

Space Program Operations Contract

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

STAR TRACKER SUBSYSTEM OPERATING PROGRAMS

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
STAR TRACKER SUBSYSTEM OPERATING PROGRAM**

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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-34and 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 Effectivity 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
1.3-1.(T)	93017G	33	Baseline RSS99D0100 with Expanded Downlist
4.66.5-1.(T)	93160B	32	Year End Roll Over (YERO) Reset
	93017G	33	Baseline RSS99D0100 with Expanded Downlist
4.66.5-2.(T)	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 documents is to specify detailed requirements and formulations that implement the Level B SOP functional requirements for the orbiter GN&C flight software.

1.2 SCOPE

This document contains the detailed requirements and formulations for the star tracker and COAS functions.

1.3 ORGANIZATION

This document is organized into the following sections:

- 1.0 Introduction
- 2.0 Applicable Documents
- 3.0 Overview
- 4.0 Detailed 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 software functions and discusses the contents of Section 4. Section 4 specifies the detailed requirements and presents software formulations for the star-tracker and COAS subsystems. 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 supplemental 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 of the I–Load (**Note)	Three alphanumeric characters: the first character must be alphabetic.										
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	<ul style="list-style-type: none"> * 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	<ul style="list-style-type: none"> * 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	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">00=Generic</td> <td style="width: 50%;">05 = SM4 Orbit P/L</td> </tr> <tr> <td>01=GN1 Ascent/GN6 RTLS</td> <td>06 = P/L9 MMU</td> </tr> <tr> <td>02=GN2 Orbit</td> <td>07 = Not Assigned</td> </tr> <tr> <td>03=GN3 Entry</td> <td>08 = GN8 On–Orbit C/O</td> </tr> <tr> <td>04=SM2 On–Orbit</td> <td>09 = GN9 Preflight</td> </tr> </table>	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
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.
REV	Revision indicator	An asterisk (*) indicates changes for the current OI version.
<p>* 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.</p> <p>** Note For additional information on any I-Load, contact the I-Load owner defined in CR 98032, JSC, USA, and Boeing I-Load Owner Assignments</p> <p>*** Note IDD output (source) tables which reflect parameters going to input (destination) "TLM" shall not be 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 9th 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).</p>		

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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 System 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 Load <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 flight software program represents the total computer program that operates in the orbiter general-purpose flight computer. 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 requirements specify system-level constraints and capabilities that 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. Levels B and C requirements are given in separate documents for GN&C, 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. The structure is described as follows:

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
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's consist of principal and specialists functions. The SOP's basically provide services and interfaces between the GN&C line replaceable units (LRU) 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)
5. BITE and failure discrete monitoring and reporting of status to redundancy management (RM) for future 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 the flight computer operating system (FCOS), nor do they include the data selection and failure management functions performed by other application programs.

3.4 FORMULATION NOTES

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

3.4.1 Computation and Coding Considerations

It should be noted that all star tracker and COAS 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 requirements.

3.4.2 Programming Deviations

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

3.5 IMPLEMENTATION CONSTRAINTS

The software design shall be 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 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 by standard "fix-ups," and error returns shall be provided that are appropriate to the function as described in Level A CPDS, Section 4.6.4.

3.5.1 COMMFAULT

Software shall protect against star tracker COMMFAULTS in the following manner. Prior to the execution of either the star tracker self-test (ST_SELF_TEST), or the star tracking (STAR_TRACK) modules, or the target tracking (TARGET_TRK), each star tracker is checked for a COMMFAULT. If a COMMFAULT occurs, this execution cycle of these modules is skipped. If a COMMFAULT occurs and is cleared while star sighting data samples are being acquired, the sighting data filter module (DATA_FILR) shall resume within 0.32 seconds (two cycles) after the COMMFAULT is removed.

3.5.2 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 DETAILED REQUIREMENTS

The 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 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 detail requirements for the star tracker and COAS subsystems. These requirements are identified as principal function 4.66.

4.66 STAR TRACKER SUBSYSTEM OPERATING PROGRAM

This section defines the detailed functional requirements and formulations for the star tracker (ST) subsystem operating program (SOP). The ST SOP defines software associated with ST moding, self-test, failure identification, star tracking, target tracking, and IMU-to-ST alignment.

4.66.1 Star Tracker Requirements Overview

4.66.1.1 ST Functional Overview.

The orbiter ST is a strapped-down, wide field of view (FOV), image-dissector electro-optical tracking device. It is used to obtain precise angular measurements of selected stars and sun-illuminated orbiting elements (targets).

Two ST's are physically located on the orbiter navigation base. The -Y axis ST centerline is approximately 10.5 degrees from the orbiter -Y axis, and the -Z axis ST centerline is approximately 3 degrees from the orbiter -Z axis. Figure 4.66.1.1-1 depicts ST and inertial measurement unit (IMU) placement on the navigation base. The ST mounts on the underside of the navigation base while a light shade and viewing window are mounted on top of the navigation base. The ST interfaces with the general purpose computer (GPC) via the serial digital multiplex/demultiplex input/output data channel.

4.66.1.1.1 ST Performance Characteristics.

The orbiter ST's exhibit the following performance characteristics and operating features:

Sensitivity – The ST's will acquire and track the 153 brightest stars based upon the S-20 star intensity scale. The ST sensitivity threshold can be adjusted via GPC control.

Field of View – The ST's total FOV is a minimum 10-degree by 10-degree square. The ST's can also be commanded to search a 1-degree by 1-degree square field within the FOV.

Accuracy – The ST's total error in measurement of star or target angles does not exceed 1 arc minute (1 sigma). Star or target magnitude measurement errors do not exceed an absolute maximum of 0.6 magnitude.

Warmup and Acquisition – The ST's will meet performance requirements within 15 minutes after power on. The ST's will search, acquire, and begin tracking a star in the FOV (if available and of sufficient magnitude) within 10 seconds of being commanded by the GPC (within 1 second in offset mode).

Bright Source Protection – The ST's have a bright source detector which causes a protective shutter to close before bright objects can cause damage to the ST's. In addition, a current limit sensor will trigger the shutter to close if an object being tracked exceeds approximately -7.0 magnitude brightness.

Bright Source Angles – The ST's are not required to track a star or target when the sun is within 30 degrees of the ST centerline or when the lighted earth's horizon is within 20 degrees of the ST centerline.

Angular Rates – The ST's will acquire and maintain accurate tracking for orbiter angular rates of up to 0.2 degrees/second. The ST's will also maintain lock-on with reduced accuracy at rates up to 0.5 degree per second.

Break Track – The ST's can be commanded to break track of a star or target and begin searching so as to not reacquire the same star or target before the remaining commanded FOV (offset or total) is searched.

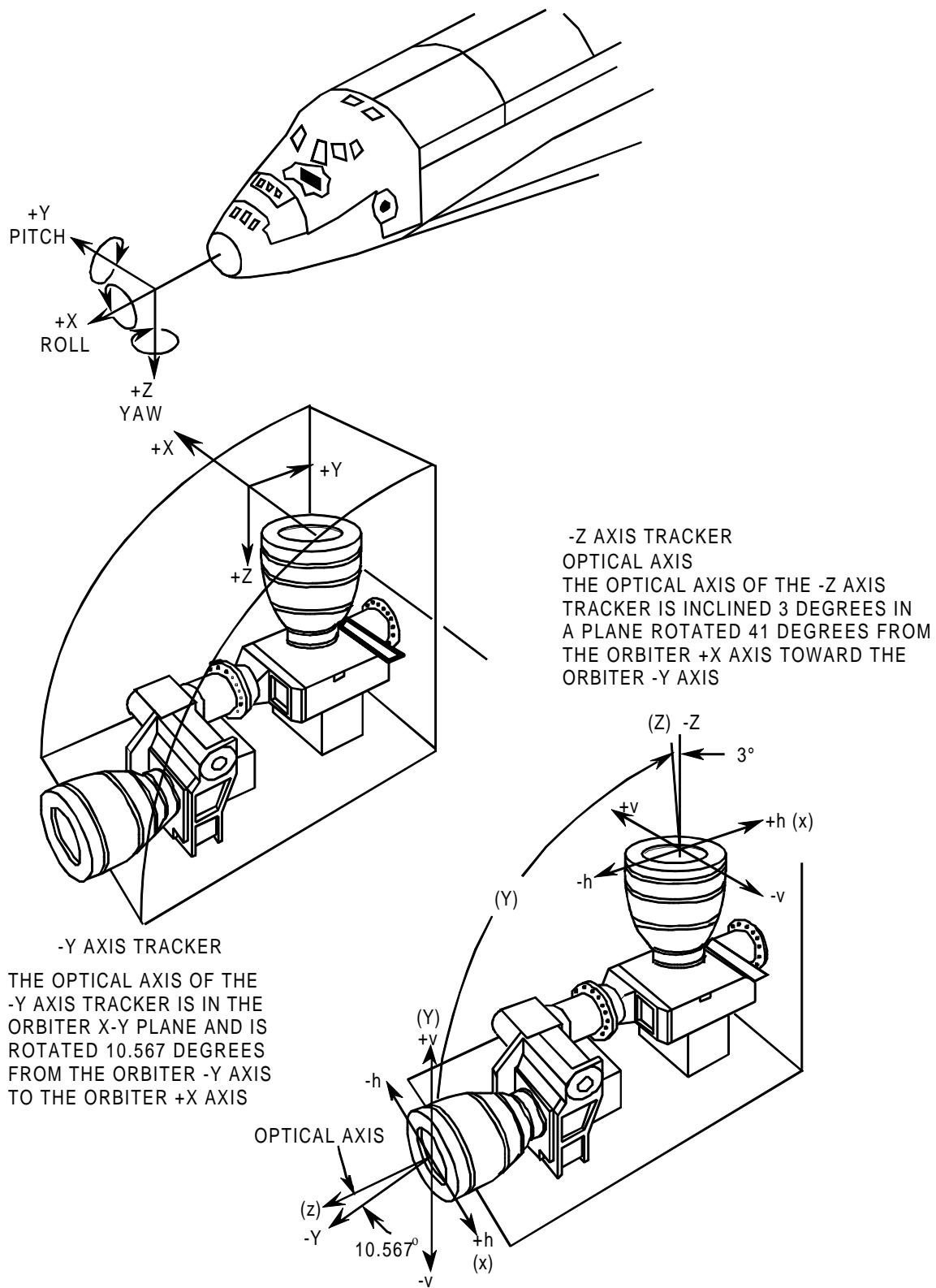


FIGURE 4.66.1.1-1.

Star Tracker Orientation

4.66.1.1.2 ST Operating Modes.

The orbiter ST's have several operating modes which are described in the following paragraphs:

Full Field Scan Mode – The full field scan mode is the normal operating mode and will be entered when power is applied and no other mode is commanded. In this mode the ST will search the total field of view (TFOV), and acquire and track the first star or target that exceeds the threshold. When a star or target is encountered in the full field search the deflection coil current values are sampled and held, and the ST begins a track scan centered about the stored deflection coil values. The track scan is a 12 arc minute cruciform pattern with a 42 millisecond period. Once a star or target has been acquired the ST will continue tracking the star until it leaves the FOV, and will then reinitiate a search of the TFOV to acquire another star or target.

Offset Scan Mode – The offset scan mode is selected when a bit is present in bit zero of the ST command word, and two five-bit coordinate locations are present in bits 6 through 15. A one degree square field centered about the commanded coordinates will be scanned. If the commanded coordinates are near the edge of the FOV, the one degree field will not extend beyond the TFOV. If a star is acquired in the offset mode and tracking is lost, the ST will return to the commanded offset coordinates and resume offset scan until the star is acquired or the ST is recommended.

Self-Test Mode – The self-test mode is mechanized such that a LED source is reflected off of a small aluminized spot on the inner surface of the window through the lens and into the ST slightly within the 10 degree FOV. The tracker will search that area and acquire and track the reflected LED image. The angular deflections and apparent magnitude will be processed internally to the ST by comparison with stored values to determine if the observed values are within tolerance. Self-test tolerance limits are ± 140 arc seconds per axis for the horizontal and vertical axes and ± 0.6 magnitude for the sensitivity. In the event of a failure, the summary fail bit and a bit denoting the type of failure will be set and latched. Since the tolerance is set at approximately 140 arc seconds for the random portion of the error, an occasional failure may be expected even if the tracker is in fact good. Failure indications are displayed to the crew.

4.66.1.1.4 ST Interfaces.

The ST interfaces with the GPC via the serial digital multiplex/demultiplex input and output data channel. The digital input/output words are 16 bits in size, plus 3 bits for synchronization and 1 bit for odd parity. Generally, throughout the ST 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 true condition for a given parameter is indicated by a logic 1. The contents, format, and bit values of the single command word to the ST and the three data words from the ST are as follows:

Command Word (GPC to ST)

Bit Number	Assignment
X	Sync
X	Sync
X	Sync
0 (MSB)	Offset scan mode command
1	Self-test command
***** 2	Break track command
**** 3	Shutter open command
* 4	Threshold set 1 – MSB
* 5	Threshold set 2 – LSB
** 6	Offset mode horiz
7	Offset mode horiz
8	Offset mode horiz
9	Offset mode horiz
10	Offset mode horiz
*** 11	Offset mode vert
12	Offset mode vert
13	Offset mode vert
14	Offset mode vert
15 (LSB)	Offset mode vert
X	Parity

MSB LSB

- * 0, 0 = Sensitivity threshold equivalent to 3.0 magnitude
- 0, 1 = Sensitivity threshold equivalent to 2.4 magnitude
- 1, 0 = Sensitivity threshold equivalent to 2.0 magnitude
- 1, 1 = Sensitivity threshold equivalent to 1.0 magnitude
- **, *** Refer to Table 4.66.1.1.4–1 for command values.
- **** When the shutter has been manually opened, there is no protection (neither hardware nor software) for the ST from bright objects.
- ***** ST responds to a change of state from 0 to 1. ST SOP must reset bit to zero after outputting 1.

Data Word 1 (ST to GPC)

Bit Number	Assignment
X	Sync
X	Sync
X	Sync
*0 (MSB)	Tracker good
1	Target suppressed
**2	Transmission word good
3	Optics shutter closed
4	Self-test mode engaged
5	Star present
6	Always 1
7	Always 0
***8–15 (LSB)	Star magnitude (MSB–LSB)
X	Parity

* Word 1, bit 0 tracker good is a combination of the following bits and states:

Word 2, bit 15 = 1 (Pressurization failure)
or

Word 3, bit 12 = 1 (Self-test angle error)
or

Word 3, bit 13 = 1 (Self-test magnitude error)
or

Word 3: bit 14 = 0 (Power supply good)
or

[Word 3, bit 15 = 1 (Bright object sensor alert off)
and

Word 1, bit 4 = 1] (Self-test mode engaged)

If any of the above conditions and states exist, the tracker good flag shall be set to 0 (failed). Normal ST operation occurs when none of the above conditions and states occur. For normal operation the tracker good flag shall be set to 1.

Bright object sensor alert off 1 = Not alert present
 0 = Alert present

Power supply good 1 = Good
 0 = Failed

Tracker good 1 = Good
 0 = Failed

Transmission word good 1 = Good
 0 = Failed

** Word 1, bit 2 transmission word good is a negation of the 'or' combination of the following bits:

Word 2, bit 12, bit count error
 Word 2, bit 13, manchester not valid
 Word 2, bit 14, parity error

*** Data word 1, bits 8 through 15 represent star intensity in unitless numbers. The numerical value of intensity for each star is recorded in the star table.

Data Word 2 (ST to GPC)

Bit Number	Assignment
X	Sync
X	Sync
X	Sync
0 (MSB)	Horizontal star/target position – Sign
1	Horizontal star/target position – 2.6°
2	Horizontal star/target position – 1.3°
3	Horizontal star/target position – 0.65°
4	Horizontal star/target position – 0.325°
5	Horizontal star/target position – 0.1625°
6	Horizontal star/target position – 0.08125°
7	Horizontal star/target position – 0.040625°
8	Horizontal star/target position – 0.0203125°
9	Horizontal star/target position – 0.01015625°
10	Horizontal star/target position – 0.005078125°
11	Horizontal star/target position – 0.0025390625°
12	Bit count error
13	Manchester code not valid
14	Parity error
15 (LSB)	Pressurization fail
X	Parity

Table 4.66.1.1.4-1. Star Tracker Offset Command

Bit Values	Angular Values (in degrees)
**6 7 8 9 10	
***11 12 13 14 15	
00000	-4.75000
00001	-4.44355
00010	-4.13710
00011	-3.83065
00100	-3.52420
00101	-3.21775
00110	-2.91130
00111	-2.60485
01000	-2.29840
01001	-1.99195
01010	-1.68550
01011	-1.37905
01100	-1.07260
01101	-0.76615
01110	-0.45970
01111	-0.15325
10000	+0.15325
10001	+0.45970
10010	+0.76615
10011	+1.07260
10100	+1.37905
10101	+1.68550
10110	+1.99195
10111	+2.29840
11000	+2.60485
11001	+2.91130
11010	+3.21775
11011	+3.52420
11100	+3.83065
11101	+4.13710
11110	+4.44355
11111	+4.75000

Note that the software shall select the bit value that is closest to the required angle. If the angle is exactly midway between bit values, the bit value in the direction of increasing angle magnitude shall be selected. Angles exceeding ± 4.75 degrees shall be limited to ± 4.75 degrees respectively and the corresponding bit value shall be selected.

4.66.1.2 ST SOP Functional Overview.

The ST SOP controls and monitors the operation of the two ST's and processes ST data for use by other program elements. The ST SOP interfaces with the ST hardware to perform the moding functions, tracking functions, data enhancement, and self-tests. The ST SOP responds to inputs from the user interface (UI) function and the navigation function and provides responses to the UI as required. The ST SOP also provides alignment data to the IMU SOP. When the ST is in the operate mode, the ST SOP will respond to UI requests to perform various submodes as follows:

- A. Terminate/Idle. This submode terminates processing associated with other submodes and sets ST output commands and UI displays to the nominal idle conditions.
- B. Self Test. This submode tests the ability of the ST to acquire and track a simulated star. Star magnitude and position data are checked against hardware prestored values for reasonableness. Pass or fail status is made available for UI functions.
- C. Unknown Star Track Submode. Deleted.

Data Word 3 (ST to GPC)

Bit Number	Assignment
X	Sync
X	Sync
X	Sync
0 (MSB)	Vertical star/target position – Sign
1	Vertical star/target position – 2.6°
2	Vertical star/target position – 1.3°
3	Vertical star/target position – 0.65°
4	Vertical star/target position – 0.325°
5	Vertical star/target position – 0.1625°
6	Vertical star/target position – 0.08125°
7	Vertical star/target position – 0.040625°
8	Vertical star/target position – 0.0203125°
9	Vertical star/target position – 0.01015625°
10	Vertical star/target position – 0.005078125°
11	Vertical star/target position – 0.0025390625°
12	Self-test angle error
13	Self-test magnitude error
14	Power supply good
15(LSB)	Bright object alert off
X	Parity

Note: Horizontal and vertical negative values are output in two's complement notation.

- D. Star Track Submode. This submode accepts computer-selected offset coordinates and crew-selected stars, and issues the required outputs to the ST's for either offset scan mode or full field scan mode tracking. Offset coordinate data is tested for FOV limitations. Star sighting data is compensated for star aberration errors. Appropriate status displays are made available to the crew. The star track submode is normally utilized whenever an IMU is sufficiently aligned to provide a suitable inertial reference. If a crew-selected star is inputted, this submode will return to TERM/IDLE at its completion. If stars of opportunity are to be selected, this submode will continue until TERM/IDLE is requested. Stars of opportunity tracking will be initiated automatically for both star trackers upon receipt of an ST-based IMU alignment complete flag.
- E. Target Track Submode. This submode commands the ST's to search and track a rendezvous target in either the offset scan mode or the full field scan mode. Target tracking utilizes navigation generated inputs defining the relative target vector. Status displays are made available to the crew. Target tracking will continue until TERM/IDLE submode is requested.
- F. COAS Sighting and Calibration Submode. This submode performs computations associated with COAS star sightings. Star line-of-sight vectors are computed for each star sighting and are stored for subsequent IMU alignment calculations. The option is also provided for target sighting to be accomplished via the COAS with appropriate transfer of sighting data to navigation. This submode also supports the on-orbit calibration of COAS alignment.
- G. Star Select Submode. Deleted.

The ST_TRK CONT/MON support module, paragraph 4.66.4.19.A.2, contains a matrix of legal combinations of modes for the two ST's.

4.66.1.3 ST Functional Module Summary.

The functional modules that constitute the ST SOP are identified in Table 4.66.1.3-1. Each of the modules, including functions and formulations, is presented in detail in Section 4.66.6.

Table 4.66.1.3-1. ST SOP Functional Modes		
Module Name	Applicable Paragraph	Module Description
ST_TERM_IDLE	4.66.4.1	ST terminate/idle submode
ST_SELF_TEST	4.66.4.2	ST self-test submode
STAR_TRACK	4.66.4.3	Star track submode
UNK_STAR_TRK	4.66.4.4	Deleted
TARGET_TRK	4.66.4.5	Target track submode
FOV_TEST	4.66.4.6	Star in FOV test
STAR_CONFIRM	4.66.4.7	Star confirmation test
DATA_FILR	4.66.4.8	Sighting data filter routine
OCCUL_TEST	4.66.4.9	Deleted
COAS_SIGHT	4.66.4.10	COAS sighting submode
STAR_IDENT	4.66.4.11	Deleted
ST_INPUT	4.66.4.12	Deleted
ST_OUTPUT	4.66.4.13	Deleted
COAS_CALIB	4.66.4.14	COAS calibration
STAR_SELECT	4.66.4.15	Deleted
BITE_DISP	4.66.4.16	Deleted
TARGET_CONFIRM	4.66.4.17	Deleted
ST_COAS	4.66.4.18	ST/COAS star location
DISP_SUP	4.66.4.19	ST TRK cont/mon support

4.66.1.4 Reference Documents.

This paragraph lists documents that were utilized in preparation of the ST SOP.

- A. Rockwell, ST Procurement Specification, MC431-0128.

4.66.1.5 Software Implementation Constraints.

The software implementation of the ST SOP shall protect against program checks and error interrupts caused by transient type errors or bad data inputs. Specifically, the ST SOP shall protect against all of the error conditions identified in paragraph 3.5 which are applicable to the ST software design and code.

4.66.2 Functional Requirements Traceability

Table 4.66.2-1 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 4.66.2-2 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 4.66.2-1. Star Tracker SOP Requirements Traceability			
Level B PF Number	Level B PF Name (Acronym)	Level C FSSR Section No.	Related Modules
4.66	Star Tracker SOP (STAR TRCK SOP)	4.66.4	ST SOP module

Table 4.66.2-2. Star Tracker SOP FSSR/PRD Correlation					
Principal Function	FSSR Paragraph	FSSR Title	BFS PRD	PRD Paragraph	BFS Title
G4.66	4.66	Star Tracker Subsystem Operating Program	N/A	N/A	N/A

4.66.3 Star Tracker SOP Interfaces

The star tracker hardware interfaces are contained in Table 4.66.3-1. Star tracker SOP interfaces with other principal functions are contained in the IDD listing in Table 4.66.5-1.

4.66.3.1 Documented Requirements Precedence.

Requirements precedence in this document shall be as follows:

1. If there is a conflict between the data in the function sub-tables 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.

Table 4.66.3-1. ST SOP Hardware Interfaces

Name	MSID	H/W Config.	Description	Input Source	Output Destination	Signal Type	Range	Units	Rate (Hz)
DATA_WORD1(1)	V71M5020P G13598		–Z ST MODE STATUS WD1	ST 1	GPC	LOGICAL	NA	NA	OD
TRACK_NOT_FAIL(1)	V71X5021B G13599		–Z ST TRACKER GOOD WD1 B0			DISCRETE	0,1	NA	OD
	V71X5022B G13600	–0011	–Z ST TARGET SUPPRESSED WD1 B1			DISCRETE	0,1	NA	OD
		–0012	–Z ST TARGET SUPPRESSED WD1 B1						
		–0013	–Z ST TARGET SUPPRESSED WD1 B1						
		–1002	–Z ST HIGH BACKGROUND PROTECTION						
	V71X5023B G13601		–Z ST TRANSMISSION WORD GOOD WD1 B2			DISCRETE	0,1	NA	OD
SHUT_CLOS(1)	V71X5024B G13602		–Z ST OPTICS SHUTTER CLOSED WD1 B3			DISCRETE	0,1	NA	OD
ST_SELF_TEST(1)	V71X5025B G13603		–Z ST SELF-TEST MODE ENGAGED WD1 B4			DISCRETE	0,1	NA	OD
STAR_PRES(1)	V71X5026B G13604		–Z ST STAR PRESENT WD1 B5			DISCRETE	0,1	NA	OD

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Table 4.66.3-1. ST SOP Hardware Interfaces

Name	MSID	H/W Config.	Description	Input Source	Output Destination	Signal Type	Range	Units	Rate (Hz)
	V71X5027B G13605	-0011 -0012 -0013 -1002	-Z ST ALWAYS 1 WD1 B6 -Z ST ALWAYS 1 WD1 B6 -Z ST TEMPERATURE RANGE – MSB -Z ST CCD TEMPERATURE RANGE – MSB			DISCRETE	0,1	NA	OD
	V71X5028B G13605	-0011 -0012 -0013 -1002	-Z ST ALWAYS 0 WD1 B7 -Z ST ALWAYS 0 WD1 B7 -Z ST TEMPERATURE RANGE – LSB -Z ST CCD TEMPERATURE RANGE – LSB			DISCRETE	0,1	NA	OD
INTENS(1)	V71Q5029B		-Z ST STAR MAGNITUDE WD1 B8–15			SCALAR	-7 – +3	NA	OD
DATA_WORD2(1)	V71M5040P		-Z ST HORIZONTAL DATA AND STATUS WD2	ST 1	GPC	LOGICAL	NA	NA	OD
HOR_ANG(1)	V71H5041B G13614		-Z ST HORIZONTAL STAR/ TARGET POSITION WD2 B0– 11			SCALAR	-5 – +5	DEG	OD

Table 4.66.3-1. ST SOP Hardware Interfaces

Name	MSID	H/W Config.	Description	Input Source	Output Destination	Signal Type	Range	Units	Rate (Hz)
	V71X5053B G13618	-0011 -0012 -0013 -1002	-Z ST BIT COUNT ERROR WD2 B12 -Z ST BIT COUNT ERROR WD2 B12 -Z ST BIT COUNT ERROR WD2 B12 -Z ST EEPROM MISCOMPARE			DISCRETE	0,1	NA	OD
	V71X5054B G13619	-0011 -0012 -0013 -1002	-Z ST MANCHESTER CODE NOT VALID WD2 B13 -Z ST MANCHESTER CODE NOT VALID WD2 B13 -Z ST MANCHESTER CODE NOT VALID WD2 B13 -Z ST RAM/ROM FAILURE			DISCRETE	0,1	NA	OD
	V71X5055B G13620	-0011 -0012 -0013 -1002	-Z ST PARITY ERROR WD2 B14 -Z ST PARITY ERROR WD2 B14 -Z ST PARITY ERROR WD2 B14 -Z ST WATCHDOG TIME-OUT			DISCRETE	0,1	NA	OD
	V71X5056B G13621		-Z ST PRESSURIZATION FAIL WD2 B15			DISCRETE	0,1	NA	OD
DATA_WORD3(1)	V71M5060P		-Z ST VERTICAL DATA AND STATUS WD3	ST 1	GPC	LOGICAL	NA	NA	OD

Table 4.66.3-1. ST SOP Hardware Interfaces

Name	MSID	H/W Config.	Description	Input Source	Output Destination	Signal Type	Range	Units	Rate (Hz)
VERT_ANG(1)	V71H5061B G13616		-Z ST VERTICAL STAR/TARGET POSITION WD3 B0-11			SCALAR	-5 - +5	DEG	OD
	V71X5073B		-Z ST SELF-TEST ANGLE ERROR WD3 B12			DISCRETE	0,1	NA	OD
	V71X5074B		-Z ST SELF-TEST MAG ERROR WD3 B13			DISCRETE	0,1	NA	OD
	V71X5075B		-Z ST PWR SUPPLY GOOD WD3 B14			DISCRETE	0,1	NA	OD
NOT_BOA(1)	V71X5076B		-Z ST BRT OBJECT ALERT OFF WD3 B15			DISCRETE	0,1	NA	OD
CMD_WORD(1)	V71M5320P G13550		-Z ST COMMAND WORD	GPC	ST 1, TLM	LOGICAL	NA	NA	OD
OFF_CMD(1)	V71K5321B G13551		-Z ST OFFSET SCAN MODE COMMAND CMD WD B0			DISCRETE	0,1	NA	OD
ST_CMD(1)	V71K5322B G13552		-Z ST SELF-TEST COMMAND CMD WD B1			DISCRETE	0,1	NA	OD
BREAK_T(1)	V71K5323B G13553		-Z ST BREAK TRACK COMMAND CMD WD B2			DISCRETE	0,1	NA	OD
SHUT_OPEN(1)	V71K5324B G13554		-Z ST SHUTTER OPEN COMMAND CMD WD B3			DISCRETE	0,1	NA	OD
THOLD(1)_SET1	V71K5325B G13555		-Z ST THRESHOLD SET 1 MSB CMD WD B4			DISCRETE	0,1	NA	OD
THOLD(1)_SET2	V71K5326B G13555		-Z ST THRESHOLD SET 2 LSB CMD WD B5			DISCRETE	0,1	NA	OD

Table 4.66.3-1. ST SOP Hardware Interfaces

Name	MSID	H/W Config.	Description	Input Source	Output Destination	Signal Type	Range	Units	Rate (Hz)
H_ANG_CMD(1)	V71K5327B G13556		-Z ST OFFSET MODE HORIZ CMD WD B6– 10			SCALAR	–5 – +5	DEG	OD
V_ANG_CMD(1)	V71K5332B G13558		-Z ST OFFSET MODE VERT CMD WD B11– 15			SCALAR	–5 – +5	DEG	OD
DATA_WORD1(2)	V71M5520P G13606		–Y ST MODE STATUS WD1	ST 2	GPC	LOGICAL	NA	NA	OD
TRACK_NOT_FAIL(2)	V71X5521B G13607		–Y ST TRACKER GOOD WD1 B0			DISCRETE	0,1	NA	OD
	V71X5522B G13608	–0011	–Y ST TARGET SUPPRESSED WD1 B1			DISCRETE	0,1	NA	OD
		–0012	–Y ST TARGET SUPPRESSED WD1 B1						
		–0013	–Y ST TARGET SUPPRESSED WD1 B1						
		–1002	–Y ST HIGH BACKGROUND PROTECTION						
	V71X5523B G16909		–Y ST TRANSMISSION WORD GOOD WD1 B2			DISCRETE	0,1	NA	OD
SHUT_CLOS(2)	V71X5524B G13610		–Y ST OPTICS SHUTTER CLOSED WD1 B3			DISCRETE	0,1	NA	OD
ST_SELF_TEST(2)	V71X5525B G13611		–Y ST SELF-TEST MODE ENGAGED WD1 B4			DISCRETE	0,1	NA	OD
STAR_PRES(2)	V71X5526B G13612		–Y ST STAR PRESENT WD1 B5			DISCRETE	0,1	NA	OD

Table 4.66.3-1. ST SOP Hardware Interfaces

Name	MSID	H/W Config.	Description	Input Source	Output Destination	Signal Type	Range	Units	Rate (Hz)
INTENS(2)	V71X5527B G13613	-0011	-Y ST ALWAYS 1 WD1 B6			DISCRETE	0,1	NA	OD
		-0012	-Y ST ALWAYS 1 WD1 B6						
		-0013	-Y ST TEMPERATURE RANGE – MSB						
		-1002	-Y ST CCD TEMPERATURE RANGE – MSB						
		-0011	-Y ST ALWAYS 0 WD1 B7						
	V71X5528B G13613	-0012	-Y ST ALWAYS 0 WD1 B7			DISCRETE	0,1	NA	OD
		-0013	-Y ST TEMPERATURE RANGE LSB						
		-1002	-Y ST CCD TEMPERATURE RANGE – LSB						
			-Y ST STAR MAGNITUDE WD1 B8–15			SCALAR	-7 – +3	NA	OD
DATA_WORD2(2)	V71M5540P		-Y ST HORIZONTAL DATA AND STATUS WD2	ST 2	GPC				
HOR_ANG(2)	V71H5541B G13615		-Y ST HORIZONTAL STAR/ TARGET POSITION WD2 B0–11			SCALAR	-5 – +5	DEG	OD

Table 4.66.3-1. ST SOP Hardware Interfaces

Name	MSID	H/W Config.	Description	Input Source	Output Destination	Signal Type	Range	Units	Rate (Hz)
DATA_WORD3(2)	V71X5553B G13622	-0011	-Y ST BIT COUNT ERROR WD2 B12			DISCRETE	0,1	NA	OD
		-0012	-Y ST BIT COUNT ERROR WD2 B12						
		-0013	-Y ST BIT COUNT ERROR WD2 B12						
		-1002	-Y ST EEPROM MISCOMPARE						
	V71X5554B G13623	-0011	-Y ST MANCHESTER CODE NOT VALID WD2 B13			DISCRETE	0,1	NA	OD
		-0012	-Y ST MANCHESTER CODE NOT VALID WD2 B13						
		-0013	-Y ST MANCHESTER CODE NOT VALID WD2 B13						
		-1002	-Y ST RAM/ROM FAILURE						
	V71X5555B G13624	-0011	-Y ST PARITY ERROR WD2 B14			DISCRETE	0,1	NA	OD
		-0012	-Y ST PARITY ERROR WD2 B14						
		-0013	-Y ST PARITY ERROR WD2 B14						
		-1002	-Y ST WATCHDOG TIME-OUT						
	V71X5556B G13625		-Y ST PRESSURIZATION FAIL WD2 B15	ST 2	GPC	DISCRETE	0,1	NA	OD
	DATA_WORD3(2)	V71M5560P	-Y ST VERTICAL DATA AND STATUS WD3						

Table 4.66.3-1. ST SOP Hardware Interfaces

Name	MSID	H/W Config.	Description	Input Source	Output Destination	Signal Type	Range	Units	Rate (Hz)
VERT_ANG(2)	V71H5561B G13617		-Y ST VERTICAL STAR/TARGET POSITION WD3 B0-11			SCALAR	-5 - +5	DEG	OD
	V71X5573B		-Y ST SELF-TEST ANGLE ERROR WD3 B12			DISCRETE	0,1	NA	OD
	V71X5574B		-Y ST SELF-TEST MAG ERROR WD3 B13			DISCRETE	0,1	NA	OD
	V71X5575B		-Y ST POWER SUPPLY GOOD WD3 B14			DISCRETE	0,1	NA	OD
NOT_BOA(2)	V71X5576B		-Y ST BRT OBJECT ALERT OFF WD3 B15			DISCRETE	0,1	NA	OD
CMD_WORD(2)	V71M5820P G13559		-Y ST COMMAND WORD	GPC	ST 2, TLM	LOGICAL	NA	NA	OD
OFF_CMD(2)	V71K5821B G13560		-Y ST OFFSET SCAN MODE COMMAND CMD WD B0			DISCRETE	0,1	NA	OD
ST_CMD(2)	V71K5822B G13561		-Y ST SELF-TEST COMMAND CMD WD B1			DISCRETE	0,1	NA	OD
BREAK_T(2)	V71K5823B G13562		-Y ST BREAK TRACK COMMAND CMD WD B2			DISCRETE	0,1	NA	OD
SHUT_OPEN(2)	V71K5824B G13563		-Y ST SHUTTER OPEN COMMAND CMD WD B3			DISCRETE	0,1	NA	OD
THOLD(2)_SET1	V71K5825B G13564		-Y ST THRESHOLD SET 1 MSB CMD WD B4			DISCRETE	0,1	NA	OD
THOLD(2)_SET2	V71K5826B G13564		-Y ST THRESHOLD SET 2 LSB CMD WD B5			DISCRETE	0,1	NA	OD

Table 4.66.3-1. ST SOP Hardware Interfaces

Name	MSID	H/W Config.	Description	Input Source	Output Desti-nation	Signal Type	Range	Units	Rate (Hz)
H_ANG_CMD(2)	V71K5827B G13565		-Y ST OFFSET MODE HORIZ CMD WD B6-10			SCALAR	-5 – +5	DEG	OD
V_ANG_CMD(2)	V71K5832B G13566		-Y ST OFFSET MODE VERT CMD WD B11-15			SCALAR	-5 – +5	DEG	OD

4.66.4 Detailed Requirements

This section defines the ST 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. Flow diagrams are 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. When the star tracker spec function is first called up, the star tracker SOP shall be brought up in the term/idle mode. The star tracker SOP shall remain active until the termination of the OPS sequence. When the star tracker spec function is deactivated and reactivated on following calls, the SOP shall remain in the same mode as when the spec function was deactivated. The three star tracker data words from each star tracker shall be read every 160 msec whenever the star tracker SOP is active.

