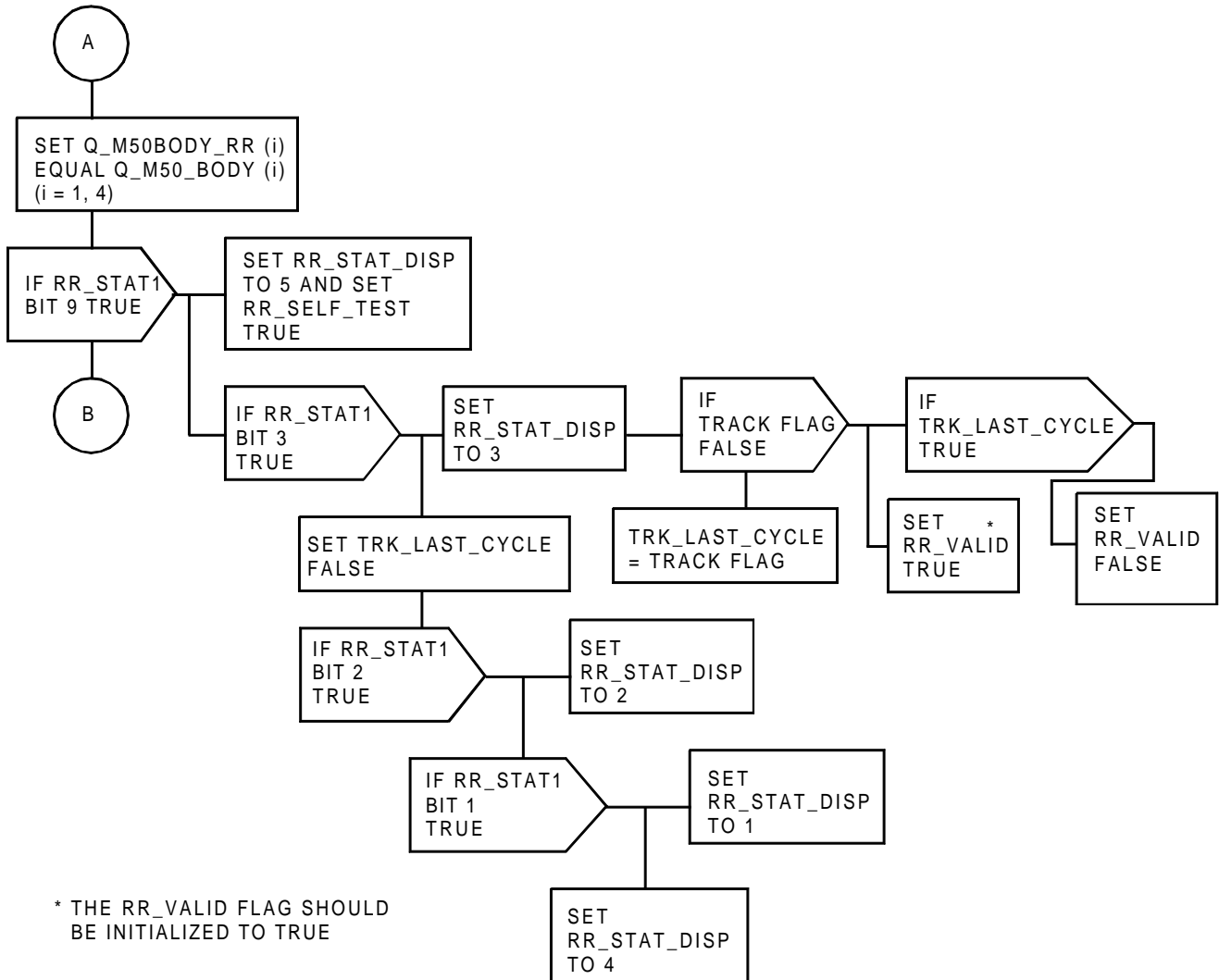


FIGURE 4.229.6.1-1.(2) RR SOP Flow Diagram (Sheet 2 of 3)

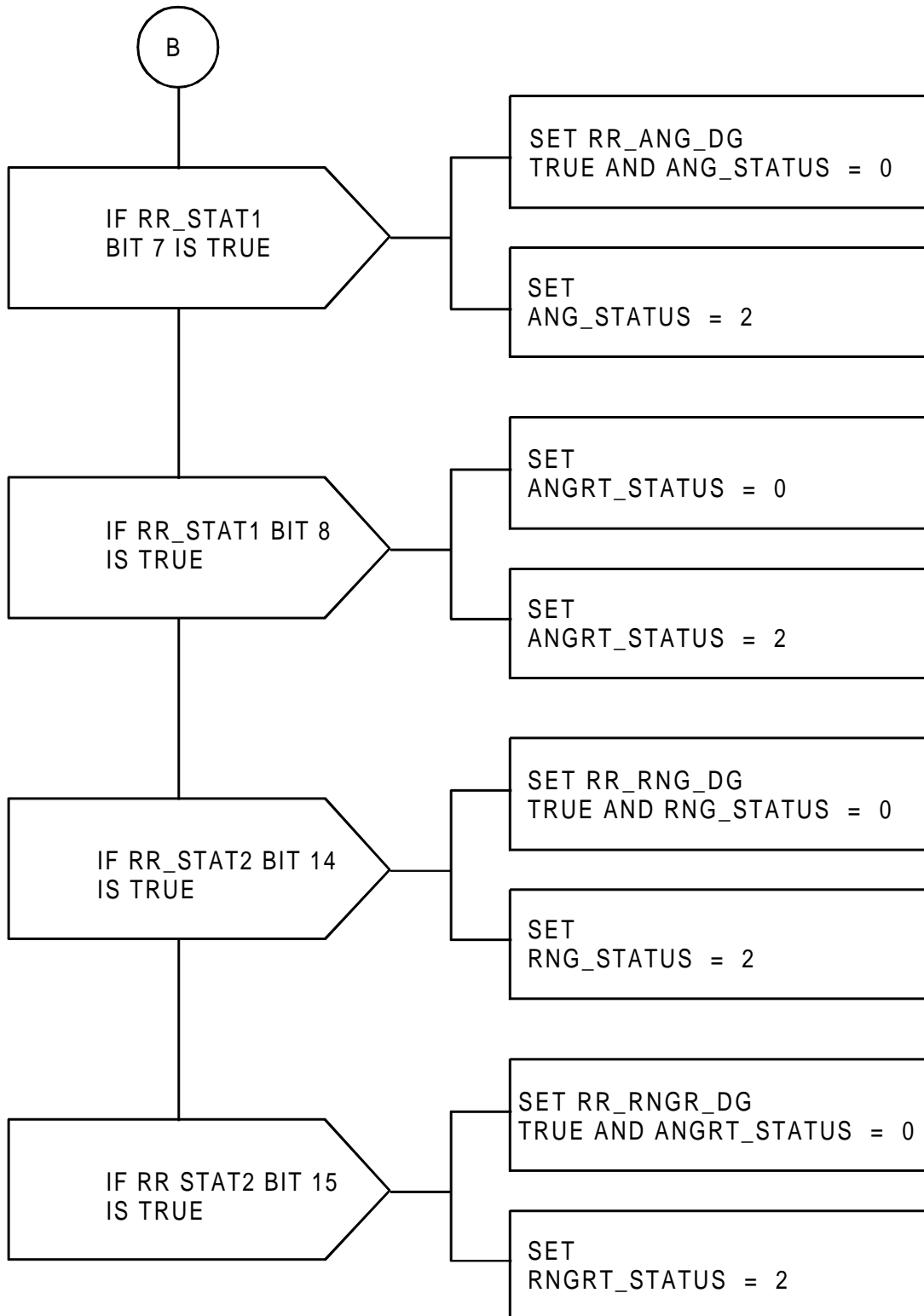


FIGURE 4.229.6.1-1.(3) RR SOP Flow Diagram (Sheet 3 of 3)

TABLE 4.229.7-1. INPUT FUNCTIONAL PARAMETERS FOR RENDEZVOUS RADAR SUBSYSTEM OPERATING PROGRAM (G4.229)

| FSSR NAME               | M/S ID     | NOMENCLATURE                     | SOURCE             | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-------------------------|------------|----------------------------------|--------------------|-------|-----------|---------|---------|-------|
| CLOCK/CLOCKTIME         | V91W5000C  | CLOCK-COMPUTER(GMT)              | FCOS               | S     |           |         | 93160B  | *     |
| Q_BOD_M50(1)/Q_B_M50(1) | V90U2240CB | M50 TO BODY QUAT MEASURED ELEM 1 | ORB ATT PROC       |       | SPL       |         | 93017G  | *     |
| Q_BOD_M50(2)/Q_B_M50(2) | V90U2241CB | M50 TO BODY QUAT MEASURED ELEM 2 | ORB ATT PROC       |       | SPL       |         | 93017G  | *     |
| Q_BOD_M50(3)/Q_B_M50(3) | V90U2242CB | M50 TO BODY QUAT MEASURED ELEM 3 | ORB ATT PROC       |       | SPL       |         | 93017G  | *     |
| Q_BOD_M50(4)/Q_B_M50(4) | V90U2243CB | M50 TO BODY QUAT MEASURED ELEM 4 | ORB ATT PROC       |       | SPL       |         | 93017G  | *     |
| RR_COM_FLT              | V91X2467X  | R RADAR COMMFAULT                | FCOS               |       |           |         |         |       |
| RR_PITCH_IN             | V74H2920B  | KU BAND A CH 2 PITCH WORD 4      | WD4 KU BAND A EA 1 | DEG   |           |         |         |       |
| RR_STAT1                | V74M2882P  | KU-A CH2 STATUS WORD 1           | WD1 KU BAND A EA 1 |       | HMD       |         |         |       |
| RR_STAT2                | V74M2900P  | KU-A CH2 STATUS WORD 2           | WD2 KU BAND A EA 1 |       | HMD       |         |         |       |
|                         | V74H2918B  | KU BAND A CH2 ROLL WORD 3        | WD3 VU             |       |           |         | 93017G  | *     |
|                         | V74H2924B  | KU-A CH 2 RDR RANGE BITS 01-16   | WD7 VU             |       |           |         | 93017G  | *     |
|                         | V74H2925B  | KU-A CH 2 RDR RANGE BITS 01-07   | WD8 VU             |       |           |         | 93017G  | *     |
|                         | V74R2921B  | KU-A CH2 RANGE RATE BITS 01-16   | WD5 VU             |       |           |         | 93017G  | *     |
|                         | V74R2926B  | KU BAND A CH 2 ROLL RATE         | WD9 VU             |       |           |         | 93017G  | *     |
|                         | V74R2928B  | KU BAND A CH 2 PITCH RATE        | WD10 VU            |       |           |         | 93017G  | *     |

NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.

TABLE 4.229.7-2. OUTPUT FUNCTIONAL PARAMETERS FROM RENDEZVOUS RADAR SUBSYSTEM OPERATING PROGRAM  
(G4.229)

| FSSR NAME       | M/S ID    | NOMENCLATURE                   | DESTINATION                 | UNITS  | DATA<br>TYPE | P<br>R<br>E<br>C | LAST CR | R<br>E<br>V |
|-----------------|-----------|--------------------------------|-----------------------------|--------|--------------|------------------|---------|-------------|
| ANGRT_STATUS    | V95J4302C | R RADAR ANGLE RATE STATUS WORD | REL NAV DISP                |        | VAR          |                  |         |             |
| ANG_STATUS      | V95J4300C | R RADAR ANGLE STATUS WORD      | REL NAV DISP                |        | VAR          |                  |         |             |
| Q_M50BODY_RR(1) | V95U4312C | M50 TO BODY R RADAR ELEM 1     | ORB/RND NAV                 |        |              |                  |         |             |
| Q_M50BODY_RR(2) | V95U4313C | M50 TO BODY R RADAR ELEM 2     | ORB/RND NAV                 |        |              |                  |         |             |
| Q_M50BODY_RR(3) | V95U4314C | M50 TO BODY R RADAR ELEM 3     | ORB/RND NAV                 |        |              |                  |         |             |
| Q_M50BODY_RR(4) | V95U4315C | M50 TO BODY R RADAR ELEM 4     | ORB/RND NAV                 |        |              |                  |         |             |
| RNGRT_STATUS    | V95J4299C | R RADAR RANGE RATE STATUS WORD | REL NAV DISP                |        | VAR          |                  |         |             |
| RNG_STATUS      | V95J4298C | R RADAR RANGE STATUS WORD      | REL NAV DISP                |        | VAR          |                  |         |             |
| RR_ANG_DG       | V95X4295X | R RADAR ANGLE DATA GOOD        | ORB/RND NAV<br>TLM          |        |              |                  |         |             |
| RR_PITCHO       | V95H4281C | R RADAR PITCH ANGLE            | ORB/RND NAV<br>REL NAV DISP | DEG    | VAR          |                  | 92297B  |             |
| RR_PRTEO        | V95R4282C | R RADAR PITCH RATE             | REL NAV DISP                | MRAD/S | VAR          |                  | 92297B  |             |
| RR_RANGEO       | V95H4287C | R RADAR RANGE                  | ORB/RND NAV<br>REL NAV DISP | FT     | VAR          |                  | 92297B  |             |
| RR_RNGRO        | V95R4288C | R RADAR RANGE RATE             | ORB/RND NAV<br>REL NAV DISP | FT/S   | VAR          |                  | 92297B  |             |
| RR_RNGR_DG      | V95X4294X | R RADAR RANGE RATE DATA GOOD   | ORB/RND NAV<br>TLM          |        |              |                  |         |             |
| RR_RNG_DG       | V95X4293X | R RADAR RANGE DATA GOOD        | ORB/RND NAV<br>TLM          |        |              |                  |         |             |
| RR_ROLLO        | V95H4284C | R RADAR ROLL ANGLE             | ORB/RND NAV<br>REL NAV DISP | DEG    | VAR          |                  | 92297B  |             |
| RR_RRTEO        | V95R4285C | R RADAR ROLL RATE              | REL NAV DISP                | MRAD/S | VAR          |                  | 92297B  |             |
| RR_SELF_TEST    | V95X4309X | R RADAR SELF TEST ON FLAG      | ORB/RND NAV                 |        |              |                  | 92297B  |             |
| RR_STAT_DISP    | V95J4303C | R RADAR MODE STATUS WORD       | REL NAV DISP                |        | VAR          |                  |         |             |
| RR_TIM          | V95W4292C | R RADAR TIME                   | ORB/RND NAV                 | S      |              |                  | 92297B  |             |
| RR_VALID        | V95X4283X | R RADAR ERROR FLAG             | GAX                         |        |              |                  |         |             |

NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.

Rate Codes: (HDR Only) 1 = 1 sample/sec 2 = 5 samples/sec 3 = 12.5 samples/sec 4 = 25 samples/sec 5 = 100 samples/sec  
(HDR and LDR) A = 1 sample/sec B = 5 samples/sec C = 12.5 samples/sec D = 25 samples/sec E = 100 samples/sec



TABLE 4.229.7-3. RENDEZVOUS RADAR SUBSYSTEM OPERATING PROGRAM (G4.229) I-LOADS

| FSSR NAME | MSID | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R<br>E<br>V |
|-----------|------|-----------|----|----|---|---|---------|----|-----|---------|-------------|
|-----------|------|-----------|----|----|---|---|---------|----|-----|---------|-------------|

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NO REQUIREMENTS

**NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.**

TABLE 4.229.7-4. RENDEZVOUS RADAR SUBSYSTEM OPERATING PROGRAM (G4.229) K-LOADS

| FSSR NAME<br>DESCRIPTION | MSID | MC | KLOAD VALUE | ENG UNITS | DT | P<br>R | S | PR FCTN | LAST CR | R<br>E<br>V |
|--------------------------|------|----|-------------|-----------|----|--------|---|---------|---------|-------------|
|--------------------------|------|----|-------------|-----------|----|--------|---|---------|---------|-------------|

NO REQUIREMENTS

**NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.**

TABLE 4.229.7-5. RENDEZVOUS RADAR SUBSYSTEM OPERATING PROGRAM (G4.229) CONSTANTS

| FSSR NAME<br>DESCRIPTION | MSID | MC | CONSTANT VALUE | ENG UNITS | DT | P<br>R | S | PR FCTN | LAST CR | R<br>E<br>V |
|--------------------------|------|----|----------------|-----------|----|--------|---|---------|---------|-------------|
|--------------------------|------|----|----------------|-----------|----|--------|---|---------|---------|-------------|

NO REQUIREMENTS

**NOTE: REFERENCE TABLE 1.3-1 FOR EXPLANATION OF DATA ELEMENTS.**

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## **5.0 SUPPLEMENTARY MATERIAL**

### **5.1 GLOSSARY**

Terms and acronyms that occur in the nav aid SOP's in this volume are identified on the following pages.

| GLOSSARY        |                                                                                                                                       |             |       |       |    |        |    |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------|-------------|-------|-------|----|--------|----|
| Acronym/Name    | Definition Description                                                                                                                | Application |       |       |    |        |    |
|                 |                                                                                                                                       | GPS         | TACAN | MSBLS | RA | NAVDAD | RR |
| AA              | Air-to-air                                                                                                                            |             | X     |       |    |        |    |
| A/L             | Approach and landing                                                                                                                  |             |       |       |    | X      |    |
| ACC_DRAG        | Drag deceleration from UPP (ft/sec <sup>2</sup> )                                                                                     |             |       |       |    | X      |    |
| ADS             | Air data system                                                                                                                       |             |       |       |    | X      |    |
| ADTA            | Air data transducer assembly                                                                                                          | X           |       |       |    | X      |    |
| AGC             | Automatic gain control                                                                                                                |             |       | X     |    |        |    |
| ALPHA_NAVDAD    | Navigation-derived angle of attack (deg)                                                                                              |             |       |       |    | X      |    |
| ALT             | Altitude above mean sea level (ft)                                                                                                    |             |       |       |    | X      |    |
| ALT_B(I)        | Altitude at base of Ith layer (ft)                                                                                                    |             |       |       |    | X      |    |
| AMI             | Alpha/mach indicator. Panel instrument giving equivalent airspeed, alpha, mach indicator, accelerometer scale                         |             |       |       |    | X      |    |
| ANG_STATUS      | Rendezvous radar angle status word                                                                                                    |             |       |       |    |        | X  |
| ANGRT_STATUS    | Rendezvous radar angle rate status word                                                                                               |             |       |       |    |        | X  |
| ATT_PROC        | Attitude processing                                                                                                                   |             |       |       |    |        | X  |
| AUTO_CHANNEL_ID | TACAN channel selection                                                                                                               |             | X     |       |    |        |    |
| AUTO_TRACK      | Auto track mode                                                                                                                       |             |       |       |    |        | X  |
| AUTOSPEC        | Automatic specification                                                                                                               |             |       |       |    | X      |    |
| AVVI            | Altitude, vertical velocity indicator. Panel instrument giving baro/nav altitude, vertical velocity, acceleration, and radar altitude |             |       |       | X  | X      |    |
| BCD             | Binary coded data                                                                                                                     |             |       |       |    |        |    |
| BITE            | Built-in test equipment                                                                                                               |             | X     | X     | X  |        | X  |
| C               | Communication function                                                                                                                |             |       |       |    |        | X  |
| C-BAND          | 7-cm electromagnetic radiation region                                                                                                 |             |       |       | X  |        |    |
| C_D             | Drag coefficient                                                                                                                      |             |       |       |    | X      |    |
| CL              | Centerline                                                                                                                            |             |       |       |    |        |    |
| CLOCK           | Clock-computer (GMT)                                                                                                                  |             | X     | X     | X  |        | X  |
| COAS            | Crewman optical alignment sight                                                                                                       |             |       |       |    |        |    |
| COMMFAULT       | Communication fault                                                                                                                   | X           | X     | X     |    |        | X  |
| COMLOCK         | No comfault and locked on to signal                                                                                                   |             | X     | X     |    |        |    |
| COMM            | Communication                                                                                                                         |             |       |       |    |        | X  |
| COMPOOL         | Common data pool                                                                                                                      |             |       |       |    |        |    |



| GLOSSARY          |                                                                            |             |       |       |    |        |    |
|-------------------|----------------------------------------------------------------------------|-------------|-------|-------|----|--------|----|
| Acronym/Name      | Definition Description                                                     | Application |       |       |    |        |    |
|                   |                                                                            | GPS         | TACAN | MSBLS | RA | NAVDAD | RR |
| COURSE_WRT_RW     | Absolute course with respect to runway CL                                  |             |       | X     |    |        |    |
| COURSE_WRT_RW_LIM | Limiting value of course with respect to runway CL                         |             |       | X     |    |        |    |
| CPDS              | Computer program development specification                                 | X           |       |       |    |        |    |
| CR                | Communication and radar function                                           |             |       |       |    |        | X  |
| CR                | Change request                                                             |             | X     | X     | X  | X      | X  |
| D&C               | Display and controls                                                       |             |       |       |    |        |    |
| DA                | Deployment assembly                                                        |             |       |       |    |        | X  |
| DDPS              | Digital data processing system                                             |             | X     | X     | X  |        |    |
| DEU               | Display electronics unit                                                   |             | X     | X     | X  |        |    |
| DPS               | Data processing subsystem                                                  |             |       |       |    |        |    |
| DYPRS_N           | Subfunction to calculate dynamic pressure as a function of navigation data |             |       |       |    | X      |    |
| EA-1              | Electronics assembly No. 1                                                 |             |       |       |    |        | X  |
| EA-2              | Electronics assembly No. 2                                                 |             |       |       |    |        | X  |
| EAS_N             | Navigation-derived equivalent airspeed (ft/sec)                            |             |       |       |    | X      |    |
| EQAS              | Subfunction to calculate equivalent airspeed from navigation data          |             |       |       |    | X      |    |
| FCOS              | Flight control operating system                                            | X           |       |       |    |        |    |
| FDIR              | Fault detection, identification, and recovery                              |             | X     | X     | X  |        |    |
| FWD               | Forward                                                                    |             |       |       |    |        | X  |
| FOM               | Figure of merit                                                            | X           |       |       |    |        |    |
| G_OVR_T           | Sea-level gravity divided by the universal gas constant ( $^{\circ}$ K/ft) |             |       |       |    | X      |    |
| GAX               | GN&C annunciator interface                                                 |             | X     | X     |    |        | X  |
| GDOP              | Geometric Dilution of Precision                                            | X           |       |       |    |        |    |
| GPC_ACQ           | GPC acquisition mode                                                       |             |       |       |    |        | X  |
| GPC_DES           | GPC designate mode                                                         |             |       |       |    |        | X  |
| GPS               | Global Positioning System                                                  | X           |       |       |    |        |    |
| GRTLS             | Glide return to launch site                                                |             |       |       |    |        |    |
| GUID              | Guidance                                                                   |             |       |       |    |        |    |
| H/W               | Hardware                                                                   |             |       |       |    |        |    |
| HSI               | Horizontal situation indicator                                             |             | X     | X     |    |        |    |

| GLOSSARY       |                                                           |             |       |       |    |        |    |
|----------------|-----------------------------------------------------------|-------------|-------|-------|----|--------|----|
| Acronym/Name   | Definition Description                                    | Application |       |       |    |        |    |
|                |                                                           | GPS         | TACAN | MSBLS | RA | NAVDAD | RR |
| I              | The Ith layer in the atmospheric model                    |             |       |       |    | X      |    |
| ID             | Identification                                            |             | X     |       |    |        |    |
| IMU            | Inertial measurement unit                                 | X           |       |       |    |        |    |
| INITIALIZATION | Initialization mode                                       |             |       |       |    |        | X  |
| KCD()          | Constant in the atmospheric model                         |             |       |       |    | X      |    |
| KU-BAND        | 2-cm microwave radiation region                           |             |       | X     |    |        | X  |
| L-BAND         | 28-cm electromagnetic radiation region                    |             | X     |       |    |        |    |
| LDG            | Landing                                                   |             |       | X     |    |        |    |
| LM (I)         | Lapse rate in the Ith layer (°K/ft)                       |             |       |       |    | X      |    |
| LOS            | Line of sight                                             |             |       |       |    |        | X  |
| LRU            | Line replaceable unit                                     | X           | X     | X     | X  |        | X  |
| LRU_ID         | TACAN LRU number                                          |             | X     |       |    |        |    |
| LSB            | Least significant bit                                     |             |       |       |    |        |    |
| M              | Current vehicle mass (slugs)                              |             |       |       |    | X      |    |
| M_N            | Navigation-derived Mach number                            |             |       |       |    | X      |    |
| MACH_N         | Subfunction to calculate Mach number from navigation data |             |       |       |    | X      |    |
| MANUAL         | Manual mode                                               |             |       |       |    |        | X  |
| MAZM_CMLK      | MLS azimuth commfault/lock-on flag                        |             |       | X     |    |        |    |
| MAZVOMLK       | Azimuth comlock                                           |             |       | X     |    |        |    |
| MDM            | Multiplexer/demultiplexer                                 | X           | X     | X     | X  |        | X  |
| MELVCMLK       | MLS elevation commfault/lock-on flag                      |             |       | X     |    |        |    |
| MELVOMLK       | Elevation comlock                                         |             |       | X     |    |        |    |
| MLS            | Combining form for MSBLS                                  |             |       | X     |    |        |    |
| MLS_CF         | MLS comfault                                              |             |       | X     |    |        |    |
| MLSNMI_FT      | MLS conversion: nautical miles to feet (ft/nmi)           |             |       | X     |    |        |    |
| MML            | Master measurement list                                   |             |       |       |    |        |    |
| MRNG_CMLK      | MLS range commfault/lock-on flag                          |             |       | X     |    |        |    |
| MRNGOMLK       | Range comlock                                             |             |       | X     |    |        |    |
| MSABZIN        | MLS azimuth in                                            |             |       | X     |    |        |    |
| MSB            | Most significant bit                                      |             |       |       |    |        |    |
| MSB            | Combining form for MSBLS                                  |             |       | X     |    |        |    |

| GLOSSARY       |                                                        |             |       |       |    |        |    |
|----------------|--------------------------------------------------------|-------------|-------|-------|----|--------|----|
| Acronym/Name   | Definition Description                                 | Application |       |       |    |        |    |
|                |                                                        | GPS         | TACAN | MSBLS | RA | NAVDAD | RR |
| MSB_DATA       | MLS data processing                                    |             |       | X     |    |        |    |
| MSB_IN         | MLS input processing                                   |             |       | X     |    |        |    |
| MSBAZ_LIM      | Maximum allowed limit on absolute value of MLS azimuth |             |       | X     |    |        |    |
| MSBAZIMDG      | MLS azimuth lock-on flag                               |             |       | X     |    |        |    |
| MSBAZIMIN      | MLS azimuth word                                       |             |       | X     |    |        |    |
| MSBAZIMO       | MLS azimuth out                                        |             |       | X     |    |        |    |
| MSBAZIMTIM     | MLS azimuth measurement time (sec)                     |             |       | X     |    |        |    |
| MSBELEV        | MLS elevation in                                       |             |       | X     |    |        |    |
| MSBELEVDG      | MLS elevation locked on                                |             |       | X     |    |        |    |
| MSBELEVIN      | MLS elevation word                                     |             |       | X     |    |        |    |
| MSBELEVO       | MLS elevation out                                      |             |       | X     |    |        |    |
| MSBELEVTIM     | MLS elevation measurement time (sec)                   |             |       | X     |    |        |    |
| MSBELMAX_LIM   | Upper limit on allowable elevation                     |             |       | X     |    |        |    |
| MSBELMIN_LIM   | Lower limit on allowable elevation                     |             |       | X     |    |        |    |
| MSBELVSTB      | MLS failure: elevation self-test bad                   |             |       | X     |    |        |    |
| MSBLS          | Microwave scanning beam landing system                 |             |       | X     |    |        |    |
| MSBRANGDG      | MLS range locked on                                    |             |       | X     |    |        |    |
| MSBRANGE       | MLS range in                                           |             |       | X     |    |        |    |
| MSBRANGE0      | MLS range out                                          |             |       | X     |    |        |    |
| MSBRANGIN      | MLS range word                                         |             |       | X     |    |        |    |
| MSBRANGTIM     | MLS range measurement time (sec)                       |             |       | X     |    |        |    |
| MSBRNG_LIM     | Maximum allowed limit on MLS range                     |             |       | X     |    |        |    |
| MSID           | Master stimulus identification                         | X           | X     | X     | X  | X      | X  |
| MTU            | Master timing unit                                     |             |       | X     |    |        |    |
| MX             | Mission/LRU dependent constant                         |             | X     | X     | X  | X      | X  |
| NAVDAD         | Navigation-derived air data                            |             |       |       |    | X      |    |
| NAVDAD_AUTO    | Selection flag for NAVDAD                              |             |       |       |    | X      |    |
| NEW_STATION_ID | TACAN 1, 2, or 3 new station channel number            |             | X     |       |    |        |    |
| NMI            | Nautical miles                                         |             | X     | X     | X  |        | X  |
| OFT            | Orbital flight test                                    |             |       |       |    |        |    |
| OWDE           | One-way Doppler extractor                              |             |       |       |    |        |    |