4.66.4.1 Star Tracker Terminate Idle (ST_TERM_IDLE).

The purpose of the ST_TERM_IDLE module is to provide the processing required to place the star tracker in the terminate/idle submode. The terminate/idle submode is first entered when the star tracker is powered up and the star tracker specialist function is selected. The terminate/idle submode is re-entered whenever other submodes run to completion (such as self-test) or are manually terminated by requesting the terminate/idle submode via the keyboard, or whenever on-orbit IMU realignment has been commanded. When changing from one mode to another (such as from star track to target track), the SOP shall cycle through the term/idle mode for the purpose of initializing parameters for the following submode. A flow diagram of the ST_TERM_IDLE module is shown in Figure 4.66.4.1-1.

A. Functional Requirements. The star tracker terminate/idle module is required to perform the following functions for each selected star tracker that is powered up:

1. Provide an indication of the terminate/idle submode to the user.
2. Reset all outputs in the command word to the star tracker to zero except the shutter open command (SHUT_OPEN = No change).
3. Reset appropriate flags as required.

B. Interface Requirements. The input and output parameters associated with the ST_TERM_IDLE functional module are contained in Tables 4.66.4.1-1 and 4.66.4.1-2.

C. Detailed Requirements. The following sequence of operations and computations are required to satisfy the functions of the ST_TERM_IDLE module:

1. Provide an indication of the terminate/idle submode for display.
2. Reset all outputs in the command word to the selected star tracker to zero except the shutter open command (SHUT_OPEN = No change). Set offset command bits:

H_ANG = 0
V_ANG = 0
OFF_CMD = 0
ST_CMD = 0

BREAK_T = 0
 THOLD = 0

Table 4.66.4.1-1. ST_TERM_IDLE Inputs							
Name	MSID/ MML No.	Description	Input Source	Signal Type	Range	Units	Rate (Hz)
NONE IDENTIFIED							

Table 4.66.4.1-2. ST_TERM_IDLE Outputs							
Name	MSID/ MML NO.	Description	Output Destination	Signal Type	Range	Units	Rate (Hz)
TERMMODE (1)		-Z ST TERM IDLE MODE FLAG	DISP_SUP	LOGICAL	0,1	NA	OD
TERMMODE (2)		-Y ST TERM IDLE MODE FLAG	DISP_SUP	LOGICAL	0,1	NA	OD
CMD_WORD(1)	V71M5320P	COMMAND WORD TO STAR TRACKER -Z	ST 1, TLM	LOGICAL	NA	NA	OD
CMD_WORD(2)	V71M5820P	COMMAND WORD TO STAR TRACKER -Y	ST 2, TLM	LOGICAL	NA	NA	OD

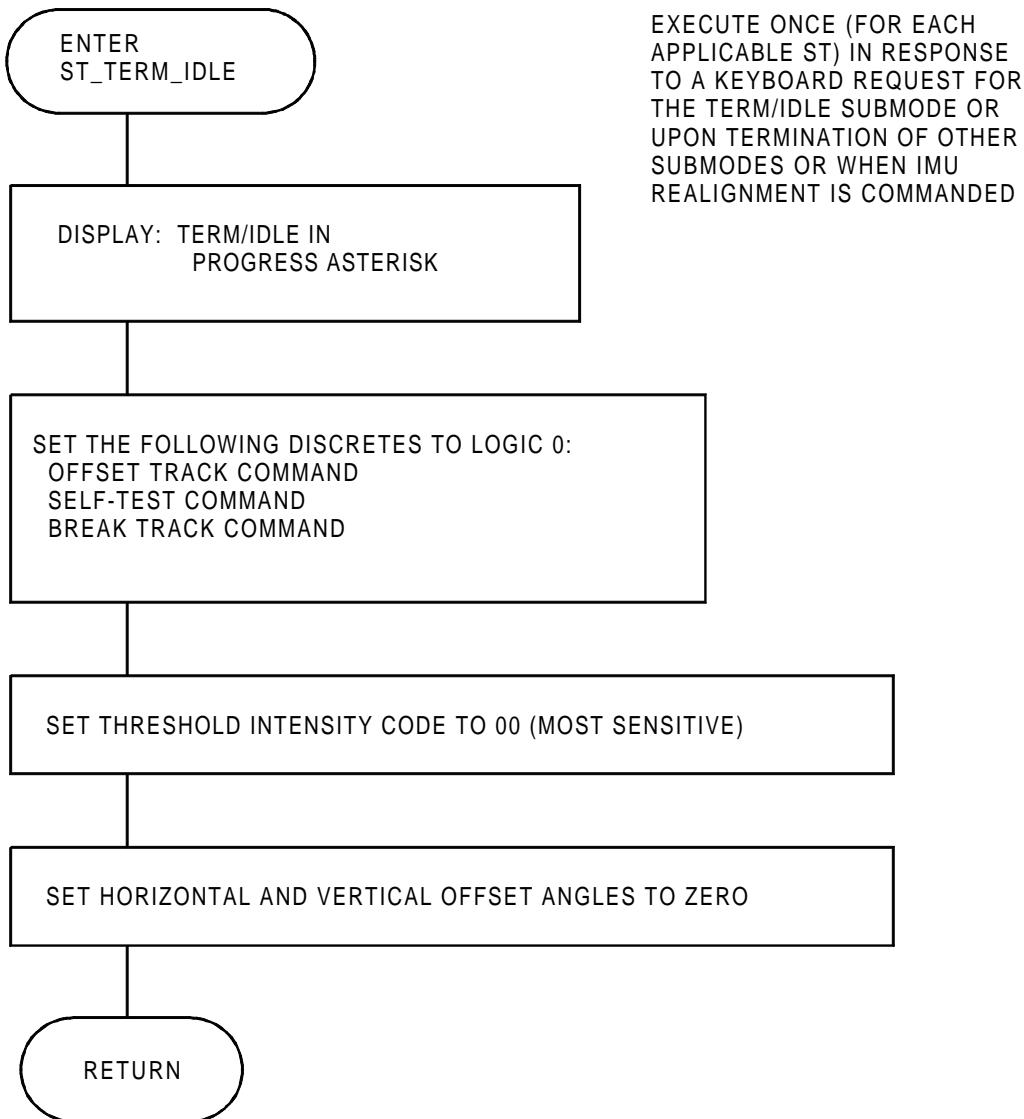


FIGURE 4.66.4.1-1. ST_TERM_IDLE Flow Diagram

4.66.4.2 Star Tracker Self-Test (ST_SELF_TEST).

The purpose of the ST_SELF_TEST module is to determine the performance goodness of the star tracker when it is commanded to track a built-in simulated star. One search and track cycle is commanded by the software. At the conclusion of the self-test mode, an indication of star tracker self-test pass or fail status is made available for display. Where it is stated that the specified conditions must be met at the end of a given time period, it is only necessary to look at the conditions at the end of the given time period.

A. Functional Requirements. The ST_SELF_TEST module is required to perform the following functions for each selected star tracker:

1. Test for bright object alert.
2. Issue self-test and break track commands to the star tracker. Test for indication of star present in offset track mode. In offset track mode, output the offset angles for the simulated star.
3. Test for and display timely response or failures for all the above commands.
4. Return to TERM/IDLE upon completion of self-test.

B. Interface Requirements. The input and output parameters associated with the ST_SELF_TEST functional module are contained in Tables 4.66.4.2-1 and 4.66.4.2-2.

C. Detailed Requirements. The SELF_TEST module shall perform the following sequence of operations and computations for the selected star tracker:

1. Provide a flag for display indicating star tracker self-test is in progress. Set the command word to zero's. Reset the MAN_OP item entry asterisk.
2. Test for bright object alert off. If bright object alert off = 0, set the self-test fail flag = 0, NO_TARGET flag = 1, and perform step 7.
3. Phase 1.

Set the self-test fail flag (ST_FAIL) = 0.

Send the following command to the tracker:

OFF_CMD = False
BREAK_T = True, momentarily

Wait at least 40 milliseconds, then send the following command to the tracker:

Offset mode (OFF_CMD = True)

Command self-test (ST_CMD = True)

Offset horizontal and vertical angle*

* Offset angles should point the star tracker at the self-test light source, and are constant values ($H = +4.137$, $V = -4.137$). The actual hardware value is approximately ($H = +4.25$, $V = -4.25$).

Monitor the input words for:

Optics shutter closed (SHUT_CLOS = True)

Self-test mode engaged (ST_SELF_TEST = True)

Star present (STAR_PRES = True)

No self-test angle error

No self-test magnitude error

No bright object alert off

When the above conditions are met, proceed to phase 2.

If the above conditions are not met within 3 seconds of the self-test command, then set self-test fail flag = 1 and proceed to phase 2.

4. Phase 2.

Send the following command to the tracker:

OFF_CMD = False

BREAK_T = True, momentarily

Wait at least 40 milliseconds, then send the same command to the tracker as in phase 1, except reverse polarity of the horizontal offset command to intentionally cause the tracker to generate a self-test fail indication.

Monitor the input words for:

Star tracker fail (TRACK_NOT_FAIL = False)

If the above condition is met, proceed to phase 3.

If the above condition is not met within 3 seconds, set the self-test fail flag (ST_FAIL) = 1 and proceed to phase 3.

5. Phase 3.

Command: Not self-test (ST_CMD = False)

Monitor the input words for:

Self-test not engaged (ST_SELF_TEST = False)

If the above condition is met, proceed to step 6.

If the above condition is not met within 1 second, set self-test fail flag (ST_FAIL) = 1 and proceed to step 6.

6. If ST_FAIL flag = 1, display ST_FAIL for the selected star tracker, else display ST_PASS.
7. Reset self-test in progress flag. Terminate self-test for the selected star tracker and return to terminate/idle.

The ST_SELF_TEST module shall be activated for each selected star tracker in response to a keyboard request for the self-test submode. The commands and responses associated with each phase are tabulated in Table 4.66.4.2-3. A suggested design flow that satisfies the ST_SELF_TEST requirements for a single star tracker is shown in Figure 4.66.4.2-1. This module may be executed for both star trackers simultaneously.

Table 4.66.4.2-1. ST_SELF_TEST Inputs

Name	MSID	Description	Input Source	Signal Type	Range	Units	Rate (Hz)
DATA_WORD1(1)	V71M5020P	-Z ST MODE STATUS WD1	ST 1	LOGICAL	NA	NA	OD
DATA_WORD1(2)	V71M5520P	-Y ST MODE STATUS WD1	ST 2	LOGICAL	NA	NA	OD
DATA_WORD3(1)	V71M5060P	-Z ST VERTICAL DATA AND STATUS WD3	ST 1	LOGICAL	NA	NA	OD
DATA_WORD3(2)	V71M5560P	-Y ST VERTICAL DATA AND STATUS WD3	ST 2	LOGICAL	NA	NA	OD
STJ	V91J3201C	SELECTED STAR TRACKER	FCOS	INTE GER	1,2	NA	25
H_SIM_ST(1)	V99U5608C	-Z ST HORIZONTAL COORD FOR SIMULATED STAR	K-LOAD	SCALAR	4.137	DEG	1.04
H_SIM_ST(2)	V99U5609C	-Y ST HORIZONTAL COORD FOR SIMULATED STAR	K-LOAD	SCALAR	4.137	DEG	1.04
V_SIM_ST(1)	V99U5711C	-Z ST VERTICAL COORD FOR SIMULATED STAR	K-LOAD	SCALAR	-4.137	DEG	1.04
V_SIM_ST(2)	V99U5712C	-Y ST VERTICAL COORD FOR SIMULATED STAR	K-LOAD	SCALAR	-4.137	DEG	1.04

Table 4.66.4.2-2. ST_SELF_TEST Outputs

Name	MSID	Description	Output Destination	Signal Type	Range	Units	Rate (Hz)
ST_SELF_T		ST SELF TEST FLAG 1 PER ST	DISP_SUP	LOGICAL	0,1	NA	1.04
CMD_WORD(1)	V71M5320P	COMMAND WORD TO STAR TRACKER -Z	ST 1	LOGICAL	NA	NA	1.04
CMD_WORD(2)	V71M5820P	COMMAND WORD TO STAR TRACKER -Y	ST 2	LOGICAL	NA	NA	1.04
ST_FAIL		ST SELF TEST FAIL FLAG: 1 PER ST	DISP_SUP	LOGICAL	0,1	NA	1.04
ST_PASS		ST SELF TEST PASS FLAG: 1 PER ST	DISP_SUP	LOGICAL	0,1	NA	1.04
NO_TARGET		NO TARGET FLAG: 1 PER ST	DISP_SUP	LOGICAL	0,1	NA	1.04
MAN_OP		SHUTTER OVERRIDE DISPLAY ASTERISK: 1 PER ST	DISP_SUP	LOGICAL	0,1	NA	1.04

Table 4.66.4.2-3. ST_SELF_TEST Command Responses		
	Set = 1	Set = 0
Phase 1		
Output: Command Word		
Offset scan mode command	Bit 0**	
Offset mode horiz and vert*		
Self-test command	Bit 1	
Input: Data Word 1		
Optics shutter closed	Bit 3	
Self-test mode engaged	Bit 4	
Star present	Bit 5	
Data Word 3		
Self-test angle error		Bit 12
Self-test magnitude error		Bit 13
Bright object alert off		Bit 15
Phase 2		
Output: Command Word		
Self-test command	Bit 1	
Offset scan mode command	Bit 0**	
Offset mode vert and horiz*		
Input: Data Word 1		
Tracker good		Bit 0
Phase 3		
Output: Command Word		
Self-test command		Bit 1
Input: Data Word 1		
Self-test mode engaged		Bit 4

*These are constant values.

**Offset scan mode commands preceded by break track and zero offset mode commands

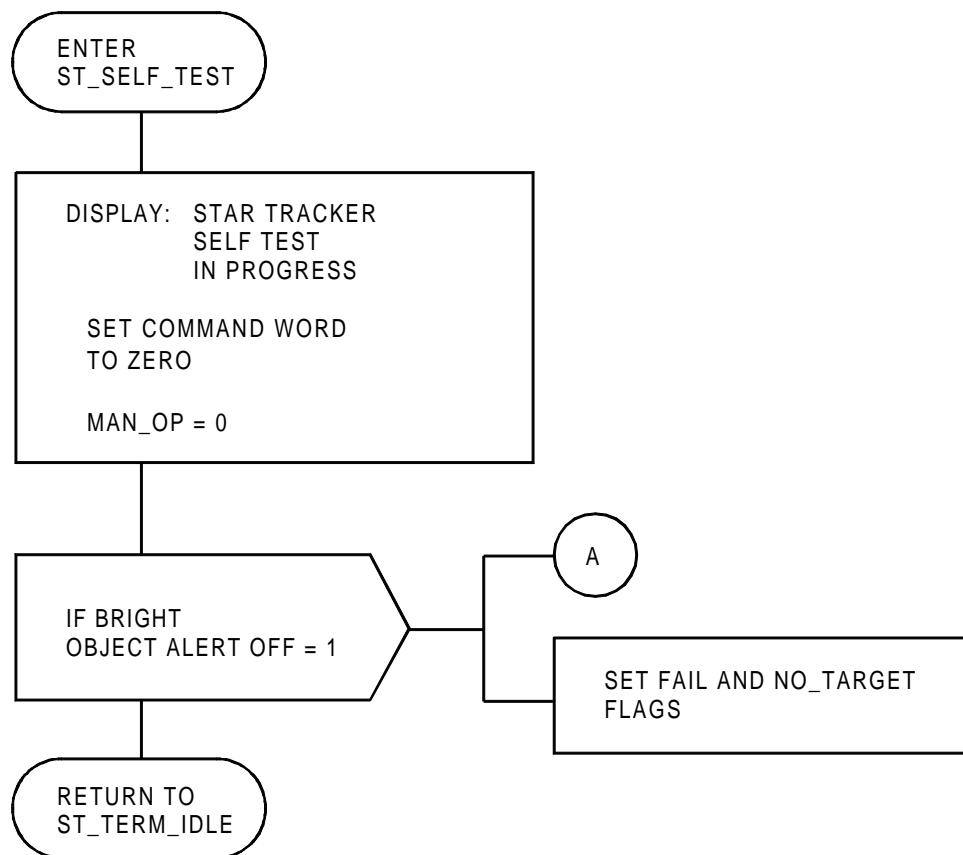


FIGURE 4.66.4.2-1.(1) ST_SELF_TEST Detailed Flow Diagram (Sheet 1 of 2)

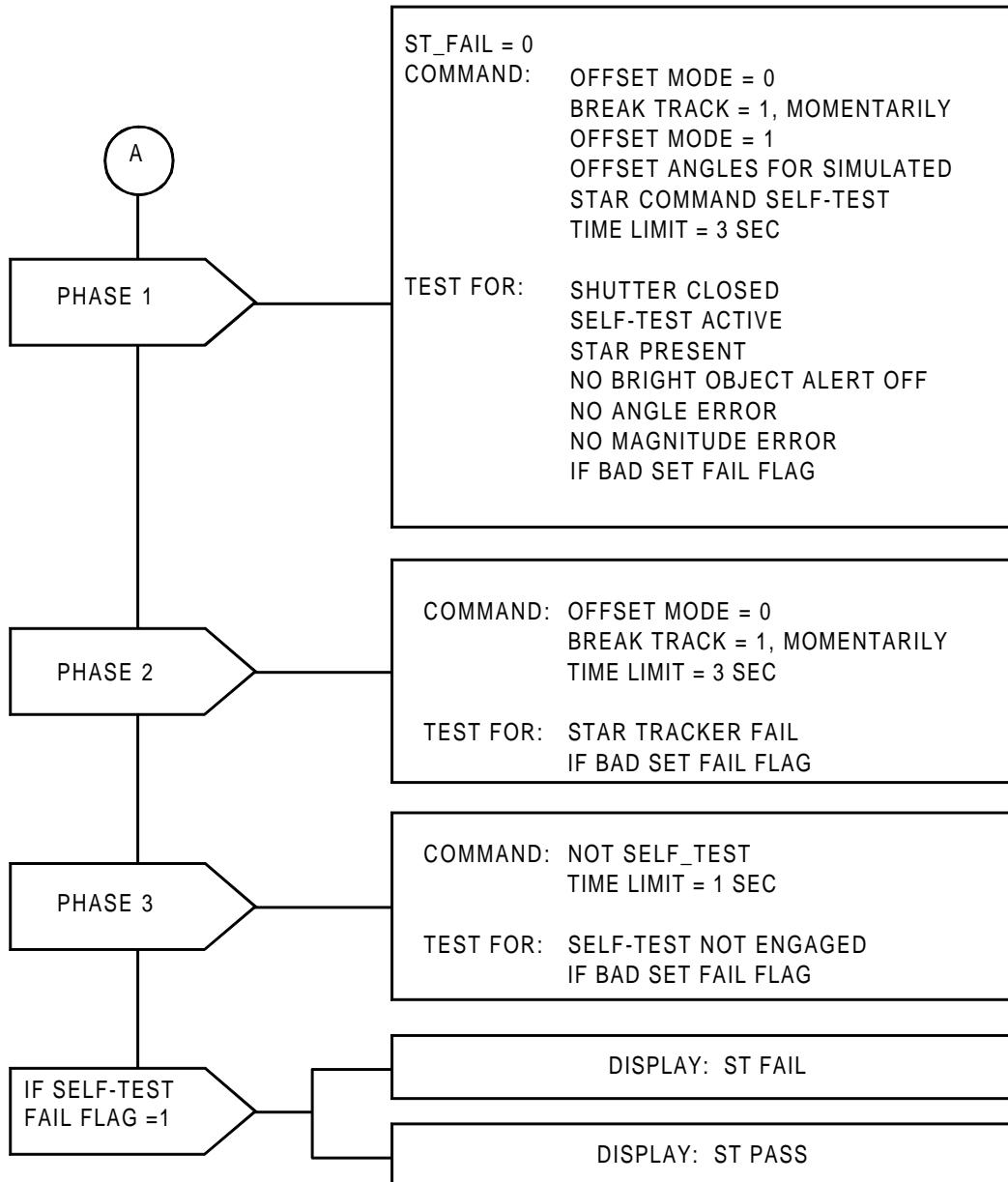


FIGURE 4.66.4.2-1.(2) ST_SELF_TEST Detailed Flow Diagram (Sheet 2 of 2)

4.66.4.3 Star Tracking (STAR_TRACK).

The purpose of the STAR_TRACK module is to perform the star tracker computations in response to a keyboard request to perform star tracking. This module accepts a crew selected star and sensitivity threshold setting and issues the required outputs to the star tracker for offset or auto scan tracking. The crew may select any of the entries in the Shuttle Star Catalog. If the crew does not specify a particular star, the SOP selects the best available star of opportunity from the navigation stars for tracking. This mode may also be initiated automatically upon receipt of an ST-based IMU align complete flag (=1).

A. Functional Requirements. The STAR_TRACK module is required to perform the following functions for each crew selected star tracker:

1. Store the keyboard input data, acknowledge that star track submode is in progress, and initialize the required variables.
2. If a star has been selected by the crew, perform the field of view test. If the star is outside the field of view, display OUT_FOV.
3. If star selection has not been inputted from the crew, select a new star from the Star Catalog that is currently within the ST field of view and closest to the center. Compute the offset angles.
4. If a trackable star is available, output the offset command and offset angles to the ST. If the star is not acquired in the offset scan, command the star tracker to auto scan tracking.
5. If the crew selected the star, return to TERM/IDLE at the completion of tracking that star, else continue with STAR_TRACK until TERM/IDLE is selected.
6. Provide appropriate status displays to the crew.
7. In OPS 2, the vector components of stars 101-110 can be changed from their initialized values by uplink.

B. Interface Requirements. The input and output parameters associated with the STAR_TRACK functional module are contained in Tables 4.66.4.3-1 and 4.66.4.3-2.

C. Detailed Requirements. The following sequence of operations and computations are required to perform the STAR_TRACK functions for each selected star tracker:

1. Initialize the following variables:

```
STARMODE =1
NO_TARGET=0
```

If the crew does not select a star identification (STAR_ID=0), set STAR_INPUT=0; otherwise set STAR_INPUT=1.

2. Determine the unit LOS vector in M50 coordinates along the star tracker centerline as follows:

- (a) Determine the transformation from nav base to present selected IMU cluster:

```
CALL TNB_CL for selected IMU,SIMU
```

- (b) Compute the unit LOS vector along the star tracker centerline in M50 coordinates as follows:

$$\bar{S}_{TM50} = \begin{bmatrix} T_{C(SIMU)}^{M50} \end{bmatrix} \begin{bmatrix} T_{NB}^{PC(SIMU)} \end{bmatrix} \begin{bmatrix} T_{NB}^{STJ}(3,1) \\ T_{NB}^{STJ}(3,2) \\ T_{NB}^{STJ}(3,3) \end{bmatrix}$$

3. If a star identification has been input (STAR_ID ≠ 0), proceed to step 5, else, set ANGDIF = 0.99 and proceed to step 4.
4. Determine the star closest to the star tracker centerline that is in the field of view by performing the following for each star (excluding Sirius) in the star catalog:
 - (a) Determine the separation between this star and the star tracker centerline as follows:

$$ANG = \bar{S}_{TM50} \cdot \bar{I}_{STAR_SEL(II)}$$

- (b) Determine if the separation angle is greater than 8.11 degrees or if this star is closer to the ST centerline than the previous closest star that was in the field of view, then perform the following:

If $ANG < ANGDIF$ (separation angle is greater indicating this is not a candidate star), return to (a) if all of the stars in the catalog have not been checked; otherwise, proceed to (f).

If ANG is greater than $ANGDIF$, proceed to (c).

- (c) Determine if this is a new star by comparing this star identification number, II, with the identification number of all stars in the star sighting table.
- (d) If this is a new star continue to (e); else, if this is not a candidate star return to (a) if all the stars in the catalog have not been checked; otherwise, proceed to (g).
- (e) Perform the FOV_TEST for this star with the following input, $\bar{V}_{ST} = \bar{I}_{STAR_SEL(II)}$. If this star is in the field of view ($OUT_FOV = 0$), then this is the new candidate star. Save this star's separation angle, horizontal offset, vertical offset, and identification as follows:

$$\begin{aligned} ANGDIF &= ANG \\ HH_ANG &= H_ANG \\ VV_ANG &= V_ANG \\ STAR_ID &= II \end{aligned}$$

- (f) If the last star in the catalog has been checked, proceed to (g); otherwise, return to (a) with the next star in the catalog.
- (g) Determine if a star was found in the field of view by testing the value of $STAR_ID$. If $STAR_ID = 0$, then set $OUT_FOV = 1$, else set $OUT_FOV = 0$. Proceed to step 5.

5. Perform the following for the requested star:

If a star has been selected (STAR_ID ≠ 0), then perform the FOV_ TEST for the requested star with the following input:

$$\bar{VST} = \bar{I}_{_STAR_SEL(STAR_ID)}$$

6. If OUT_FOV = 0, perform the following; otherwise, proceed to step 11.

- (a) A command of BREAK TRACK = 1 and OFFSET MODE = 0, shutter open = no change, except if shutter is closed and bright object sensor indicates no bright object is present, then set Shutter Cmd = 1 and set shutter unlatch flag.

After at least 40 milliseconds, set the command word for the selected star tracker as follows:

Break track = 0

Offset mode = 1

Horizontal coordinate = H_ANG (or HH_ANG)

Vertical coordinate = V_ANG (or VV_ANG)

Threshold = THOLD

SELF_TEST = 0

Shutter open = no change, except if shutter unlatch flag is set, then set Shutter Cmd = 0 and reset shutter unlatch flag. (This shall be accomplished even if a COMMFAULT condition exists.)

- (b) Output the command word to the selected star tracker

- (c) Set T_ERROR = T_LIM1

7. Wait a maximum of 4 seconds ± 160 milliseconds to acquire the star. The star present bit is read every 160 milliseconds. The DATA_FILR module shall be scheduled for a single execution on transition of the STAR_PRES flag from logic 0 to logic 1. If STAR_PRES = 1, proceed to step 9. Else continue to step 8 at the end of 4 seconds.

8. Select the auto scan tracking mode for the star tracker.

- (a) Set the command word for the selected ST as follows:

OFF_CMD = 0
 V_ANG = 0
 H_ANG = 0

- (b) Output the command word to the selected ST

- (c) Set T_ERROR = T_LIM2

- (d) Wait a maximum of 40 seconds \pm 160 milliseconds to acquire the star. The DATA_FILR module shall be scheduled for a single execution on transition of the STAR_PRES flag from logic 0 to logic 1.

If STAR_PRES = 1, set IPASS to 1 and proceed to step 9. Else, set the NO_TARGET flag to 1 and then proceed to step 11 at the end of 40 seconds.

9. Wait for DATA_FILR and STAR_CONFIRM to process and evaluate the data, then proceed to step 10.
10. If false tracking was determined (FALSE_TK = 1), break tracking by setting BREAK_T = 1 and return to step 7 or step 8 (depending on which step detected the STAR_PRES). Do not count the time spent executing DATA_FILR and STAR_CONFIRM against the 4-second or the 40-second wait time.
11. If the crew inputs a star (STAR_INPUT = 1), terminate STAR_TRACK by returning to TERM/IDLE. Reset the flag STARMODE to zero prior to returning to TERM/IDLE. If stars of opportunity are being tracked (STAR_INPUT = 0), set STAR_ID = 0 and exit STAR_TRACK for this cycle.

The STAR_TRACK module shall be executed once in response to a keyboard request to track a specific star (crew input STAR_ID = 0 or 1 through 110). When requested to track stars of opportunity (STAR_ID not input by crew), the STAR_TRACK logic shall be restarted no more frequently than once per 5 seconds.

The accumulation of data samples by DATA_FILR shall begin within 0.48 seconds (three cycles) of detection of star present by STAR_TRACK.

Star track submode processing shall not be performed during execution of on-orbit IMU realignment. Upon receipt of the align execute command, the software shall automatically discontinue star track submode processing (if in progress) and return to star tracker terminate/idle mode processing. IMU realignment processing shall proceed after the star tracker terminate/idle mode has been achieved. The software shall not respond to any star tracker submode requests from the keyboard during the execution of on-orbit IMU realignment functions. Upon completion of the IMU on-orbit alignment, both star trackers will be commanded to STAR_TRACK mode for stars of opportunity tracking.

A suggested design flow that satisfies the STAR_TRACK requirements is shown in Figure 4.66.4.3-1.

Table 4.66.4.3-1. STAR_TRACK Inputs

Name	MSID/ MML No.	Description	Input Source	Signal Type	Range	Units	Rate (Hz)
SIMU	V90J2560C	SELECTED IMU ID	IMU RM (4.72)	INTEGER	1,2,3	NA	1.04
STAR_ID		SELECTED STAR ID 1 PER ST	DISP_SUP	INTEGER	0 – 110	NA	1.04
H_ANG	V95H4825C V95H4826C	HORIZONTAL OFFSET ANGLE: 1 PER ST	FOV_TEST	SCALAR	+/-1.57	RAD	OD
V_ANG	V95H4827C V95H4828C	VERTICAL OFFSET ANGLE: 1 PER ST	FOV_TEST	SCALAR	+/-1.57	RAD	OD
STJ	V91J3201C	SELECTED STAR TRACKER	FCOS	INTEGER	1,2	NA	25
DP(K)	V99H2660CA V99H2661CA V99H2662CA	IMU K ROLL/PITCH NON-ORTHOGONALITY: K = 1,2,3	IMU SOP (HANG_CALB)	SCALAR	+/-0.006	RAD	OD
CMD_WORD(1)	V71M5320P	COMMAND WORD TO STAR TRACKER -Z	DISP_SUP	LOGICAL	NA	NA	1.04
CMD_WORD(2)	V71M5820P	COMMAND WORD TO STAR TRACKER -Y	DISP_SUP	LOGICAL	NA	NA	1.04
M50_T_C(K)	V99U3450CA THRU V99U3476CA	TRANSFORMATION: PRESENT CLUSTER TO M50 IMU K: K = 1,2,3	IMU ORB A/CAL (4.208)	MATRIX	+/- 1	NA	OD
DATA_WORD1(1)	V71M5020P	-Z ST MODE STATUS WD1	ST 1	LOGICAL	NA	NA	OD
DATA_WORD1(2)	V71M5520P	-Y ST MODE STATUS WD1	ST 2	LOGICAL	NA	NA	OD
FALSE_TK		FLAG INDICATING FALSE TRACKING: 1 PER ST	STAR_CONFIRM	LOGICAL	0,1	NA	OD
OUT_FOV		STAR/TARGET OUT OF FOV FLAG: 1 PER ST	FOV_TEST	LOGICAL	0,1	NA	OD
STJ_T_(3,1)_NB	V99U5682C V99U5691C	COMPONENT 3,1 OF THE TRANSFORMATION FROM NAV BASE TO STAR TRACKER: 1 PER ST; J = 1,2	I-LOAD	SCALAR	+/- 1	NA	6.25
STJ_T_(3,2)_NB	V99U5683C V99U5692C	COMPONENT 3,2 OF THE TRANSFORMATION FROM NAV BASE TO STAR TRACKER: 1 PER ST; J = 1,2	I-LOAD	SCALAR	+/- 1	NA	6.25
STJ_T_(3,3)_NB	V99U5684C V99U5693C	COMPONENT 3,3 OF THE TRANSFORMATION FROM NAV BASE TO STAR TRACKER: 1 PER ST; J = 1,2	I-LOAD	SCALAR	+/- 1	NA	6.25
PANG	V95H0050CA V95H1050CA V95H2050CA	IMU K COMP PITCH RES ANGLE: 1 PER IMU	IMU INT PROC (4.38)	SCALAR	0 – 360	DEG	OD

Table 4.66.4.3-1. STAR_TRACK Inputs

Name	MSID/ MML No.	Description	Input Source	Signal Type	Range	Units	Rate (Hz)
AZANG	V95H0051CA V95H1051CA V95H2051CA	IMU K COMP AZIMUTH RES ANGLE: 1 PER IMU	IMU INT PROC (4.38)	SCALAR	0 – 360	DEG	OD
IRANG	V95H0053CA V95H1053CA V95H2053CA	IMU K COMP INNER ROLL RES ANGLE: 1 PER IMU	IMU INT PROC (4.38)	SCALAR	0 – 15 345– 360	DEG	OD
ORANG	V95H0054CA V95H1054CA V95H2054CA	IMU K COMP OUTER ROLL RES ANGLE: 1 PER IMU	IMU INT PROC (4.38)	SCALAR	0 – 360	DEG	OD
T_LIM1	V99U5638C	TEST LIMIT FOR OFFSET SCAN MODE	I-LOAD	SCALAR		DEG	6.25
T_LIM2	V99U5639C	TEST LIMIT FOR FULL FIELD SCAN MODE	I-LOAD	SCALAR		DEG	6.25
THOLD		COMMANDED THRESHOLD SETTING: 1 PER ST	DISP_SUP	INTEGER	0,1,2,3	NA	1.04
I_STAR_ SEL(I)	V97U2721CA THRU V97U2750CA	STAR UNIT VECTORS IN M50 COORDINATES: I = 101 THROUGH 110	UL (A5.7.2)	VECTOR	+/- 1	NA	OD

Table 4.66.4.3-2. STAR_TRACK Outputs

Name	MSID/ MML No.	Description	Output Destination	Signal Type	Range	Units	Rate (Hz)
T_ERROR		TEST TOLERANCE BASED UPON TRACKING MODE: 1 PER ST	STAR_CONFIRM		0.5– 2.0	DEG	6.25
VST	V95U4820C V95U4821C V95U4822C	UNIT VECTOR OF SELECTED STAR OR TARGET IN M50 COORDINATES	FOV_TEST TLM	VECTOR	+/- 1	NA	6.25
CMD_ WORD(1)	V71M5320P	COMMAND WORD TO STAR TRACKER -Z	ST 1	LOGICAL	NA	NA	6.25
CMD_ WORD(2)	V71M5820P	COMMAND WORD TO STAR TRACKER -Y	ST 2	LOGICAL	NA	NA	6.25
STARMODE		ST STAR TRACKING FLAG: 1 PER ST	DISP_SUP	LOGICAL	0,1	NA	6.25
STAR_ID		SELECTED STAR ID: 1 PER ST	DISP_SUP STAR_CONFIRM	INTEGER	0–110	NA	6.25
NO_TARGET		FLAG INDICATING NO STAR WAS FOUND: 1 PER ST	DISP_SUP	LOGICAL	0,1	NA	6.25
I_STAR_ SEL(I)		STAR UNIT VECTORS IN M50 COORDINATES: I = 11 THROUGH 110	STAR_CONFIRM COAS_CALIB DISP_SUP	VECTOR	+/- 1	NA	6.25
IPASS		FIRST PASS FLAG; 1 PER ST	DATA_FILR	LOGICAL	0,1	NA	6.25

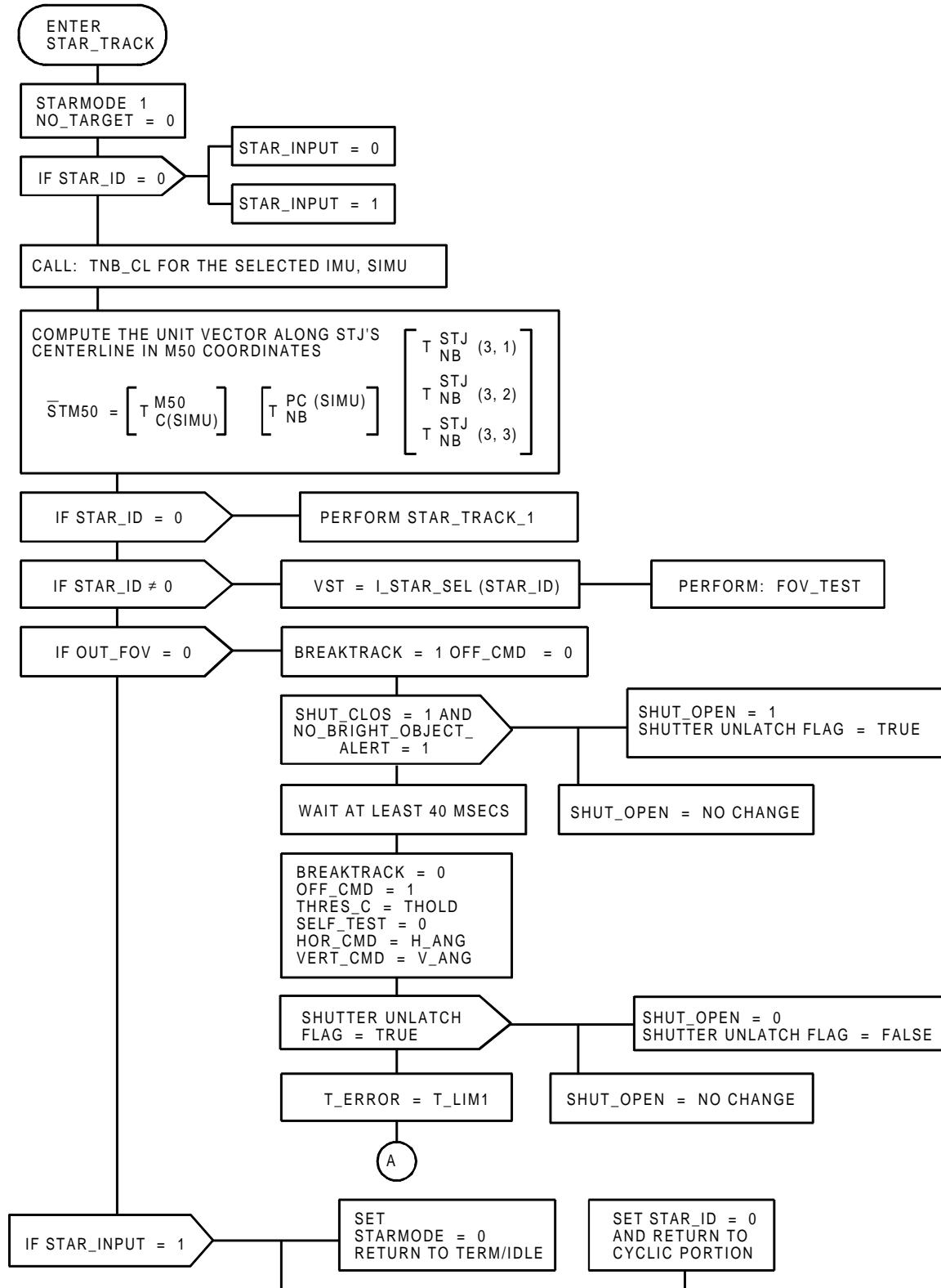


FIGURE 4.66.4.3-1.(1) STAR_TRACK Detailed Flow Diagram (Sheet 1 of 3)

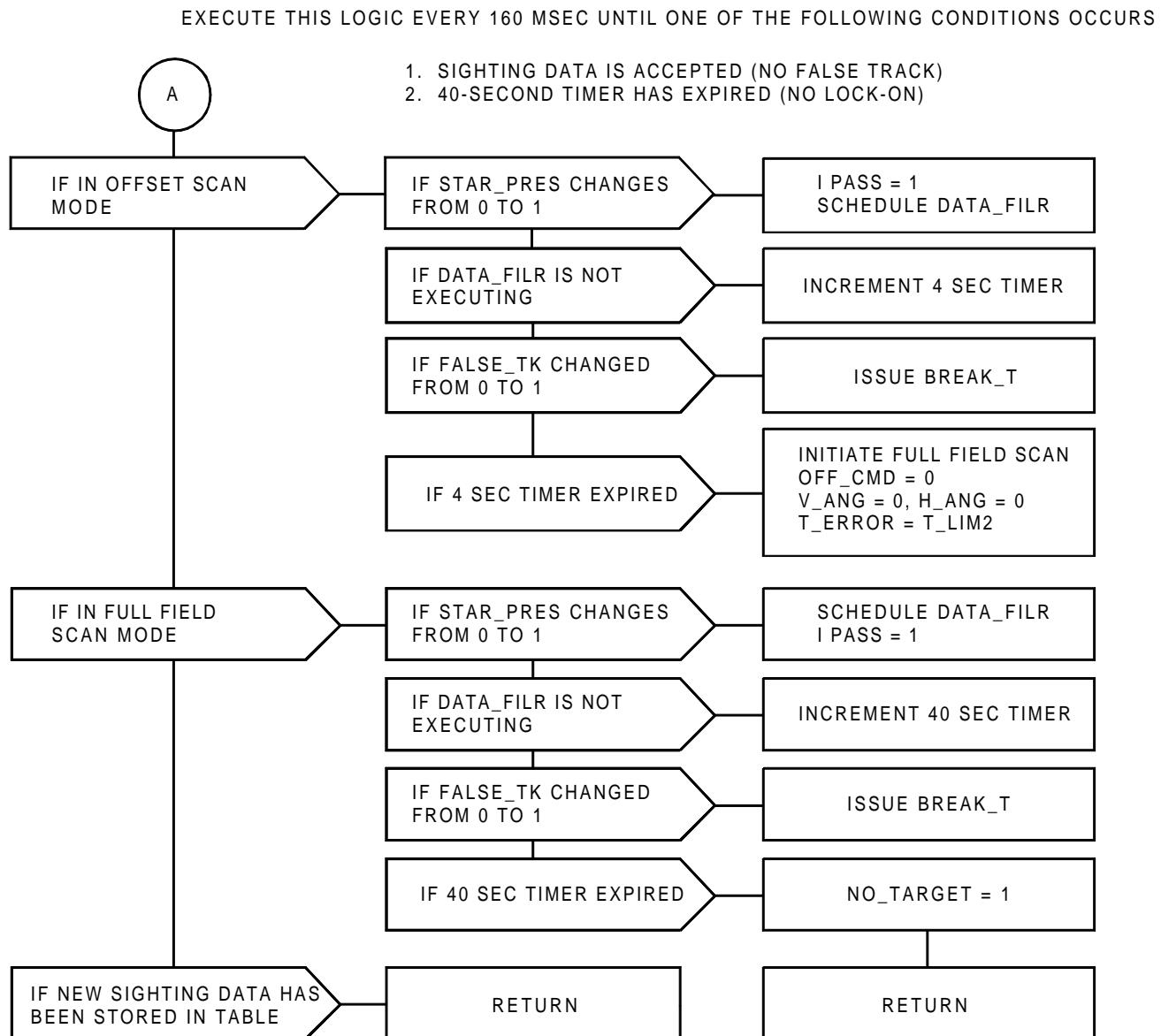


FIGURE 4.66.4.3-1.(2) STAR_TRACK Detailed Flow Diagram (Sheet 2 of 3)

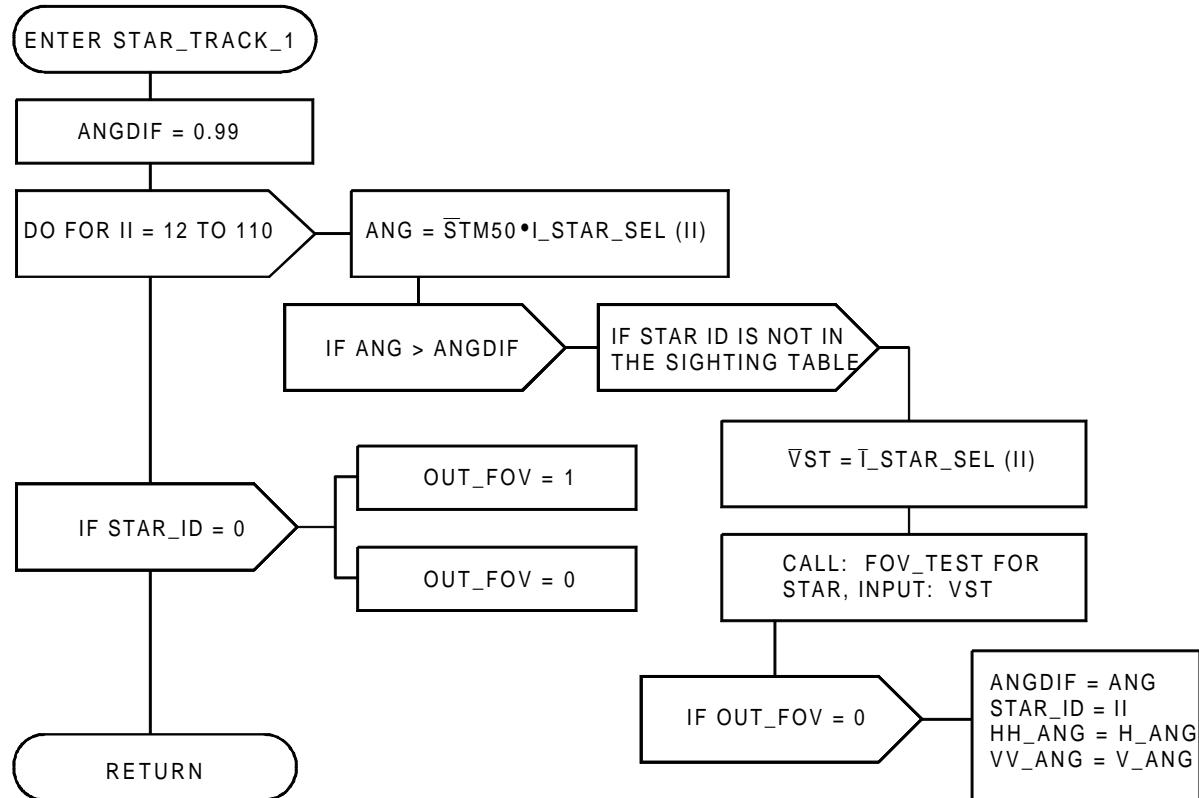


FIGURE 4.66.4.3-1.(3) STAR_TRACK Detailed Flow Diagram (Sheet 3 of 3)

4.66.4.5 Target Track (TARGET_TRK).

The purpose of the TARGET_TRK module is to perform the star tracker computations associated with tracking a rendezvous target vehicle. This module accepts navigation generated inputs defining the relative target position vector and issues the required outputs to the star tracker for offset or full field scan tracking.

A. Functional Requirements. The TARGET_TRK module is required to perform the following functions after the preferred tracking attitude has been obtained:

1. Input the selected star tracker and sensitivity threshold.
2. Input the orbiter and target position vectors from navigation.
3. Perform field of view test.
4. Issue the required offset commands and data to the applicable star tracker.
5. If the target is not acquired in 4 seconds, command the star tracker to full field scan mode and wait an additional 20 seconds for target acquisition.
6. Provide appropriate displays to the crew.

B. Interface Requirements. The input and output parameters associated with the TARGET_TRK functional module are contained in Tables 4.66.4.5–1 and 4.66.4.5–2.

C. Detailed Requirements. The following set of equations and sequence of computations are required to perform the TARGET_TRK functions for the selected star tracker:

1. Determine if this is the first pass (PASS = 1), or if there is an indication of false tracking (FALSE_TARG = 1), or if the target being tracked was lost (STAR_PRES = 0). If any one of the above conditions is met, initialize the following parameters and continue to step 2.

```
DATA_GOOD = 0  
PASS = 0  
TARMODE = 1  
NO_TARGET = 0
```

If none of the conditions are met, schedule DATA_FILR and continue to step 6.

2. Compute the estimated unit LOS vector from the orbiter to the target in M50 coordinates utilizing the target position vector and orbiter position vector in earth-centered M50 coordinates from NAV.

$$\bar{U}_{ESTAR} = \text{UNIT}(\bar{R}_{\text{TARGET}} - \bar{R}_{\text{P}})$$

3. Determine if the target is in the field of view of the crew-selected star tracker by calling the FOV_TEST. If OUT_FOV equals zero, then issue the following commands to the selected star tracker: offset track, horizontal offset angle, break track, vertical offset angle, and threshold setting. If shutter is closed and bright object sensor indicates no bright object is present, then set SHUTTER_CMD = 1 and set shutter unlatch flag . Otherwise, do not change shutter setting. Else set pass to 1, and terminate TARGET_TRK processing for this cycle.

Call FOV_TEST ($\bar{V}_{ST} = \bar{U}_{ESTAR}$)

If OUT_FOV = 0, then command the following to each applicable star tracker: BREAK_T = 1, OFF_CMD = 0, shutter open = no change except if shutter is closed and bright object sensor indicates no bright object is present, then set SHUTTER_CMD = 1 and set shutter unlatch flag. After at least 40 milliseconds, set the command word for the applicable star tracker as follows:

BREAK_T = 0
OFF_CMD = 1
OFFSET_FLAG = 1
HORIZONTAL_CMD = H_ANG
VERTICAL_CMD = V_ANG
THRES_C = THOLD
SHUT_OPEN = No change except if shutter unlatch flag is set, then set
SHUTTER_CMD = 0 and reset shutter unlatch flag. (This shall be accomplished
even if a COMMFAULT condition exists.)
SELF_TEST = 0
SET FALSE_TARG = 0

Output the command word to the selected star tracker. Proceed to step 4. Else, set PASS = 1 and proceed to step 6.

4. Wait for maximum of 4 seconds for target acquisition in the offset mode. The STAR_PRES bit is read every 160 milliseconds. If the target is not acquired within 4 seconds, command full field scan mode and wait for a maximum of 20 seconds. In either case, if the star present flag transitions from logic 0 to logic 1 the DATA_FILR module should be scheduled once during the current TARGET_TRK module execution cycle and cyclically every 7.5 seconds thereafter.

Wait 4 seconds.

If STAR_PRES = 0, set the command for the selected star tracker as follows:

OFFSET_FLAG = 0
OFF_CMD = 0

Output the command word to the selected star tracker.

Wait 20 seconds, then proceed to step 5.

Else, set IPASS to 1 and schedule DATA_FILR then proceed to step 6.

5. If the target is not acquired (STAR_PRES = 0), set the NO_TARGET and PASS flags equal to one. If target is acquired, schedule DATA_FILR.

6. Terminate TARGET_TRK processing for this cycle and reset the STARMODE and NAV_TARGET flags to zero if termination of this mode was requested by the crew.

The TARGET_TRK module shall be executed at a 7.5-second rate if none of the following conditions are met: (a) PASS = 1, (b) FALSE_TARG = 1, or (c) STAR_PRES = 0. If any of these conditions are met, the execution time shall not exceed 30 seconds. If the DATA_GOOD flag is not updated within 15 seconds since it was last updated, the TARGET_TRK module shall set the DATA_GOOD flag to OFF. In the presence of a COMMFAULT, on the STAR TRACKER currently in the TARGET TRACK MODE, the execution of the TARGET_TRK MODULE should be skipped. If the star tracker COMMFAULT prevents the DATA_GOOD flag from being updated within 15 seconds since it was last updated, the DATA_GOOD flag should be set to OFF by the TARGET_TRK MODULE. The software shall not be required to support simultaneous TARGET_TRK utilizing both star trackers. A suggested design flow that satisfies the TARGET_TRK requirements is shown in Figure 4.66.4.5-1.

The star tracker hardware command mode flag (OFF_CMD) should not be confused with the software offset mode flag (OFFSET_FLAG).

Table 4.66.4.5-1. TARGET_TRK Inputs

Name	MSID/ MML No.	Description	Input Source	Signal Type	Range	Units	Rate (Hz)
R_TARGET	V95H0862E V95H0863C V95H0864G	TARGET POSITION VECTOR IN M50 COORDINATES	ORB UPP (4.22)	VECTOR	TBD	FT	1.04
RP	V95H0185C V95H0186C V95H0187C	ORBITER POSITION VECTOR IN M50 COORDINATES	ORB UPP(4.22) ENT UPP(4.23)	VECTOR	TBD	FT	1.04 0.52
OUT_FOV		STAR/TARGET OUT OF FOV FLAG: 1 PER ST	FOV_TEST	LOGICAL	0,1	NA	OD
H_ANG	V95H4825C V95H4826C	HORIZONTAL OFFSET ANGLE: 1 PER ST	FOV_TEST	SCALAR	+/-1.57	RAD	OD
V_ANG	V95H4827C V95H4828C	VERT OFFSET ANGLE: 1 PER ST	FOV_TEST	SCALAR	+/-1.57	RAD	OD
CMD_WORD(1)	V71M5320P	COMMAND WORD TO STAR TRACKER -Z	DISP_SUP	LOGICAL	NA	NA	1.04
CMD_WORD(2)	V71M5820P	COMMAND WORD TO STAR TRACKER -Y	DISP_SUP	LOGICAL	NA	NA	1.04
DATA_WORD1(1)	V71M5020P	-Z ST MODE STATUS WD1	ST 1	LOGICAL	NA	NA	OD
DATA_WORD1(2)	V71M5520P	-Y ST MODE STATUS WD1	ST 2	LOGICAL	NA	NA	OD
STJ	V91J3201C	SELECTED STAR TRACKER	FCOS	INTEGER	1,2	NA	25
THOLD		COMMANDED THRESHOLD SETTING: 1 PER ST	DISP_SUP	INTEGER	0,1,2,3	NA	1.04
FALSE_TARG	V90X1422X	FALSE TRACK FLAG	ORB/RND NAV (4.126)	LOGICAL	0, 1	NA	0.26
PASS		FIRST PASS FLAG	TERM_IDLE	LOGICAL	0, 1	NA	OD

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Table 4.66.4.5-2. TARGET_TRK Outputs

Name	MSID/ MML No.	Description	Output Destination	Signal Type	Range	Units	Rate (Hz)
TARMODE		TARGET MODE FLAG: 1 PER ST	DATA_FILR DISP_SUP	LOGICAL	0, 1	NA	6.25
VST	V95U4820C V95U4821C V95U4822C	UNIT VECTOR OF SELECTED STAR OR TARGET IN M50 COORDINATES	FOV_TEST TLM	VECTOR	+/- 1	NA	6.25
CMD_WORD(1)	V71M5320P	COMMAND WORD TO STAR TRACKER -Z	ST 1	LOGICAL	NA	NA	6.25
CMD_WORD(2)	V71M5820P	COMMAND WORD TO STAR TRACKER -Y	ST 2	LOGICAL	NA	NA	6.25
NO_TARGET		NO TARGET FLAG: 1 PER ST	DISP_SUP	LOGICAL	0, 1	NA	6.25
DATA_GOOD	V95X4771X	DATA GOOD FLAG	ORB/RND NAV (4.126) TLM	LOGICAL	0, 1	NA	6.25
IPASS		FIRST PASS FLAG: 1 PER ST	DATA_FILR	LOGICAL	0,1	NA	6.25
NAV_TARGET	V95X4778X	NAVIGATION TARGET FLAG	ORB/RND NAV (4.126) TLM	LOGICAL	0,1	NA	6.25

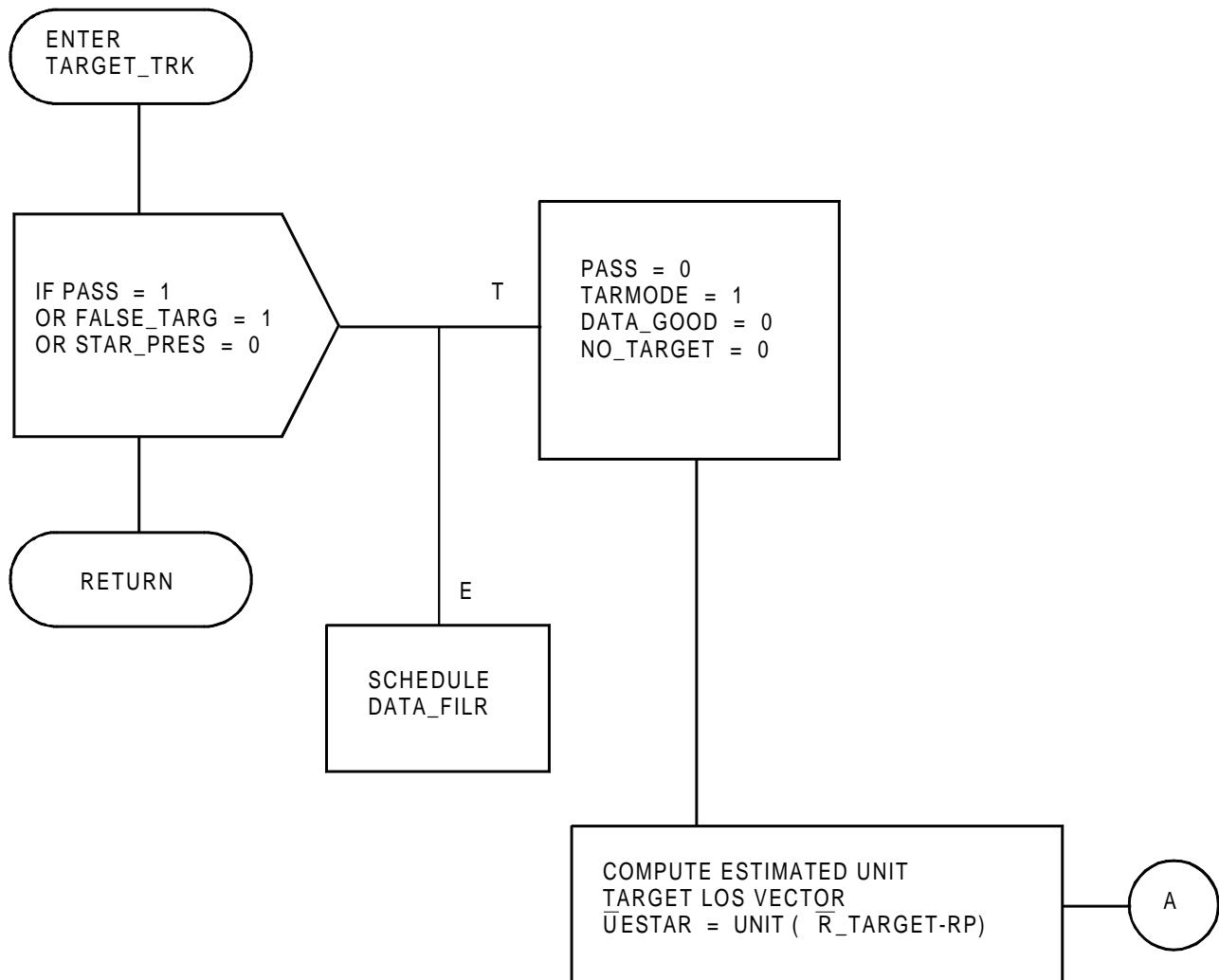


FIGURE 4.66.4.5-1.(1) TARGET_TRK Detailed Flow Diagram (Sheet 1 of 2)

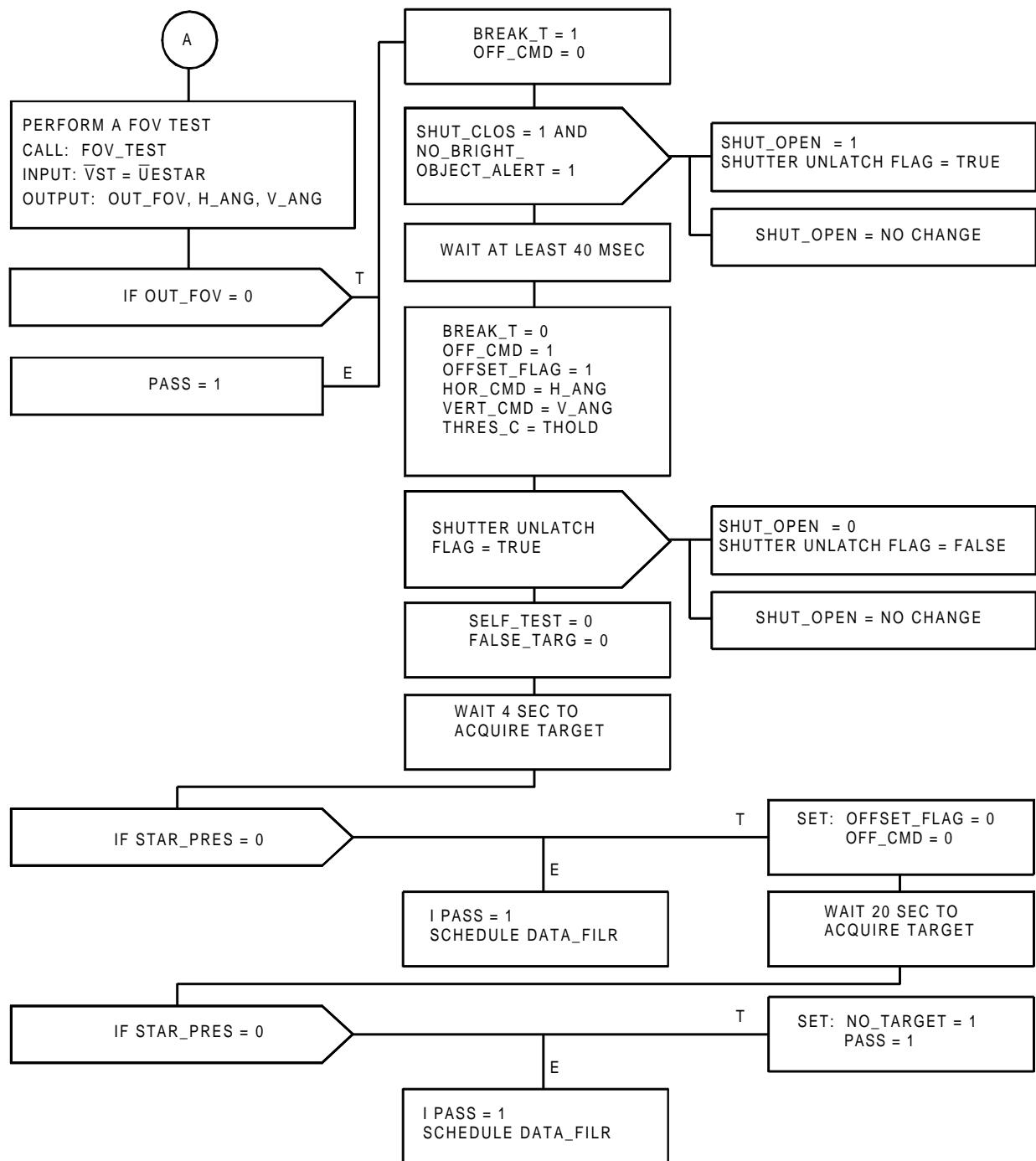


FIGURE 4.66.4.5-1.(2) TARGET_TRK Detailed Flow Diagram (Sheet 2 of 2)

4.66.4.6 Star in Field of View Test (FOV_TEST).

The purpose of the FOV_TEST module is to determine if the horizontal and vertical offset angles associated with the star or rendezvous target (selected by either the crew or the computer) lie within the star tracker's field of view.

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

1. Obtain the star or rendezvous target coordinates and compute the required horizontal and vertical offset angles.
2. Test the horizontal and vertical offset angles to determine if the star or target lies within the star tracker 10 degree x 10 degree field of view.
3. If the offset angles are not within the star tracker field of view, set a flag and provide a display to indicate this condition.

B. Interface Requirements. The input and output parameters associated with the FOV_TEST functional module are contained in Tables 4.66.4.6-1 and 4.66.4.6-2.

C. Detailed Requirements. The following set of equations and sequence of computations are required to perform the FOV_TEST functions.

1. Initialize OUT_FOV to zero.

OUT_FOV is a flag indicating whether the star is in or out of the total field of view.

2. Determine the navigation base to present cluster (specified by IMU RM, SIMU) transformation by calling the TNB_CL module in the IMU SOP.
3. Form the M50 to star tracker transformation utilizing the IMU present cluster to M50 transformation (specified by IMU RM, SIMU) from the IMU SOP COMPOOL, the navigation base to present cluster transformation obtained in step 2, and the navigation base to star tracker transformation for the applicable star tracker from COMPOOL.

$$[T_{M50}^{STJ}] = [T_{NB}^{STJ}] [T_{NB}^{PC(SIMU)}]^T [T_{C(SIMU)}^{M50}]^T$$

4. Form the star/target position vector in star tracker coordinates utilizing the star position vector in M50 coordinates from the STAR_TRACK module or the target position vector in vehicle centered M50 coordinates from the TARGET_TRK module and the M50 to star tracker transformation formed in step 3.

$$\bar{VSTM50} = [T_{M50}^{STJ}] \bar{VST}$$

5. Form the horizontal and vertical offset angles for the star tracker using the star/target position vector in star tracker coordinates found in step 4.

$$H_ANG = ARCTAN2(VSTM50(2), VSTM50(3))$$

$$V_ANG = ARCTAN2(-VSTM50(1), VSTM50(3))$$

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6. Determine if the absolute values of both the horizontal and vertical offset angles are less than or equal to FOV_LIM. If $|H_ANG| \leq FOV_LIM$ and $|V_ANG| \leq FOV_LIM$ proceed to step 7, else set the out of field of view flag, OUT_FOV, equal to one.
7. Exit from the FOV_TEST module.

The FOV_TEST module shall be executed once (for the applicable star tracker) when called. A suggested design flow which satisfies the FOV_TEST requirements is shown in Figure 4.66.4.6-1.