| GLOSSARY      |                                                                                                                             |             |       |       |    |        |    |
|---------------|-----------------------------------------------------------------------------------------------------------------------------|-------------|-------|-------|----|--------|----|
| Acronym/Name  | Definition Description                                                                                                      | Application |       |       |    |        |    |
|               |                                                                                                                             | GPS         | TACAN | MSBLS | RA | NAVDAD | RR |
| PCN           | Page change notification                                                                                                    |             | X     | X     | X  | X      | X  |
| PROC          | Processor, processing                                                                                                       |             |       |       |    |        |    |
| Q_M50BODY     | M50-to-body quaternion element                                                                                              |             |       |       |    |        |    |
| Q_M50BODY_RR  | M50-to-body RR element                                                                                                      |             |       |       |    |        | X  |
| QBAR_N        | Navigation-derived dynamic pressure (lb/ft <sup>2</sup> ) (dynamic pressure is pressure from forward motion of the vehicle) |             |       |       |    |        | X  |
| R             | Radar function                                                                                                              |             |       |       |    |        | X  |
| R             | Receive mode                                                                                                                |             | X     |       |    |        |    |
| R/T           | Receiver-transmitter                                                                                                        |             | X     |       | X  |        |    |
| RA            | Radar altimeter                                                                                                             | X           |       |       | X  |        |    |
| RA_ALTIN      | Radar altimeter parent word                                                                                                 |             |       |       | X  |        |    |
| RA_ALTO       | Radar altimeter altitude                                                                                                    |             |       |       | X  |        |    |
| RA_DATA       | Radar altimeter data processing                                                                                             |             |       |       | X  |        |    |
| RA_PWR_ON     | Radar altimeter ready                                                                                                       |             |       |       | X  |        |    |
| RA_TIME       | Radar altimeter time                                                                                                        |             |       |       | X  |        |    |
| RALT_CMLK     | RA commfault/lock-on flag                                                                                                   |             |       |       | X  |        |    |
| RALT_DG       | Radar altimeter locked on                                                                                                   |             |       |       | X  |        |    |
| RAPODD        | Parity sum of radar altimeter parent word                                                                                   |             |       |       | X  |        |    |
| RCVR_LEFT     | HSI receiver select                                                                                                         |             | X     | X     |    |        |    |
| RCVR_RIGHT    | HSI receiver select                                                                                                         |             | X     | X     |    |        |    |
| RDR           | Radar                                                                                                                       |             |       |       |    |        | X  |
| REF_AREA      | Reference area (ft <sup>2</sup> ) for vehicle model associated with C_D                                                     |             |       |       |    | X      |    |
| REL NAV       | Relative navigation                                                                                                         |             |       |       |    |        | X  |
| REL_MOT       | Relative motion                                                                                                             |             |       |       |    |        | X  |
| REL_VEL_MAG   | Ground relative velocity magnitude (ft/sec)                                                                                 |             |       |       |    | X      |    |
| RENDZ         | Rendezvous                                                                                                                  |             |       |       |    |        | X  |
| RHO_B(I)      | Air density at the base of the Ith layer (slugs/ft <sup>3</sup> )                                                           |             |       |       |    | X      |    |
| RHO_N         | Navigation-derived air density (slugs/ft <sup>3</sup> )                                                                     |             |       |       |    | X      |    |
| RHO_SEA_LEVEL | Sea-level air density (slugs/ft <sup>3</sup> )                                                                              |             |       |       |    | X      |    |
| RL_TIMER      | Range lock-on timer                                                                                                         |             | X     |       |    |        |    |
| RM            | Redundancy management                                                                                                       |             | X     | X     | X  |        |    |

| GLOSSARY     |                                         |             |       |       |    |        |    |
|--------------|-----------------------------------------|-------------|-------|-------|----|--------|----|
| Acronym/Name | Definition Description                  | Application |       |       |    |        |    |
|              |                                         | GPS         | TACAN | MSBLS | RA | NAVDAD | RR |
| RND RDR      | Rendezvous radar                        |             |       |       |    |        | X  |
| RNG_STATUS   | Rendezvous radar range status word      |             |       |       |    |        | X  |
| RNGRT_STATUS | Rendezvous radar range rate status word |             |       |       |    |        | X  |
| RR           | Rendezvous radar                        |             |       |       |    |        | X  |
| RR_ANG_DG    | Rendezvous radar angle data good        |             |       |       |    |        | X  |
| RR_ANGR_DG   | Rendezvous radar angle rate data good   |             |       |       |    |        | X  |
| RR_COM_FLT   | Rendezvous radar commfault              |             |       |       |    |        | X  |
| RR_PITCH_IN  | Ku-band A channel 2 pitch WD4 WD4       |             |       |       |    |        | X  |
| RR_PITCHO    | Rendezvous radar pitch angle out        |             |       |       |    |        | X  |
| RR_PRTE_IN   | Ku-band A channel 2 pitch rate WD10     |             |       |       |    |        | X  |
| RR_PRTEO     | Rendezvous radar pitch rate out         |             |       |       |    |        | X  |
| RR_RANGE_A   | Ku-band A channel 2 range WD7 WD7       |             |       |       |    |        | X  |
| RR_RANGE_B   | Ku-band A channel 2 range WD8 WD8       |             |       |       |    |        | X  |
| RR_RANGEO    | Rendezvous radar range out              |             |       |       |    |        | X  |
| RR_RANGRO    | Rendezvous radar range rate out         |             |       |       |    |        | X  |
| RR_RNG_DG    | Rendezvous radar range rate data good   |             |       |       |    |        | X  |
| RR_RNGRTE_A  | Ku-band A channel 2 range rate WD5      |             |       |       |    |        | X  |
| RR_RNGRTE_B  | Ku-band A channel 2 range rate WD6      |             |       |       |    |        | X  |
| RR_ROLL_IN   | Ku-band A channel 2 roll rate WD3 WD3   |             |       |       |    |        | X  |
| RR_ROLLO     | Rendezvous radar roll angle out         |             |       |       |    |        | X  |
| RR_RRTE_IN   | Ku-band A channel 2 roll rate WD9       |             |       |       |    |        | X  |
| RR_RRTEO     | Rendezvous radar roll rate out          |             |       |       |    |        | X  |
| RR_SELF_TEST | Rendezvous radar self-test in progress  |             |       |       |    |        | X  |
| RR_STAT      | Ku-band A channel 2 status word         |             |       |       |    |        | X  |
| RR_STAT_DISP | Radar mode status word                  |             |       |       |    |        | X  |
| RR_VALID     | Rendezvous radar data valid             |             |       |       |    |        | X  |
| RTLS         | Return to launch site                   |             | X     | X     | X  | X      |    |

| GLOSSARY     |                                                              |             |       |       |    |        |    |
|--------------|--------------------------------------------------------------|-------------|-------|-------|----|--------|----|
| Acronym/Name | Definition Description                                       | Application |       |       |    |        |    |
|              |                                                              | GPS         | TACAN | MSBLS | RA | NAVDAD | RR |
| SAT_N        | Navigation-derived static air temperature (°K)               |             |       |       |    | X      |    |
| SELF_TEST    | Self_test mode                                               |             | X     | X     | X  |        | X  |
| SF           | Selection filter                                             |             | X     | X     | X  |        |    |
| SITE_LOOKUP  | Site location of TACAN station from mini-table               |             | X     |       |    |        |    |
| SM           | System management                                            |             |       |       |    |        | X  |
| SOP          | Subsystem operating program                                  | X           | X     | X     | X  | X      | X  |
| SOURCE_LEFT  | HSI source select                                            |             | X     | X     |    |        |    |
| SOURCE_RIGHT | HSI source select                                            |             | X     | X     |    |        |    |
| SPD_SND_CON  | Speed-of-sound constant for air (ft/sec °K <sup>-1/2</sup> ) |             |       |       |    | X      |    |
| ST           | Star tracker                                                 |             |       |       |    |        |    |
| STS          | Space Transportation System                                  |             |       |       |    |        |    |
| SW           | Software                                                     |             | X     | X     | X  | X      | X  |
| SX           | Soft constant                                                |             | X     | X     | X  | X      | X  |
| T/R          | Transmit/receive                                             |             | X     |       |    |        |    |
| TAC_ANT      | TACAN antenna selection                                      |             | X     |       |    |        |    |
| TAC_BEARHI   | TACAN bearing high limit (deg)                               |             | X     |       |    |        |    |
| TAC_BEARLO   | TACAN bearing low limit (deg)                                |             | X     |       |    |        |    |
| TAC_BIT      | TACAN built-in test                                          |             | X     |       |    |        |    |
| TAC_BRGFL    | TACAN bearing self-test fail                                 |             | X     |       |    |        |    |
| TAC_CHAN     | TACAN channel command                                        |             | X     |       |    |        |    |
| TAC_CNTRL    | TACAN control word                                           |             | X     |       |    |        |    |
| TAC_DATA     | TACAN data processing                                        |             | X     |       |    |        |    |
| TAC_DW       | MDM FFO( ) discrete in CD00 channel 5                        |             | X     |       |    |        |    |
| TAC_GPC      | TACAN auto discrete                                          |             | X     |       |    |        |    |
| TAC_RLTIM    | TACAN range lock-on time limit                               |             | X     |       |    |        |    |
| TAC_RNGFL    | TACAN range self-test fail                                   |             | X     |       |    |        |    |
| TAC_RNGHI    | TACAN range high limit (nmi)                                 |             | X     |       |    |        |    |
| TAC_RNGLO    | TACAN range low limit (nmi)                                  |             | X     |       |    |        |    |
| TAC_STIP     | Self-test in progress                                        |             | X     |       |    |        |    |
| TAC_STTIM    | TACAN self-test time (sec)                                   |             | X     |       |    |        |    |
| TAC_SUPP_ACT | TACAN suppression active                                     |             | X     |       |    |        |    |
| TAC_TEST     | TACAN self-test processing                                   |             | X     |       |    |        |    |
| TAC_TIM_TAG  | TACAN time tag                                               |             | X     |       |    |        |    |

| GLOSSARY       |                                                   |             |       |       |    |        |    |
|----------------|---------------------------------------------------|-------------|-------|-------|----|--------|----|
| Acronym/Name   | Definition Description                            | Application |       |       |    |        |    |
|                |                                                   | GPS         | TACAN | MSBLS | RA | NAVDAD | RR |
| TACAN          | Tactical air navigation                           |             | X     |       |    |        |    |
| TACANTINH      | TACAN antenna switch inhibit                      |             | X     |       |    |        |    |
| TACANTSEL      | TACAN channel selection                           |             | X     |       |    |        |    |
| TACBEARA       | TACAN bearing word A                              |             | X     |       |    |        |    |
| TACBEARB       | TACAN bearing word B                              |             | X     |       |    |        |    |
| TACBEARDG      | TACAN bearing locked on                           |             | X     |       |    |        |    |
| TACBEARO       | TACAN bearing out                                 |             | X     |       |    |        |    |
| TACCFM         | MDM FFO discrete in CD00 channel 6                |             | X     |       |    |        |    |
| TACCHAN        | TACAN channel with mode                           |             | X     |       |    |        |    |
| TACPOD         | TACAN power discrete                              |             | X     |       |    |        |    |
| TACPON         | TACAN buffered power status                       |             | X     |       |    |        |    |
| TACRANGA       | TACAN range word A                                |             | X     |       |    |        |    |
| TACRANGB       | TACAN range word B                                |             | X     |       |    |        |    |
| TACRANGDG      | TACAN range locked on                             |             | X     |       |    |        |    |
| TACRANGE0      | TACAN range out                                   |             | X     |       |    |        |    |
| TAEM           | Terminal area energy management                   |             |       |       | X  |        |    |
| TBRG_CMLK      | TACAN bearing commfault/lock-on flag              |             | X     |       |    |        |    |
| TCH_CHNG       | TACAN channel change indicator                    |             | X     |       |    |        |    |
| TDRS           | Tracking and data relay satellite                 |             |       |       |    |        | X  |
| TLM            | Telemetry                                         |             | X     | X     | X  | X      | X  |
| TMB(I)         | Temperature at base of Ith layer (°K)             |             |       |       |    | X      |    |
| TNMFT          | TACAN nautical miles to feet conversion (ft/nmi)  |             | X     |       |    |        |    |
| TRK_LAST_CYCLE | Track flag for rendezvous                         |             |       |       |    |        | X  |
| TRNG_CMLK      | TACAN range commfault/lock-on flag                |             | X     |       |    |        |    |
| UPLINK         | Data relayed from ground to orbiter               |             |       |       |    |        |    |
| UPP            | User parameter processor                          | X           |       | X     |    | X      |    |
| V_NAVDAD       | Switching point from drag model to $1/2 \rho v^2$ |             |       |       |    | X      |    |
| VU             | Vehicle utility (display)                         |             |       | X     | X  |        |    |
| WGS84          | World Geodetic Survey 1984                        | X           |       |       |    |        |    |
| WR_RTLS        | Current vehicle mass (slugs) for entry guidance   |             |       |       |    |        |    |
| WRT            | With respect to                                   |             |       |       |    |        |    |

| GLOSSARY     |                                           |             |       |       |    |        |    |
|--------------|-------------------------------------------|-------------|-------|-------|----|--------|----|
| Acronym/Name | Definition Description                    | Application |       |       |    |        |    |
|              |                                           | GPS         | TACAN | MSBLS | RA | NAVDAD | RR |
| X            | Hard constant                             |             | X     | X     | X  | X      | X  |
| X/Y          | TACAN ground beacon mode function: X or Y |             | X     |       |    |        |    |
| X            | TACAN ground beacon: direct mode          |             |       |       |    |        |    |
| Y            | TACAN ground beacon: reverse mode         |             | X     |       |    |        |    |



## **5.2 NONREQUIREMENT FLOW CHARTS/DIAGRAMS**

This section contains nonrequirement flow charts and diagrams applicable to the nav aid SOP. Flow diagrams applicable to a specific functional module are included in that module section.