Table 4.66.4.6-1. FOV_TEST Inputs

Name	MSID	Description	Input Source	Signal Type	Range	Units	Rate (Hz)
STJ T NB M50 T C(K)	V99U5676C THRU V99U5693C V99U3450CA THRU V99U3476CA	TRANSFORMATION: NAV BASE TO STAR TRACKER: 1 PER ST; J = 1,2 TRANSFORMATION: PRESENT CLUSTER TO M50 IMU K: K = 1,2,3	I-LOAD IMU ORB A/CAL (4.208)	MATRIX MATRIX	+/- 1 +/- 1	NA NA	OD OD
STJ VST	V91J3201C V95U4820C V95U4821C V95U4822C	SELECTED STAR TRACKER UNIT VECTOR OF SELECTED STAR OR TARGET IN M50 COORDINATES	FCOS STAR_TRACK TARGET_TRK	INTEGER VECTOR	1,2 +/- 1	NA NA	25 6.25
SIMU FOV_LIM	V90J2560C V99U5604C	SELECTED IMU ID FIELD OF VIEW TEST ANGLE LIMIT	IMU RM (4.72) K-LOAD	INTEGER SCALAR	1,2,3 .0785398	NA RAD	1.04 OD
DP(K)	V99H2660CA V99H2661CA V99H2662CA	IMU K ROLL/PITCH NON-ORTHOGONALITY: K = 1,2,3	IMU SOP (HANG_CALB)	SCALAR	+/- .006	RAD	OD
PANG	V95H0050CA V95H1050CA V95H2050CA	IMU K COMP PITCH RES ANGLE: 1 PER IMU	IMU INT PROC (4.38)	SCALAR	0 - 360	DEG	OD
AZANG	V95H0051CA V95H1051CA V95H2051CA	IMU K COMP AZIMUTH RES ANGLE: 1 PER IMU	IMU INT PROC (4.38)	SCALAR	0 - 360	DEG	OD
IRANG	V95H0053CA V95H1053CA V95H2053CA	IMU K COMP INNER ROLL RES ANGLE: 1 PER IMU	IMU INT PROC (4.38)	SCALAR	0-15 345-360	DEG	OD
ORANG	V95H0054CA V95H1054CA V95H2054CA	IMU COMP OUTER ROLL RES ANGLE: 1 PER IMU	IMU INT PROC (4.38)	SCALAR	0 - 360	DEG	OD

Table 4.66.4.6-2. FOV_TEST Outputs

Name	MSID	Description	Output Destination	Signal Type	Range	Units	Rate (Hz)
H_ANG(1) H_ANG(2)	V95H4825C V95H4826C	HORIZONTAL OFFSET ANGLE: 1 PER ST	STAR_TRACK TLM TARGET_TRK	SCALAR	+/-1.57	RAD	OD
V_ANG(1) V_ANG(2)	V95H4827C V95H4828C	VERTICAL OFFSET ANGLE: 1 PER ST	STAR_TRACK TLM TARGET_TRK	SCALAR	+/-1.57	RAD	OD
OUT_FOV		STAR/TARGET OUT OF FOV FLAG: 1 PER ST	STAR_TRACK TARGET_TRK DISP_SUP	LOGICAL	0,1	NA	OD

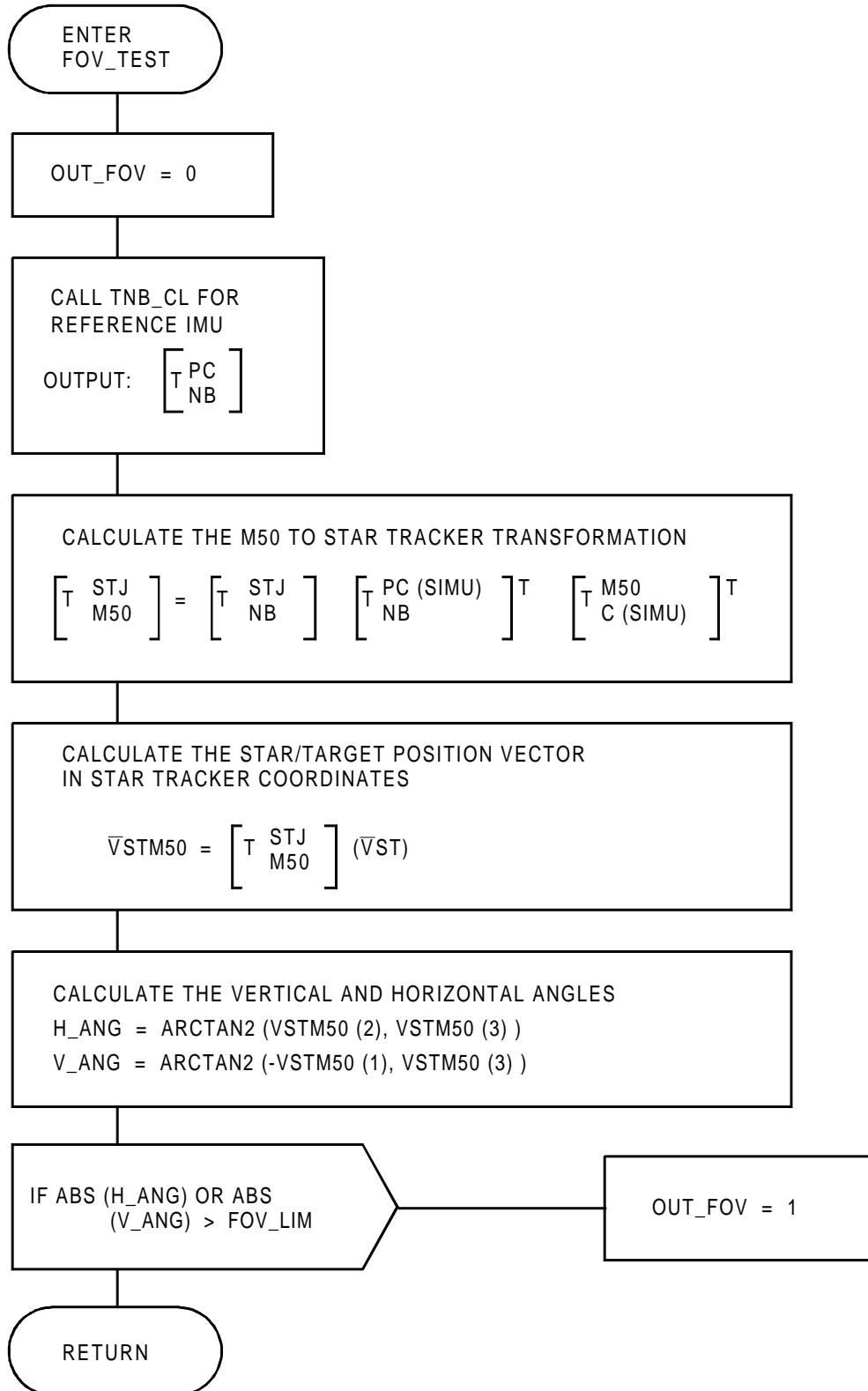


FIGURE 4.66.4.6-1. FOV_TEST Detailed Flow Diagram

4.66.4.7 Star Confirmation (STAR_CONFIRM).

The purpose of the STAR_CONFIRM module is to determine if the star tracker has locked onto the selected star or is false tracking on another star or bright object. Tests are performed on LOS error, celestial body position stability, and star separation angles.

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

1. Compare the indicated LOS vector with the estimated LOS vector (based on a stabilized IMU) for reasonableness.
2. Compare the indicated LOS vector rate of change with a predefined limit for reasonableness.
3. If sighting data are available on two or more stars, check the indicated separation angle between star pairs with the known separation angle.
4. Issue the break track command and ignore the current star sighting data upon failure to confirm reasonable star tracking.
5. When sufficient star sighting data are available to compute an alignment, display the align enable asterisk.
6. Provide appropriate status displays to the crew.

B. Interface Requirements. The input and output parameters associated with the STAR_CONFIRM functional module are contained in Tables 4.66.4.7–1 and 4.66.4.7–2.

C. Detailed Requirements. The following sequence of operations and computations are required to perform the STAR_CONFIRM functions:

1. Initialize the following variables:

FALSE_TK(J) = 0
BREAK_T(J) = 0

2. Determine the transformation from nav base to present cluster for each IMU in operate. Use the average values for the gimbal angles computed during previous DATA_FILR execution (from resolver processing) to compute these transformations as follows.

CALL TNB_CL for all IMU's in operate.

- 3a. Transform the measured unit LOS vector from nav base to present selected IMU cluster, SIMU, as follows:

$$\bar{I}_{ST} = [T_{NB}^{PC(SIMU)}] \bar{I}_{STT}$$

- 3b. Transform the first and last measured unit LOS vector from nav base to selected cluster coordinates as follows:

$$\bar{I}_{ST1} = (T1) (\bar{V}EC_1)$$

$$\bar{I}_{ST21} = (T21) (\bar{V}EC_21)$$

Note: The same selected IMU must be used in steps 3, 4, and 5.

- 3c. Check for gimbal averaging error for the selected IMU, SIMU. If the area parameter (computed in IMU Resolver Processing) is greater than the acceptable limit, then replace the 21 sample averaged vector with an average of the 2 end point vectors.

If AREA > TOL9 then

$$\bar{I}_{ST} = 1/2 (\bar{I}_{ST1} + \bar{I}_{ST21})$$

4. Compensate the LOS unit vector for aberration as follows:

- (a) Compute the aberration correction vector:

$$GAM = LOS_ZERO + TIME LOS_R$$

$$\bar{C}_{CORR} = \frac{\bar{V}_AVGG}{C_LIGHT} + (ABER) \begin{bmatrix} +\sin(GAM) \\ -\text{LOSK1} \cos(GAM) \\ -\text{LOSK3} \cos(GAM) \end{bmatrix}$$

- (b) Correct the LOS vector for aberration as follows:

$$\bar{I}_{ST} = \text{UNIT}(\bar{I}_{ST} - [T_{C(SIMU)}^{M50}]^T (\bar{C}_{CORR}))$$

5. Determine the separation (cosine of the angle) between the actual and measured LOS as follows:

- (a) Transform the actual unit LOS vector to present selected IMU cluster as follows:

$$\bar{I}_{STA} = [T_{C(SIMU)}^{M50}]^T (\bar{I}_{STAR_SEL(STAR_ID)})$$

where STAR_ID is the identification of the star being tracked.

- (b) Compute the separation between the actual and measured LOS as follows:

$$ANG = \text{ARCCOS}(\bar{I}_{ST} \cdot \bar{I}_{STA}) (\text{RADDEG})$$

6. If the separation is greater than T_ERROR set FALSE_TK and BREAK_T(J)=1, and proceed to step 14.

7. Determine the separation (sine squared of the angle) between the vectors formed from the first and last samples as follows:

$$\bar{I}_{STX} = \bar{I}_{ST1} \times \bar{I}_{ST21}$$

$$RATE_{ST} = \bar{I}_{STX} \bullet \bar{I}_{STX}$$

8. If RATE_ST is greater than TOL12, set FALSE_TK = 1 and BREAK_T(J) = 1 and proceed to step 14; else, proceed to step 9.
9. Perform the following if data has been stored previously on at least one star:
 - (a) Compute the actual separation angle between this and the last stored star (using star catalog vectors) as follows:

$$AGG = ARCCOS(\bar{I}_{STAR_SEL(STAR_ID)} \bullet \bar{I}_{STAR_SEL(I_PREV)})$$

where I_PREV is the identification number of the last star stored in the star table.

- (b) Compute the measured separation angle between this and the last stored star in the star sighting table as follows:

$$ANGG = ARCCOS(\bar{I}_{ST} \bullet \bar{I}_{STAR_SELC(I,SIMU)})$$

where I is the last stored star in the star sighting table and must be referenced to the same IMU as \bar{I}_{ST} .

- (c) If $|AGG - ANGG| > TOL10$ then perform the following:

If data has been stored on exactly one star, delete the sighting data for the stored star. Set FALSE_TK = 1 and BREAK_T(J) = 1 and proceed to step 14.

10. If the sighting table contains data on three stars proceed to step 11; otherwise, proceed to step 12.
11. If the oldest data is older than TOL13, delete the oldest data from the sighting table; otherwise, using the three stored sightings and the new sighting, select and identify the two stars that have a separation angle closest to 90 degrees, then for the remaining sightings delete the older data and push up all data into older slots.
12. (a) Transform the measured unit LOS vector from nav base to present cluster for all other IMU's K in operate as follows:

$$\bar{I}_{ST} = [T_{NB}^{PCK}] \bar{I}_{STT}$$

- (b) If the area parameter for any non-selected IMU K is greater than the acceptable limit, then transform the first and last measured unit LOS vectors from nav base to cluster coordinates for that IMU K in operate and then replace the 21 sample averaged vector with an average of the 2 end point vectors.

If AREA > TOL9 then

$$I_{ST1} = (T1) (\bar{V}EC_1)$$

$$\bar{I}_{ST21} = (T21) (\bar{V}EC_21)$$

$$\bar{I}_{ST} = 1/2 (\bar{I}_{ST1} + \bar{I}_{ST21})$$

- (c) Correct the LOS vector for aberration for all other IMU's in operate as follows:

$$\bar{I}_{ST} = \text{UNIT}(I_{ST} - [T_{CK}^{M50}]^T (\bar{C}ORR))$$

- (d) Store the following data in the sighting table:

Measured LOS unit vector in cluster coordinates for each IMU in operate mode.

Effective time tag.

STAR_ID number.

13. (a) If there are at least two stars in the sighting table with adequate separation angle (TOL14), select the two stars that have a separation angle closest to 90 degrees. Designate these sightings for use by the IMU on-orbit alignment function. Set the selection flags for the applicable stars to drive the asterisk displays. Set the AL_ENABLE flag to 1.

Else, set the AL_ENABLE flag to 0.

- (b) The crew has the capability to override the selected star pair for alignment by executing the appropriate item entries on the S TRK/COAS CNTL display. This capability is described in paragraph 4.66.4.19, detailed requirements item 25.

14. Exit from the STAR_CONFIRM module.

The STAR_CONFIRM module shall be executed once when called by the DATA_FILR module. A suggested design flow which satisfies the STAR_CONFIRM requirements is shown in Figure 4.66.4.7-1.

Table 4.66.4.7-1. STAR_CONFIRM Inputs

Name	MSID	Description	Input Source	Signal Type	Range	Units	Rate (Hz)
STAR_ID		SELECTED STAR ID: 1 PER ST	STAR_TRACK	INTEGER	11 – 110	NA	6.25
I_STAR_SEL(I)		STAR UNIT VECTORS IN M50 COORDINATES: I = 11 THROUGH 110	STAR_TRACK	VECTOR	+/- 1	NA	6.25
T_ERROR		TEST TOLERANCE BASED UPON TRACKING MODE: 1 PER ST	STAR_TRACK	SCALAR	0.5 – 2.0	DEG	6.25
I_STAR_SELC(I,K)	V95H4721C THRU V95H4729C V95H4738C THRU V95H4746C V95H4790C THRU V95H4798C	MEASURED UNIT LOS VECTOR OF STAR I IN PRESENT CLUSTER COORDINATES FOR IMU K: I = 1,2,3; K = 1,2,3	COAS_SIGHT DISP_SUP	MATRIX	+/- 1	NA	1.04
M50_T_C(K)	V99U3450CA THRU V99U3476CA	TRANSFORMATION: PRESENT CLUSTER TO M50: IMU K; K = 1,2,3	IMU ORB A/CAL (4.208)	MATRIX	+/- 1	NA	OD
DP(K)	V99H2660CA V99H2661CA V99H2662CA	IMU K ROLL/PITCH NON-ORTHOGONALITY: K = 1,2,3	IMU SOP (HANG_CALB)	SCALAR	+/- .006	RAD	OD
TIME		TIME TAG FOR SIGHTING DATA	DATA_FILR	SCALAR	TBD	SEC	OD
I_STT		STAR/TARGET LOS UNIT VECTOR IN NB COORD: 1 PER ST	DATA_FILR	VECTOR	+/- 1	NA	OD
LOSK1	V96U9123C	COSINE OF OBLIQUITY ANGLE	I-LOAD	SCALAR	-1.0 to +1.0	NA	OD
LOSK3	V96U9124C	SINE OF OBLIQUITY ANGLE	I-LOAD	SCALAR	-1.0 to +1.0	NA	OD
LOS_R	V96U9125C	MEAN MOTION OF EARTH	K-LOAD	SCALAR		RAD/SEC	OD
LOS_ZERO	V96U9126C	TRUE LONGITUDE OF SUN AT EPOCH	I-LOAD	SCALAR	0.0 to 2π	RAD	OD
VEC_1		FIRST DATA LOS UNIT VECTOR IN NB COORD	DATA_FILR	VECTOR	+/- 1	NA	OD
VEC_21		LAST DATA LOS UNIT VECTOR IN NB COORD	DATA_FILR	VECTOR	+/- 1	NA	OD
AL_ENABLE	V95X4995X	ALIGN ENABLE FLAG	DISP_SUP	LOGICAL	0,1	NA	1.04
SIMU	V90J2560C	SELECTED IMU ID	IMU RM (4.72)	INTEGER	1,2,3	NA	1.04
TOL10	V99U5698C	TOLERANCE LIMIT 10	I-LOAD	SCALAR		RAD	OD
TOL12	V99U5699C	TOLERANCE LIMIT 12	I-LOAD	SCALAR		NA	OD
TOL13	V99U5700C	TOLERANCE LIMIT 13	K-LOAD	SCALAR	60.0	MIN	OD
TOL14	V99U5701C	TOLERANCE LIMIT 14	I-LOAD	SCALAR		NA	OD

Table 4.66.4.7-1. STAR_CONFIRM Inputs

Name	MSID	Description	Input Source	Signal Type	Range	Units	Rate (Hz)
V_AVGG	V95L0190C V95L0191C V95L0192C	ORBITER VELOCITY VECTOR IN M50 COORDINATES	ORB UPP(4.22) ENT UPP(4.23)	VECTOR	+/- 30K	FT/SEC	1.04 0.52
PANG	V95H0050CA V95H1050CA V95H2050CA	IMU K COMP PITCH RES ANGLE: IMU	IMU INT PROC (4.38)	SCALAR	0 - 360	DEG	OD
AZANG	V95H0051CA V95H1051CA V95H2051CA	IMU K COMP AZIMUTH RES ANGLE: 1 PER IMU	IMU INT PROC (4.38)	SCALAR	0 - 360	DEG	OD
IRANG	V95H0053CA V95H1053CA V95H2053CA	IMU K COMP INNER ROLL RES ANGLE: 1 PER IMU	IMU INT PROC (4.38)	SCALAR	0 - 15 345 - 360	DEG	OD
ORANG	V95H0054CA V95H1054CA V95H2054CA	IMU K COMP OUTER ROLL RES ANGLE: 1 PER IMU	IMU INT PROC (4.38)	SCALAR	0 - 360	DEG	OD
STJ	V91J3201C	SELECTED STAR TRACKER	FCOS	INTEGER	1,2	NA	25
TIME1	V95W4761C	TIME TAG FOR SIGHTING DATA STAR 1	DISP_SUP	SCALAR	TBD	SEC	1.04
TIME2	V95W4762C	TIME TAG FOR SIGHTING DATA STAR 2	DISP_SUP	SCALAR	TBD	SEC	1.04
TIME3	V95W4763C	TIME TAG FOR SIGHTING DATA STAR 3	DISP_SUP	SCALAR	TBD	SEC	1.04
T1		TRANSFORMATION NB TO CLUSTER FOR FIRST SIGHTING DATA; 1 PER IMU	DATA_FILR	MATRIX	+/- 1	NA	OD
T21		TRANSFORMATION NB TO CLUSTER FOR LAST SIGHTING DATA; 1 PER IMU	DATA_FILR	MATRIX	+/- 1	NA	OD
IDNO(L)		SELECTED STAR ID; L = 1,2,3	DISP_SUP	INTEGER	11 - 110	NA	1.04
SELFLAG		SELECT FLAG INDICATION	DISP_SUP	LOGICAL	0,1	NA	1.04
SELECT1		STAR 1 SELECTED FOR ALIGNMENT	DISP_SUP	LOGICAL	0,1	NA	1.04
SELECT2		STAR 2 SELECTED FOR ALIGNMENT	DISP_SUP	LOGICAL	0,1	NA	1.04
SELECT3		STAR 3 SELECTED FOR ALIGNMENT	DISP_SUP	LOGICAL	0,1	NA	1.04
TOL9	V96U9706C	AREA PARAMETER LIMIT	I-LOAD	SCALAR		DEG	OD
AREA(1)	V96H7217C	GIMBAL AREA PARAMETER, IMU 1	IMU INT PROC (4.38)	SCALAR	0-2500	DEG	OD
AREA(2)	V96H7218C	GIMBAL AREA PARAMETER, IMU 2	IMU INT PROC (4.38)	SCALAR	0-2500	DEG	OD
AREA(3)	V96H7219C	GIMBAL AREA PARAMETER, IMU 3	IMU INT PROC (4.38)	SCALAR	0-2500	DEG	OD

Table 4.66.4.7-1. STAR_CONFIRM Inputs

Name	MSID	Description	Input Source	Signal Type	Range	Units	Rate (Hz)
C_LIGHT	V99U5603C	SPEED OF LIGHT IN A VACUUM	LEVEL A CONSTANT	SCALAR	9.8357119E+8	FT/SEC	OD
ABER	V99U5600C	CONSTANT OF ABERRATION	LEVEL A CONSTANT	SCALAR	0.9935105E-4	RAD	OD
DEG_PER_RAD	V97U0112C	RADIAN TO DEGREE CONVERSION FACTOR	LEVEL A CONSTANT	SCALAR	57.2957795	DEG/RAD	OD

Table 4.66.4.7-2. STAR_CONFIRM Outputs

Name	MSID	Description	Output Destination	Signal Type	Range	Units	Rate (Hz)
I_STAR_SEL(I,K)	V95H4721C THRU V95H4729C V95H4738C THRU V95H4746C V95H4790C THRU V95H4798C	MEASURED UNIT LOS VECTOR OF STAR I IN PRESENT CLUSTER COORDINATES FOR IMU K: I = 1,2,3; K = 1,2,3	COAS_SIGHT, IMU ORB A/CAL (4.208), DISP_SUP, TLM (I = 1 & 2 ONLY)	MATRIX	+/- 1	NA	OD
SELECT1		STAR 1 SELECTED FOR ALIGNMENT	DISP_SUP	LOGICAL	0,1	NA	OD
SELECT2		STAR 2 SELECTED FOR ALIGNMENT	DISP_SUP	LOGICAL	0,1	NA	OD
SELECT3		STAR 3 SELECTED FOR ALIGNMENT	DISP_SUP	LOGICAL	0,1	NA	OD
TIME1	V95W4761C	TIME TAG FOR SIGHTING DATA STAR 1	DISP_SUP, TLM	SCALAR	TBD	SEC	OD
TIME2	V95W4762C	TIME TAG FOR SIGHTING DATA STAR 2	DISP_SUP, TLM	SCALAR	TBD	SEC	OD
TIME3	V95W4763C	TIME TAG FOR SIGHTING DATA STAR 3	DISP_SUP, TLM	SCALAR	TBD	SEC	OD
IDNO(L)		SELECTED STAR ID: L = 1,2,3	DISP_SUP	INTEGER	11–110	NA	OD
AL_ENABLE	V95X4995X	ALIGN ENABLE FLAG	TLM DISP_SUP IMU ALIGN (6.26)	LOGICAL	0,1	NA	OD
ANG		SEPARATION ANGLE BETWEEN ACTUAL AND EST STAR LOS VECTORS	DISP_SUP	SCALAR	0 – 180	DEG	OD
I_STAR_SEL1	V95H4732C V95H4733C V95H4734C	UNIT LOS VECTOR FOR SELECTED STAR 1 IN M50 COORDINATES	IMU ORB A/CAL (4.208) DISP_SUP	VECTOR	+/- 1	NA	OD
I_STAR_SEL2	V95H4748C V95H4749C V95H4750C	UNIT LOS VECTOR FOR SELECTED STAR 2 IN M50 COORDINATES	IMU ORB A/CAL (4.208) DISP_SUP	VECTOR	+/- 1	NA	OD
FALSE_TK		FALSE TRACK FLAG: 1 PER ST	STAR_TRACK DISP_SUP	LOGICAL	0,1	NA	OD
CMD_WORD(1)	V71M5320P	COMMAND WORD TO STAR TRACKER -Z	ST 1	LOGICAL	NA	NA	OD
CMD_WORD(2)	V71M5820P	COMMAND WORD TO STAR TRACKER -Y	ST 2	LOGICAL	NA	NA	OD
ANG12		MEASURED SEPARATION ANGLE COSINE BETWEEN STARS 1 AND 2	DISP_SUP	SCALAR	+/- 1	NA	OD
ANG13		MEASURED SEPARATION ANGLE COSINE BETWEEN STARS 1 AND 3	DISP_SUP	SCALAR	+/- 1	NA	OD
ANG23		MEASURED SEPARATION ANGLE COSINE BETWEEN STARS 2 AND 3	DISP_SUP	SCALAR	+/- 1	NA	OD

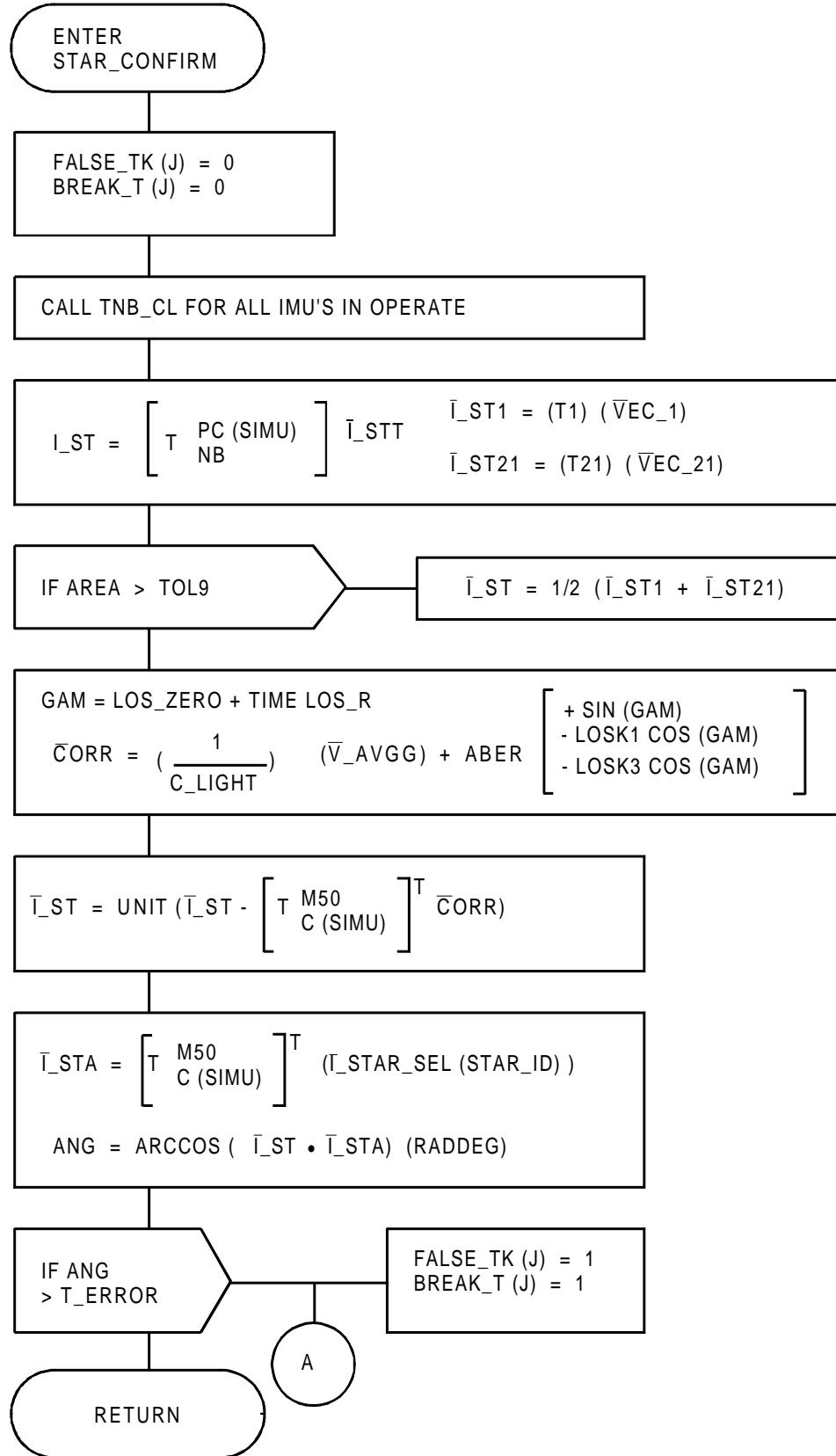


FIGURE 4.66.4.7-1.(1) STAR_CONFIRM Detailed Flow Diagram (Sheet 1 of 4)

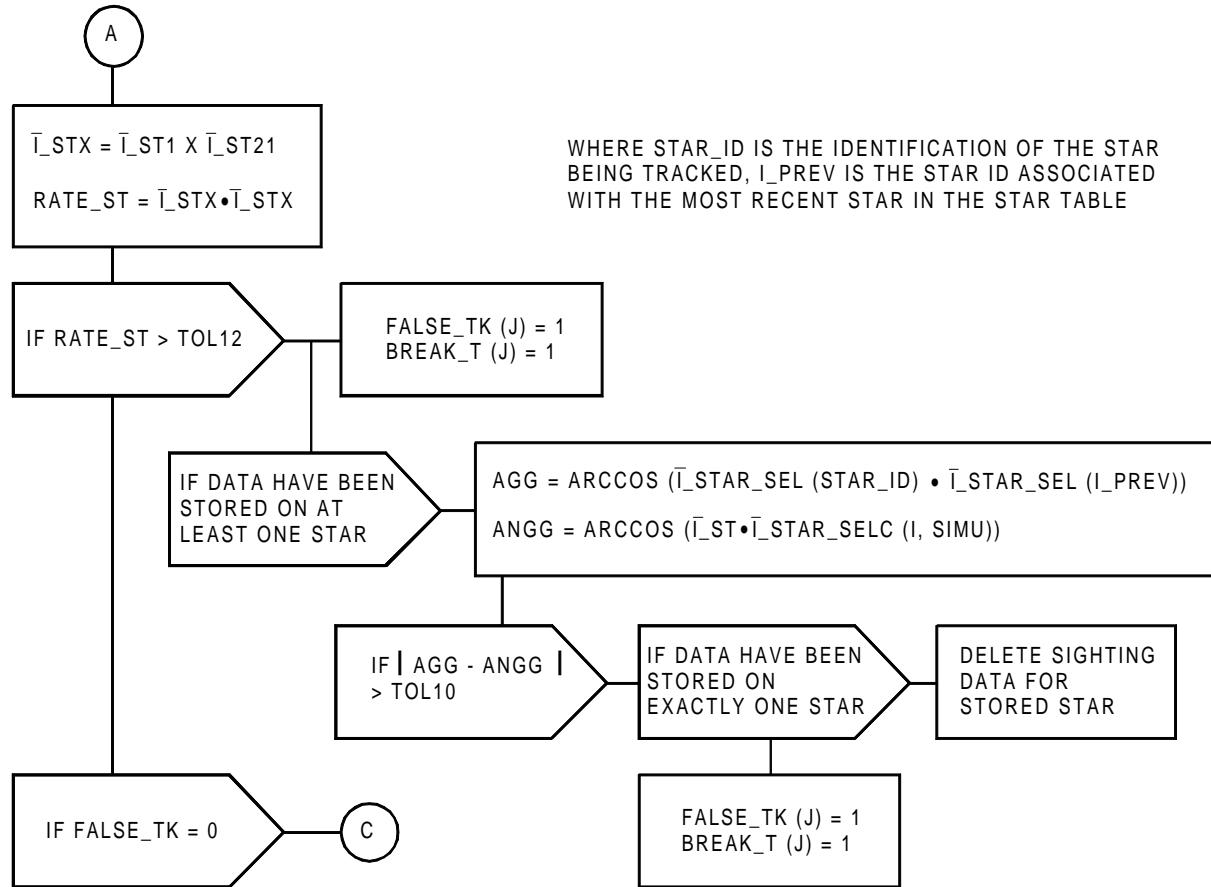


FIGURE 4.66.4.7-1.(2) STAR_CONFIRM Detailed Flow Diagram (Sheet 2 of 4)

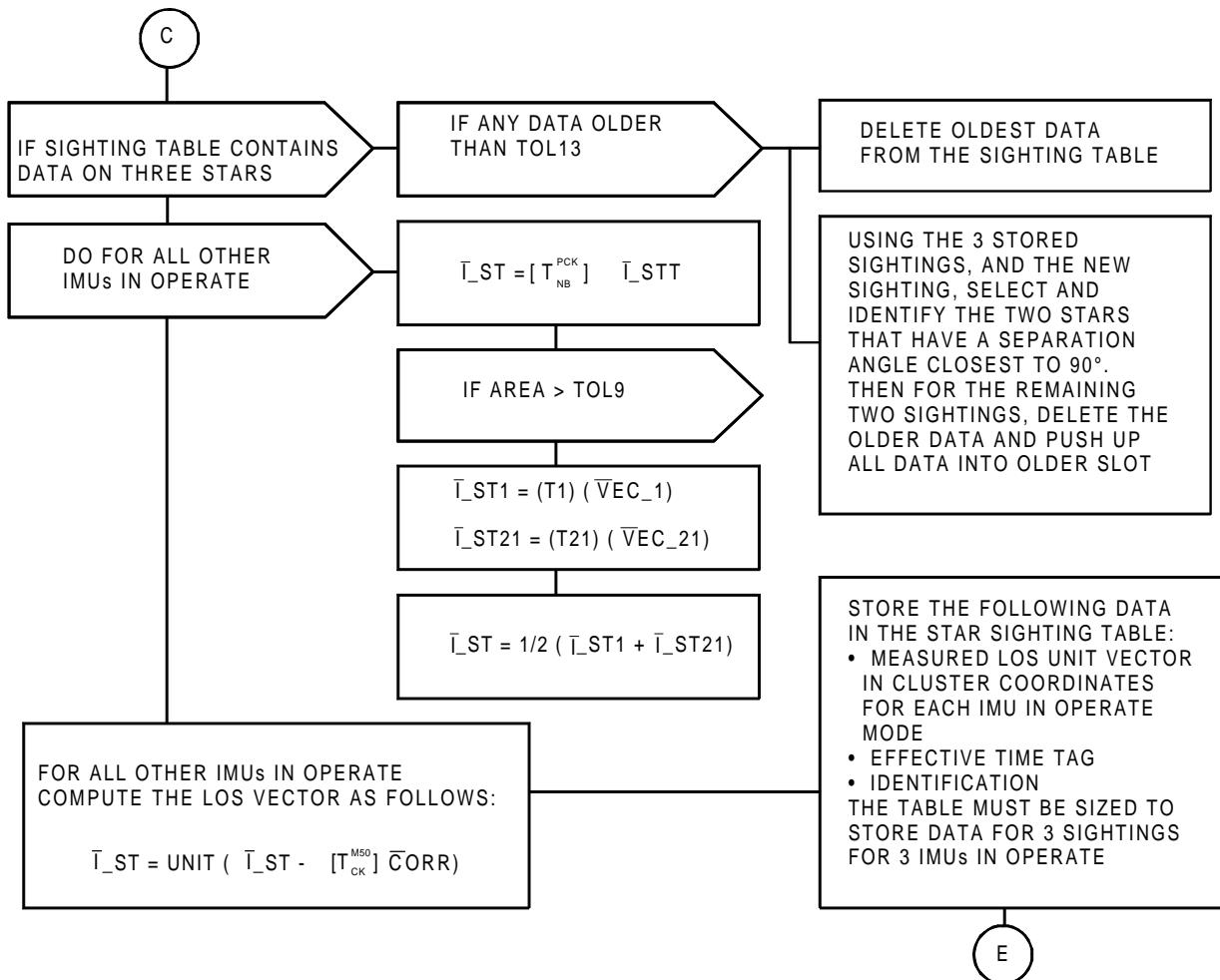


FIGURE 4.66.4.7-1.(3) STAR_CONFIRM Detailed Flow Diagram (Sheet 3 of 4)

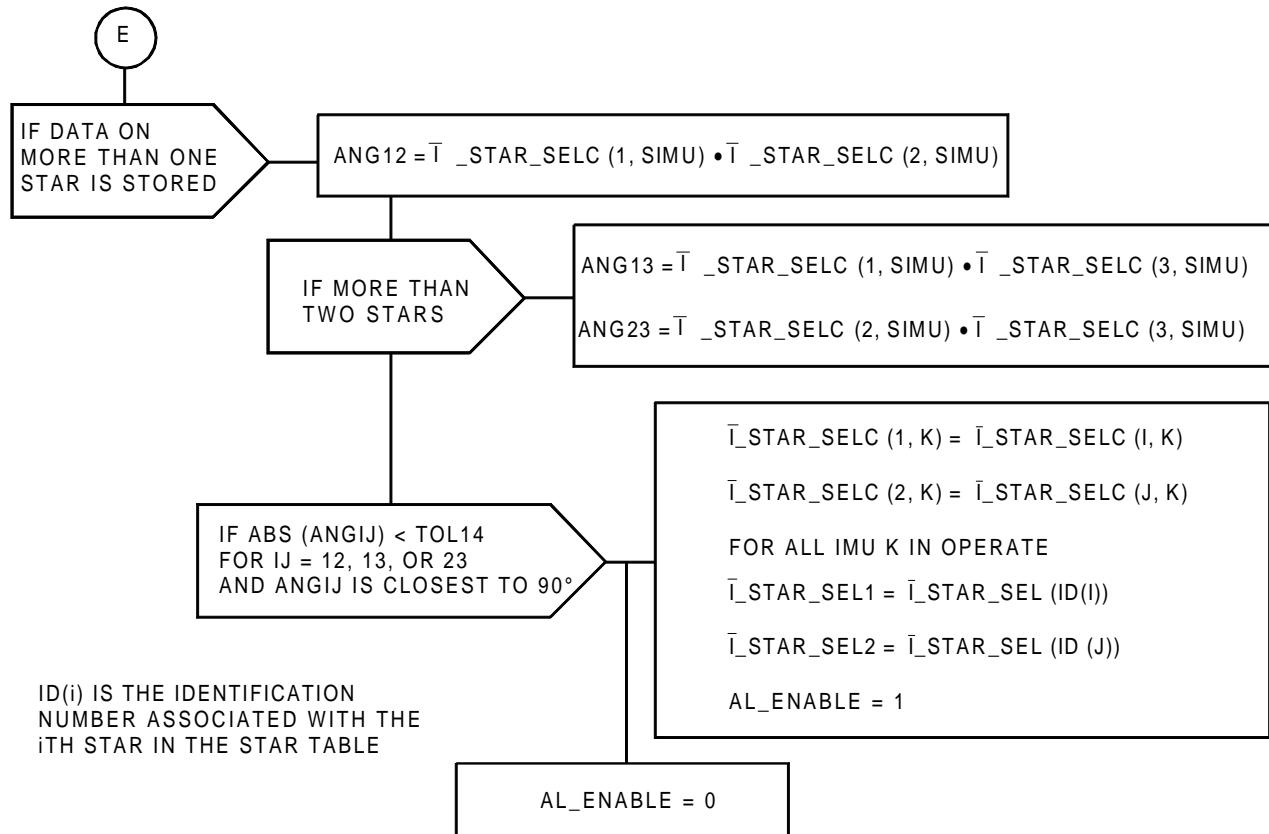


FIGURE 4.66.4.7-1.(4) STAR_CONFIRM Detailed Flow Diagram (Sheet 4 of 4)

4.66.4.8 Sighting Data Filter (DATA_FILR).

The purpose of the DATA_FILR module is to enhance the star tracker/IMU data inputs by determining average values for star or target horizontal and vertical offset angles over a specified time interval. In addition, this module determines the effective time tag and the rate of change associated with the filtered data.