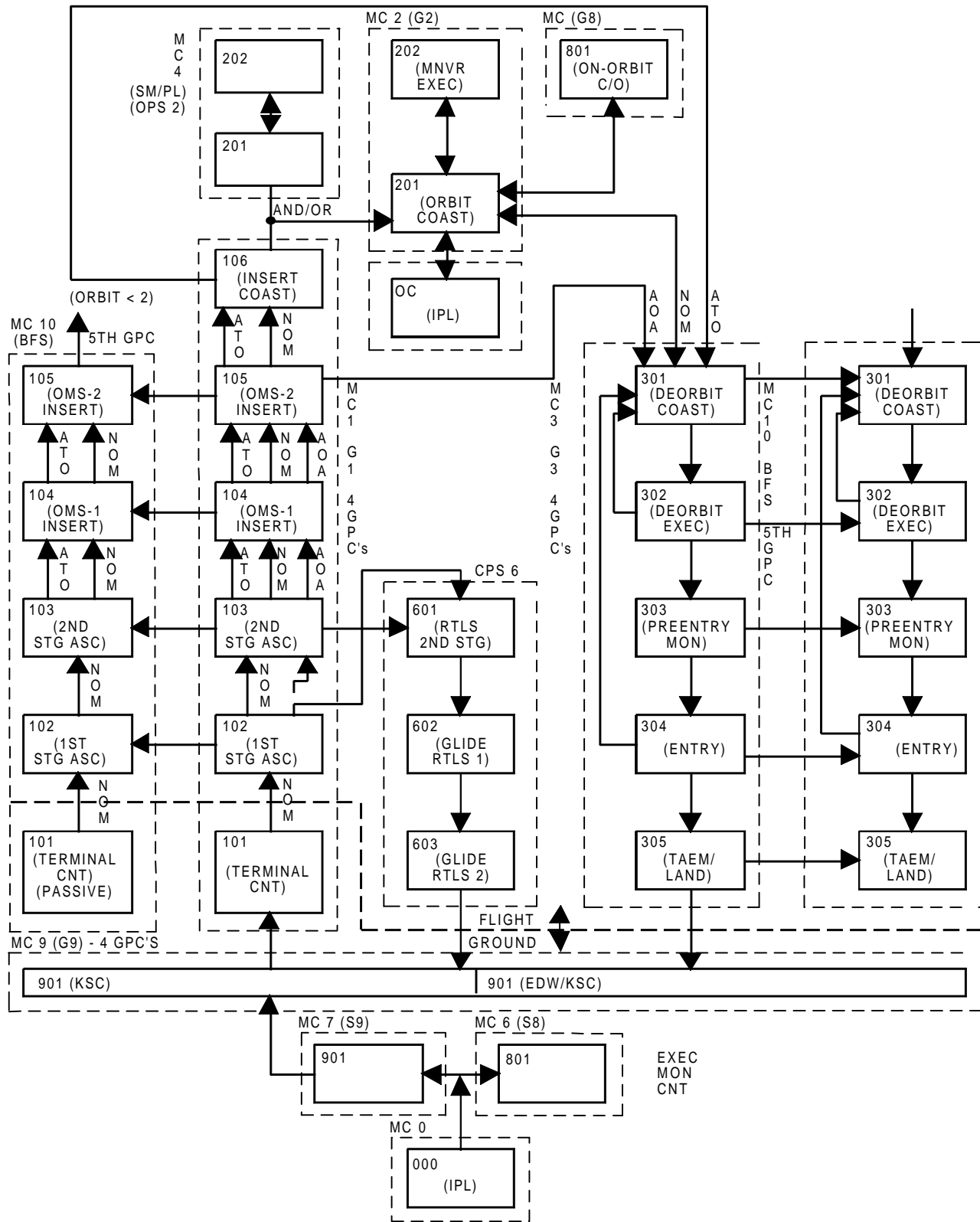


FIGURE 5.2-1. Major Modes and Transitions

**APPENDIX R CHANGE AUTHORIZATION REFERENCES**

**R.1 CR REFERENCE SUMMARY**

Table R.1-1. lists the paragraphs, tables (T), and figures (F) that have been changed as a result of approved change requests commencing with OI-26 up to the current OI. Changes incorporated prior to OI-26 are listed in the Historical Change Request Summary.

| Table R.1-1. CR Reference Summary |            |        |                                                            |                                         |
|-----------------------------------|------------|--------|------------------------------------------------------------|-----------------------------------------|
| Paragraph                         | CR No.     | OI     | CR Title                                                   |                                         |
| N/A                               | 92103A     | 26B    | FSSR Parameter Table Upgrade                               |                                         |
|                                   | 92307      | 29     | FSSR Format Change - Documentation Only                    |                                         |
| 3.3                               | 91051K     | 26B    | Streamlined Shuttle GPS Capability                         |                                         |
|                                   | 92025B     | 26B    | Onorbit Tacan Deletion                                     |                                         |
| 4.0                               | 92069B     | 26B    | Single-String GPS Documentation Cleanup                    |                                         |
|                                   | 92025B     | 26B    | Onorbit Tacan Deletion                                     |                                         |
| 4.0.1-1.(T)                       | 92067D     | 27     | Three String GPS Capability                                |                                         |
|                                   | 92069B     | 26B    | Single-String GPS Documentation Cleanup                    |                                         |
|                                   | 92364D     | 29     | Just-In-Time Flight Design (JITFD) I-Load Uplink Expansion |                                         |
|                                   | 92529B     | 30     | GPS Capability Enhancements for OI-30                      |                                         |
| 4.0.1-2.(T)                       | 92069B     | 26B    | Single-String GPS Documentation Cleanup                    |                                         |
| 4.17                              | 91051K     | 26B    | Streamlined Shuttle GPS Capability                         |                                         |
| 4.17.1                            | 91051K     | 26B    | Streamlined Shuttle GPS Capability                         |                                         |
| 4.17.1.1                          | 91051K     | 26B    | Streamlined Shuttle GPS Capability                         |                                         |
| 4.17.1.1-1.(F)                    | 91051K     | 26B    | Streamlined Shuttle GPS Capability                         |                                         |
| 4.17.1.1.1                        | 91051K     | 26B    | Streamlined Shuttle GPS Capability                         |                                         |
|                                   | 92056D     | 26B    | Remove Unnecessary GPS SOP Processing in G9                |                                         |
|                                   | 92067D     | 27     | Three String GPS Capability                                |                                         |
|                                   | 92144C     | 27     | Three String GPS Document Cleanup                          |                                         |
|                                   | 92277      | 27     | GPS SOP Self-Test Bit SWAP                                 |                                         |
|                                   | 92289A     | 27     | Post STS-91 OI-27 GPS Redesign                             |                                         |
|                                   | 92369B     | 29     | PASS GPS Operational Enhancements                          |                                         |
|                                   | 92630A     | 30     | I-Load Controls for GPS Residual Edit Logic                |                                         |
|                                   | 4.17.1.1.2 | 91051K | 26B                                                        | Streamlined Shuttle GPS Capability      |
|                                   |            | 92069B | 26B                                                        | Single-String GPS Documentation Cleanup |
| 4.17.1.1.2-1.(T)                  | 91051K     | 26B    | Streamlined Shuttle GPS Capability                         |                                         |
| 4.17.1.1.2-2.(T)                  | 91051K     | 26B    | Streamlined Shuttle GPS Capability                         |                                         |
|                                   | 92035D     | 26B    | GPS SOP Processing Relief                                  |                                         |

| Table R.1-1. CR Reference Summary |        |     |                                                            |
|-----------------------------------|--------|-----|------------------------------------------------------------|
| Paragraph                         | CR No. | OI  | CR Title                                                   |
| 4.17.1.1.2-3.(T)                  | 92049C | 26B | Corrections to CR 91051K, Streamlined Shuttle GPS          |
|                                   | 92067D | 27  | Three String GPS Capability                                |
|                                   | 91051K | 26B | Streamlined Shuttle GPS Capability                         |
| 4.17.1.1.2-4.(T)                  | 92630A | 30  | I-Load Controls for GPS Residual Edit Logic                |
|                                   | 91051K | 26B | Streamlined Shuttle GPS Capability                         |
| 4.17.1.1.2-5.(T)                  | 92049C | 26B | Corrections to CR 91051K, Streamlined Shuttle GPS          |
|                                   | 92067D | 27  | Three String GPS Capability                                |
|                                   | 91051K | 26B | Streamlined Shuttle GPS Capability                         |
| 4.17.1.1.2-6.(T)                  | 92067D | 27  | Three String GPS Capability                                |
|                                   | 91051K | 26B | Streamlined Shuttle GPS Capability                         |
| 4.17.1.1.2-7.(T)                  | 92049C | 26B | Corrections to CR 91051K, Streamlined Shuttle GPS          |
|                                   | 92069B | 26B | Single-String GPS Documentation Cleanup                    |
|                                   | 92067D | 27  | Three String GPS Capability                                |
|                                   | 91051K | 26B | Streamlined Shuttle GPS Capability                         |
|                                   | 92049C | 26B | Corrections to CR 91051K, Streamlined Shuttle GPS          |
| 4.17.1.1.3                        | 92067D | 27  | Three String GPS Capability                                |
|                                   | 92529B | 30  | GPS Capability Enhancements for OI-30                      |
| 4.17.1.2                          | 91051K | 26B | Streamlined Shuttle GPS Capability                         |
|                                   | 91051K | 26B | Streamlined Shuttle GPS Capability                         |
|                                   | 92067D | 27  | Three String GPS Capability                                |
|                                   | 92364D | 29  | Just-In-Time Flight Design (JITFD) I-Load Uplink Expansion |
| 4.17.1.3                          | 92529B | 30  | GPS Capability Enhancements for OI-30                      |
|                                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift                   |
|                                   | 91051K | 26B | Streamlined Shuttle GPS Capability                         |
| 4.17.1.3-1.(T)                    | 91051K | 26B | Streamlined Shuttle GPS Capability                         |
|                                   | 92067D | 27  | Three String GPS Capability                                |
|                                   | 92364D | 29  | Just-In-Time Flight Design (JITFD) I-Load Uplink Expansion |
|                                   | 92529B | 30  | GPS Capability Enhancements for OI-30                      |
|                                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift                   |
| 4.17.1.4                          | 91051K | 26B | Streamlined Shuttle GPS Capability                         |
| 4.17.1.5                          | 91051K | 26B | Streamlined Shuttle GPS Capability                         |
| 4.17.2                            | 91051K | 26B | Streamlined Shuttle GPS Capability                         |
| 4.17.3                            | 91051K | 26B | Streamlined Shuttle GPS Capability                         |
|                                   | 92069B | 26B | Single-String GPS Documentation Cleanup                    |
| 4.17.4                            | 91051K | 26B | Streamlined Shuttle GPS Capability                         |

| Table R.1-1. CR Reference Summary |                 |        |                                                            |                                                               |
|-----------------------------------|-----------------|--------|------------------------------------------------------------|---------------------------------------------------------------|
| Paragraph                         | CR No.          | OI     | CR Title                                                   |                                                               |
| 4.17.5                            | 92035D          | 26B    | GPS SOP Processing Relief                                  |                                                               |
|                                   | 92067D          | 27     | Three String GPS Capability                                |                                                               |
|                                   | 92817C          | 32     | GPS FSW Compensation for GPC Clock Drift                   |                                                               |
|                                   | 91051K          | 26B    | Streamlined Shuttle GPS Capability                         |                                                               |
|                                   | 92067D          | 27     | Three String GPS Capability                                |                                                               |
| 4.17.6                            | 92817C          | 32     | GPS FSW Compensation for GPC Clock Drift                   |                                                               |
|                                   | 91051K          | 26B    | Streamlined Shuttle GPS Capability                         |                                                               |
|                                   | 92035D          | 26B    | GPS SOP Processing Relief                                  |                                                               |
|                                   | 92049C          | 26B    | Corrections to CR 91051K, Streamlined Shuttle GPS          |                                                               |
|                                   | 92056D          | 26B    | Remove Unnecessary GPS SOP Processing in G9                |                                                               |
|                                   | 92069B          | 26B    | Single-String GPS Documentation Cleanup                    |                                                               |
|                                   | 92067D          | 27     | Three String GPS Capability                                |                                                               |
|                                   | 92144C          | 27     | Three String GPS Document Cleanup                          |                                                               |
|                                   | 92289A          | 27     | Post STS-91 OI-27 GPS Redesign                             |                                                               |
|                                   | 92364D          | 29     | Just-In-Time Flight Design (JITFD) I-Load Uplink Expansion |                                                               |
|                                   | 92369B          | 29     | PASS GPS Operational Enhancements                          |                                                               |
|                                   | 92529B          | 30     | GPS Capability Enhancements for OI-30                      |                                                               |
|                                   | 92817C          | 32     | GPS FSW Compensation for GPC Clock Drift                   |                                                               |
|                                   | 4.17.6-1.(F)    | 91051K | 26B                                                        | Streamlined Shuttle GPS Capability                            |
|                                   |                 | 92035D | 26B                                                        | GPS SOP Processing Relief                                     |
| 92069B                            |                 | 26B    | Single-String GPS Documentation Cleanup                    |                                                               |
| 92067D                            |                 | 27     | Three String GPS Capability                                |                                                               |
| 92144C                            |                 | 27     | Three String GPS Document Cleanup                          |                                                               |
| 92289A                            |                 | 27     | Post STS-91 OI-27 GPS Redesign                             |                                                               |
| 92369B                            |                 | 29     | PASS GPS Operational Enhancements                          |                                                               |
| 4.17.6-1.(T)                      |                 | 91051K | 26B                                                        | Streamlined Shuttle GPS Capability                            |
|                                   |                 | 92069B | 26B                                                        | Single-String GPS Documentation Cleanup                       |
|                                   |                 | 92067D | 27                                                         | Three String GPS Capability                                   |
|                                   | 92144C          | 27     | Three String GPS Document Cleanup                          |                                                               |
|                                   | 92289A          | 27     | Post STS-91 OI-27 GPS Redesign                             |                                                               |
|                                   | 92369B          | 29     | PASS GPS Operational Enhancements                          |                                                               |
|                                   | 4.17.6-1.(1)(F) | 92392C | 29                                                         | Doc-Only Corrections for OI-29 CRs 92329E, 92364D, and 92369B |
|                                   |                 | 92817C | 32                                                         | GPS FSW Compensation for GPC Clock Drift                      |
|                                   |                 | 92817C | 32                                                         | GPS FSW Compensation for GPC Clock Drift                      |

| Table R.1-1. CR Reference Summary |        |     |                                           |
|-----------------------------------|--------|-----|-------------------------------------------|
| Paragraph                         | CR No. | OI  | CR Title                                  |
| 4.17.6-1.(3)(F)                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift  |
| 4.17.6-2.(T)                      | 91051K | 26B | Streamlined Shuttle GPS Capability        |
|                                   | 92069B | 26B | Single-String GPS Documentation Cleanup   |
|                                   | 92067D | 27  | Three String GPS Capability               |
|                                   | 92289A | 27  | Post STS-91 OI-27 GPS Redesign            |
|                                   | 92369B | 29  | PASS GPS Operational Enhancements         |
|                                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift  |
| 4.17.6.1                          | 91051K | 26B | Streamlined Shuttle GPS Capability        |
|                                   | 92069B | 26B | Single-String GPS Documentation Cleanup   |
|                                   | 92067D | 27  | Three String GPS Capability               |
|                                   | 92132C | 27  | Three String GPS GN&C Corrections         |
|                                   | 92208C | 28  | GPS Issues for Correction on OI-28        |
|                                   | 92281D | 28  | Post FACI OI-28 GPS Documentation Cleanup |
|                                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift  |
| 4.17.6.1.(F)                      | 91051K | 26B | Streamlined Shuttle GPS Capability        |
|                                   | 92067D | 27  | Three String GPS Capability               |
|                                   | 92208C | 28  | GPS Issues for Correction on OI-28        |
|                                   | 92281D | 28  | Post FACI OI-28 GPS Documentation Cleanup |
| 4.17.6.1-1.(T)                    | 91051K | 26B | Streamlined Shuttle GPS Capability        |
|                                   | 92069B | 26B | Single-String GPS Documentation Cleanup   |
|                                   | 92067D | 27  | Three String GPS Capability               |
|                                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift  |
| 4.17.6.1-2.(T)                    | 91051K | 26B | Streamlined Shuttle GPS Capability        |
|                                   | 92069B | 26B | Single-String GPS Documentation Cleanup   |
|                                   | 92208C | 28  | GPS Issues for Correction on OI-28        |
|                                   | 92281D | 28  | Post FACI OI-28 GPS Documentation Cleanup |
| 4.17.6.1.1                        | 91051K | 26B | Streamlined Shuttle GPS Capability        |
|                                   | 92067D | 27  | Three String GPS Capability               |
|                                   | 92289A | 27  | Post STS-91 OI-27 GPS Redesign            |
|                                   | 92369B | 29  | PASS GPS Operational Enhancements         |
| 4.17.6.1.1.(F)                    | 91051K | 26B | Streamlined Shuttle GPS Capability        |
|                                   | 92035D | 26B | GPS SOP Processing Relief                 |
|                                   | 92069B | 26B | Single-String GPS Documentation Cleanup   |
|                                   | 92067D | 27  | Three String GPS Capability               |
|                                   | 92289A | 27  | Post STS-91 OI-27 GPS Redesign            |

| Table R.1-1. CR Reference Summary |                |        |                                                                     |
|-----------------------------------|----------------|--------|---------------------------------------------------------------------|
| Paragraph                         | CR No.         | OI     | CR Title                                                            |
| 4.17.6.1.1-1.(T)                  | 92369B         | 29     | PASS GPS Operational Enhancements                                   |
|                                   | 91051K         | 26B    | Streamlined Shuttle GPS Capability                                  |
|                                   | 92069B         | 26B    | Single-String GPS Documentation Cleanup                             |
|                                   | 92067D         | 27     | Three String GPS Capability                                         |
| 4.17.6.1.1-2.(T)                  | 92817C         | 32     | GPS FSW Compensation for GPC Clock Drift                            |
|                                   | 91051K         | 26B    | Streamlined Shuttle GPS Capability                                  |
|                                   | 92069B         | 26B    | Single-String GPS Documentation Cleanup                             |
|                                   | 92067D         | 27     | Three String GPS Capability                                         |
| 4.17.6.1.1-3.(T)                  | 92369B         | 29     | PASS GPS Operational Enhancements                                   |
|                                   | 92817C         | 32     | GPS FSW Compensation for GPC Clock Drift                            |
|                                   | 91051K         | 26B    | Streamlined Shuttle GPS Capability                                  |
|                                   | 92067D         | 27     | Three String GPS Capability                                         |
| 4.17.6.1.2                        | 92369B         | 29     | PASS GPS Operational Enhancements                                   |
|                                   | 91051K         | 26B    | Streamlined Shuttle GPS Capability                                  |
|                                   | 92069B         | 26B    | Single-String GPS Documentation Cleanup                             |
|                                   | 92067D         | 27     | Three String GPS Capability                                         |
|                                   | 92132C         | 27     | Three String GPS GN&C Corrections                                   |
|                                   | 92289A         | 27     | Post STS-91 OI-27 GPS Redesign                                      |
|                                   | 92369B         | 29     | PASS GPS Operational Enhancements                                   |
|                                   | 92529B         | 30     | GPS Capability Enhancements for OI-30                               |
|                                   | 92817C         | 32     | GPS FSW Compensation for GPC Clock Drift                            |
|                                   | 4.17.6.1.2.(F) | 91051K | 26B                                                                 |
| 92067D                            |                | 27     | Three String GPS Capability                                         |
| 92289A                            |                | 27     | Post STS-91 OI-27 GPS Redesign                                      |
| 92369B                            |                | 29     | PASS GPS Operational Enhancements                                   |
| 92392C                            |                | 29     | Doc-Only Corrections for OI-29 CRs 92329E, 92364D, and 92369B       |
| 92430B                            |                | 29     | Protect Against GPS Receiver Non-Homogenous Data, DRs 109743/109744 |
| 4.17.6.1.2-1.(T)                  | 91051K         | 26B    | Streamlined Shuttle GPS Capability                                  |
|                                   | 92069B         | 26B    | Single-String GPS Documentation Cleanup                             |
|                                   | 92067D         | 27     | Three String GPS Capability                                         |
|                                   | 92364D         | 29     | Just-In-Time Flight Design (JITFD) I-Load Uplink Expansion          |
|                                   | 92529B         | 30     | GPS Capability Enhancements for OI-30                               |
|                                   | 92817C         | 32     | GPS FSW Compensation for GPC Clock Drift                            |

| Table R.1-1. CR Reference Summary |        |     |                                                                     |
|-----------------------------------|--------|-----|---------------------------------------------------------------------|
| Paragraph                         | CR No. | OI  | CR Title                                                            |
| 4.17.6.1.2-2.(T)                  | 91051K | 26B | Streamlined Shuttle GPS Capability                                  |
|                                   | 92049C | 26B | Corrections to CR 91051K, Streamlined Shuttle GPS                   |
|                                   | 92069B | 26B | Single-String GPS Documentation Cleanup                             |
|                                   | 92067D | 27  | Three String GPS Capability                                         |
|                                   | 92233  | 27  | Clean-up of GPS_SEC_DL Data Types                                   |
|                                   | 92369B | 29  | PASS GPS Operational Enhancements                                   |
|                                   | 92389C | 29  | Spiral HAC in TAEM Area Navigation                                  |
|                                   | 92430B | 29  | Protect Against GPS Receiver Non-Homogenous Data, DRs 109743/109744 |
|                                   | 92529B | 30  | GPS Capability Enhancements for OI-30                               |
|                                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift                            |
| 4.17.6.1.2-3.(T)                  | 91051K | 26B | Streamlined Shuttle GPS Capability                                  |
|                                   | 92067D | 27  | Three String GPS Capability                                         |
| 4.17.6.1.2-4.(T)                  | 91051K | 26B | Streamlined Shuttle GPS Capability                                  |
| 4.17.6.1.2-5.(T)                  | 91051K | 26B | Streamlined Shuttle GPS Capability                                  |
|                                   | 92067D | 27  | Three String GPS Capability                                         |
| 4.17.6.1.2-6.(T)                  | 91051K | 26B | Streamlined Shuttle GPS Capability                                  |
| 4.17.6.1.2.(1)(F)                 | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift                            |
| 4.17.6.1.2.1                      | 91051K | 26B | Streamlined Shuttle GPS Capability                                  |
|                                   | 92281D | 28  | Post FACI OI-28 GPS Documentation Cleanup                           |
| 4.17.6.1.2.1.(F)                  | 91051K | 26B | Streamlined Shuttle GPS Capability                                  |
|                                   | 92281D | 28  | Post FACI OI-28 GPS Documentation Cleanup                           |
| 4.17.6.1.2.1-1.(T)                | 91051K | 26B | Streamlined Shuttle GPS Capability                                  |
|                                   | 92069B | 26B | Single-String GPS Documentation Cleanup                             |
|                                   | 92067D | 27  | Three String GPS Capability                                         |
|                                   | 92281D | 28  | Post FACI OI-28 GPS Documentation Cleanup                           |
|                                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift                            |
| 4.17.6.1.2.1-2.(T)                | 91051K | 26B | Streamlined Shuttle GPS Capability                                  |
|                                   | 92069B | 26B | Single-String GPS Documentation Cleanup                             |
|                                   | 92067D | 27  | Three String GPS Capability                                         |
|                                   | 92214A | 27  | Post-CI Three-String GPS Documentation Cleanup                      |
|                                   | 92281D | 28  | Post FACI OI-28 GPS Documentation Cleanup                           |
|                                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift                            |
| 4.17.6.1.2.1-3.(T)                | 91051K | 26B | Streamlined Shuttle GPS Capability                                  |
|                                   | 92069B | 26B | Single-String GPS Documentation Cleanup                             |



Table R.1-1. CR Reference Summary

| Paragraph           | CR No. | OI  | CR Title                                 |
|---------------------|--------|-----|------------------------------------------|
| 4.17.6.1.2.1-4.(T)  | 91051K | 26B | Streamlined Shuttle GPS Capability       |
| 4.17.6.1.2.1-5.(T)  | 91051K | 26B | Streamlined Shuttle GPS Capability       |
| 4.17.6.1.2.1-6.(T)  | 91051K | 26B | Streamlined Shuttle GPS Capability       |
| 4.17.6.1.2.1-7.(T)  | 91051K | 26B | Streamlined Shuttle GPS Capability       |
| 4.17.6.1.2.1-8.(T)  | 91051K | 26B | Streamlined Shuttle GPS Capability       |
|                     | 92529B | 30  | GPS Capability Enhancements for OI-30    |
| 4.17.6.1.2.1-9.(T)  | 91051K | 26B | Streamlined Shuttle GPS Capability       |
| 4.17.6.1.2.1-10.(T) | 91051K | 26B | Streamlined Shuttle GPS Capability       |
| 4.17.6.1.2.1-11.(T) | 91051K | 26B | Streamlined Shuttle GPS Capability       |
| 4.17.6.1.3          | 91051K | 26B | Streamlined Shuttle GPS Capability       |
|                     | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift |
| 4.17.6.1.3.(F)      | 91051K | 26B | Streamlined Shuttle GPS Capability       |
| 4.17.6.1.3-1.(T)    | 91051K | 26B | Streamlined Shuttle GPS Capability       |
|                     | 92069B | 26B | Single-String GPS Documentation Cleanup  |
|                     | 92067D | 27  | Three String GPS Capability              |
|                     | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift |
| 4.17.6.1.3-2.(T)    | 91051K | 26B | Streamlined Shuttle GPS Capability       |
|                     | 92069B | 26B | Single-String GPS Documentation Cleanup  |
|                     | 92067D | 27  | Three String GPS Capability              |
|                     | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift |
| 4.17.6.1.3-3.(T)    | 91051K | 26B | Streamlined Shuttle GPS Capability       |
| 4.17.6.1.4          | 91051K | 26B | Streamlined Shuttle GPS Capability       |
|                     | 92067D | 27  | Three String GPS Capability              |
|                     | 92277  | 27  | GPS SOP Self-Test Bit SWAP               |
|                     | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift |
| 4.17.6.1.4.(F)      | 91051K | 26B | Streamlined Shuttle GPS Capability       |
|                     | 92067D | 27  | Three String GPS Capability              |
|                     | 92277  | 27  | GPS SOP Self-Test Bit SWAP               |
| 4.17.6.1.4-1.(T)    | 91051K | 26B | Streamlined Shuttle GPS Capability       |
|                     | 92069B | 26B | Single-String GPS Documentation Cleanup  |
|                     | 92067D | 27  | Three String GPS Capability              |
|                     | 92144C | 27  | Three String GPS Document Cleanup        |
|                     | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift |
| 4.17.6.1.4-2.(T)    | 91051K | 26B | Streamlined Shuttle GPS Capability       |
|                     | 92069B | 26B | Single-String GPS Documentation Cleanup  |