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

1. When a star or target is being tracked, accumulate 21 consecutive data samples from the ST for horizontal offset and vertical offset angles. Time tag the ST data.
2. Compute the average value for horizontal and vertical offset angles.
3. Determine the effective time tag associated with the sighting data by compensating for data staleness.
4. Provide appropriate status displays to the crew.

B. Interface Requirements. The input and output parameters associated with the DATA_FILR functional module are contained in Tables 4.66.4.8-1 and 4.66.4.8-2.

C. Detailed Requirements. The following set of equations and sequence of computations are needed to perform the DATA_FILR functions:

1. If this is the first pass for the current accumulation of 21 consecutive samples of data, initialize the following variables, else proceed to step 2.

If IPASSj = 1, SET

IPASSj = 0	HI_RATEj = 0
Nj = 0	VERT_PREVj = VERT_ANGj
HSUMj = 0.0	HOR_PREVj = HOR_ANGj
VSUMj = 0.0	
TSUMj = 0.0	

Where j equals the star tracker number (STj).

Proceed to step 2.

2. If STAR_PRESj = 0 or $|HOR_PREVj - HOR_ANGj| > TOL6$ or $|VERT_PREVj - VERT_ANGj| > TOL6$ then set the following flags; IPASSj = 1, and if in the TARGET MODE then DATA_GOOD = 0, and exit. Else proceed to step 3.

If STAR_PRESj = 0

or $|HOR_PREVj - HOR_ANGj| > TOL6$

or $|VERT_PREVj - VERT_ANGj| > TOL6$

SET: IPASSj = 1
 If TARMODE = 1

SET: DATA_GOOD = 0
Proceed to step 12.

Else proceed to step 3.

3. Index the counter and accumulate data.

```

Nj = Nj + 1
HSUMj = HSUMj + HOR_ANGj
VSUMj = VSUMj + VERT_ANGj
HOR_PREVj = HOR_ANGj
VERT_PREVj = VERT_ANGj
TSUMj = TSUMj + CLOCK

```

4. If this is the first data sample, save these data for a later computation.

If Nj = 1

```

VANG1j = VERT_ANGj
HANG1j = HOR_ANGj

```

- (a) If this is the target tracking mode, call the transformation TNB_CL in the IMU SOP for the selected IMU. Use the first recorded gimbal angles in this computation. Otherwise, call the transformation TNB_CL in the IMU SOP for all three IMU's. Use the first recorded gimbal angles in this computation. Save these transformations.

If TARMODE = 1,

CALL TNB_CL, T1 = $[T_{NB}^{CL}]$ for the first set of gimbal angles.

Proceed to step 5.

ELSE, CALL TNB_CL, T1_K = $[T_{NB}^{CLK}]$ for the first of gimbal angles for all IMU's.

5. If 21 consecutive samples have been accumulated, discontinue the fast cycle iterative processing, and divide the sums by 21 to obtain the averages; else exit for this cycle.

If Nj = 21, terminate data accumulation

```

HAVEj = HSUMj/21
VAVEj = VSUMj/21
IPASSj = 1
TAVEj = TSUMj/21

```

Proceed to step 6.

Else, proceed to step 13.

6. Save these data for a later computation.

VANG21j = VERT_ANGj
 HANG21j = HOR_ANGj

- (a) If this is the target tracking mode, call the transformation TNB_CL in the IMU SOP for the selected IMU. Use the twenty-first recorded gimbal angles in this computation. Otherwise, call the transformation TNB_CL in the IMU SOP for all IMU's in operate. Use the twenty-first recorded gimbal angles in this computation. Save these transformations.

If TARMODE = 1,

CALL TNB_CL, T21 = $[T_{NB}^{CL}]$ for the twenty - first set of gimbal angles.

Proceed to step 7.

ELSE, CALL TNB_CL, T21_K = $[T_{NB}^{CLK}]$ for the twenty - first set of gimbal angles for all IMU's in operate.

- 7. During OPS 2, obtain the body rate vector from the on-orbit DAP (state estimator). During OPS 3, obtain the RGA rates from the SF (selected RGA pitch, roll, yaw rates). Calculate the magnitude of the body rate.

If OPS 2,

BODY_RATE = ABVAL(RATE_EST)

If OPS 3,

BODY_RATE = ABVAL(VECTOR(P_ORB, Q_ORB, R_ORB))

- 8. If the body rate is greater than TOL8, set HI_RATE = 1, when TARMODE = 1 also set DATA_GOOD = 0, and exit; else, determine the time tag for the star tracker data by subtracting from the average time tag the star tracker electronic processing lag of 11 milliseconds and the average sampling staleness of 21 milliseconds. This time must be double precision for rendezvous navigation target measurements.

If BODY_RATE > TOL8,

HI_RATE =1

If TARMODE = 1,

DATA_GOOD = 0

Proceed to step 12

Else,

TIMEj = TAVEj - 0.032 seconds

- 9. If in the STAR_TRACK mode (TARMODE = 0), proceed to step 11; else, set the target tracking flag NAV_TARGET equal to 1 and set the DATA_GOOD flag equal to 1.

- (a) If the area for the selected IMU is greater than TOL9, convert the transformations T1 and T21 to an average transformation using quaternions. Otherwise, call TNB_CL for the selected IMU using the average IMU gimbal angles.

If $\text{AREA}_{\text{SIMU}} > \text{TOL9}$,

CALL MAT_TO_QUAT WITH T1 and T21
ASSIGN QUAT1, QUAT21

Compute an average quaternion from QUAT1 and QUAT21 by adding and normalizing.

$$\begin{aligned}\text{QUAT_AVG (S)} &= \text{QUAT1 (S)} + \text{QUAT21 (S)} \\ \text{QUAT_AVG (V)} &= \text{QUAT1 (V)} + \text{QUAT21 (V)}\end{aligned}$$

$$\text{QUAT_AVG} = \left(\frac{\text{QUAT_AVG (S)}}{\text{QUAT_AVG (V)}} \right)$$

CALL QUAT_NORM WITH QUAT_AVG
ASSIGN QUAT_AVG

COMPUTE A TRANSFORMATION FROM QUAT_AVG

CALL QUAT_TO_MAT; ASSIGN $[T_{\text{NB}}^{\text{CL}}]$

COMPUTE AVERAGE STAR TRACKER ANGLES FROM THE FIRST AND TWENTY-FIRST MEASUREMENTS.

$$\begin{aligned}\text{HAVEj} &= 1/2 [\text{HANG1j} + \text{HANG21j}] \\ \text{VAVEj} &= 1/2 [\text{VANG1j} + \text{VANG21j}]\end{aligned}$$

ELSE, CALL TNB_CL FOR THE SELECTED IMU USING THE AVERAGE GIMBAL ANGLES.

10. Compute the transformation from M50 to selected star tracker using the transformation nav base to selected star tracker, the transformation nav base to cluster determined in the preceding step, and the transformation from cluster to M50 for the selected IMU.

$$[T_{\text{M50}}^{\text{ST}}] = [T_{\text{NB}}^{\text{STJ}}] [T_{\text{NB}}^{\text{CL}}]^T [T_{\text{C(SIMU)}}^{\text{M50}}]^T$$

$$\begin{aligned}\text{Set } H_{\text{NAV}} &= \text{HAVEj/RADDEG} \\ V_{\text{NAV}} &= \text{VAVEj/RADDEG} \\ T_{\text{NAV}} &= \text{TIMEj}\end{aligned}$$

Provide rendezvous nav with the following homogeneous data sets: averaged star tracker angles, the transformation M50 to star tracker, the data good flag, the target tracking flag, and time of sighting. Proceed to step 12.

11. Compute the LOS unit vector in nav base coordinates.

$$\bar{I}_{\text{STT}} = [T_{\text{NB}}^{\text{STJ}}]^T \left(\frac{1}{D} \right) \begin{bmatrix} -VVV \\ HHH \\ 1 \end{bmatrix}$$

where $HHH = \text{TAN}(\text{HAVE}(J))$

$VVV = \text{TAN}(\text{VAVE}(J))$

$D = \text{SQRT}(HHH^2 + VVV^2 + 1)$

Determine the unit LOS vector for the 1st and 21st measurements in nav base coordinates.

$$H1j = \text{TAN}\left(\frac{HANG1j}{\text{RADDEG}}\right); V1j = \text{TAN}\left(\frac{VANG1j}{\text{RADDEG}}\right)$$

$$H21j = \text{TAN}\left(\frac{HANG21j}{\text{RADDEG}}\right); V21j = \text{TAN}\left(\frac{VANG21j}{\text{RADDEG}}\right)$$

$$D1j = (H1j^2 + V1j^2 + 1)^{1/2}$$

$$D21j = (H21j^2 + V21j^2 + 1)^{1/2}$$

$$\bar{V}\text{EC}_{-1j} = [T_{\text{NB}}^{\text{STJ}}]^T \frac{1}{D1j} \begin{bmatrix} -V1 \\ H1 \\ 1 \end{bmatrix}$$

$$\bar{V}\text{EC}_{-21j} = [T_{\text{NB}}^{\text{STJ}}]^T \frac{1}{D21j} \begin{bmatrix} -V21 \\ H21 \\ 1 \end{bmatrix}$$

Call the STAR_CONFIRM module and proceed to step 12.

12. Discontinue all DATA_FILR processing until the next time that STAR_TRACK or TARGET_TRK requires DATA_FILR processing.
13. Terminate DATA_FILR processing for this cycle.

The DATA_FILR module is required to support star tracker processing in either the STAR_TRACK or TARGET_TRK submodes. The DATA_FILR module shall be scheduled for a single execution on transition of the star present flag from Logic 0 to Logic 1 to support STAR_TRACK. To support TARGET_TRK, the DATA_FILR module shall be scheduled every 7.5 seconds after transition of the star present flag from Logic 0 to Logic 1. The cyclic portion shall be executed at a 6.25 Hz rate during the 21 sample data accumulation period. After data accumulation has been completed, the remaining DATA_FILR and STAR_CONFIRM computations must be completed prior to the next iteration of the submode module. In the event of simultaneous tracking by two star trackers, the DATA_FILR module is required to process both sightings concurrently. In order to reduce processing requirements, the DATA_FILR module is required to not begin or complete processing sighting data for both

trackers on the same 6.25 Hz cycle if both trackers are in STAR_TRACK mode. A suggested design flow that satisfies the DATA_FILR requirements is shown in Figure 4.66.4.8-1.

D. Special Considerations. It is required that as the DATA_FILR accumulates and processes the 21 star tracker output angles, the resolver processing (RES_PROC) module in the IMU SOP likewise accumulate and process 21 consecutive samples of the IMU gimbal angles. These 21 consecutive samples do not include COMMFAULT DATA.

The resolver processing module must also compute an area parameter for gimbal angle averaging error detection. The area parameter is required by the DATA_FILR and STAR_CONFIRM modules to perform a reasonableness check of the gimbal averaging accuracy. Detailed requirements for the area parameter computation are given in the Resolver Processing module of the IMU SOP.

The time difference between reading the first star tracker data and the first IMU data shall be less than 5 milliseconds. The same selected IMU must be used during the accumulation and processing of data; and if RM changes the selected IMU, this change should be ignored during data accumulation.

Table 4.66.4.8-1. DATA_FILR Inputs

Name	MSID/ MML No.	Description	Input Source	Signal Type	Range	Units	Rate (Hz)
DATA_WORD1(1)	V71M5020P	-Z ST MODE STATUS WD1	ST 1	LOGICAL	NA	NA	OD
DATA_WORD1(2)	V71M5520P	-Y ST MODE STATUS WD1	ST 2	LOGICAL	NA	NA	OD
DATA_WORD2(1)	V71M5040P	-Z ST DATA WORD TO GPC	ST 1	LOGICAL	NA	NA	OD
DATA_WORD2(2)	V71M5540P	-Y ST DATA WORD TO GPC	ST 2	LOGICAL	NA	NA	OD
DATA_WORD3(1)	V71M5060P	-Z ST DATA WORD TO GPC	ST 1	LOGICAL	NA	NA	OD
DATA_WORD3(2)	V71M5560P	-Y ST DATA WORD TO GPC	ST 2	LOGICAL	NA	NA	OD
CLOCK	V91W5000C	CLOCK COMPUTER – GMT	FCOS	FLOAT PT	TBD	SEC	25
TARMODE		TARGET MODE FLAG: 1 PER ST	TARGET_TRK	LOGICAL	0,1	NA	6.25
STJ	V91J3201C	SELECTED STAR TRACKER	FCOS	INTEGER	1,2	NA	25
RATE_EST	V90R2223C V90R2224C V90R2225C	BODY RATE ESTIMATE	ON ORBIT DAP (4.35)	VECTOR		DEG/ SEC	12.5
P_ORB	V90R5301CA	SELECTED RGA RATE	SF* (4.71)	SCALAR	+/-40	DEG/ SEC	1.04
Q_ORB	V90R5321CA				+/-20		
R_ORB	V90R5341CA				+/-20		
TOL6	V99U5706C	TOLERANCE LIMIT 6	I-LOAD	SCALAR		DEG	OD
TOL8	V99U5708C	TOLERANCE LIMIT 8	K-LOAD	SCALAR	0.75	DEG/ SEC	OD
ST_CF	V91X2714X V91X2715X	ST COMMFAULT: 1 PER ST	FCOS	LOGICAL	0,1	NA	25
M50 T C(K)	V99U3450CA THRU V99U3476CA	TRANSFORMATION: PRESENT CLUSTER TO M50 FOR IMU K: K = 1,2,3	IMU ORB A/CAL (4.208)	MATRIX	+/-1	NA	OD
STJ T NB	V99U5676C THRU V99U5693C	TRANSFORMATION: NAV BASE TO STAR TRACKER: 1 PER ST; J=1,2	I-LOAD	MATRIX	+/-1	NA	OD
DP(K)	V99H2660CA V99H2661CA V99H2662CA	IMU K ROLL/PITCH NON-ORTHOGONALITY: K = 1,2,3	IMU SOP (HANG_CALB)	SCALAR	+/-0.006	RAD	OD
PANG	V95H0050CA V95H1050CA V95H2050CA	IMU K COMP PITCH RES ANGLE: 1 PER IMU	IMU INT PROC (4.38)	SCALAR	0-360	DEG	OD
AZANG	V95H0051CA V95H1051CA V95H2051CA	IMU K COMP AZIMUTH RES ANGLE: 1 PER IMU	IMU INT PROC (4.38)	SCALAR	0-360	DEG	OD
TOL9	V96U9706C	AREA PARAMETER LIMIT	I-LOAD	SCALAR		DEG	OD

Table 4.66.4.8-1. DATA_FILR Inputs

Name	MSID/ MML No.	Description	Input Source	Signal Type	Range	Units	Rate (Hz)
AREA(1)	V96H7217C	GIMBAL AREA PARAMETER IMU 1	IMU INT PROC (4.38)	SCALAR	0–2500	DEG	OD
AREA(2)	V96H7218C	GIMBAL AREA PARAMETER IMU 2	IMU INT PROC (4.38)	SCALAR	0–2500	DEG	OD
AREA(3)	V96H7219C	GIMBAL AREA PARAMETER IMU 3	IMU INT PROC (4.38)	SCALAR	0–2500	DEG	OD
IRANG	V95H0053CA V95H1053CA V95H2053CA	IMU K COMP INNER ROLL RES ANGLE: 1 PER IMU	IMU INT PROC (4.38)	SCALAR	0 – 15 345–360	DEG	OD
ORANG	V95H0054CA V95H1054CA V95H2054CA	IMU K COMP OUTER ROLL RES ANGLE: 1 PER IMU	IMU INT PROC (4.38)	SCALAR	0 – 360	DEG	OD
IPASS		FIRST PASS FLAG: 1 PER ST	STAR_TRACK, TARGET_TRK	LOGICAL	0,1	NA	OD
DEG_PER_RAD	V97U0112C	RADIAN TO DEGREE CONVERSION FACTOR	LEVEL A CONSTANT	SCALAR	57.2957795	DEG/ RAD	OD

*The RGA input is used during OPS 3.

Table 4.66.4.8-2. DATA_FILR Outputs

Name	MSID	Description	Output Destination	Signal Type	Range	Units	Rate (Hz)
TIME		TIME TAG FOR SIGHTING DATA: 1 PER ST	STAR_CONFIRM	SCALAR	TBD	SEC	OD
VEC_1		FIRST DATA LOS UNIT VECTOR IN NB COORD	STAR_CONFIRM	VECTOR	+/-1	NA	OD
VEC_21		LAST DATA LOS UNIT VECTOR IN NB COORD	STAR_CONFIRM	VECTOR	+/-1	NA	OD
HI_RATE		HIGH BODY RATE FLAG: 1 PER ST	DISP_SUP	LOGICAL	0,1	NA	OD
I_STT		STAR/TARGET LOS UNIT VECTOR IN NB COORD: 1 PER ST	STAR_CONFIRM	VECTOR	+/-1	NA	OD
H_NAV	V95H4753C	SELECTED ST AVERAGE HORIZ ANGLE	ORB/RND NAV (4.126); TLM	SCALAR	+/-0.089	RAD	OD
V_NAV	V95H4754C	SELECTED ST AVERAGE VERT ANGLE	ORB/RND NAV (4.126); TLM	SCALAR	+/-0.089	RAD	OD
DATA_GOOD	V95X4771X	DATA GOOD FLAG	ORB/RND NAV (4.126); TLM	LOGICAL	0,1	NA	OD
ST	V95U4800C	TRANSFORMATION M50 TO SELECTED ST	ORB/RND NAV (4.126); TLM	MATRIX	+/-1	NA	OD
T	THRU						
M50	V95U4808C						
NAV_TARGET	V95X4778X	NAV TARGET TRACK MODE FLAG	ORB/RND NAV (4.126); TLM	LOGICAL	0,1	NA	OD
T1		TRANSFORMATION NB TO CLUSTER FOR FIRST SIGHTING DATA: 1 PER IMU	STAR_CONFIRM	MATRIX	+/-1	NA	OD
T21		TRANSFORMATION NB TO CLUSTER FOR LAST SIGHTING DATA: 1 PER IMU	STAR_CONFIRM	MATRIX	+/-1	NA	OD
T_NAV	V95W4760C	TIME TAG FOR SIGHTING DATA	ORB/RND NAV (4.126); TLM	SCALAR	TBD	SEC	OD

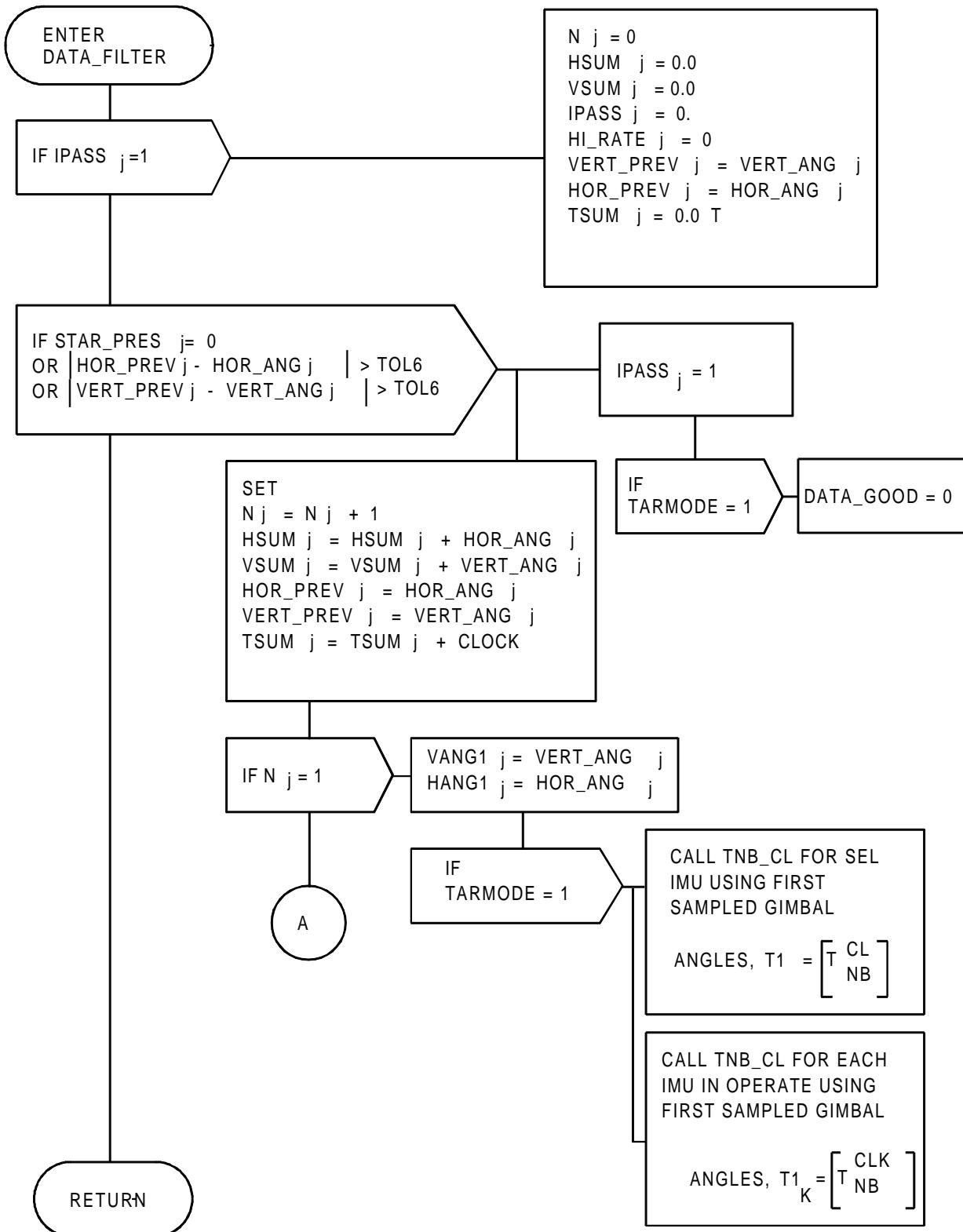


FIGURE 4.66.4.8-1.(1) DATA_FILR Detailed Flow Diagram (Sheet 1 of 3)

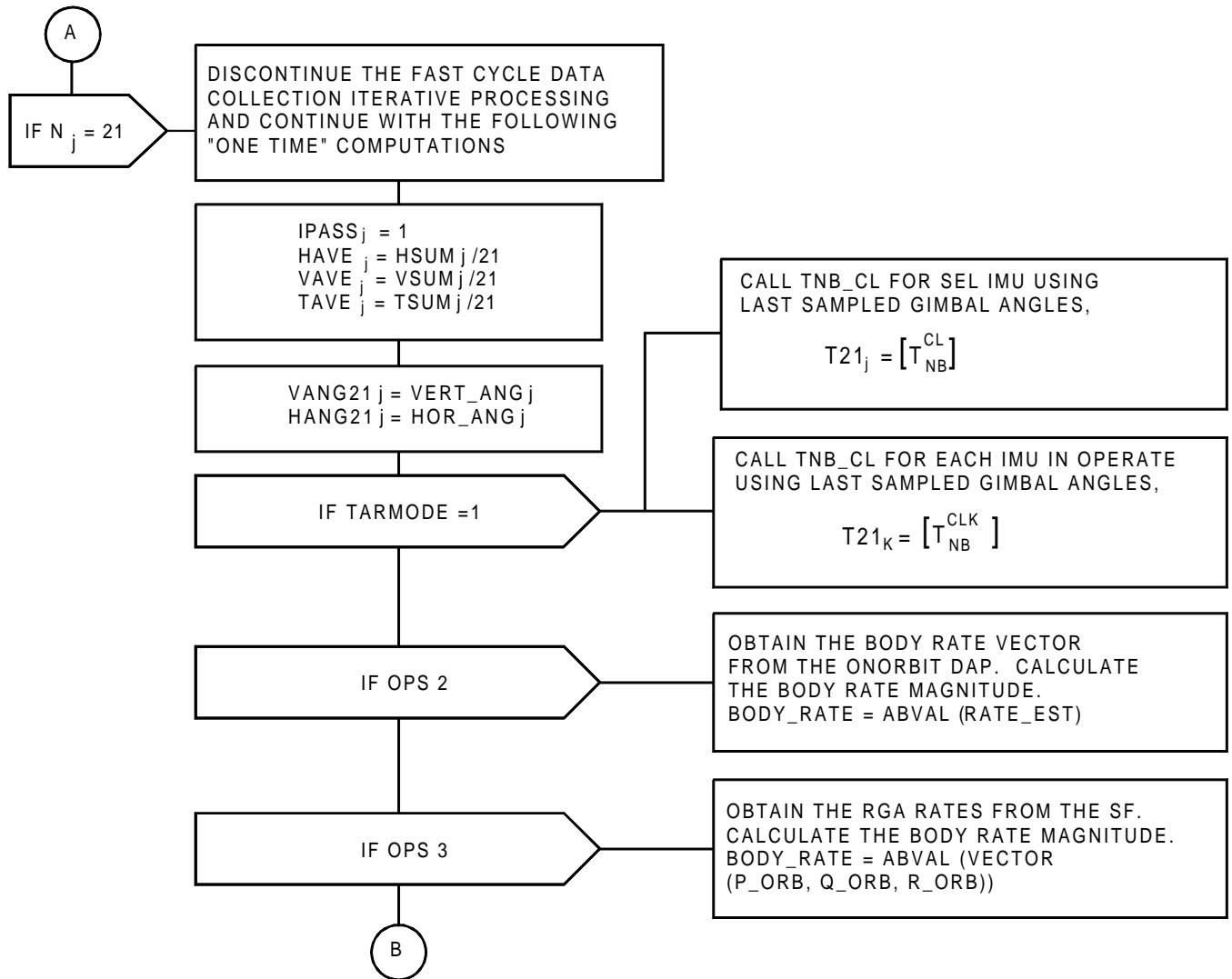


FIGURE 4.66.4.8-1.(2) DATA_FILR Detailed Flow Diagram (Sheet 2 of 3)

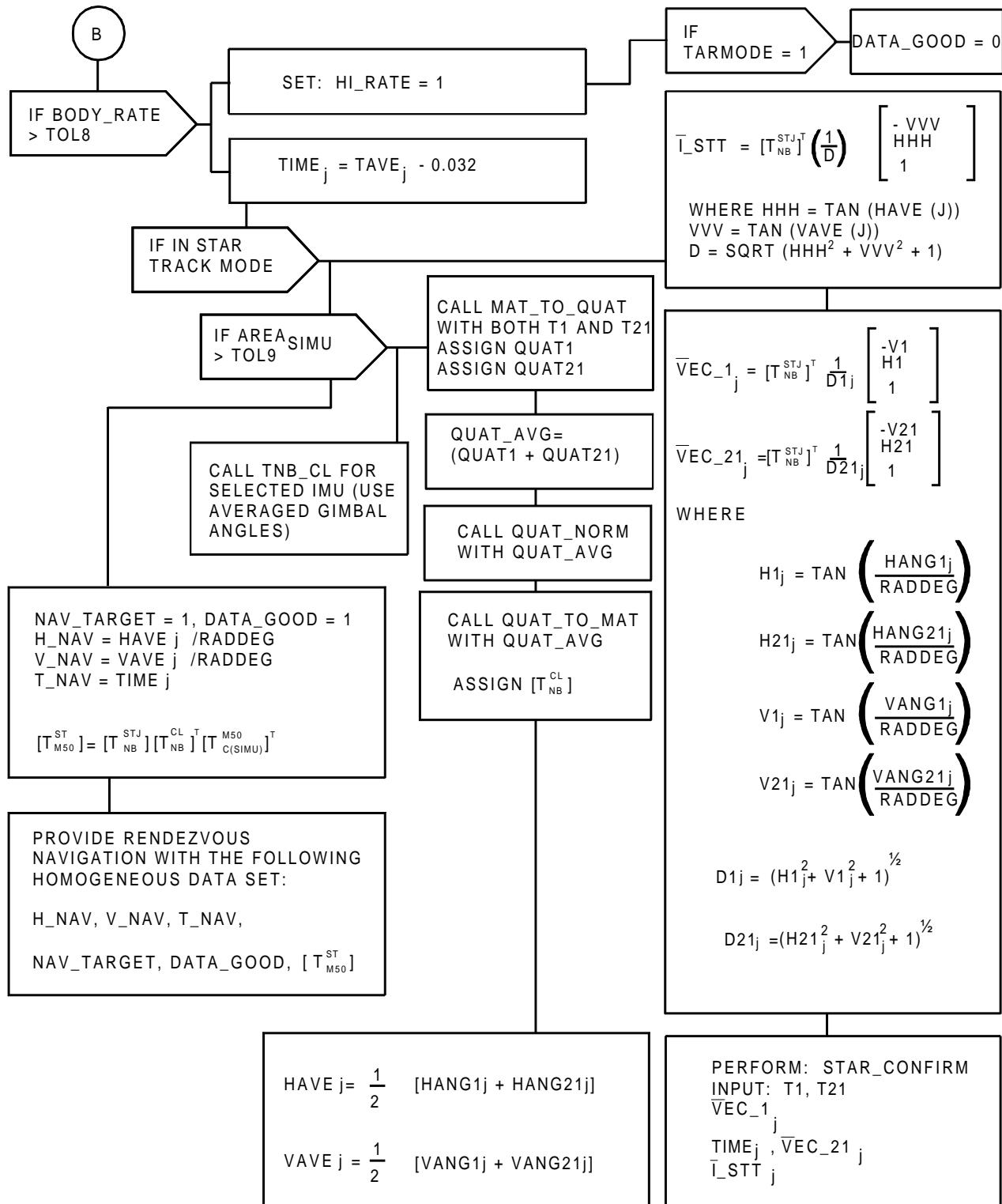


FIGURE 4.66.4.8-1.(3) DATA_FILR Detailed Flow Diagram (Sheet 3 of 3)

4.66.4.10 COAS Sighting (COAS_SIGHT).

The purpose of this module is to perform the COAS computations in response to a keyboard request for either the star tracking or target tracking mode of operation. Once the COAS mark command is received, the IMU gimbal angles, time of the marking, star identification number (if applicable), and -Z or X COAS indicator are stored. The measured star LOS vector in present IMU cluster coordinates or the measured rendezvous target LOS vector in M50 coordinates is then computed and stored.

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

1. Acknowledge that COAS sighting is in progress and initialize the required variables.
2. Store IMU gimbal angles, time of marking, star identification number (if any), and -Z or X COAS indicator upon a COAS mark request.
3. If tracking a target, provide nav with COAS calibration angles, COAS identification, and the mark time.
4. Compute the measured LOS vector of the marked star in present cluster coordinates.
5. Save the measured star LOS and time tag in present cluster coordinates.
6. Provide appropriate status displays to the crew.

B. Interface Requirements. The input and output parameters associated with the COAS sighting functional module are contained in Tables 4.66.4.10-1 and 4.66.4.10-2.

C. Detailed Requirements. The following sequence of operations and computations are required for the COAS_SIGHT module:

1. (a) If first pass since COAS_SIGHT request, set the following flags:

COAS_SPROG = 1

(b) If in target track mode (STAR_ID = 1), proceed to step 2; else, proceed to step 3.
2. (a) Upon receipt of a COAS mark indication (FWD_ATT_REF_PB=1 or AFT_ATT_REF_PB=1) store the IMU gimbal angles for the selected IMU, SIMU, and record the mark time as T_IMU_S (the IMU time tag).

(b) Call: TNB_CL using the stored IMU gimbal angles from step (a).

(c) Calculate the transformation from M50 to body using the transformation NB to body from I-load, the transformation cluster (SIMU) to M50 from the IMU SOP and the transformation NB to cluster.

$$[T_{M50}^{BODY}] = [T_{NB}^{BODY}] [[T_{C(SIMU)}^{M50}]] [[T_{NB}^{CL}]]^T$$

(d) Set NAV_SIGHT = 1

$$\text{COAS_HORIZ} = \text{H_CAL(AXN)}$$

$$\text{COAS_VERT} = \text{V_CAL(AXN)}$$

(e) Provide rendezvous nav with the COAS calibration angles (COAS_HORIZ and COAS_VERT) the COAS identification (AXN), the mark time (T_TARLOS), the nav sighting flag (NAV_SIGHT), and transformation M50 to body.

(f) Proceed to step 7.

3. Upon receipt of a new COAS mark indication (FWD_ATT_REF_PB=1 or AFT_ATT_REF_PB=1) store the IMU gimbal angles and the time tag for all IMU's in operate.
4. Upon receipt of a COAS ACCEPT indication, determine the transformation from navigation base to present IMU cluster for all IMU's in operate. Use the stored IMU gimbal angles to compute the transformation.

CALL TNB_CL for all IMU's in operate.

5. Compute the unit LOS vector in present selected IMU (SIMU) cluster as follows:

$$\bar{\mathbf{l}}_{\text{ST}} = [T_{\text{NB}}^{\text{PC(SIMU)}}] (\bar{\mathbf{l}}_{\text{COAS(AXN)}})$$

Note: In step 6 (b), second equation, the vector $\bar{\mathbf{l}}_{\text{STAR_SELC}}(1, \text{SIMU})$ shall be referenced to the IMU (SIMU) used in step 5.