| Table R.1-1. CR Reference Summary |        |     |                                                                     |
|-----------------------------------|--------|-----|---------------------------------------------------------------------|
| Paragraph                         | CR No. | OI  | CR Title                                                            |
| 4.17.6.2                          | 92067D | 27  | Three String GPS Capability                                         |
|                                   | 92144C | 27  | Three String GPS Document Cleanup                                   |
|                                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift                            |
|                                   | 91051K | 26B | Streamlined Shuttle GPS Capability                                  |
|                                   | 92067D | 27  | Three String GPS Capability                                         |
|                                   | 92369B | 29  | PASS GPS Operational Enhancements                                   |
|                                   | 92430B | 29  | Protect Against GPS Receiver Non-Homogenous Data, DRs 109743/109744 |
| 4.17.6.2.(F)                      | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift                            |
|                                   | 91051K | 26B | Streamlined Shuttle GPS Capability                                  |
|                                   | 92369B | 29  | PASS GPS Operational Enhancements                                   |
|                                   | 92430B | 29  | Protect Against GPS Receiver Non-Homogenous Data, DRs 109743/109744 |
| 4.17.6.2-1.(T)                    | 91051K | 26B | Streamlined Shuttle GPS Capability                                  |
|                                   | 90269B | 26B | Streamlined Shuttle GPS Capability                                  |
|                                   | 92430B | 29  | Protect Against GPS Receiver Non-Homogenous Data, DRs 109743/109744 |
| 4.17.6.2-2.(T)                    | 91051K | 26B | Streamlined Shuttle GPS Capability                                  |
|                                   | 90269B | 26B | Streamlined Shuttle GPS Capability                                  |
|                                   | 92067D | 27  | Three String GPS Capability                                         |
| 4.17.6.3                          | 91051K | 26B | Streamlined Shuttle GPS Capability                                  |
|                                   | 92067D | 27  | Three String GPS Capability                                         |
| 4.17.6.3.(F)                      | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift                            |
|                                   | 91051K | 26B | Streamlined Shuttle GPS Capability                                  |
|                                   | 92067D | 27  | Three String GPS Capability                                         |
| 4.17.6.3-1.(T)                    | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift                            |
|                                   | 91051K | 26B | Streamlined Shuttle GPS Capability                                  |
|                                   | 92067D | 27  | Three String GPS Capability                                         |
|                                   | 92364D | 29  | Just-In-Time Flight Design (JITFD) I-Load Uplink Expansion          |
| 4.17.6.3-2.(T)                    | 92529B | 30  | GPS Capability Enhancements for OI-30                               |
|                                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift                            |
|                                   | 91051K | 26B | Streamlined Shuttle GPS Capability                                  |
| 4.17.6.4                          | 91051K | 26B | Streamlined Shuttle GPS Capability                                  |
|                                   | 92035D | 26B | GPS SOP Processing Relief                                           |
|                                   | 92069B | 26B | Single-String GPS Documentation Cleanup                             |

| Table R.1-1. CR Reference Summary |        |     |                                                               |
|-----------------------------------|--------|-----|---------------------------------------------------------------|
| Paragraph                         | CR No. | OI  | CR Title                                                      |
| 4.17.6.4.(F)                      | 92080B | 26B | Single-String GPS UPP and SOP Corrections                     |
|                                   | 92067D | 27  | Three String GPS Capability                                   |
|                                   | 92369B | 29  | PASS GPS Operational Enhancements                             |
|                                   | 92630A | 30  | I-Load Controls for GPS Residual Edit Logic                   |
|                                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift                      |
|                                   | 91051K | 26B | Streamlined Shuttle GPS Capability                            |
| 4.17.6.4-1.(T)                    | 92035D | 26B | GPS SOP Processing Relief                                     |
|                                   | 92080B | 26B | Single-String GPS UPP and SOP Corrections                     |
|                                   | 92067D | 27  | Three String GPS Capability                                   |
|                                   | 92369B | 29  | PASS GPS Operational Enhancements                             |
|                                   | 91051K | 26B | Streamlined Shuttle GPS Capability                            |
|                                   | 92035D | 26B | GPS SOP Processing Relief                                     |
| 4.17.6.4-2.(T)                    | 92069B | 26B | Single-String GPS Documentation Cleanup                       |
|                                   | 92080B | 26B | Single-String GPS UPP and SOP Corrections                     |
|                                   | 92067D | 27  | Three String GPS Capability                                   |
|                                   | 92329E | 29  | Onboard Calculation of RNP Matrix                             |
|                                   | 92369B | 29  | PASS GPS Operational Enhancements                             |
|                                   | 92392C | 29  | Doc-Only Corrections for OI-29 CRs 92329E, 92364D, and 92369B |
| 4.17.6.4.1                        | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift                      |
|                                   | 91051K | 26B | Streamlined Shuttle GPS Capability                            |
|                                   | 92035D | 26B | GPS SOP Processing Relief                                     |
|                                   | 92069B | 26B | Single-String GPS Documentation Cleanup                       |
|                                   | 92080B | 26B | Single-String GPS UPP and SOP Corrections                     |
|                                   | 92067D | 27  | Three String GPS Capability                                   |
| 4.17.6.4.1                        | 92369B | 29  | PASS GPS Operational Enhancements                             |
|                                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift                      |
|                                   | 91051K | 26B | Streamlined Shuttle GPS Capability                            |
|                                   | 92035D | 26B | GPS SOP Processing Relief                                     |
|                                   | 92056D | 26B | Remove Unnecessary GPS SOP Processing in G9                   |
|                                   | 92080B | 26B | Single-String GPS UPP and SOP Corrections                     |
| 4.17.6.4.1                        | 92067D | 27  | Three String GPS Capability                                   |
|                                   | 92144C | 27  | Three String GPS Document Cleanup                             |
|                                   | 92214A | 27  | Post-CI Three-String GPS Documentation Cleanup                |
|                                   | 92276A | 27  | GPS SOP Satellite De-Select Activation                        |

| Table R.1-1. CR Reference Summary |        |     |                                                            |
|-----------------------------------|--------|-----|------------------------------------------------------------|
| Paragraph                         | CR No. | OI  | CR Title                                                   |
| 4.17.6.4.1.(F)                    | 92369B | 29  | PASS GPS Operational Enhancements                          |
|                                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift                   |
|                                   | 91051K | 26B | Streamlined Shuttle GPS Capability                         |
|                                   | 92035D | 26B | GPS SOP Processing Relief                                  |
|                                   | 92067D | 27  | Three String GPS Capability                                |
| 4.17.6.4.1-1.(T)                  | 92144C | 27  | Three String GPS Document Cleanup                          |
|                                   | 92369B | 29  | PASS GPS Operational Enhancements                          |
|                                   | 91051K | 26B | Streamlined Shuttle GPS Capability                         |
|                                   | 92035D | 26B | GPS SOP Processing Relief                                  |
|                                   | 92069B | 26B | Single-String GPS Documentation Cleanup                    |
|                                   | 92067D | 27  | Three String GPS Capability                                |
|                                   | 92144C | 27  | Three String GPS Document Cleanup                          |
|                                   | 92289A | 27  | Post STS-91 OI-27 GPS Redesign                             |
|                                   | 92364D | 29  | Just-In-Time Flight Design (JITFD) I-Load Uplink Expansion |
|                                   | 92369B | 29  | PASS GPS Operational Enhancements                          |
| 4.17.6.4.1-2.(T)                  | 92529B | 30  | GPS Capability Enhancements for OI-30                      |
|                                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift                   |
|                                   | 91051K | 26B | Streamlined Shuttle GPS Capability                         |
|                                   | 92069B | 26B | Single-String GPS Documentation Cleanup                    |
|                                   | 92067D | 27  | Three String GPS Capability                                |
| 4.17.6.4.1-3.(T)                  | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift                   |
|                                   | 91051K | 26B | Streamlined Shuttle GPS Capability                         |
|                                   | 92035D | 26B | GPS SOP Processing Relief                                  |
|                                   | 92069B | 26B | Single-String GPS Documentation Cleanup                    |
|                                   | 92067D | 27  | Three String GPS Capability                                |
| 4.17.6.4.1.(3)(F)                 | 92276A | 27  | GPS SOP Satellite De-Select Activation                     |
| 4.17.6.4.1.(3)(F)                 | 92369B | 29  | PASS GPS Operational Enhancements                          |
| 4.17.6.4.1.(3)(F)                 | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift                   |
| 4.17.6.4.2                        | 91051K | 26B | Streamlined Shuttle GPS Capability                         |
|                                   | 92067D | 27  | Three String GPS Capability                                |
|                                   | 92630A | 30  | I-Load Controls for GPS Residual Edit Logic                |
|                                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift                   |
| 4.17.6.4.2.(F)                    | 91051K | 26B | Streamlined Shuttle GPS Capability                         |
|                                   | 92630A | 30  | I-Load Controls for GPS Residual Edit Logic                |
| 4.17.6.4.2-1.(T)                  | 91051K | 26B | Streamlined Shuttle GPS Capability                         |

| Table R.1-1. CR Reference Summary |        |     |                                             |
|-----------------------------------|--------|-----|---------------------------------------------|
| Paragraph                         | CR No. | OI  | CR Title                                    |
| 4.17.6.4.2-2.(T)                  | 91051K | 26B | Streamlined Shuttle GPS Capability          |
|                                   | 92069B | 26B | Single-String GPS Documentation Cleanup     |
|                                   | 92067D | 27  | Three String GPS Capability                 |
|                                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift    |
| 4.17.6.4.2-3.(T)                  | 92630A | 30  | I-Load Controls for GPS Residual Edit Logic |
| 4.17.6.4.2-4.(T)                  | 92630A | 30  | I-Load Controls for GPS Residual Edit Logic |
| 4.17.6.4.3                        | 91051K | 26B | Streamlined Shuttle GPS Capability          |
|                                   | 92067D | 27  | Three String GPS Capability                 |
|                                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift    |
| 4.17.6.4.3.(F)                    | 91051K | 26B | Streamlined Shuttle GPS Capability          |
| 4.17.6.4.3-1.(T)                  | 91051K | 26B | Streamlined Shuttle GPS Capability          |
|                                   | 92067D | 27  | Three String GPS Capability                 |
| 4.17.6.4.3-2.(T)                  | 91051K | 26B | Streamlined Shuttle GPS Capability          |
|                                   | 92069B | 26B | Single-String GPS Documentation Cleanup     |
|                                   | 92067D | 27  | Three String GPS Capability                 |
|                                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift    |
| 4.17.6.5                          | 91051K | 26B | Streamlined Shuttle GPS Capability          |
|                                   | 92056D | 26B | Remove Unnecessary GPS SOP Processing in G9 |
|                                   | 92069B | 26B | Single-String GPS Documentation Cleanup     |
|                                   | 92067D | 27  | Three String GPS Capability                 |
|                                   | 92144C | 27  | Three String GPS Document Cleanup           |
|                                   | 92208C | 28  | GPS Issues for Correction on OI-28          |
| 4.17.6.5.(F)                      | 91051K | 26B | Streamlined Shuttle GPS Capability          |
|                                   | 92056D | 26B | Remove Unnecessary GPS SOP Processing in G9 |
|                                   | 92067D | 27  | Three String GPS Capability                 |
|                                   | 92208C | 28  | GPS Issues for Correction on OI-28          |
| 4.17.6.5-1.(T)                    | 91051K | 26B | Streamlined Shuttle GPS Capability          |
|                                   | 92069B | 26B | Single-String GPS Documentation Cleanup     |
|                                   | 92067D | 27  | Three String GPS Capability                 |
|                                   | 92208C | 28  | GPS Issues for Correction on OI-28          |
|                                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift    |
| 4.17.6.5-2.(T)                    | 91051K | 26B | Streamlined Shuttle GPS Capability          |
|                                   | 92069B | 26B | Single-String GPS Documentation Cleanup     |
|                                   | 92067D | 27  | Three String GPS Capability                 |
|                                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift    |

| Table R.1-1. CR Reference Summary |        |     |                                                |
|-----------------------------------|--------|-----|------------------------------------------------|
| Paragraph                         | CR No. | OI  | CR Title                                       |
| 4.17.6.5-3.(T)                    | 91051K | 26B | Streamlined Shuttle GPS Capability             |
|                                   | 92067D | 27  | Three String GPS Capability                    |
| 4.17.6.6                          | 91051K | 26B | Streamlined Shuttle GPS Capability             |
|                                   | 92069B | 26B | Single-String GPS Documentation Cleanup        |
|                                   | 92067D | 27  | Three String GPS Capability                    |
|                                   | 92369B | 29  | PASS GPS Operational Enhancements              |
|                                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift       |
| 4.17.6.6.(F)                      | 91051K | 26B | Streamlined Shuttle GPS Capability             |
|                                   | 92067D | 27  | Three String GPS Capability                    |
|                                   | 92369B | 29  | PASS GPS Operational Enhancements              |
|                                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift       |
| 4.17.6.6-1.(T)                    | 91051K | 26B | Streamlined Shuttle GPS Capability             |
|                                   | 92069B | 26B | Single-String GPS Documentation Cleanup        |
|                                   | 92067D | 27  | Three String GPS Capability                    |
|                                   | 92369B | 29  | PASS GPS Operational Enhancements              |
|                                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift       |
| 4.17.6.6-2.(T)                    | 91051K | 26B | Streamlined Shuttle GPS Capability             |
|                                   | 92067D | 27  | Three String GPS Capability                    |
|                                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift       |
| 4.17.6.6-3.(T)                    | 91051K | 26B | Streamlined Shuttle GPS Capability             |
|                                   | 92069B | 26B | Single-String GPS Documentation Cleanup        |
|                                   | 92067D | 27  | Three String GPS Capability                    |
|                                   | 92132C | 27  | Three String GPS GN&C Corrections              |
|                                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift       |
| 4.17.6.6-4.(T)                    | 92067D | 27  | Three String GPS Capability                    |
|                                   | 92144C | 27  | Three String GPS Document Cleanup              |
|                                   | 92369B | 29  | PASS GPS Operational Enhancements              |
| 4.17.6.7                          | 91051K | 26B | Streamlined Shuttle GPS Capability             |
|                                   | 92056D | 26B | Remove Unnecessary GPS SOP Processing in G9    |
|                                   | 92069B | 26B | Single-String GPS Documentation Cleanup        |
|                                   | 92067D | 27  | Three String GPS Capability                    |
|                                   | 92132C | 27  | Three String GPS GN&C Corrections              |
| 4.17.6.7.(F)                      | 92369B | 29  | PASS GPS Operational Enhancements              |
|                                   | 91051K | 26B | Streamlined Shuttle GPS Capability             |
|                                   | 92214A | 27  | Post-CI Three-String GPS Documentation Cleanup |

Table R.1-1. CR Reference Summary

| Paragraph      | CR No. | OI  | CR Title                                                      |
|----------------|--------|-----|---------------------------------------------------------------|
| 4.17.6.7-1.(T) | 92369B | 29  | PASS GPS Operational Enhancements                             |
|                | 92369B | 29  | PASS GPS Operational Enhancements                             |
|                | 91051K | 26B | Streamlined Shuttle GPS Capability                            |
|                | 92069B | 26B | Single-String GPS Documentation Cleanup                       |
|                | 92067D | 27  | Three String GPS Capability                                   |
| 4.17.6.7-2.(T) | 92369B | 29  | PASS GPS Operational Enhancements                             |
|                | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift                      |
|                | 91051K | 26B | Streamlined Shuttle GPS Capability                            |
|                | 92069B | 26B | Single-String GPS Documentation Cleanup                       |
| 4.17.6.8       | 92067D | 27  | Three String GPS Capability                                   |
|                | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift                      |
|                | 91051K | 26B | Streamlined Shuttle GPS Capability                            |
|                | 92035D | 26B | GPS SOP Processing Relief                                     |
|                | 92067D | 27  | Three String GPS Capability                                   |
|                | 92132C | 27  | Three String GPS GN&C Corrections                             |
|                | 92364D | 29  | Just-In-Time Flight Design (JITFD) I-Load Uplink Expansion    |
| 4.17.6.8.(F)   | 92392C | 29  | Doc-Only Corrections for OI-29 CRs 92329E, 92364D, and 92369B |
|                | 92529B | 30  | GPS Capability Enhancements for OI-30                         |
|                | 92067D | 27  | Three String GPS Capability                                   |
|                | 92364D | 29  | Just-In-Time Flight Design (JITFD) I-Load Uplink Expansion    |
| 4.17.6.8-0.(T) | 92529B | 30  | GPS Capability Enhancements for OI-30                         |
|                | 91051K | 26B | Streamlined Shuttle GPS Capability                            |
| 4.17.6.8-1.(T) | 92035D | 26B | GPS SOP Processing Relief                                     |
|                | 91051K | 26B | Streamlined Shuttle GPS Capability                            |
|                | 92069B | 26B | Single-String GPS Documentation Cleanup                       |
|                | 92105B | 26B | GPS MSID Documentation Corrections                            |
|                | 92067D | 27  | Three String GPS Capability                                   |
| 4.17.6.8-2.(T) | 92364D | 29  | Just-In-Time Flight Design (JITFD) I-Load Uplink Expansion    |
|                | 92529B | 30  | GPS Capability Enhancements for OI-30                         |
|                | 91051K | 26B | Streamlined Shuttle GPS Capability                            |
|                | 92069B | 26B | Single-String GPS Documentation Cleanup                       |
|                | 92105B | 26B | GPS MSID Documentation Corrections                            |
|                | 92067D | 27  | Three String GPS Capability                                   |
| 4.17.6.8-2.(T) | 92364D | 29  | Just-In-Time Flight Design (JITFD) I-Load Uplink Expansion    |

| Table R.1-1. CR Reference Summary |                |        |                                                                 |                                          |
|-----------------------------------|----------------|--------|-----------------------------------------------------------------|------------------------------------------|
| Paragraph                         | CR No.         | OI     | CR Title                                                        |                                          |
| 4.17.6.8-3.(T)                    | 92529B         | 30     | GPS Capability Enhancements for OI-30                           |                                          |
|                                   | 91051K         | 26B    | Streamlined Shuttle GPS Capability                              |                                          |
|                                   | 92069B         | 26B    | Single-String GPS Documentation Cleanup                         |                                          |
|                                   | 92080B         | 26B    | Single-String GPS UPP and SOP Corrections                       |                                          |
|                                   | 92098D         | 26B    | Single-String GPS RCVR STATE PROC/Status Display Corrections    |                                          |
| 4.17.6.8-4.(T)                    | 92102B         | 26B    | GPS I-Load Category Update                                      |                                          |
|                                   | 91051K         | 26B    | Streamlined Shuttle GPS Capability                              |                                          |
| 4.17.6.8-5.(T)                    | 91051K         | 26B    | Streamlined Shuttle GPS Capability                              |                                          |
| 4.17.6.9                          | 92067D         | 27     | Three String GPS Capability                                     |                                          |
|                                   | 92817C         | 32     | GPS FSW Compensation for GPC Clock Drift                        |                                          |
| 4.17.6.9(F)                       | 92817C         | 32     | GPS FSW Compensation for GPC Clock Drift                        |                                          |
| 4.17.6.9-0.(T)                    | 92067D         | 27     | Three String GPS Capability                                     |                                          |
|                                   | 92369B         | 29     | PASS GPS Operational Enhancements                               |                                          |
| 4.17.6.9-1.(T)                    | 92067D         | 27     | Three String GPS Capability                                     |                                          |
|                                   | 92144C         | 27     | Three String GPS Documentation Cleanup                          |                                          |
|                                   | 92289A         | 27     | Post STS-91 OI-27 GPS Redesign                                  |                                          |
|                                   | 92329E         | 29     | Onboard Calculation of RNP Matrix                               |                                          |
|                                   | 92353D         | 29     | Automated Alpha-Beta Management During Mated Coast & MM104      |                                          |
|                                   | 92364D         | 29     | Just-In-Time Flight Design (JITFD) I-Load Uplink Expansion      |                                          |
|                                   | 92369B         | 29     | PASS GPS Operational Enhancements                               |                                          |
|                                   | 92389C         | 29     | Spiral HAC in TAEM Area Navigation                              |                                          |
|                                   | 92392C         | 29     | Doc-Only Corrections for OI-29 CRs 92329E, 92364D, and 92369B   |                                          |
|                                   | 92450C         | 29     | Documentation Clean-up for CR 92389                             |                                          |
|                                   | 92332D         | 30     | Add Theta Limits Bracket to MEDS ADI Displays                   |                                          |
|                                   | 92522D         | 30     | Overhaul MEDS Composite Flight Instrument Display               |                                          |
|                                   | 92571B         | 30     | Drive HSD MLS, TAC, DRAG and ADTA A/I/F Asterisks at Item Entry |                                          |
|                                   | 4.17.6.9-2.(T) | 92817C | 32                                                              | GPS FSW Compensation for GPC Clock Drift |
|                                   |                | 92067D | 27                                                              | Three String GPS Capability              |
| 92132C                            |                | 27     | Three String GPS GN&C Corrections                               |                                          |
| 92214A                            |                | 27     | Post-CI Three-String GPS Documentation Cleanup                  |                                          |
| 92233                             |                | 27     | Clean-up of GPS_SEC_DL Data Types                               |                                          |
| 92276A                            |                | 27     | GPS SOP Satellite De-Select Activation                          |                                          |



| Table R.1-1. CR Reference Summary |        |     |                                                                     |
|-----------------------------------|--------|-----|---------------------------------------------------------------------|
| Paragraph                         | CR No. | OI  | CR Title                                                            |
| 4.17.6.9-3.(T)                    | 92261C | 28  | Add PPS Erase KEY MSID's To Three String GPS Downlist               |
|                                   | 92289A | 27  | Post STS-91 OI-27 GPS Redesign                                      |
|                                   | 92281D | 28  | Post FACI OI-28 GPS Documentation Cleanup                           |
|                                   | 92369B | 29  | PASS GPS Operational Enhancements                                   |
|                                   | 92389C | 29  | Spiral HAC in TAEM Area Navigation                                  |
|                                   | 92529B | 30  | GPS Capability Enhancements for OI-30                               |
|                                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift                            |
|                                   | 92067D | 27  | Three String GPS Capability                                         |
|                                   | 92139  | 27  | GPS I-Load Categorization Updates                                   |
|                                   | 92292B | 28  | GPS Related Category Modifications for OI-28                        |
|                                   | 92329E | 29  | Onboard Calculation of RNP Matrix                                   |
|                                   | 92369B | 29  | PASS GPS Operational Enhancements                                   |
| 4.17.6.9-4.(T)                    | 92430B | 29  | Protect Against GPS Receiver Non-Homogenous Data, DRs 109743/109744 |
|                                   | 92630A | 30  | I-Load Controls for GPS Residual Edit Logic                         |
| 4.17.6.10                         | 92067D | 27  | Three String GPS Capability                                         |
|                                   | 92292B | 28  | GPS Related Category Modifications for OI-28                        |
| 4.17.6.10-0.(T)                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift                            |
| 4.17.6.10-1.(T)                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift                            |
| 4.17.6.10-2.(T)                   | 93090E | 33  | Bearing Displays                                                    |
|                                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift                            |
| 4.17.6.10-3.(T)                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift                            |
| 4.17.6.10-4.(T)                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift                            |
| 4.17.6.10-5.(T)                   | 92817C | 32  | GPS FSW Compensation for GPC Clock Drift                            |
|                                   | 93090E | 33  | Bearing Displays                                                    |
| 4.43.6.5-1.(T)                    | 92025B | 26B | Onorbit Tacan Deletion                                              |
|                                   | 92067D | 27  | Three String GPS Capability                                         |
|                                   | 92297B | 27  | Delete Erroneous TLM Destinations for NAV                           |
|                                   | 92522D | 30  | Overhaul MEDS Composite Flight Instrument Display                   |
|                                   | 93090E | 33  | Bearing Displays                                                    |
| 4.43.6.5-2.(T)                    | 92157  | 28  | IDD Clarification to Remove Blanks from FSSR Names                  |
| 4.43.6.5-3.(T)                    | 92025B | 26B | Onorbit Tacan Deletion                                              |
| 4.44.1.2-1.(F)                    | 92289A | 27  | Post STS-91 OI-27 GPS Redesign                                      |
| 4.44.4-1.(T)                      | 92297B | 27  | Delete Erroneous TLM Destinations for NAV                           |

| Table R.1-1. CR Reference Summary |        |     |                                                   |
|-----------------------------------|--------|-----|---------------------------------------------------|
| Paragraph                         | CR No. | OI  | CR Title                                          |
| 4.44.6.3-1.(T)                    | 92025B | 26B | Onorbit Tacan Deletion                            |
|                                   | 92067D | 27  | Three String GPS Capability                       |
|                                   | 92389C | 29  | Spiral HAC in TAEM Area Navigation                |
|                                   | 92450C | 29  | Documentation Clean-up for CR 92389               |
|                                   | 92522D | 30  | Overhaul MEDS Composite Flight Instrument Display |
|                                   | 93090E | 33  | Bearing Displays                                  |
| 4.44.6.3-2. (T)                   | 92297B | 27  | Delete Erroneous TLM Destinations for NAV         |
| 4.45.6.2-1.(T)                    | 92025B | 26B | Onorbit Tacan Deletion                            |
|                                   | 92067D | 27  | Three String GPS Capability                       |
|                                   | 92522D | 30  | Overhaul MEDS Composite Flight Instrument Display |
|                                   | 93090E | 33  | Bearing Displays                                  |
| 4.45.6.2-2.(T)                    | 91051K | 26B | Streamlined Shuttle GPS Capability                |
| 4.122.2.4-1.(T)                   | 92067D | 27  | Three String GPS Capability                       |
|                                   | 92144C | 27  | Three String GPS Document Cleanup                 |
|                                   | 92389C | 29  | Spiral HAC in TAEM Area Navigation                |
|                                   | 92450C | 29  | Documentation Clean-up for CR 92389               |
|                                   | 93090E | 33  | Bearing Displays                                  |
| 4.229.7-1.(T)                     | 92025B | 26B | Onorbit Tacan Deletion                            |
|                                   | 92067D | 27  | Three String GPS Capability                       |
|                                   | 92522D | 30  | Overhaul MEDS Composite Flight Instrument Display |
|                                   | 93090E | 33  | Bearing Displays                                  |
| 4.229.7-2. (T)                    | 92297B | 27  | Delete Erroneous TLM Destinations for NAV         |
| 4.253                             | 92025B | 26B | Onorbit Tacan Deletion                            |
| 4.253.1                           | 92025B | 26B | Onorbit Tacan Deletion                            |
| 4.253.1.1                         | 92025B | 26B | Onorbit Tacan Deletion                            |
| 4.253.1.1.1                       | 92025B | 26B | Onorbit Tacan Deletion                            |
| 4.253.1.1-1.(F)                   | 92025B | 26B | Onorbit Tacan Deletion                            |
| 4.253.1.1.2                       | 92025B | 26B | Onorbit Tacan Deletion                            |
| 4.253.1.1.2-1.(F)                 | 92025B | 26B | Onorbit Tacan Deletion                            |
| 4.253.1.1.2-2.(F)                 | 92025B | 26B | Onorbit Tacan Deletion                            |
| 4.253.1.1.2-3.(F)                 | 92025B | 26B | Onorbit Tacan Deletion                            |
| 4.253.1.1.2-4.(F)                 | 92025B | 26B | Onorbit Tacan Deletion                            |
| 4.253.1.1.2-5.(F)                 | 92025B | 26B | Onorbit Tacan Deletion                            |
| 4.253.1.1.2-6.(F)                 | 92025B | 26B | Onorbit Tacan Deletion                            |
| 4.253.1.1.3                       | 92025B | 26B | Onorbit Tacan Deletion                            |