6. If data from a previous star have been saved, proceed to (a); otherwise, proceed to (e).

(a) Store this star unit vector as the second star as follows:

$$\bar{\mathbf{l}}_{\text{STAR_SEL1}} = \bar{\mathbf{l}}_{\text{STAR_SEL(STAR_ID)}}$$

(b) Compute the actual and measured separation angles between the two stars as follows:

$$\text{ANG} = \text{ARCCOS}(\bar{\mathbf{l}}_{\text{STAR_SEL1}} \cdot \bar{\mathbf{l}}_{\text{STAR_SEL2}})$$

$$\text{ANG12} = (\bar{\mathbf{l}}_{\text{STAR_SELC}(2,\text{SIMU})} \cdot \bar{\mathbf{l}}_{\text{ST}})$$

(c) Store the measured unit LOS vector in cluster coordinates in the star sighting table as follows for the selected IMU, SIMU:

$$\bar{\mathbf{l}}_{\text{STAR_SELC}(1,\text{SIMU})} = \bar{\mathbf{l}}_{\text{ST}}$$

For all other IMU's K in operate:

$$\bar{\mathbf{l}}_{\text{STAR_SELC}(1,K)} = [T_{\text{NB}}^{\text{PCK}}] (\bar{\mathbf{l}}_{\text{COAS(AXN)}})$$

Store the applicable time tag in the star sighting table.

Set AL_ENABLE=1, SELECT1=1, SELECT2=1

- (d) Proceed to step 7.
- (e) Store this star unit LOS vector as the first star as follows:

$$\bar{I}_{\text{STAR_SEL2}} = \bar{I}_{\text{STAR_SEL}}(\text{STAR_ID})$$

- (f) Store the measured star unit LOS vector in cluster coordinates in the star sighting table as follows:

For the selected IMU

$$\bar{I}_{\text{STAR_SELC}}(2, \text{SIMU}) = \bar{I}_{\text{ST}}$$

For all other IMU's K in operate

$$\bar{I}_{\text{STAR_SELC}}(2, K) = [T_{\text{NB}}^{\text{PCK}}] (\bar{I}_{\text{COAS}}(\text{AXN}))$$

- (g) Store the applicable time tag in the star sighting table.

7. Terminate COAS_SIGHT processing for this cycle.

The COAS_SIGHT module shall be executed once each time that a COAS mark is input (while the COAS sight submode is active). The IMU gimbal angles shall be read and stored within 160 milliseconds of receipt of the COAS mark indication. When the COAS_SIGHT mode is terminated (by either DESELECT or SELECTION of COAS_CAL) the flags NAV_SIGHT and COAS_SPROG shall be set false. A suggested design flow that satisfies the COAS_SIGHT requirements is shown in Figure 4.66.4.10-1.

Table 4.66.4.10-1. COAS_SIGHT Inputs

Name	MSID	Description	Input Source	Signal Type	Range	Units	Rate (Hz)
I_STAR_SEL(I)		STAR UNIT VECTORS IN M50 COORDINATES: I = 11 THRU 110	STAR_TRACK	VECTOR	+/- 1	NA	6.25
STAR_ID		SELECTED STAR ID	DISP_SUP	INTEGER	1 - 110	NA	1.04
I_STAR_SELC (I,K)	V95H4721C THRU V95H4729C V95H4738C THRU V95H4746C V95H4790C THRU V95H4798C	MEASURED UNIT LOS VECTOR OF SELECTED STAR I IN PRESENT CLUSTER COORDINATES FOR IMU K: I = 1,2,3; K = 1,2,3	STAR_CONFIRM DISP_SUP	MATRIX	+/- 1	NA	1.04
M50	V99U3450CA	TRANSFORMATION: PRESENT CLUSTER TO M50:	IMU ORB	MATRIX	+/- 1	NA	OD
T_C(SIMU)	THRU V99U3476CA	A/CAL (4.208) SIMU = 1,2,3					
SIMU	V90J2560C	SELECTED IMU ID	IMU RM (4.72)	INTEGER	1,2,3	NA	1.04
AXN	V95X4972X	SELECTED COAS AXIS: X OR -Z	DISP_SUP	INTEGER	-Z=1 +X=2	NA	1.04
DP(K)	V99H2660CA V99H2661CA V99H2662CA	IMU K ROLL/PITCH NON-ORTHOGONALITY: K = 1,2,3	IMU SOP (HANG_CALB)	SCALAR	+/- 0.006	RAD	OD
PANG	V95H0050CA V95H1050CA V95H2050CA	IMU K COMP PITCH RES ANGLE: 1 PER IMU	IMU INT PROC (4.38)	SCALAR	0- 360	DEG	OD
AZANG	V95H0051CA V95H1051CA V95H2051CA	IMU K COMP AZIMUTH RES ANGLE: 1 PER IMU	IMU INT PROC (4.38)	SCALAR	0-360	DEG	OD
IRANG	V95H0053CA V95H1053CA V95H2053CA	IMU K COMP INNER ROLL RES ANGLE: 1 PER IMU	IMU INT PROC (4.38)	SCALAR	0-15 345-360	DEG	OD
ORANG	V95H0054CA V95H1054CA V95H2054CA	IMU K COMP OUTER ROLL RES ANGLE: 1 PER IMU	IMU INT PROC (4.38)	SCALAR	0-360	DEG	OD
T_IMU_S	V95W0002C	IMU INPUT (TRANS) TIME TAG	IMU INT PROC (4.38)	SCALAR	TBD	SEC	OD
I_COAS (AXN)	V99U5610C THRU V99U5615C	UNIT VECTOR ALONG COAS AXIS, AXN, IN NAV BASE COORDINATES: AXN = X, -Z	COAS_CALIB	VECTOR	+/- 1	ND	OD
V_CAL (AXN)		VERTICAL COAS CALIB ANGLE: AXN = +X OR -Z	COAS_CALIB	SCALAR	± 3.14159	RAD	OD
H_CAL (AXN)		HORIZONTAL COAS CALIB ANGLE: AXN = +X OR -Z	COAS_CALIB	SCALAR	± 3.14159	RAD	OD
ACCEPT	V93X6644X	S TRK/COAS CNTL COAS ACCEPT COMMAND	DISP_SUP	LOGICAL	0,1	NA	OD
FWD_ATT_REF_PB	V90X7897X	STA SEL FWD ADI ATT REF PB	GNC SW RM (4.180)	LOGICAL	0,1	NA	6.25

Table 4.66.4.10-1. COAS_SIGHT Inputs

Name	MSID	Description	Input Source	Signal Type	Range	Units	Rate (Hz)
AFT_ATT_REF_PB	V90X7701X	SEL AFT ADI ATT REF PB	GNC SW RM (4.180)	LOGICAL	0,1	NA	6.25

Table 4.66.4.10-2. COAS_SIGHT Outputs

Name	MSID/ MML No.	Description	Output Destination	Signal Type	Range	Units	Rate (Hz)
ANG12		MEASURED SEPARATION ANGLE COSINE BETWEEN STARS 1 AND 2	DISP_SUP	SCALAR	+/- 1	NA	OD
I_STAR_SEL1	V95H4732C V95H4733C V95H4734C	UNIT LOS VECTOR FOR SELECTED STAR 1 IN M50 COORDINATES	IMU ORB A/CAL (4.208)	VECTOR	+/- 1	NA	OD
I_STAR_SEL2	V95H4748C V95H4749C V95H4750C	UNIT LOS VECTOR FOR SELECTED STAR 2 IN M50 COORDINATES	IMU ORB A/CAL (4.208)	VECTOR	+/- 1	NA	OD
I_STAR_SELC (I,K)	V95H4721C THRU V95H4729C V95H4738C THRU V95H4746C V95H4790C THRU V95H4798C	MEASURED UNIT LOS VECTOR FOR SELECTED STAR I IN PRESENT CLUSTER COORDINATES FOR IMU K: I = 1,2,3; K = 1,2,3	STAR_CONFIRM, DISP_SUP, IMU ORB A/CAL (4.208), TLM (I = 1 & 2 ONLY)	MATRIX	+/- 1	NA	OD
T_TARLOS	V95W4985C	TIME OF TARGET SIGHTING	ORB/RND NAV (4.126); TLM	SCALAR	TBD	SEC	OD
IDNO(L)		SELECTED STAR ID: L = 1,2,3	DISP_SUP	INTEGER	11-110	NA	OD
SELECT1		STAR 1 SELECTED FOR ALIGNMENT	DISP_SUP	LOGICAL	0,1	NA	OD
SELECT2		STAR 2 SELECTED FOR ALIGNMENT	DISP_SUP	LOGICAL	0,1	NA	OD
AL_ENABLE	V95X4995X	ALIGN ENABLE FLAG	DISP_SUP IMU ALIGN (6.26); TLM	LOGICAL	0,1	NA	OD
AXN	V95X4972X	SELECTED COAS AXIS: X OR -Z	ORB/RND NAV (4.126); TLM	INTEGER	-Z=1 +X=2	NA	
NAV_SIGHT	V95X4779X	NAVIGATION SIGHTING FLAG COAS	ORB/RND NAV (4.126); TLM	LOGICAL	0,1	NA	OD
BODY T M50	V95U4809C THRU V95U4817C	TRANSFORMATION: M50 TO BODY	ORB/RND NAV (4.126); TLM	MATRIX	+/- 1	NA	OD
COAS_SPROG		COAS SIGHT IN PROGRESS FLAG	DISP_SUP	LOGICAL	0,1	NA	OD

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Table 4.66.4.10-2. COAS_SIGHT Outputs

Name	MSID/ MML No.	Description	Output Destination	Signal Type	Range	Units	Rate (Hz)
COAS_HORIZ	V95U4969C V95U4968C	COAS HORIZ CALIBRATION ANGLE; -Z AND +X	ORB/RND NAV (4.126); TLM	SCALAR	± 3.14159	RAD	OD
COAS_VERT	V95U4992C V95U4993C	COAS VERT CALIBRATION ANGLE; -Z AND +X	ORB/RND NAV (4.126); TLM	SCALAR	± 3.14159	RAD	OD
TIME1	V95W4761C	TIME TAG FOR SIGHTING DATA STAR 1	DISP_SUP	SCALAR	TBD	SEC	OD
TIME2	V95W4762C	TIME TAG FOR SIGHTING DATA STAR 2	DISP_SUP	SCALAR	TBD	SEC	OD

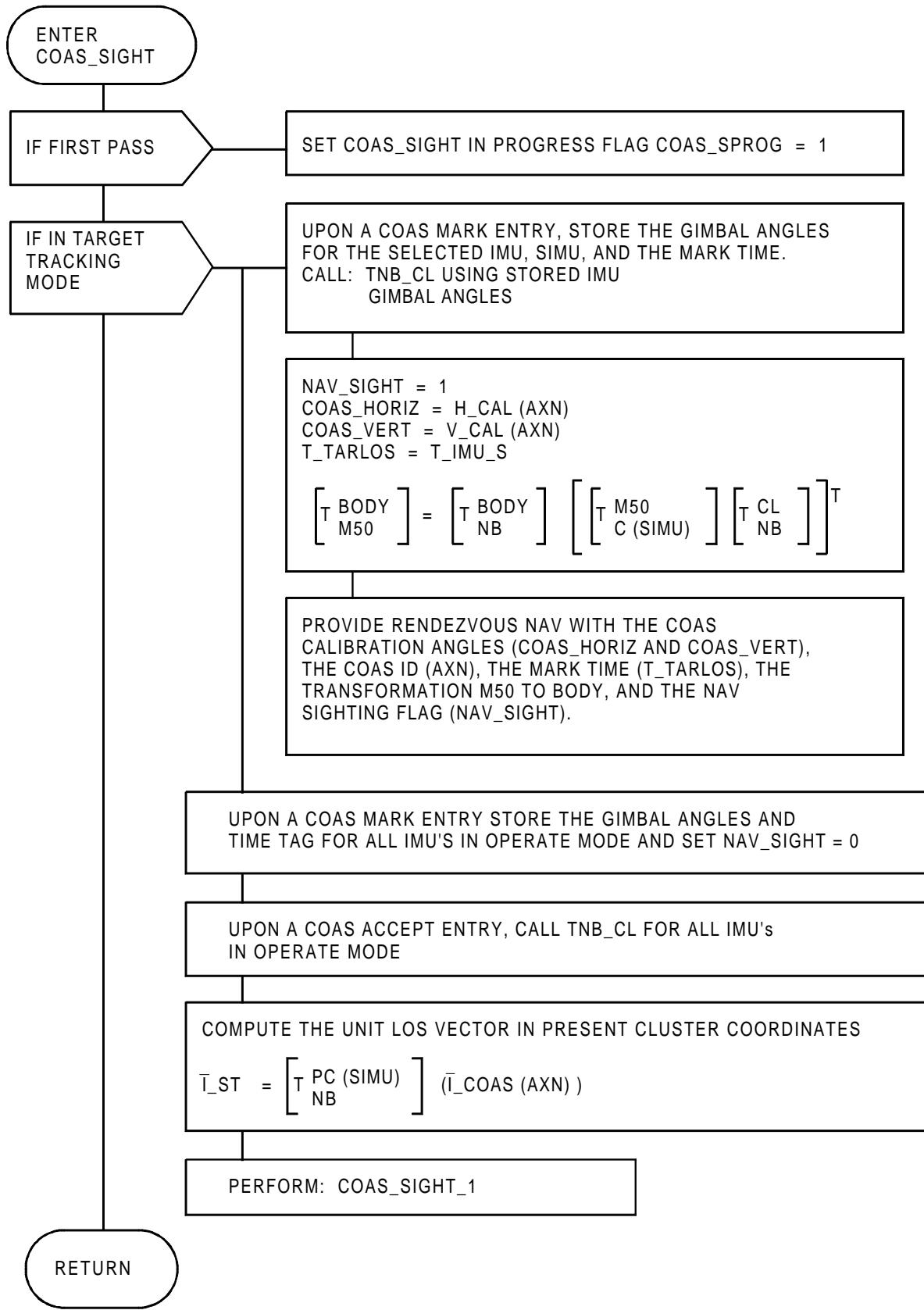


FIGURE 4.66.4.10-1.(1) COAS_SIGHT Detailed Flow Diagram (Sheet 1 of 2)

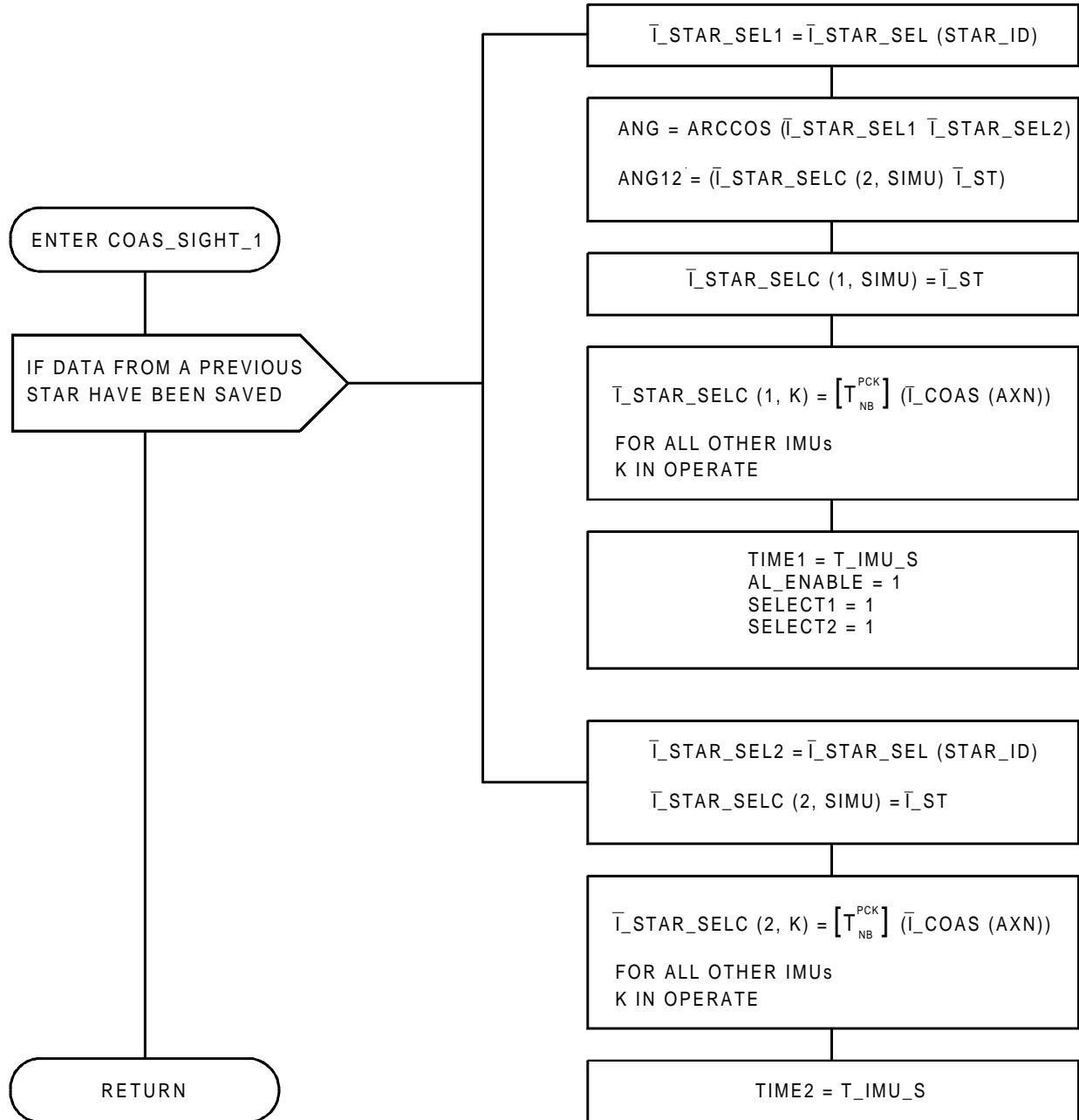


FIGURE 4.66.4.10-1.(2) COAS_SIGHT Detailed Flow Diagram (Sheet 2 of 2)

4.66.4.14 COAS Calibration (COAS_CALIB).

The purpose of the COAS_CALIB module is to perform on-orbit calibration of the COAS. The IMU reference is used to determine the -Z and +X axis COAS orientation with respect to the calibration base from COAS star sightings.

A. Functional Requirements. The COAS calibration module is required to perform the following functions.

1. Process manual sighting marks on stars selected by the crew using either the +X axis or the -Z axis COAS.
2. Using the selected IMU as a reference, determine from the sighting data the orientation of the selected COAS with respect to the navigation base.
3. Provide displays for crew evaluation of the COAS calibration results.

B. Interface Requirements. The input and output parameters associated with the COAS_CALIB module are contained in Tables 4.66.4.14-1 and 4.66.4.14-2.

C. Detailed Requirements. The following sequence of operations and computations are required to satisfy the functions of the COAS_CALIB module:

1. If first pass since COAS_CALIB request, set COAS_CPROG=1.
 - (a) Upon receipt of a new COAS mark indication (FWD_ATT_REF_PB=1 or AFT_ATT_REF_PB=1) store the IMU gimbal angles for the selected IMU, SIMU, and continue with the following steps.
2. Determine the transformation from nav base to present cluster for the selected IMU. Use the stored IMU gimbal angles to form this transformation. Call TNB_CL for IMU, SIMU.
3. Compute the current COAS unit LOS vector in navigation base coordinates as follows:

$$\bar{I}_{\text{CO}} = [T_{\text{NB}}^{\text{PC(SIMU)}}]^T \quad [T_{\text{C(SIMU)}}^{\text{M50}}]^T (\bar{I}_{\text{STAR_SEL(STAR_ID)})})$$

4. Compute the COAS calibration angles in body coordinates.

$$\bar{I}_{\text{ST}} = [T_{\text{NB}}^{\text{BODY}}] \bar{I}_{\text{CO}}$$

5. (a) If the -Z COAS location is being used, compute calibration angles along positive Y and X body axes, respectively, as

$$H_{\text{TEM}} = \text{ARCTAN2}(I_{\text{ST}}(2), -I_{\text{ST}}(3))$$

$$V_{\text{TEM}} = \text{ARCTAN2}(I_{\text{ST}}(1), -I_{\text{ST}}(3))$$

- (b) If the X COAS location is being used, compute calibration angles along positive Y and Z body axes, respectively, as

$$H_TEM = \text{ARCTAN2}(I_ST(2), I_ST(1))$$

$$V_TEM = \text{ARCTAN2}(I_ST(3), I_ST(1))$$

6. Compute the angular difference between the old and new COAS axis, AXN, unit LOS vectors, and update the vector as follows:

$$\text{ANGDCO}(AXN) = \text{ARCCOS}(\bar{I}_{CO} \cdot \bar{I}_{COAS}(AXN)) \text{ (RADDEG)}$$

7. If the crew commands an update of the COAS axis, AXN, unit LOS vector, update the vector as follows:

$$\bar{I}_{COAS}(\text{UPDATE}) = \bar{I}_{CO}$$

$$H_{CAL}(\text{UPDATE}) = H_{TEM}$$

$$V_{CAL}(\text{UPDATE}) = V_{TEM}$$

$H_{CAL}(\text{UPDATE})$ and $V_{CAL}(\text{UPDATE})$ locations in COMPOOL must be zeroed when initially loaded into computer in OPS-2; current values must be carried across the OPS-2/OPS-3/OPS-8 transition if updated during OPS-2.

and zero the display of ANGDCO(AXN), which is ΔBIAS in DISP_SUP.

8. Terminate COAS_CALIB processing for this cycle.

The COAS_CALIB module shall be executed once each time that a COAS mark is input (while the COAS_CALIB submode is active). The IMU gimbal angles shall be read and stored within 160 milliseconds of receipt of the COAS mark indication. When the COAS_CALIB mode is terminated (by either DESEL or selection of COAS_SIGHT) the COAS_CPROG flag shall be set false. A suggested design flow that satisfies the COAS_CALIB requirements is shown in Figure 4.66.4.14-1.

Table 4.66.4.14-1. COAS_CALIB Inputs

Name	MSID	Description	Input Source	Signal Type	Range	Units	Rate (Hz)
STAR_ID		SELECTED STAR ID: 1 PER ST	DISP_SUP	INTEGER	1–110	NA	1.04
I_STAR_SEL(I)		STAR UNIT VECTORS IN M50 COORD: I = 11 TO 110	STAR_TRACK	VECTOR	+/- 1	NA	6.25
SIMU	V90J2560C	SELECTED IMU ID	IMU RM (4.72)	INTEGER	1,2,3	NA	1.04
I_COAS(AXN)	V99U5610C	UNIT VECTOR ALONG COAS AXIS, AXN, IN NAV	I-LOAD	VECTOR	+/- 1	ND	OD
	THRU	BASE COORD: AXN = X OR -Z					
M50	V99U3450CA	TRANSFORMATION: PRESENT CLUSTER TO	IMU ORB	MATRIX	+/- 1	NA	OD
T	THRU	M50 FOR IMU K: K =	A/CAL (4.208)				
C(K)	V99U3476CA	1,2,3					
AXN	V95X4972X	SELECTED COAS AXIS: X OR -Z	DISP_SUP	INTEGER	-Z=1 +X=2	NA	1.04
BODY	V96U7096C	TRANSFORMATION: NAVIGATION BASE TO	I-LOAD	MATRIX	+/- 1	NA	OD
T	THRU	BODY					
NB	V96U7104C	COAS CAL UPDATE CMD	DISP_SUP	LOGICAL	0,1	NA	1.04
UPDATE_CAL							
DP(K)	V99H2660CA	IMU K ROLL/PITCH NON-	IMU SOP	SCALAR	+/-0.006	RAD	OD
	V99H2661C	ORTHOGONALITY:	(HANG_CALB)				
	V99H2662CA	K = 1,2,3					
PANG	V95H0050CA	IMU K COMP PITCH RES	IMU INT PROC	SCALAR	0–360	DEG	OD
	V95H1050CA	ANGLE: 1 PER IMU	(4.38)				
	V95H2050CA						
AZANG	V95H0051CA	IMU K COMP AZIMUTH	IMU INT PROC	SCALAR	0–360	DEG	OD
	V95H1051CA	RES ANGLE: 1 PER IMU	(4.38)				
	V95H2051CA						
IRANG	V95H0053CA	IMU K COMP INNER	IMU INT PROC	SCALAR	0–15	DEG	OD
	V95H1053CA	ROLL RES ANGLE: 1 PER	(4.38)		345–360		
	V95H2053CA	IMU					
ORANG	V95H0054CA	IMU K COMP OUTER	IMU INT PROC	SCALAR	0–360	DEG	OD
	V95H0054CA	ROLL RES ANGLE: 1 PER	(4.38)				
	V95H0054CA	IMU					
FWD_ATT_REF_PB	V90X7897X	STA SEL FWD ADI ATT	GNC SW RM	LOGICAL	0,1	NA	6.25
		REF PB	(4.180)				
AFT_ATT_REF_PB	V90X7701X	SEL AFT ADI ATT REF PB	GNC SW RM	LOGICAL	0,1	NA	6.25
		(4.180)					
DEG_PER_RAD	V97U0112C	RADIAN TO DEGREE CONVERSION FACTOR	LEVEL A CONSTANT	SCALAR	57.2957795	DEG/ RAD	OD

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Table 4.66.4.14-2. COAS_CALIB Outputs

Name	MSID	Description	Output Destination	Signal Type	Range	Units	Rate (Hz)
ANGDCO (AXN)		ANGULAR DIFFERENCE BETWEEN THE OLD AND NEW COAS AXIS, AXN, UNIT LOS VECTORS: AXN = X OR -Z	DISP_SUP	SCALAR	0-180	DEG	OD
I_COAS (AXN)	V99U5610C THRU V99U5615C	UNIT VECTOR ALONG COAS AXIS, AXN. IN NAV BASE COORD: AXN = X OR -Z	COAS_SIGHT TLM	VECTOR	+/- 1	ND	OD
H_CAL (AXN)		HORIZONTAL COAS CALIB ANGLE: AXN = -Z OR +X	COAS_SIGHT ST_COAS	SCALAR	+/-3.14159	RAD	OD
V_CAL (AXN)		VERTICAL COAS CALIB ANGLE: AXN = -Z OR +X	COAS_SIGHT ST_COAS	SCALAR	+/-3.14159	RAD	OD
COAS_CPROG		COAS CALIB IN PROGRESS FLAG	DISP_SUP	LOGICAL	0,1	NA	OD
I_CO (AXN)	V95U4850C THRU V95U4855C	CURRENT UNIT VECTOR ALONG COAS AXIS, AXN. IN NAV BASE COORD: AXN = X OR -Z	TLM	VECTOR	+/- 1	ND	OD

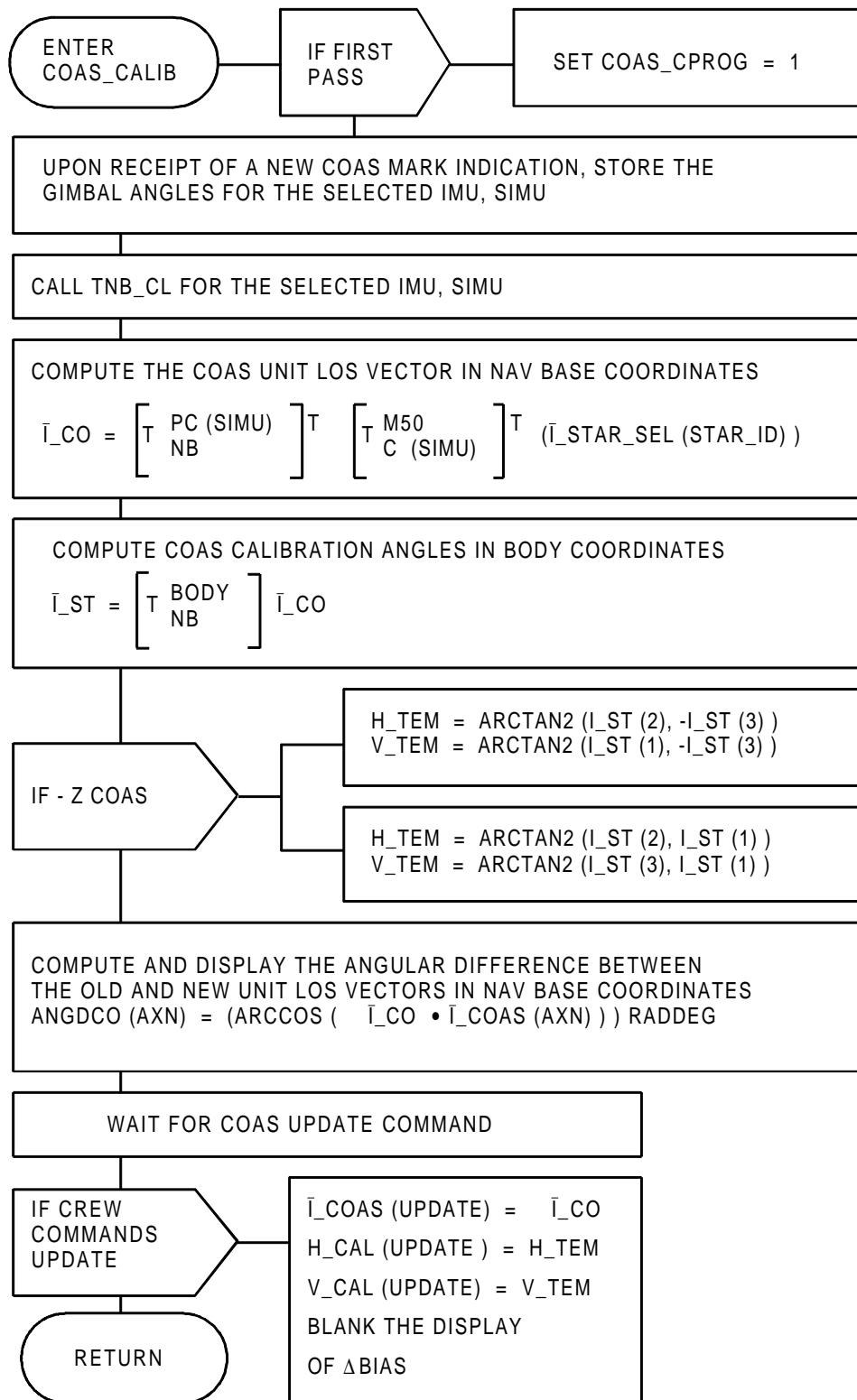


FIGURE 4.66.4.14-1. COAS_CALIB Detailed Flow Diagram

4.66.4.18 Star Tracker to COAS (ST_COAS).

The purpose of the ST_COAS module is to determine the location of a star/target in the -Z axis COAS when the star/target is being tracked in the -Z axis star tracker.

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

1. When a star or target is being tracked by the -Z star tracker, determine the location of the star/target in the -Z axis COAS. Display the calculated COAS angles.

B. Interface Requirements. The input and output parameters associated with the ST_COAS module are contained in Tables 4.66.4.18-1 and 4.66.4.18-2.

C. Detailed Requirements. The following sequence of operations and computations are required to satisfy the functions of the ST_COAS module:

1. If $\text{STAR_PRES}_Z = 1$, save the measured -Z star tracker angles; otherwise, go to step 4.

$$\text{VANG_COAS}_Z = \text{VERT_ANG}_Z$$

$$\text{HANG_COAS}_Z = \text{HOR_ANG}_Z$$

2. Determine the star/target measured unit vector in nav base coordinates.

$$H = \tan \left[\frac{\text{HANG_COAS}_Z}{\text{RADDEG}} \right]$$

$$V = \tan \left[\frac{\text{VANG_COAS}_Z}{\text{RADDEG}} \right]$$

$$D = \sqrt{H^2 + V^2 + 1}$$

$$\bar{I}_{-STC} = [T_{NB}^{STZ}]^T \frac{1}{D} \begin{bmatrix} -V \\ H \\ 1 \end{bmatrix}$$

3. Compute the star/target offset angles for the -Z axis COAS.

- a. Transform the star/target unit LOS vector from nav base to body coordinates.

$$\bar{I}_{-CO} = [T_{NB}^{BODY}] \bar{I}_{-STC}$$

- b. Compute the COAS offset angles

$$V_{COA} = \text{ARCTAN2}(I_{CO}(1), -I_{CO}(3))$$

$$H_{COA} = \text{ARCTAN2}(I_{CO}(2), -I_{CO}(3))$$

- c. Add last computed COAS calibration angles to COAS offset angles

$$V_{COA} = (V_{COA} - V_{CAL}(Z)) \text{ (RADDEG)}$$

$$H_{COA} = (H_{COA} - H_{CAL}(Z)) \text{ (RADDEG)}$$

4. Terminate ST_COAS for this cycle.

The ST_COAS module shall be executed at a rate of once per second whenever the star present bit (STAR_PRES_Z) is on for the -Z star tracker. A suggested design flow which satisfies the ST_COAS requirements is shown in Figure 4.66.4.18-1.