| Table R.1-1. CR Reference Summary |        |     |                                         |
|-----------------------------------|--------|-----|-----------------------------------------|
| Paragraph                         | CR No. | OI  | CR Title                                |
| 4.253.1.2                         | 92025B | 26B | Onorbit Tacan Deletion                  |
| 4.253.1.3                         | 92025B | 26B | Onorbit Tacan Deletion                  |
| 4.253.1.3-1.(T)                   | 92025B | 26B | Onorbit Tacan Deletion                  |
| 4.253.1.4                         | 92025B | 26B | Onorbit Tacan Deletion                  |
| 4.253.1.5                         | 92025B | 26B | Onorbit Tacan Deletion                  |
| 4.253.2                           | 92025B | 26B | Onorbit Tacan Deletion                  |
| 4.253.3                           | 92025B | 26B | Onorbit Tacan Deletion                  |
| 4.253.4                           | 92025B | 26B | Onorbit Tacan Deletion                  |
| 4.253.4-1.(1)                     | 92025B | 26B | Onorbit Tacan Deletion                  |
| 4.253.4-1.(2)                     | 92025B | 26B | Onorbit Tacan Deletion                  |
| 4.253.5                           | 92025B | 26B | Onorbit Tacan Deletion                  |
| 4.253.5-1                         | 92025B | 26B | Onorbit Tacan Deletion                  |
| 4.253.6                           | 92025B | 26B | Onorbit Tacan Deletion                  |
| 4.253.6-1.(F)                     | 92025B | 26B | Onorbit Tacan Deletion                  |
| 4.253.6.1                         | 92025B | 26B | Onorbit Tacan Deletion                  |
| 4.253.6.2                         | 92025B | 26B | Onorbit Tacan Deletion                  |
| 4.253.6.2-1.(F)                   | 92025B | 26B | Onorbit Tacan Deletion                  |
| 4.253.6.3                         | 92025B | 26B | Onorbit Tacan Deletion                  |
| 4.253.6.3-1.(F)                   | 92025B | 26B | Onorbit Tacan Deletion                  |
| 4.253.6.4                         | 92025B | 26B | Onorbit Tacan Deletion                  |
| 4.253.6.4-1.(F)                   | 92025B | 26B | Onorbit Tacan Deletion                  |
| 4.253.7                           | 92025B | 26B | Onorbit Tacan Deletion                  |
| 4.253.7-1.(T)                     | 92025B | 26B | Onorbit Tacan Deletion                  |
| 4.253.7-2.(T)                     | 92025B | 26B | Onorbit Tacan Deletion                  |
| 4.253.7-3.(T)                     | 92025B | 26B | Onorbit Tacan Deletion                  |
| 4.253.7-4.(T)                     | 92025B | 26B | Onorbit Tacan Deletion                  |
| 4.253.7-5.(T)                     | 92025B | 26B | Onorbit Tacan Deletion                  |
| 5.1                               | 92069B | 26B | Single-String GPS Documentation Cleanup |

**R.2 HISTORICAL CHANGE REQUEST SUMMARY**

Table R.2-1. is an historical record of approved change requests incorporated since the initial baseline up to OI-26. Change requests commencing with OI-26 are reformatted and listed in the CR Reference Summary.

| Table R.2-1. Historical Change Request Summary |    |                                            |
|------------------------------------------------|----|--------------------------------------------|
| CR No.                                         | OI | CR Title                                   |
| 2066                                           |    | MDM Constraint on Tacan S/W Entry I/O      |
| 2166                                           |    | LVL C SDC NAV DATA/GAX/MSC                 |
| 2235A                                          |    | NAV DATA/GAX/MSC                           |
| 12019                                          |    | Standardization of FSSR PRIN FUNC          |
| 12054B                                         |    | Horiz Sit Disp Changes                     |
| 12112                                          |    | GAX-Annunciation Rewrite                   |
| 2391                                           |    | OWDE BCE Element Bypass Require            |
| 2602A                                          |    | Radar Altimeter SOP Chgs                   |
| 12177B                                         |    | Dedicated Display Rate Reduction           |
| 12336                                          |    | I-Load OFT-1 Baseline                      |
| 12337                                          |    | I-Load OFT-1 Baseline                      |
| 12338                                          |    | I-Load OFT-1 Baseline                      |
| 12339                                          |    | I-Load OFT-1 Baseline                      |
| 12109                                          |    | On ORB 1, I/O Update                       |
| 12148                                          |    | MSBLS SOP Changes                          |
| 12266A                                         |    | Tacan SOP & RM                             |
| 12374                                          |    | RR SOP I/F (1DD Only)                      |
| 12316                                          |    | GN&C Switch RM PROC Rate                   |
| 12443                                          |    | I-Load for Entry FACI                      |
| 12403A                                         |    | MSBLS Range Elev & Azimuth Limits          |
| 12419A                                         |    | RR SOP Corrections                         |
| 12442A                                         |    | Integrated ENT NAV, ASC NAV & ORB NAV      |
| 12471A                                         |    | TAEM GUID NAVDAD/DEFAULT                   |
| 12698A                                         |    | Tacan SOP/Site Look Up Interface           |
| 12749A                                         |    | RR SOP Changes                             |
| 12522                                          |    | Route "Current Vehicle Mass" to NAVDAD SOP |
| 12812A                                         |    | Relative NAV Display                       |
| 12918                                          |    | Correct Command Seq to Self Test           |
| 19022                                          |    | MODS to MPAD I-Load                        |
| 12848H                                         |    | Optional TAEM Targeting                    |
| 12868A                                         |    | I-Load Change to Reflect Mode TAEM Actions |

| Table R.2-1. Historical Change Request Summary |    |                                                         |
|------------------------------------------------|----|---------------------------------------------------------|
| CR No.                                         | OI | CR Title                                                |
| 12948                                          |    | Addition of Automatic Maneuver                          |
| 19159                                          |    | MSBLS SOP Limits Revised Specification                  |
| 19222                                          |    | ET SEP Switch Default & Overrid                         |
| 19059                                          |    | Tacan SOP & RM                                          |
| 19391                                          |    | Change to I-Load Values                                 |
| 19100                                          |    | FSSR Update                                             |
| 19335                                          |    | Delete Tacan "AUTO" Discrete Test                       |
| 19455                                          |    | Measurement Attribute Correction                        |
| 19361A                                         |    | Rewrite On-ORB NAV FSSR                                 |
| 19300                                          |    | FSSR Update II                                          |
| 19480                                          |    | RA DATA Flow: Changes to RA SOP                         |
| 19434A                                         |    | Changes to RNDZ Radar                                   |
| 19611A                                         |    | Provide Time Homogeneous Data to NAVDAD                 |
| 19690A                                         |    | Changes to I-Load Values for NAVDAD                     |
| 19845A                                         |    | Tacan Commonfault Addition                              |
| 19900                                          |    | FSSR Update 5                                           |
| 29107                                          |    | Tacan Description Error                                 |
| 29123                                          |    | Change Value of V_NAVDAD                                |
| 29279                                          |    | Correction to MSBLS NMI to Feet Conversion Rate (STS-2) |
| 29149B                                         |    | Add Program Interrupt Handling to LVLA                  |
| 29349                                          |    | Units Correction for NAV Related (REF)                  |
| 29410A                                         |    | Change RENDZ Radar STAT WD 1                            |
| 29471B                                         |    | HFE Overrun Definition                                  |
| 29478                                          |    | RTLS NAVDAD Drag Coefficients (REF Only)                |
| 29500                                          |    | FSSR Update 7                                           |
| 29611A                                         |    | MOD to RENDZ Radar SOP                                  |
| 29660A                                         |    | Current Vehicle MASS Update                             |
| 29800                                          |    | FSSR Update 8                                           |
| 29999A                                         |    | OTT Rewrite (IDD)                                       |
| 39000                                          |    | FSSR Update 9                                           |
| 39192A                                         |    | Cycle 3.3.3 I-Load                                      |
| 39224A                                         |    | Tacan CHAN Change Flag Reset                            |
| 39264E                                         |    | HUD Autoland Monitor Format                             |
| 39400                                          |    | FSSR Update 10 (R18)                                    |
| 39595                                          |    | CR Implementation Baseline, August 1981                 |
| 39640                                          |    | FSSR Update 11 (R18), 2(R19)                            |
| 39655                                          |    | Tacan Y-Mode Selection Fix (STS-3 REF)                  |

| Table R.2-1. Historical Change Request Summary |    |                                                                      |
|------------------------------------------------|----|----------------------------------------------------------------------|
| CR No.                                         | OI | CR Title                                                             |
| 39783                                          |    | MSBLS SOP Low Elev Cut Off Lim (STS-4 REF)                           |
| 39980                                          |    | CR Implementation Baseline- Feb, 1982                                |
| 39988F                                         |    | STS-5 CY 3 DES/ENT I/L (STS-5; REF)                                  |
| 59220                                          |    | CR Implementation Baseline- July, 1982                               |
| 59375A                                         |    | CR implementation Baseline - Sept, 1982                              |
| 59408D                                         |    | STS-8 CYC 1 NAV/ENT I-Load (IL REF Only)                             |
| 59455G                                         |    | Tacan Orbiter NAV-Data ACQ & D/L                                     |
| 59737A                                         |    | RR Track Loss Annunciation                                           |
| 59951                                          |    | Design Dependent I-Loads                                             |
| 59972                                          |    | I-Load Scrub: Atmosphere                                             |
| 69056                                          |    | STS-13 CYC 1 NAV I-Loads (REF Only)                                  |
| 69070                                          |    | FSSR Update 3 (OI2, 3, and 4)                                        |
| 69119C                                         |    | I-Load Scrub: Tacan Scale Factor                                     |
| 69125B                                         |    | CR Implementation Baseline - November 1983                           |
| 69154A                                         |    | STS-14 Cycle 1 NAV I-Loads (REF Only)                                |
| 69402C                                         |    | Create A Category For GRTLS TAEM Mission - Unique I-Loads (REF Only) |
| 69427                                          |    | I-Load Units/Configuration Change - IMRB (22) (REF Only)             |
| 69550B                                         |    | CR Implementation Baseline - March/April, 1984                       |
| 69700                                          |    | FSSR Update Baseline 4                                               |
| 69893                                          |    | Cleanup of CR 39264E                                                 |
| 79217A                                         |    | Entry Tacan SOP Interface Documentation Cleanup                      |
| 79425                                          |    | CR Implementation Baseline - April, 1985                             |
| 79442C                                         |    | Inadvertent Mode Transitions                                         |
| 79470B                                         |    | MSBLS SOP DOC I/F Cleanup                                            |
| 79499                                          |    | FSSR Update No. 5                                                    |
| 79790                                          |    | CR Implementation Baseline - Nov, 1985                               |
| 79991A                                         |    | Errata STS 83-0014A V1                                               |
| 89137C                                         |    | Delete HUD 2 (Autoland) FMT                                          |
| 89250B                                         |    | Bailout Control System                                               |
| 89372B                                         |    | Errata CR for FSSR 10                                                |
| 89491C                                         |    | I-Load Owner Change                                                  |
| 89497                                          |    | STS 83-0014B, Vol. 1, B/L                                            |
| 89599C                                         |    | Cleanup Level B GN&C Document                                        |
| 89662B                                         |    | FSSR STS 83-0003B Errata Update                                      |
| 89672A                                         |    | STS 83-0014B, Vol 1, PCN-1, Errata                                   |
| 89740B                                         |    | FSSR-7, OI-8B, PCN-1, Errata                                         |

Table R.2-1. Historical Change Request Summary

| CR No. | OI | CR Title                                                    |
|--------|----|-------------------------------------------------------------|
| 89845B |    | MSBLS Input Processing Time TAG Cleanup                     |
| 90044A |    | STS 83-0014B, Vol 1, PCN-2, Errata                          |
| 90182  | 21 | SCM Scrub Completion                                        |
| 90185A |    | Add CR Field to FSSR I/O Tables                             |
| 90278D | 21 | MSBLS Data Downlist Cleanup                                 |
| 90374C |    | Automated FSSR Constrants                                   |
| 90380C | 23 | Downlist Update for New Tacan                               |
| 90587C | 23 | SOP Updates for New Collins Tacan                           |
| 90606E | 23 | PFS/BFS ICD Baseline                                        |
| 90690A | 24 | Deletion of EQTN MSID Column from K-Load FSSR Tables        |
| 90705H | 25 | 3 Engines Out Auto Contingency                              |
| 90790  | 24 | Add Memory Configuration to the FSSR I-Load Tables          |
| 90814C | 24 | Add Description of Database Generated FSSR Parameter Tables |
| 90881A | 25 | FSSR STS 83-0001 Documentation Changes                      |
| 90891  | 23 | FSSR Doc Only Changes, NAV AIDS SOP                         |
| 90964  | 25 | Interface Clarification for 3 Engines Out – CR 90705H       |
| 90966A | 24 | Deletion of the Qualifier from the FSSR I-Load Tables       |
| 91066D | 25 | Standardize the FSSR Correlation Tables.                    |
| 92027B | 25 | TDMS-2 Required FSSR Changes                                |

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