Table 4.66.4.18-1. ST_COAS Inputs

Name	MSID	Description	Input Source	Signal Type	Range	Units	Rate (Hz)
BODY T NB	V96U7096C THRU V96U7104C	TRANSFORMATION: NAVIGATION BASE TO BODY	I-LOAD	MATRIX	+/- 1	NA	1.04
DATA_WORD1(1)	V71M5020P	-Z ST MODE STATUS WD1	ST 1	LOGICAL	NA	NA	OD
DATA_WORD2(1)	V71M5040P	-Z ST DATA WORD TO GPC	ST 1	LOGICAL	NA	NA	OD
DATA_WORD3(1)	V71M5060P	-Z ST DATA WORD TO GPC	ST 1	LOGICAL	NA	NA	OD
STZ T NB	V99U5676C THRU V99U5684C	TRANSFORMATION: NAV BASE TO -Z STAR TRACKER	I-LOAD	MATRIX	+/- 1	NA	1.04
H_CAL(Z)		HORIZONTAL COAS CALIBRATION ANGLE FOR -Z TRACKER	COAS_CALIB	SCALAR	\pm 3.14159	RAD	OD
V_CAL(Z)		VERTICAL COAS CALIBRATION ANGLE FOR -Z TRACKER	COAS_CALIB	SCALAR	\pm 3.14159	RAD	OD
DEG_PER_RAD	V97U0112C	RADIAN TO DEGREE CONVERSION FACTOR	LEVEL A CONSTANT	SCALAR	57.2957795	DEG/ RAD	1.04

Table 4.66.4.18-2. ST_COAS Outputs

Name	MSID	Description	Output Destination	Signal Type	Range	Units	Rate (Hz)
H_COAS	V95H4941C	COAS HORIZONTAL OFFSET ANGLE FOR -Z AXIS COAS	DISP_SUP (6.11) DISPL (6.44) DISPL	SCALAR	+/- 180	DEG	1.04
V_COAS	V95H4940C	COAS VERTICAL OFFSET ANGLE FOR -Z AXIS COAS	DISP_SUP (6.11) DISPL (6.44) DISPL	SCALAR	+/- 180	DEG	1.04

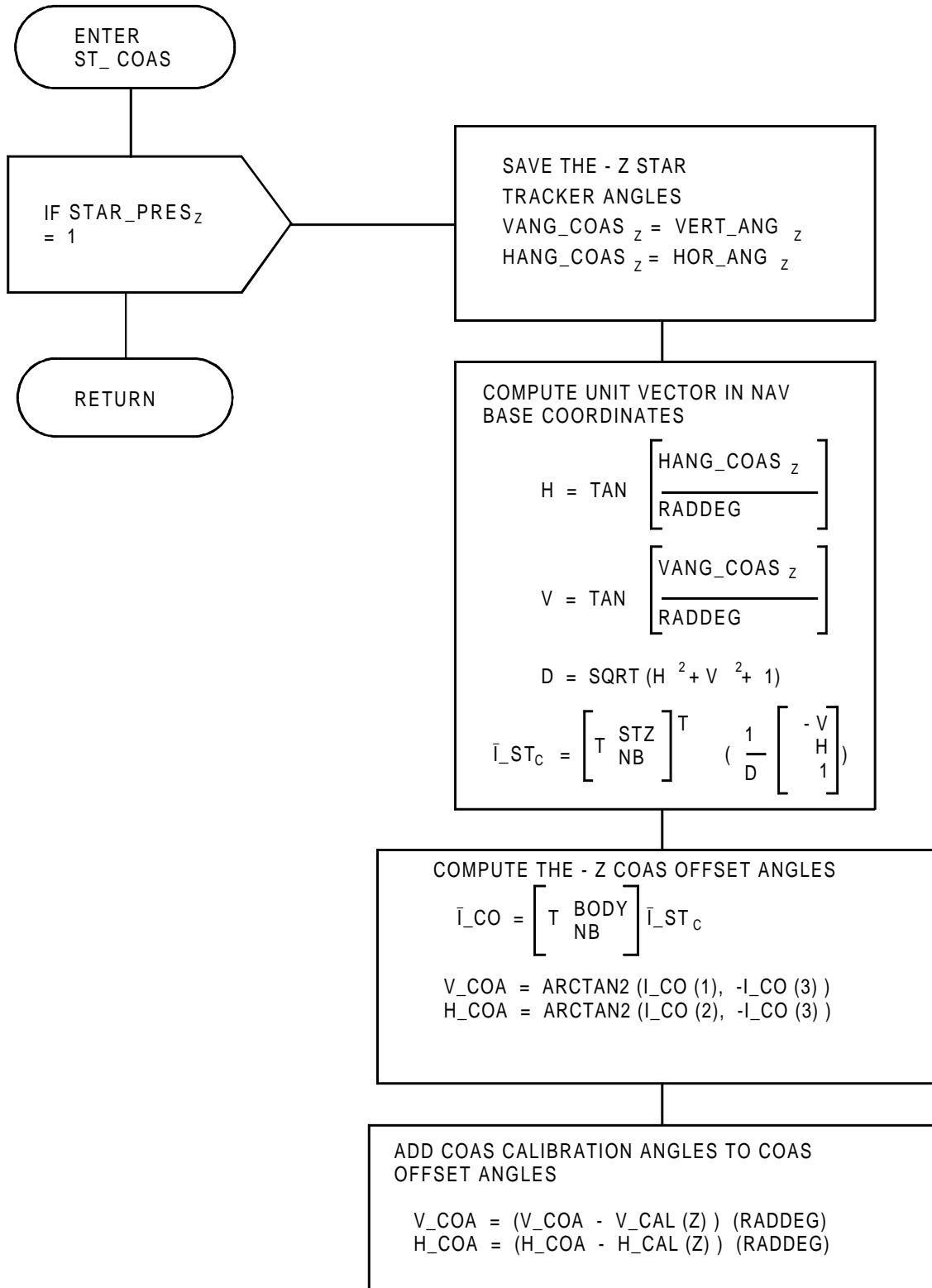


FIGURE 4.66.4.18-1. ST_COAS Detailed Flow Diagram

4.66.4.19 ST_TRK CONT/MON Support Function (DISP_SUP).

The purpose of the ST_TRK CONT/MON support function is to perform the formatting, logical decisions and computations which are necessary for support of the S TRK/COAS CNTL display and are not normally performed in other software modules.

A. Functional Requirements. The ST_TRK CONT/MON support module is required to perform the following functions:

1. Accept the star tracker module control inputs from keyboard entries and process according to the selection options available on the S TRK/COAS CNTL display and provide flags for controlling execution of the ST SOP.
2. Control the output of asterisks, parameters, and status words for the S TRK/COAS CNTL display.

Star Tracker SOP Mode Controls. The star tracker SOP modes are controlled by keyboard selection. A star tracker SOP mode command shall cause the star tracker SOP to assume the commanded mode if there is no conflict with the star tracker SOP mode for the other star tracker. The matrix of allowable SOP modes is shown below:

		Other Star Tracker			
		T	A	S	R
Commanded Star tracker	S	T	G	T	
	E	A	E	E	
	L	R	T	R	
	F			M	
		T	T	/	
	T	R	R	I	
	E	A	A	D	
	S	C	C	L	
	T	K	K	E	
SELF-TEST		1	2	2	2
STAR TRACK		2	2	2	2
TARGET TRACK		2	2	3	2
TERM/IDLE		2	2	2	2

The matrix codes are defined as follows:

1. Not used.
2. Indicates both star trackers may be in the commanded modes simultaneously.

3. The other star tracker is moded to TERM/IDLE as a result of a TARGET TRACK command.

The mode commands shall cause transition to the commanded mode by the time of the next display update. Break track may be commanded during any mode without mode transition. There is no requirement to support simultaneous star tracker and COAS operation.

B. Interface Requirements. The input and output parameters associated with ST_TRK CONT/MON Support Module are contained in Table 4.66.4.19-1 and Table 4.66.4.19-2.

C. Detailed Requirements. The following requirements and logical decisions are required to perform the ST_TRK CONT/MON support function:

1. Self-Test Indication (-Y/-Z). Self-test indication shall be generated by the ST_SELF_T signal from ST_SELF_TEST. Self-test indication shall drive the appropriate asterisk.
2. SELF-TEST Command. SELF-TEST Command shall be generated by keyboard input of SELF-TEST Command of (-Y) or (-Z) star tracker. This keyboard input shall command execution of ST_SELF_TEST operating on the selected star tracker. SELF_TEST in progress shall be determined by the SELF_TEST indication signals.
3. Star Track Indication (-Y/-Z). Star track indication shall be generated by a starmode indication from the STAR_TRACK mode. Star track indication shall drive the appropriate asterisk.
4. STAR TRACK Command. STAR TRACK command shall be generated by keyboard input of STAR TRACK command for star tracker (-Y) or (-Z). This input item shall command execution of STAR TRACK using the selected star tracker. When a STAR TRACK command is received, the selected star tracker shall be moded to TERM/IDLE and then to STAR TRACK. Also, a STAR TRACK command will be generated automatically for both star trackers upon receipt of the ST-based IMU alignment complete flag (ST_AL_COMP = 1).
5. Target Track Indication (-Y/-Z). The target track indication shall be generated by TARMODE signal from target track module. Target track indication shall drive the appropriate asterisk.
6. TARGET TRACK Command. TARGET TRACK command shall be generated by keyboard input of TARGET TRACK for star tracker (-Y) or (-Z). This input shall command execution of target track using the selected star tracker. When a TARGET TRACK command is received, the selected star tracker shall be moded to TERM/IDLE and then to target track. If the other star tracker is in the target track mode, set that star tracker to TERM/IDLE. Target track is determined by the TARGET TRACK indication.
7. BREAK TRACK Command. BREAK TRACK command shall be generated by keyboard input of BREAK TRACK for either (-Y) or (-Z) star tracker. This command shall be output to the selected star tracker.
8. TERM/IDLE Command. TERM/IDLE command shall be generated by keyboard input of TERM/IDLE command for either (-Y) or (-Z) star tracker. The input shall command termination of the current mode and return to TERM/IDLE for the selected star tracker, and blank the status display.

9. TERM/IDLE Indication (-Y/-Z). TERM/IDLE indication shall be generated by a TERM/IDLE signal from TERM/IDLE module. TERM/IDLE indication shall drive the appropriate asterisk.
10. ST PRES Indication (-Y/-Z). ST PRES indication shall be generated by the appropriate star tracker. ST PRES shall drive an asterisk for either or both star trackers according to the contents of the star tracker output words.
11. TRK ID Indication (-Y/-Z). TRK ID indication shall be generated by keyboard input or star track module. If either SEL_ID input is other than zero, use the item input as TRK ID. If either SEL_ID is zero, then use STAR_ID from STAR_TRACK for the appropriate TRK ID. These two combinations shall be used independent of each other.
12. ST MAG Indication (-Y/-Z). Deleted.
13. HOR Indication (-Y/-Z). Deleted.
14. VERT Indication (-Y/-Z). Deleted.
15. ΔANG Indication (-Y/-Z). The Δ ANG indication shall be a display of ANG signal from STAR CONFIRM.
16. SEL_ID Command. SEL_ID is an input from the keyboard for selecting the star or target to be tracked. SEL_ID shall cause the input number to be displayed adjacent to the item number. SEL_ID shall drive STAR ID in STAR TRACK. Zero required ID on display following completion of star track manual mode processing.
17. THOLD Command. THOLD command shall be generated by a keyboard input. THOLD shall be a one-digit number (value 0,1,2, or 3) and shall be displayed adjacent to the item number. THOLD shall also drive THOLD in STAR TRACK or TARGET TRACK.
18. Shutter Indication (-Y/-Z). Shutter indication shall be generated by SHUT_CLOS from the star tracker. Shutter shall drive the display to OP for open and CL for closed.
19. SH OPEN Command. SH OPEN command shall be generated by the keyboard entry. SH OPEN shall command shutter open on the appropriate star tracker. (SH OPEN is a toggling command. A subsequent entry will command automatic operation.) SH OPEN shall drive SHUT_OPEN in the star tracker command word. SH OPEN shall also drive an asterisk adjacent to the selected item number. This asterisk shall be reset to indicate automatic shutter control at the initiation of star tracker self-test.
20. Status Indication (-Y/-Z). Status indication will display various flags indicating the status of the respective star trackers. The flags and details are listed below:
 - ST_FAIL. ST_FAIL shall be driven by ST_FAIL from ST_SELF_TEST at the completion of self-test if self-test failed.
 - ST_PASS. ST_PASS shall be driven by a ST_PASS signal from ST_SELF_TEST.
 - FALSE_TK. FALSE_TK shall be driven by FALSE_TK signal from STAR_CONFIRM or NAV_FALSE_TARG signal from rendezvous navigation.

OUT_FOV. OUT_FOV shall be driven by the OUT_FOV signal from FOV_TEST.

HI_RATE. HI_RATE shall be driven by the HI_RATE signal from the DATA_FILR module.

NO_TARGET. NO_TARGET shall be driven by the NO_TARGET signal from STAR_TRACK, TARGET_TRK, and ST_SELF_TEST.

The above outputs which are displayed in the status location shall display the last flag to change from logic 0 to logic 1 for each star tracker. When the flag that is currently being displayed changes from logic 1 to logic 0, the status display will be blanked. If the LRU is OFF the display for that LRU shall be blank.

<u>STAT</u>	<u>DISPLAY FLAG</u>
0	BLANK
1	ST FAIL
2	ST PASS
3	FALSE TK
4	OUT FOV
5	HI RATE
6	NO TARGET

Where STATUS is an integer from 0 through 6.

BITE Display. If TRACKER GOOD is false or TRANSMISSION WORD GOOD is false, the word BITE shall be displayed on the line below the STATUS display. The “BITE” word shall be positioned to indicate ST1 or ST2.

21. STAR TABLE. The STAR TABLE entries shall be derived from the sighting table. Each parameter shall be derived from each of the three parts of the sighting table and displayed under the appropriate heading.
22. TRK ID. TRK ID shall be driven by the star ID (IDNO) stored in the sighting table.
23. ΔMIN. ΔMIN is the elapsed time in minutes since the respective star entry was stored in the sighting table. ΔMIN is equal to current time minus sighting time as stored in the table. Sighting time is equal to TIME as read in DATA_FILR.
24. ANG DIF.

ANG DIF is the measured angular separation between two adjacent entry LOS's.

ANGDIF1 = ARCCOS(ANG12) (RADDEG)

ANGDIF2 = ARCCOS(ANG23) (RADDEG)

ANGDIF3 = ARCCOS(ANG13) (RADDEG)

ANG12, ANG23, and ANG13 are generated in the STAR_CONFIRM module.

ANG12 is also from COAS_SIGHT.

ANG ERR.

ANG ERR is the difference between the measured angular separation as displayed under ANG DIF and the equivalent angular separation from the LOS's of the same star pair as recorded in the star catalog:

$$\text{ANGERR1} = \text{ANGDIF1} - \text{ARCCOS}[\bar{I}_{\text{STAR_SEL}}(\text{IDNO}(1)) \bullet$$

$$\bar{I}_{\text{STAR_SEL}}(\text{IDNO}(2))] (\text{RADDEG})$$

$$\text{ANGERR2} = \text{ANGDIF2} - \text{ARCCOS}[\bar{I}_{\text{STAR_SEL}}(\text{IDNO}(2)) \bullet$$

$$\bar{I}_{\text{STAR_SEL}}(\text{IDNO}(3))] (\text{RADDEG})$$

$$\text{ANGERR3} = \text{ANGDIF3} - \text{ARCCOS}[\bar{I}_{\text{STAR_SEL}}(\text{IDNO}(3)) \bullet$$

$$\bar{I}_{\text{STAR_SEL}}(\text{IDNO}(1))] (\text{RADDEG})$$

where $[\bar{I}_{\text{STAR_SEL}}(\text{IDNO}(L_1)) \bullet \bar{I}_{\text{STAR_SEL}}(\text{IDNO}(L_2))]$ is the angular difference between the same star pair as recorded in the star catalog.

25. **SELECT**. SELECT controls the selection of a star pair for alignment purposes. Normally the STAR_CONFIRM module shall set the SELECT for the pair of stars to be used. This setting shall be reflected in DISP_SUP by the setting of two of the three indicators. Automatic selection may be overridden by manual selection. Keyboard input of the items shall control the select indicators. Input of the item shall cause the indicators to change state, i.e., from false to true or true to false with the following restrictions: No false set indicator may be set true if the other two indicators are set true. SELECT shall drive asterisks for each indicator that is true.

Control of the selection indicator inputs (i.e., from STAR_CONFIRM, COAS_SIGHT or from keyboard input) shall be determined by a SEL_CONTROL indicator. When SEL_CONTROL is false STAR_CONFIRM shall control the selection indicators. When a keyboard input is received SEL_CONTROL shall be set true and the keyboard inputs shall control the selection indicators. Upon receipt of the next star measurement, the SEL_CONTROL indicator shall be reset to false. The initial condition for SEL_CONTROL is false. Completion of IMU alignment shall cause a ST_AL_COMP signal from IMU_SOP to set SEL_CONTROL to false.

A flag shall be provided to the display processor as an indicator of whether or not there is selected star data available for IMU alignment. If two stars have been selected for alignment by either the software or the crew, and data is available for both selected star table positions, then the AL_ENABLE flag shall be set to TRUE; otherwise set it to FALSE. The IMU alignment display processor does not allow the execution of an option 1 or 3 IMU alignment when AL_ENABLE = FALSE.

Upon receipt of the ST_AL_COMP flag (a change of state from 0 to 1) the following parameters shall be set to zero:

TIME	SEL_I1
TIME2	SEL_I2
TIME3	SEL_I3
IDNO(I), I=1,2,3	ANGERR1
I_STAR_SELC(I,J), I=1,2,3; J=1,2,3	ANGERR2
I_STAR_SEL1	ANGERR3
I_STAR_SEL2	ANGDIF1
ALIGN_COMP (ST_AL_COMP)	ANGDIF2
AL_ENABLE	ANGDIF3

- 25a. S_TBL_CLR. The S_TBL_CLR item removes all sighting data from the table by setting ST_AL_COMP to a 1 and setting the item flag to a 0. The SOP then operates on the ST_AL_COMP flag as if it had been set by an actual alignment completion.
26. REQD_ID. REQD_ID is a keyboard input which drives the STAR_ID input in COAS_SIGHT and COAS_CALIB. The format of the input is the same as for SEL_ID command.
27. +X POS -Z POS. These items are COAS selectors and are generated by keyboard inputs. They also drive the asterisks displayed along side the item number on the CRT page. They will drive the AXN term in COAS_SIGHT and COAS_CALIB.
28. SIGHT MODE. SIGHTSEL shall command execution of COAS_SIGHT mode. COAS_SPROG shall enable the ADI_ATT_REF button to provide a COAS mark. When the COAS_SPROG indicator is true, an asterisk (SIGHT_I) will be placed on the CRT adjacent to the item input. Item 25 is only accepted while in the COAS sight mode.
29. CAL MODE. CALSEL shall command the execution of COAS_CALIB mode. COAS_SPROG shall enable the ADI_ATT_REF button to provide a COAS mark. When the COAS_CPROG indicator is true, an asterisk (CAL_I) will be placed on the CRT adjacent to the item input. Items 28 and 29 are only accepted while in the CAL mode.
30. DESEL. DESEL shall cause termination of either sight mode or Cal mode. When DESEL is true, SIGHTSEL and CALSEL flags shall be set false and NAV_SIGHT shall be set false. SIGHTSEL, CALSEL, and DESEL shall be mutually exclusive.
31. ΔBIAS. ΔBIAS (AXN) is driven by ANGDCO(AXN) from COAS_CALIB. If no COAS calibration has been performed, zero the ΔBIAS display.
32. Update Items. The update items shall be driven by keyboard input. If Item 28 or Item 29 are input in COAS_CAL mode, then I_COAS (UPDATE), H_CAL(UPDATE) and V_CAL(UPDATE) shall be transferred from COAS_CALIB to COAS_SIGHT. The value of UPDATE shall be controlled by which item entry is input.

33. X and Y Output Parameters. The H_COA and V_COA parameters are generated by ST_COAS module and shall be output to the S TRK/COAS CNTL display and REL NAV display. The output terms are H_COAS and V_COAS. The values are in degrees.
34. STAT Indication. The STAT indication is driven by either STATUS(1) or STATUS(2) depending upon which star tracker is in the TARGET_TRK mode. If neither star tracker is in the TARGET_TRK mode, the display shall be blank.
35. BITE Indication. The BITE_II indication is driven by either BITE_I(1) or BITE_I(2) depending upon which star tracker is in the TARGET_TRK mode. If neither star tracker is in the TARGET_TRK mode, the display shall be blank.

The ST_TRK CONT/MON support function shall be executed once per second.

Table 4.66.4.19-1. DISP_SUP Inputs

Name	MSID	Description	Input Source	Signal Type	Range	Units	Rate (Hz)
STSELFCOMY	V93X6601X	ST SELF TEST COMMAND (-Y)	UI	LOGICAL	0,1	NA	OD
STSELFCOMZ	V93X6602X	ST SELF TEST COMMAND (-Z)	UI	LOGICAL	0,1	NA	OD
ST_SELF_T		ST SELF TEST FLAG: 1 PER ST	ST_SELF_TEST	LOGICAL	0,1	NA	1.04
STARCOMY	V93X6604X	STAR TRACK COMMAND (-Y)	UI	LOGICAL	0,1	NA	OD
STARCOMZ	V93X6605X	STAR TRACK COMMAND (-Z)	UI	LOGICAL	0,1	NA	OD
STARMODE		ST STAR TRACK FLAG: 1 PER ST	STAR_TRACK	LOGICAL	0,1	NA	6.25
STTARCOMY	V93X6610X	ST TARGET COMMAND (-Y)	UI	LOGICAL	0,1	NA	OD
STTARCOMZ	V93X6611X	ST TARGET COMMAND (-Z)	UI	LOGICAL	0,1	NA	OD
TARMODE		TARGET MODE FLAG: 1 PER ST	TARGET_TRK	LOGICAL	0,1	NA	6.25
BREAKCOMY	V93X6614X	S TRK/COAS CNTL -Y BREAK TRACK FLAG	UI	LOGICAL	0,1	NA	OD
BREAKCOMZ	V93X6615X	S TRK/COAS CNTL -Z BREAK TRACK FLAG	UI	LOGICAL	0,1	NA	OD
STTERMCOMY	V93X6618X	ST TERM/IDLE COMMAND (-Y)	UI	LOGICAL	0,1	NA	OD
STTERMCOMZ	V93X6619X	ST TERM/IDLE COMMAND (-Z)	UI	LOGICAL	0,1	NA	OD
TERMMODE(1)		-Z ST TERM IDLE MODE FLAG	ST_TERM_IDLE	LOGICAL	0,1	NA	OD
TERMMODE(2)		-Y ST TERM IDLE MODE FLAG	ST_TERM_IDLE	LOGICAL	0,1	NA	OD
STAR_ID		SELECTED STAR ID: 1 PER ST	STAR_TRACK	INTEGER	0 – 110	NA	6.25

Table 4.66.4.19-1. DISP_SUP Inputs

Name	MSID	Description	Input Source	Signal Type	Range	Units	Rate (Hz)
DATA_WORD1(1)	V71M5020P	-Z ST MODE STATUS WD1	ST 1	LOGICAL	NA	NA	OD
DATA_WORD1(2)	V71M5520P	-Y ST MODE STATUS WD1	ST 2	LOGICAL	NA	NA	OD
DATA_WORD2(1)	V71M5040P	-Z ST STATUS WD2	ST 1	LOGICAL	NA	NA	OD
DATA_WORD2(2)	V71M5540P	-Y ST STATUS WD2	ST 2	LOGICAL	NA	NA	OD
DATA_WORD3(1)	V71M5060P	-Z ST STATUS WD3	ST 1	LOGICAL	NA	NA	OD
DATA_WORD3(2)	V71M5560P	-Y ST STATUS WD3	ST 2	LOGICAL	NA	NA	OD
ANG		SEPARATION ANGLE BETWEEN ACTUAL AND EST STAR LOS VECTORS: 1 PER ST	STAR_CONFIRM	SCALAR	0 – 180	DEG	OD
SEL_ID	V93Q6622C V93Q6623C	STAR ID NUMBER: 1 PER ST	UI	INTEGER	0 – 110	NA	OD
THOLDY	V93Q6625C	ST THRESHOLD CMD (-Y)	UI	INTEGER	0,1,2,3	NA	OD
THOLDZ	V93Q6626C	ST THRESHOLD CMD (-Z)	UI	INTEGER	0,1,2,3	NA	OD
SHUTY	V93X6629XA	SHUTTER OPEN CMD (-Y)	UI	LOGICAL	0,1	NA	OD
SHUTZ	V93X6630XA	SHUTTER OPEN CMD (-Z)	UI	LOGICAL	0,1	NA	OD
ST_FAIL		ST SELF TEST FAIL FLAG: 1 PER ST	ST_SELF_TEST	LOGICAL	0,1	NA	1.04
ST_PASS		ST SELF TEST PASS FLAG: 1 PER ST	ST_SELF_TEST	LOGICAL	0,1	NA	1.04
MAN_OP		SHUTTER OVERRIDE DISPLAY ASTERISK: 1 PER ST	ST_SELF_TEST	LOGICAL	0,1	NA	1.04
FALSE_TK		FALSE TRACK FLAG: 1 PER ST	STAR_CONFIRM	LOGICAL	0,1	NA	OD
NAV_FALSE_TARG	V90X4300X	FALSE TARGET FLAG FOR DISP	ORB/RND NAV (4.126)	LOGICAL	0,1	NA	0.26
OUT_FOV		STAR/TARGET OUT OF FOV FLAG: 1 PER ST	FOV_TEST	LOGICAL	0,1	NA	OD
HI_RATE		HIGH BODY RATE FLAG: 1 PER ST	DATA_FILR	LOGICAL	0,1	NA	OD
NO_TARGET		NO STAR/TARGET FLAG: 1 PER ST	TARGET_TRK STAR_TRACK ST_SELF_TEST	LOGICAL	0,1	NA	6.25 6.25 1.04
SELECT1		STAR 1 SELECTED FOR ALIGNMENT	STAR_CONFIRM COAS_SIGHT	LOGICAL	0,1	NA	OD
SELECT2		STAR 2 SELECTED FOR ALIGNMENT	STAR_CONFIRM COAS_SIGHT	LOGICAL	0,1	NA	OD

Table 4.66.4.19-1. DISP_SUP Inputs

Name	MSID	Description	Input Source	Signal Type	Range	Units	Rate (Hz)
SELECT3		STAR 3 SELECTED FOR ALIGNMENT	STAR_CONFIRM	LOGICAL	0,1	NA	OD
ST_AL_COMP	V95X0545X	ST BASED ALIGN COMP	IMU ORB A/CAL (4.208)	LOGICAL	0,1	NA	OD
TIME1	V95W4761C	TIME TAG FOR SIGHTING DATA STAR 1	STAR_CONFIRM COAS_SIGHT	SCALAR	TBD	SEC	OD
TIME2	V95W4762C	TIME TAG FOR SIGHTING DATA STAR 2	STAR_CONFIRM COAS_SIGHT	SCALAR	TBD	SEC	OD
TIME3	V95W4763C	TIME TAG FOR SIGHTING DATA 0STAR 3	STAR_CONFIRM	SCALAR	TBD	SEC	OD
CLOCK	V91W5000C	CLOCK COMPUTER - GMT	FCOS	FLOAT PT	TBD	SEC	25
ANG12		MEASURED SEPARATION ANGLE COSINE BETWEEN STARS 1 AND 2	STAR_CONFIRM COAS_SIGHT	SCALAR	+/- 1	NA	OD
ANG13		MEASURED SEPARATION ANGLE COSINE BETWEEN STARS 1 AND 3	STAR_CONFIRM	SCALAR	+/- 1	NA	OD
ANG23		MEASURED SEPARATION ANGLE COSINE BETWEEN STARS 2 AND 3	STAR_CONFIRM	SCALAR	+/- 1	NA	OD
I_STAR_SEL(I,K)	V95H4721C THRU V95H4729C V95H4738C THRU V95H4746C V95H4790C THRU V95H4798C	MEASURED UNIT LOS VECTOR OF STAR I IN PRESENT CLUSTER COORDINATES FOR IMU K: I = 1,2,3; K = 1,2,3	STAR_CONFIRM COAS_SIGHT	MATRIX	+/- 1	NA	OD
I_STAR_SEL(M)		STAR UNIT VECTORS IN M50 COORDINATES: M = IDNO(L); L = 1,2,3 SIGHTING TABLE DESIGNATORS	STAR_TRACK	VECTOR	+/- 1.0	NA	6.25
IDNO(L)		SELECTED STAR ID: L = 1,2,3	STAR_CONFIRM COAS_SIGHT	INTEGER	11 – 110	NA	OD
SLCT1	V93X6633X	STAR 1 SELECTED FOR ALIGNMENT INDICATOR	(6.44) DISPL	LOGICAL	0,1	NA	OD

Table 4.66.4.19-1. DISP_SUP Inputs

Name	MSID	Description	Input Source	Signal Type	Range	Units	Rate (Hz)
SLCT2	V93X6634X	STAR 2 SELECTED FOR ALIGNMENT INDICATOR	(6.44) DISPL	LOGICAL	0,1	NA	OD
SLCT3	V93X6635X	STAR 3 SELECTED FOR ALIGNMENT INDICATOR	(6.44) DISPL	LOGICAL	0,1	NA	OD
S_TBL_CLR	V93X6636X	S TABLE CLEAR COMMAND	(6.44) DISPL	LOGICAL	0,1	NA	OD
AL_ENABLE	V95X4995X	ALIGN ENABLE FLAG	STAR_CONFIRM COAS_SIGHT	LOGICAL	0,1	NA	OD
REQD_ID	V93Q6638C	S TRK/COAS CNTL COAS TRACK ID	(6.44) DISPL	SCALAR	1 – 110	NA	OD
I_STAR_SEL1	V95H4732C V95H4733C V95H4734C	UNIT LOS VECTOR FOR SELECTED STAR 1 IN M50 COORDINATES	STAR_CONFIRM	VECTOR	+/- 1	NA	OD
I_STAR_SEL2	V95H4748C V95H4749C V59H4750C	UNIT LOS VECTOR FOR SELECTED STAR 2 IN M50 COORDINATES	STAR_CONFIRM	VECTOR	+/- 1	NA	OD
XPOS	V93X6640X	X COAS POSITION SELECT	(6.44) DISPL	LOGICAL	0,1	NA	OD
ZPOS	V93X6641X	-Z COAS POSITION SELECT	(6.44) DISPL	LOGICAL	0,1	NA	OD
SIGHTSEL	V93X6643X	COAS SIGHT MODE SELECT	(6.44) DISPL	LOGICAL	0,1	NA	OD
CALSEL	V93X6645X	COAS CALIB MODE SELECT	(6.44) DISPL	LOGICAL	0,1	NA	OD
DESEL	V93X6647X	COAS MODE DESELECT	(6.44) DISPL	LOGICAL	0,1	NA	OD
ANGDCO(AXN)		ANGULAR DIFFERENCE BETWEEN THE OLD AND NEW COAS AXIS, AXN, UNIT LOS VECTORS: AXN = X AND -Z	COAS_CALIB	SCALAR	0 – 180	DEG	OD
H_COA	V95H4941C	COAS HORIZONTAL OFFSET ANGLE FOR -Z AXIS COAS	ST_COAS	SCALAR	+/- 180	DEG	1.04
V_COA	V95H4940C	COAS VERTICAL OFFSET ANGLE FOR -Z AXIS COAS	ST_COAS	SCALAR	+/- 180	DEG	1.04
COAS_SPROG		COAS SIGHT IN PROGRESS FLAG	COAS_SIGHT	LOGICAL	0,1	NA	OD
COAS_CPROG		COAS CALIB IN PROGRESS FLAG	COAS_CALIB	LOGICAL	0,1	NA	OD
ACCEPT	V93X6644X	S TRK/COAS CNTL ACCEPT COMMAND	(6.44) DISPL	LOGICAL	0,1	NA	OD
UPDATE(1)	V93X6650X	COAS -Z CAL UPDATE	(6.44) DISPL	LOGICAL	0,1	NA	OD
UPDATE(2)	V93X6649X	COAS +X CAL UPDATE	(6.44) DISPL	LOGICAL	0,1	NA	OD

Table 4.66.4.19-1. DISP_SUP Inputs

Name	MSID	Description	Input Source	Signal Type	Range	Units	Rate (Hz)
DEG_PER_RAD	V97U0112C	RADIAN TO DEGREE CONVERSION FACTOR	LEVEL A CONSTANT	SCALAR	57.2957795	DEG/RAD	OD

Table 4.66.4.19-2. DISP_SUP Outputs

Name	MSID	Description	Output Destination	Signal Type	Range	Units	Rate (Hz)
STSELF(1)	V95X4973X	-Z ST SELF TEST CMD	FCOS	LOGICAL	0,1	NA	1.04
STSELF(2)	V95X4974X	-Y ST SELF TEST CMD	FCOS	LOGICAL	0,1	NA	1.04
SELF_T_I(1)	V95X4912X	-Z ST SELF TEST INDICATION	S TRK/COAS CNTL (6.44) TLM	LOGICAL	0,1	NA	1.04
SELF_T_I(2)	V95X4913X	-Y ST SELF TEST INDICATION	S TRK/COAS CNTL (6.44) TLM	LOGICAL	0,1	NA	1.04
STSTARTR(1)	V95X4979X	-Z ST STAR TRACK CMD	FCOS	LOGICAL	0,1	NA	1.04
STSTARTR(2)	V95X4980X	-Y ST STAR TRACK CMD	FCOS	LOGICAL	0,1	NA	1.04
STAR_T_I(1)	V95X4902X	-Z ST STAR TRACK INDICATION	S TRK/COAS CNTL (6.44) TLM	LOGICAL	0,1	NA	1.04
STAR_T_I(2)	V95X4903X	-Y ST STAR TRACK INDICATION	S TRK/COAS CNTL (6.44) TLM	LOGICAL	0,1	NA	1.04
STTARTR(1)	V95X4981X	-Z ST TARGET TRACK COMMAND	FCOS	LOGICAL	0,1	NA	1.04
STTARTR(2)	V95X4982X	-Y ST TARGET TRACK COMMAND	FCOS	LOGICAL	0,1	NA	1.04
TAR_T_I(1)	V95X4914X	-Z ST TARGET TRACK INDICATION	S TRK/COAS CNTL (6.44) TLM	LOGICAL	0,1	NA	1.04
TAR_T_I(2)	V95X4915X	-Y ST TARGET TRACK INDICATION	S TRK/COAS CNTL (6.44) TLM	LOGICAL	0,1	NA	1.04
STTERMCOM (1)	V95X4977X	-Z ST TERM/IDLE CMD	FCOS	LOGICAL	0,1	NA	1.04
STTERMCOM (2)	V95X4978X	-Y ST TERM/IDLE CMD	FCOS	LOGICAL	0,1	NA	1.04
TERM_I(1)	V95X4900X	-Z ST TERM/IDLE INDICATION	S TRK/COAS CNTL (6.44) TLM	LOGICAL	0,1	NA	1.04
TERM_I(2)	V95X4901X	-Y ST TERM/IDLE INDICATION	S TRK/COAS CNTL (6.44) TLM	LOGICAL	0,1	NA	1.04
STAR_I(1)	V95X4906X	-Z ST STAR PRESENT INDICATION	S TRK/COAS CNTL (6.44)	LOGICAL	0,1	NA	1.04
STAR_I(2)	V95X4907X	-Y ST STAR PRESENT INDICATION	S TRK/COAS CNTL (6.44)	LOGICAL	0,1	NA	1.04
STAR_ID		SELECTED STAR ID: 1 PER ST	STAR_TRACK COAS_SIGHT COAS_CALIB	INTEGER	0 – 110	NA	1.04
D_ANG(1)	V95U4960C	-Z ST OUTPUT DELTA ANGLE	S TRK/COAS CNTL (6.44) TLM	SCALAR	0 – 180	DEG	1.04
D_ANG(2)	V95U4961C	-Y ST OUTPUT DELTA ANGLE	S TRK/COAS CNTL (6.44) TLM	SCALAR	0 – 180	DEG	1.04
STAR_ID_I(1)	V95J4925C	-Z ST STAR IDENT INDICATION	S TRK/COAS CNTL (6.44) TLM	INTEGER	0 – 110	NA	1.04
STAR_ID_I(2)	V95J4926C	-Y ST STAR IDENT INDICATION	S TRK/COAS CNTL (6.44) TLM	INTEGER	0 – 110	NA	1.04
THOLD(1)		-Z ST SENSITIVITY THRESHOLD	STAR_TRACK TARGET_TRK	INTEGER	0,1,2,3	NA	1.04
THOLD(2)		-Y ST SENSITIVITY THRESHOLD	STAR_TRACK TARGET_TRK	INTEGER	0,1,2,3	NA	1.04

Table 4.66.4.19-2. DISP_SUP Outputs

Name	MSID	Description	Output Destination	Signal Type	Range	Units	Rate (Hz)
SHUT_IND(1)	V95X4935X	-Z ST SHUTTER CLOSE INDICATION	S TRK/COAS CNTL (6.44)	LOGICAL	0,1	NA	1.04
SHUT_IND(2)	V95X4936X	-Y ST SHUTTER CLOSE INDICATION	S TRK/COAS CNTL (6.44)	LOGICAL	0,1	NA	1.04
I_STAR_SEL_C (I,K)	V95H4721C THRU V95H4729C V95H4738C THRU V95H4746C V95H4790C THRU V95H4798C	MEASURED UNIT LOS VECTOR OF STAR I IN PRESENT CLUSTER COORDINATES FOR IMU K: I = 1,2,3; K = 1,2,3	STAR_CONFIRM COAS_SIGHT IMU ORB A/CAL (4.208)	MATRIX	+/- 1	NA	1.04
CMD_WORD(1)	V71M5320P	COMMAND WORD TO STAR TRACKER 1	STAR_TRACK TARGET_TRK ST 1 TLM	LOGICAL	NA	NA	1.04
CMD_WORD(2)	V71M5820P	COMMAND WORD TO STAR TRACKER 2	STAR_TRACK TARGET_TRK ST 2 TLM	LOGICAL	NA	NA	1.04
STATUS(1)	V95J4929C	-Z ST STATUS INDICATION	S TRK/COAS CNTL (6.44) TLM, REL NAV (6.11)	INTEGER	0 - 6	NA	1.04
STATUS(2)	V95J4930C	-Y ST STATUS INDICATION	S TRK/COAS CNTL (6.44) TLM, REL NAV (6.11)	INTEGER	0 - 6	NA	1.04
STAT	V95J4909C	TARGET TRK ST STATUS INDICATION	REL_NAV (6.11)	INTEGER	0 - 6	NA	1.04
BITE_I(1)	V95X4927X G13527	-Z ST BITE INDICATION	S TRK/COAS CNTL (6.44)	LOGICAL	0,1	NA	1.04
BITE_I(2)	V95X4928X G13528	-Y ST BITE INDICATION	S TRK/COAS CNTL (6.44)	LOGICAL	0,1	NA	1.04
BITE_II	V95X4731X	TARGET TRK ST BITE INDICATION	REL NAV (6.11)	LOGICAL	0,1	NA	1.04
SEL_I1	V95X4955X	STAR 1 SELECT INDICATION	S TRK/COAS CNTL (6.44) TLM	LOGICAL	0,1	NA	1.04
SEL_I2	V95X4956X	STAR 2 SELECT INDICATION	S TRK/COAS CNTL (6.44) TLM	LOGICAL	0,1	NA	1.04
SEL_I3	V95X4957X	STAR 3 SELECT INDICATION	S TRK/COAS CNTL (6.44) TLM	LOGICAL	0,1	NA	1.04
D_TIME1	V95W4946C	STAR 1 DELTA TIME	S TRK/COAS CNTL (6.44) TLM	SCALAR	0 - 99	MIN	1.04
D_TIME2	V95W4947C	STAR 2 DELTA TIME	S TRK/COAS CNTL (6.44) TLM	SCALAR	0 - 99	MIN	1.04

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Table 4.66.4.19-2. DISP_SUP Outputs

Name	MSID	Description	Output Destination	Signal Type	Range	Units	Rate (Hz)
D_TIME3	V95W4948C	STAR 3 DELTA TIME	S TRK/COAS CNTL (6.44) TLM	SCALAR	0 – 99	MIN	1.04
ANGDIF1	V95U4949C	MEASURED SEPARATION ANGLE BETWEEN STARS 1 AND 2	S TRK/COAS CNTL (6.44) TLM	SCALAR	0 – 180	DEG	1.04
ANGDIF2	V95U4950C	MEASURED SEPARATION ANGLE BETWEEN STARS 2 AND 3	S TRK/COAS CNTL (6.44) TLM	SCALAR	0 – 180	DEG	1.04
ANGDIF3	V95U4951C	MEASURED SEPARATION ANGLE BETWEEN STARS 1 AND 3	S TRK/COAS CNTL (6.44) TLM	SCALAR	0 – 180	DEG	1.04
ANGERR1	V95U4952C	DIFFERENCE IN MEASURED AND ACTUAL SEPARATION ANGLES FOR STARS 1 AND 2	S TRK/COAS CNTL (6.44) TLM	SCALAR	0 – 180	DEG	1.04
ANGERR2	V95U4953C	DIFFERENCE IN MEASURED AND ACTUAL SEPARATION ANGLES FOR STARS 2 AND 3	S TRK/COAS CNTL (6.44) TLM	SCALAR	0 – 180	DEG	1.04
ANGERR3	V95U4954C	DIFFERENCE IN MEASURED AND ACTUAL SEPARATION ANGLES FOR STARS 1 AND 3	S TRK/COAS CNTL (6.44) TLM	SCALAR	0 – 180	DEG	1.04
SELFLAG		SELECT FLAG INDICATION	STAR_CONFIRM	LOGICAL	0,1	NA	1.04
SELECT1		STAR 1 SELECTED FOR ALIGNMENT	STAR_CONFIRM IMU ORB A/CAL (4.208)	LOGICAL	0,1	NA	1.04
SELECT2		STAR 2 SELECTED FOR ALIGNMENT	STAR_CONFIRM IMU ORB A/CAL (4.208)	LOGICAL	0,1	NA	1.04
SELECT3		STAR 3 SELECTED FOR ALIGNMENT	STAR_CONFIRM IMU ORB A/CAL (4.208)	LOGICAL	0,1	NA	1.04
TRK_ID1	V95U4942C	STAR 1 ID FROM SIGHTING TABLE	S TRK/COAS CNTL (6.44) TLM	INTEGER	11 – 110	NA	1.04
TRK_ID2	V95U4943C	STAR 2 ID FROM SIGHTING TABLE	S TRK/COAS CNTL (6.44) TLM	INTEGER	11 – 110	NA	1.04
TRK_ID3	V95U4944C	STAR 3 ID FROM SIGHTING TABLE	S TRK/COAS CNTL (6.44) TLM	INTEGER	11–110	NA	1.04
ALIGN_COMP	V95X4986X	ST BASED ALIGN COMPLETE	IMU ORB A/CAL (4.208)	LOGICAL	0,1	NA	1.04

Table 4.66.4.19-2. DISP_SUP Outputs

Name	MSID	Description	Output Destination	Signal Type	Range	Units	Rate (Hz)
AL_ENABLE	V95X4995X	ALIGN ENABLE FLAG	TLM STAR_CONFIRM IMU ALIGN (6.26)	LOGICAL	0,1	NA	1.04
XZPOS_I	V95X4962X G46604	COAS POSITION INDICATION X OR -Z	S TRK/COAS CNTL (6.44)	LOGICAL	0,1	NA	1.04
SIGHT_I	V95X4963X	SIGHT MODE INDICATION	S TRK/COAS CNTL (6.44) TLM	LOGICAL	0,1	NA	1.04
CAL_I	V95X4964X	CALIB MODE INDICATION	S TRK/COAS CNTL (6.44) TLM	LOGICAL	0,1	NA	1.04
UPDATE_CAL_AXN	V93X6225X V95X4972X	COAS CAL UPDATE CMD SELECTED COAS AXIS: X OR -Z	COAS_CALIB COAS_SIGHT COAS_CALIB TLM ORB/RND NAV (4.126)	LOGICAL INTEGER	0,1 -Z = 1, +X = 2	NA	1.04
TIME1	V95W4761C	TIME TAG FOR SIGHTING DATA STAR 1	STAR_CONFIRM	SCALAR	TBD	SEC	1.04
TIME2	V95W4762C	TIME TAG FOR SIGHTING DATA STAR 2	STAR_CONFIRM	SCALAR	TBD	SEC	1.04
TIME3	V95W4763C	TIME TAG FOR SIGHTING DATA STAR 3	STAR_CONFIRM	SCALAR	TBD	SEC	1.04
IDNO(L)		SELECTED STAR ID: L = 1,2,3	STAR_CONFIRM	INTEGER	11–110	NA	1.04
I_STAR_SEL1	V95H4732C V95H4733C V95H4734C	UNIT LOS VECTOR FOR SELECTED STAR 1 IN M50 COORDINATES	IMU ORB A/CAL (4.208)	VECTOR	+/- 1	NA	1.04
I_STAR_SEL2	V95H4748C V95H4749C V95H4750C	UNIT LOS VECTOR FOR SELECTED STAR 2 IN M50 COORDINATES	IMU ORB A/CAL (4.208)	VECTOR	+/- 1	NA	1.04
BIAS(1)	V95U4966C	-Z COAS ANGULAR DIFFERENCE BETWEEN OLD AND NEW AXIS	S TRK/COAS CNTL (6.44) TLM	SCALAR	0–180	DEG	1.04
BIAS(2)	V95U4965C	X COAS ANGULAR DIFFERENCE BETWEEN OLD AND NEW AXIS	S TRK/COAS CNTL (6.44) TLM	SCALAR	0–180	DEG	1.04
H_COAS	V95H4941C	HORIZONTAL OFFSET OF -Z COAS INDICATION	S TRK/COAS CNTL (6.44) TLM REL NAV (6.11)	SCALAR	+/-180	DEG	1.04
V_COAS	V95H4940C	VERTICAL OFFSET OF -Z COAS INDICATION	S TRK/COAS CNTL (6.44) TLM REL NAV (6.11)	SCALAR	+/-180	DEG	1.04
SHUTR_MAN_IND_Y	V93X6629X	S TRK/COAS CNTL -Y A/F SHTR OP CMD	S TRK/COAS CNTL (6.44)	LOGICAL	0,1	NA	1.04
SHUTR_MAN_IND_Z	V93X6630X	S TRK/COAS CNTL -Z A/F SHTR OP CMD	S TRK/COAS CNTL (6.44)	LOGICAL	0,1	NA	1.04

Table 4.66.4.19-2. DISP_SUP Outputs

Name	MSID	Description	Output Destination	Signal Type	Range	Units	Rate (Hz)
ACCEPT	V93X6644X	S TRK/COAS CNTL COAS ACCEPT COMMAND	COAS_SIGHT	LOGICAL	0,1	NA	1.04
NAV_SIGHT	V95X4779X	NAVIGATION SIGHTING FLAG COAS	ORB/RND NAV (4.126); TLM	LOGICAL	0,1	NA	1.04
NAV_TARGET	V95X4778X	NAVIGATION TARGET FLAG	ORB/RND NAV (4.126); TLM	LOGICAL	0,1	NA	1.04
PASS		FIRST PASS FLAG	TARGET_TRK	LOGICAL	0,1	NA	1.04

4.66.5 Star Tracker SOP Parameter Tables

IDD TABLES

Tables 4.66.5–1 and 4.66.5–2 specifies the Star Tracker SOP IDD requirements.

In the event of a conflict between the IDD tables in Tables 4.66.5–1 and 4.66.5–2 and the internal input/output tables in Section 4.66, the IDD tables shall take precedence.

I-LOAD TABLES

Table 4.66.5–3 specifies Star Tracker SOP I-load requirements.

In the event of a conflict between the I-load tables in Table 4.66.5–3 and the internal tables in Section 4.66, the I-load tables shall take precedence.

K-LOAD TABLES

Table 4.66.5–4 specifies Star Tracker SOP K-load requirements.

In the event of a conflict between the K-load tables in Table 4.66.5–4 and the internal tables in Section 4.66, the K-load tables shall take precedence.

CONSTANT TABLES

Table 4.66.5–5 specifies Star Tracker SOP constants.

STAR TRACKER INPUT VARIABLE CROSS REFERENCE

An input variable cross-reference for table 4.66.5-1 is listed below.

Star Tracker SOP Input Variable Cross-Reference	
Local Name	Source Name
FALSE_TARG	FALSE_FLAG
HOR_ANG	HORIZ_ANG
NAV_FALSE_TARG	NAV_FALSE_TGT
RATE_EST	BOD_RATE
RP	R_AVGG
SIMU	SEL_IMU_ID
T_IMU_S	T_IMUS

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TABLE 4.66.5-1. INPUT FUNCTIONAL PARAMETERS FOR STAR TRACKER SUBSYSTEM OPERATING PROGRAM (G4.66)

FSSR NAME	M/S ID	NOMENCLATURE	SOURCE	UNITS	DATA TYPE	P R E C	L A S T C R	R E V	
ACCEPT	V93X6644X	COAS ACCEPT CMD	STAR TRKR/COAS DISP	BD	89673B				
AFT_ATT_REF_PB	V90X7701X	SEL AFT ADI ATT REF PB	GN&C SW RM	BD	93017G	*			
AREA(1)	V96H7217C	IMU 1 GIMBAL AREA PARAMETER	IMU INT PROC	DEG					
AREA(2)	V96H7218C	IMU 2 GIMBAL AREA PARAMETER	IMU INT PROC	DEG					
AREA(3)	V96H7219C	IMU 3 GIMBAL AREA PARAMETER	IMU INT PROC	DEG					
AZANG(1)	V95H0051CA	IMU 1 COMP AZIMUTH RES ANGLE	IMU INT PROC	DEG			93017G	*	
AZANG(2)	V95H1051CA	IMU 2 COMP AZIMUTH RES ANGLE	IMU INT PROC	DEG			93017G	*	
AZANG(3)	V95H2051CA	IMU 3 COMP AZIMUTH RES ANGLE	IMU INT PROC	DEG			93017G	*	
BREAKCOMY	V93X6614X	Y BREAK TRACK CMD	STAR TRKR/COAS DISP	BD					
BREAKCOMZ	V93X6615X	Z BREAK TRACK CMD	STAR TRKR/COAS DISP	BD					
CALSEL	V93X6645X	COAS CALIBRATE MODE CMD	STAR TRKR/COAS DISP	BD					
CLOCK/CLOCKTIME	V91W5000C	CLOCK-COMPUTER(GMT)	FCOS	S			93160B	*	
DATA_WORD1(1)	V71M5020P	-Z ST MODE STATUS	WD1	ST 1			HMD	93017G	*
DATA_WORD1(2)	V71M5520P	-Y ST MODE STATUS	WD1	ST 2			HMD	93017G	*
DATA_WORD2(1)	V71M5040P	-Z ST HORIZONTAL DATA & STATUS	WD2	ST 1			HMD	93017G	*
DATA_WORD2(2)	V71M5540P	-Y ST HORIZONTAL DATA & STATUS	WD2	ST 2			HMD	93017G	*
DATA_WORD3(1)	V71M5060P	-Z ST VERTICAL DATA & STATUS	WD3	ST 1			HMD	93017G	*
DATA_WORD3(2)	V71M5560P	-Y ST VERTICAL DATA & STATUS	WD3	ST 2			HMD	93017G	*
DESEL	V93X6647X	COAS DES CMD	STAR TRKR/COAS DISP	BD					
DP(1)	V99H2660CA	IMU-1 ROLL/PITCH NONORTHOGONALITY	IMU GND CAL	RAD				93017G	*
DP(2)	V99H2661CA	IMU-2 ROLL/PITCH NONORTHOGONALITY	IMU GND CAL	RAD				93017G	*
DP(3)	V99H2662CA	IMU-3 ROLL/PITCH NONORTHOGONALITY	IMU GND CAL	RAD				93017G	*
FALSE_FLAG	V90X1422X	FALSE TRACKING FLAG	ORB/RND NAV					89493B	
FWD_ATT_REF_PB	V90X7897X	STA SEL FWD ADI ATT REF PB	GN&C SW RM						
HORIZ_ANG(1)	V71H5041B	-Z ST HORIZONTAL POS	WD2 B0-11	ST 1			BSS	93017G	*
HORIZ_ANG(2)	V71H5541B	-Y ST HORIZONTAL POS	WD2 B0-11	ST 2			BSS	93017G	*
INTENS(1)	V71Q5029B	-Z ST STAR INTENSITY	WD1 B8-15	ST 1			BSU	93017G	*
INTENS(2)	V71Q5529B	-Y ST STAR INTENSITY	WD1 B8-15	ST 2			BSU	93017G	*
IRANG(1)	V95H0053CA	IMU 1 COMP INNER ROLL RES ANGLE	IMU INT PROC	DEG				93017G	*
IRANG(2)	V95H1053CA	IMU 2 COMP INNER ROLL RES ANGLE	IMU INT PROC	DEG				93017G	*
IRANG(3)	V95H2053CA	IMU 3 COMP INNER ROLL RES ANGLE	IMU INT PROC	DEG				93017G	*
I_STAR_SEL(101)X	V97U2721CA	STAR 101 UNIT VECT X COMP	UL	ND	SPL	S	91044C		
I_STAR_SEL(101)Y	V97U2722CA	STAR 101 UNIT VECT Y COMP	UL	ND	SPL	S	91044C		
I_STAR_SEL(101)Z	V97U2723CA	STAR 101 UNIT VECT Z COMP	UL	ND	SPL	S	91044C		
I_STAR_SEL(102)X	V97U2724CA	STAR 102 UNIT VECT X COMP	UL	ND	SPL	S	91044C		
I_STAR_SEL(102)Y	V97U2725CA	STAR 102 UNIT VECT Y COMP	UL	ND	SPL	S	91044C		
I_STAR_SEL(102)Z	V97U2726CA	STAR 102 UNIT VECT Z COMP	UL	ND	SPL	S	91044C		
I_STAR_SEL(103)X	V97U2727CA	STAR 103 UNIT VECT X COMP	UL	ND	SPL	S	91044C		
I_STAR_SEL(103)Y	V97U2728CA	STAR 103 UNIT VECT Y COMP	UL	ND	SPL	S	91044C		
I_STAR_SEL(103)Z	V97U2729CA	STAR 103 UNIT VECT Z COMP	UL	ND	SPL	S	91044C		
I_STAR_SEL(104)X	V97U2730CA	STAR 104 UNIT VECT X COMP	UL	ND	SPL	S	91044C		
I_STAR_SEL(104)Y	V97U2731CA	STAR 104 UNIT VECT Y COMP	UL	ND	SPL	S	91044C		
I_STAR_SEL(104)Z	V97U2732CA	STAR 104 UNIT VECT Z COMP	UL	ND	SPL	S	91044C		
I_STAR_SEL(105)X	V97U2733CA	STAR 105 UNIT VECT X COMP	UL	ND	SPL	S	91044C		
I_STAR_SEL(105)Y	V97U2734CA	STAR 105 UNIT VECT Y COMP	UL	ND	SPL	S	91044C		
I_STAR_SEL(105)Z	V97U2735CA	STAR 105 UNIT VECT Z COMP	UL	ND	SPL	S	91044C		

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TABLE 4.66.5-1. INPUT FUNCTIONAL PARAMETERS FOR STAR TRACKER SUBSYSTEM OPERATING PROGRAM (G4.66)

FSSR NAME	M/S ID	NOMENCLATURE	SOURCE	UNITS	DATA TYPE	P R E C	L A S T	C R E V	R E C
I_STAR_SEL(106)X	V97U2736CA	STAR 106 UNIT VECT X COMP	UL	ND	SPL	S	91044C		
I_STAR_SEL(106)Y	V97U2737CA	STAR 106 UNIT VECT Y COMP	UL	ND	SPL	S	91044C		
I_STAR_SEL(106)Z	V97U2738CA	STAR 106 UNIT VECT Z COMP	UL	ND	SPL	S	91044C		
I_STAR_SEL(107)X	V97U2739CA	STAR 107 UNIT VECT X COMP	UL	ND	SPL	S	91044C		
I_STAR_SEL(107)Y	V97U2740CA	STAR 107 UNIT VECT Y COMP	UL	ND	SPL	S	91044C		
I_STAR_SEL(107)Z	V97U2741CA	STAR 107 UNIT VECT Z COMP	UL	ND	SPL	S	91044C		
I_STAR_SEL(108)X	V97U2742CA	STAR 108 UNIT VECT X COMP	UL	ND	SPL	S	91044C		
I_STAR_SEL(108)Y	V97U2743CA	STAR 108 UNIT VECT Y COMP	UL	ND	SPL	S	91044C		
I_STAR_SEL(108)Z	V97U2744CA	STAR 108 UNIT VECT Z COMP	UL	ND	SPL	S	91044C		
I_STAR_SEL(109)X	V97U2745CA	STAR 109 UNIT VECT X COMP	UL	ND	SPL	S	91044C		
I_STAR_SEL(109)Y	V97U2746CA	STAR 109 UNIT VECT Y COMP	UL	ND	SPL	S	91044C		
I_STAR_SEL(109)Z	V97U2747CA	STAR 109 UNIT VECT Z COMP	UL	ND	SPL	S	91044C		
I_STAR_SEL(110)X	V97U2748CA	STAR 110 UNIT VECT X COMP	UL	ND	SPL	S	91044C		
I_STAR_SEL(110)Y	V97U2749CA	STAR 110 UNIT VECT Y COMP	UL	ND	SPL	S	91044C		
I_STAR_SEL(110)Z	V97U2750CA	STAR 110 UNIT VECT Z COMP	UL	ND	SPL	S	91044C		
NAV_FALSE_TGT	V90X4300X	FALSE TARGET FLAG FOR DISP	ORB/RND NAV	BD	93017G	*			
NOT_BOA(1)	V71X5076B	-Z ST BRT OBJECT ALERT OFF	WD3B15	ST 1	BD	93017G	*		
NOT_BOA(2)	V71X5576B	-Y ST BRT OBJECT ALERT OFF	WD3B15	ST 2	BD	93017G	*		
ORANG(1)	V95H0054CA	IMU 1 COMP OUTER ROLL RES ANGLE	IMU INT PROC	DEG		93017G	*		
ORANG(2)	V95H1054CA	IMU 2 COMP OUTER ROLL RES ANGLE	IMU INT PROC	DEG		93017G	*		
ORANG(3)	V95H2054CA	IMU 3 COMP OUTER ROLL RES ANGLE	IMU INT PROC	DEG		93017G	*		
PANG(1)	V95H0050CA	IMU 1 COMP PITCH RES ANGLE	IMU INT PROC	DEG		93017G	*		
PANG(2)	V95H1050CA	IMU 2 COMP PITCH RES ANGLE	IMU INT PROC	DEG		93017G	*		
PANG(3)	V95H2050CA	IMU 3 COMP PITCH RES ANGLE	IMU INT PROC	DEG		93017G	*		
PS_NOT_FAIL(1)	V71X5075B	-Z ST POWER SUPPLY GOOD	WD3B14	ST 1	BD	93017G	*		
PS_NOT_FAIL(2)	V71X5575B	-Y ST POWER SUPPLY GOOD	WD3B14	ST 2	BD	93017G	*		
P_ORB	V90R5301CA	SELECTED RGA ROLL RATE	SF	DEG/S		93017G	*		
Q_ORB/Q	V90R5321CA	SELECTED RGA PITCH RATE	SF	DEG/S		93017G	*		
RATE_EST(1)/BOD_RATE(1)	V90R2223C	IMU DERIVED BODY RATE X-AXIS	ORB DAP	DEG/S	SPL	93017G	*		
RATE_EST(2)/BOD_RATE(2)	V90R2224C	IMU DERIVED BODY RATE Y-AXIS	ORB DAP	DEG/S	SPL	93017G	*		
RATE_EST(3)/BOD_RATE(3)	V90R2225C	IMU DERIVED BODY RATE Z-AXIS	ORB DAP	DEG/S	SPL	93017G	*		
REQD_ID	V93Q6638C	COAS TRACK ID	STAR TRKR/COAS DISP	VAR					
R_AVGG(1)	V95H0185CC	X-COMP OF CUR SHUTTLE POS VCTR M50	ENT UPP	FT	DPL	93017G	*		
R_AVGG(1)	V95H0185CF	X-COMP OF CUR SHUTTLE POS VCTR M50	ORB UPP	FT	DPL	93017G	*		
R_AVGG(2)	V95H0186CC	Y-COMP OF CUR SHUTTLE POS VCTR M50	ENT UPP	FT	DPL	93017G	*		
R_AVGG(2)	V95H0186CF	Y-COMP OF CUR SHUTTLE POS VCTR M50	ORB UPP	FT	DPL	93017G	*		
R_AVGG(3)	V95H0187CC	Z-COMP OF CUR SHUTTLE POS VCTR M50	ENT UPP	FT	DPL	93017G	*		
R_AVGG(3)	V95H0187CF	Z-COMP OF CUR SHUTTLE POS VCTR M50	ORB UPP	FT	DPL	93017G	*		
R_ORB	V90R5341CA	SELECTED RGA YAW RATE	SF	DEG/S		93017G	*		
R_TARGET(1)	V95H0862C	X-COMP OF CURRENT TARGET POS VCTR	ORB UPP	FT	DPL	93017G	*		
R_TARGET(2)	V95H0863C	Y-COMP OF CURRENT TARGET POS VCTR	ORB UPP	FT	DPL	93017G	*		
R_TARGET(3)	V95H0864C	Z-COMP OF CURRENT TARGET POS VCTR	ORB UPP	FT	DPL	93017G	*		
SEL_ID	V93Q6622C	Y SELECT STAR ID	STAR TRKR/COAS DISP	VAR					
SEL_ID	V93Q6623C	Z SELECT STAR ID	STAR TRKR/COAS DISP	VAR					
SEL_IMU_ID	V90J2560C	SELECTED IMU ID	IMU RM	HXS	93017G	*			
SHUTY	V93X6629XA	Y A/F SHTR OP CMD	STAR TRKR/COAS DISP						

TABLE 4.66.5-1. INPUT FUNCTIONAL PARAMETERS FOR STAR TRACKER SUBSYSTEM OPERATING PROGRAM (G4.66)

FSSR NAME	M/S ID	NOMENCLATURE	SOURCE	UNITS	DATA TYPE	P R E C	L A S T C R	R E V
SHUTZ	V93X6630XA	Z A/F SHTR OP CMD	STAR TRKR/COAS DISP					
SHUT_CLOS(1)	V71X5024B	-Z ST SHUTTER CLOSED	WD1 B3	ST 1	BD		93017G	*
SHUT_CLOS(2)	V71X5524B	-Y ST SHUTTER CLOSED	WD1 B3	ST 2	BD		93017G	*
SIGHTSEL	V93X6643X	COAS SIGHT MODE	STAR TRKR/COAS DISP		BD			
SLCT1	V93X6633X	TABLE 1 ALIGN SEL	STAR TRKR/COAS DISP		BD			
SLCT2	V93X6634X	TABLE 2 ALIGN SEL	STAR TRKR/COAS DISP		BD			
SLCT3	V93X6635X	TABLE 3 ALIGN SEL	STAR TRKR/COAS DISP		BD			
STARCOMY	V93X6604X	Y STAR TRACK CMD	STAR TRKR/COAS DISP		BD		89673B	
STARCOMZ	V93X6605X	Z STAR TRACK CMD	STAR TRKR/COAS DISP		BD		89673B	
STAR_PRES(1)	V71X5026B	-Z ST STAR PRESENT	WD1 B5	ST 1	BD		93017G	*
STAR_PRES(2)	V71X5526B	-Y ST STAR PRESENT	WD1 B5	ST 2	BD		93017G	*
STJ	V91J3201C	SELECTED STAR TRACKER	FCOS					
STSELFCOMY	V93X6601X	Y SLF TST MODE CMD	STAR TRKR/COAS DISP		BD			
STSELFCOMZ	V93X6602X	Z SLF TST MODE CMD	STAR TRKR/COAS DISP		BD			
STTARCOMY	V93X6610X	Y TARGET TRACK CMD	STAR TRKR/COAS DISP		BD			
STTARCOMZ	V93X6611X	Z TARGET TRACK CMD	STAR TRKR/COAS DISP		BD			
STTERMCOMY	V93X6618X	Y TERM IDLE CMD	STAR TRKR/COAS DISP		BD			
STTERMCOMZ	V93X6619X	Z TERM IDLE CMD	STAR TRKR/COAS DISP		BD			
ST_AL_COMP	V95X0545X	ST BASED ALIGN COMPLETE	IMU ORB A/CAL					
ST_CF(1)	V91X2714X	-Z ST COMMFAULT	FCOS					
ST_CF(2)	V91X2715X	-Y ST COMMFAULT	FCOS					
ST_SELF_TEST(1)	V71X5025B	-Z ST SELF-TEST	WD1 B4	ST 1	BD		93017G	*
ST_SELF_TEST(2)	V71X5525B	-Y ST SELF TEST ENGAGED	WD1 B4	ST 2	BD		93017G	*
S_TBLE_CLR	V93X6636X	S TABLE CLEAR CMD	STAR TRKR/COAS DISP		BD			
THOLDY	V93Q6625C	Y STAR MAGNITUDE THLD	STAR TRKR/COAS DISP		VAR			
THOLDZ	V93Q6626C	Z STAR MAGNITUDE THLD	STAR TRKR/COAS DISP		VAR			
TRACK_NOT_FAIL(1)	V71X5021B	-Z ST TRACKER GOOD	WD1B0	ST 1	BD		93017G	*
TRACK_NOT_FAIL(2)	V71X5521B	-Y ST TRACKER GOOD	WD1B0	ST 2	BD		93017G	*
T_CLUSTER_M50(1,1,1)	V99U3450CA	CLUSTER TO M50/IMU-1 COMPONENT 1,1	IMU ORB A/CAL				93017G	*
T_CLUSTER_M50(1,1,1)	V99U3450CB	CLUSTER TO M50/IMU-1 COMPONENT 1,1	IMU GC ALIGN				93017G	*
T_CLUSTER_M50(1,1,2)	V99U3453CA	CLUSTER TO M50/IMU-1 COMPONENT 1,2	IMU ORB A/CAL				93017G	*
T_CLUSTER_M50(1,1,2)	V99U3453CB	CLUSTER TO M50/IMU-1 COMPONENT 1,2	IMU GC ALIGN				93017G	*
T_CLUSTER_M50(1,1,3)	V99U3456CA	CLUSTER TO M50/IMU-1 COMPONENT 1,3	IMU ORB A/CAL				93017G	*
T_CLUSTER_M50(1,1,3)	V99U3456CB	CLUSTER TO M50/IMU-1 COMPONENT 1,3	IMU GC ALIGN				93017G	*
T_CLUSTER_M50(1,2,1)	V99U3459CA	CLUSTER TO M50/IMU 1 COMPONENT 2,1	IMU ORB A/CAL				93017G	*
T_CLUSTER_M50(1,2,1)	V99U3459CB	CLUSTER TO M50/IMU 1 COMPONENT 2,1	IMU GC ALIGN				93017G	*
T_CLUSTER_M50(1,2,2)	V99U3462CA	CLUSTER TO M50/IMU-1 COMPONENT 2,2	IMU ORB A/CAL				93017G	*
T_CLUSTER_M50(1,2,2)	V99U3462CB	CLUSTER TO M50/IMU-1 COMPONENT 2,2	IMU GC ALIGN				93017G	*
T_CLUSTER_M50(1,2,3)	V99U3465CA	CLUSTER TO M50/IMU-1 COMPONENT 2,3	IMU ORB A/CAL				93017G	*
T_CLUSTER_M50(1,2,3)	V99U3465CB	CLUSTER TO M50/IMU-1 COMPONENT 2,3	IMU GC ALIGN				93017G	*
T_CLUSTER_M50(1,3,1)	V99U3468CA	CLUSTER TO M50/IMU-1 COMPONENT 3,1	IMU ORB A/CAL				93017G	*
T_CLUSTER_M50(1,3,1)	V99U3468CB	CLUSTER TO M50/IMU-1 COMPONENT 3,1	IMU GC ALIGN				93017G	*
T_CLUSTER_M50(1,3,2)	V99U3471CA	CLUSTER TO M50/IMU-1 COMPONENT 3,2	IMU ORB A/CAL				93017G	*
T_CLUSTER_M50(1,3,2)	V99U3471CB	CLUSTER TO M50/IMU-1 COMPONENT 3,2	IMU GC ALIGN				93017G	*
T_CLUSTER_M50(1,3,3)	V99U3474CA	CLUSTER TO M50/IMU-1 COMPONENT 3,3	IMU ORB A/CAL				93017G	*
T_CLUSTER_M50(1,3,3)	V99U3474CB	CLUSTER TO M50/IMU-1 COMPONENT 3,3	IMU GC ALIGN				93017G	*

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TABLE 4.66.5-1. INPUT FUNCTIONAL PARAMETERS FOR STAR TRACKER SUBSYSTEM OPERATING PROGRAM (G4.66)

FSSR NAME	M/S ID	NOMENCLATURE	SOURCE	UNITS	DATA TYPE	P R E C	L A S T	C R E V	R E V
T_CLUSTER_M50(2,1,1)	V99U3451CA	CLUSTER TO M50/IMU-2 COMPONENT 1,1	IMU ORB A/CAL				93017G	*	
T_CLUSTER_M50(2,1,1)	V99U3451CB	CLUSTER TO M50/IMU-2 COMPONENT 1,1	IMU GC ALIGN				93017G	*	
T_CLUSTER_M50(2,1,2)	V99U3454CA	CLUSTER TO M50/IMU-2 COMPONENT 1,2	IMU ORB A/CAL				93017G	*	
T_CLUSTER_M50(2,1,2)	V99U3454CB	CLUSTER TO M50/IMU-2 COMPONENT 1,2	IMU GC ALIGN				93017G	*	
T_CLUSTER_M50(2,1,3)	V99U3457CA	CLUSTER TO M50/IMU-2 COMPONENT 1,3	IMU ORB A/CAL				93017G	*	
T_CLUSTER_M50(2,1,3)	V99U3457CB	CLUSTER TO M50/IMU-2 COMPONENT 1,3	IMU GC ALIGN				93017G	*	
T_CLUSTER_M50(2,2,1)	V99U3460CA	CLUSTER TO M50/IMU-2 COMPONENT 2,1	IMU ORB A/CAL				93017G	*	
T_CLUSTER_M50(2,2,1)	V99U3460CB	CLUSTER TO M50/IMU-2 COMPONENT 2,1	IMU GC ALIGN				93017G	*	
T_CLUSTER_M50(2,2,2)	V99U3463CA	CLUSTER TO M50/IMU-2 COMPONENT 2,2	IMU ORB A/CAL				93017G	*	
T_CLUSTER_M50(2,2,2)	V99U3463CB	CLUSTER TO M50/IMU-2 COMPONENT 2,2	IMU GC ALIGN				93017G	*	
T_CLUSTER_M50(2,2,3)	V99U3466CA	CLUSTER TO M50/IMU-2 COMPONENT 2,3	IMU ORB A/CAL				93017G	*	
T_CLUSTER_M50(2,2,3)	V99U3466CB	CLUSTER TO M50/IMU-2 COMPONENT 2,3	IMU GC ALIGN				93017G	*	
T_CLUSTER_M50(2,3,1)	V99U3469CA	CLUSTER TO M50/IMU-2 COMPONENT 3,1	IMU ORB A/CAL				93017G	*	
T_CLUSTER_M50(2,3,1)	V99U3469CB	CLUSTER TO M50/IMU-2 COMPONENT 3,1	IMU GC ALIGN				93017G	*	
T_CLUSTER_M50(2,3,2)	V99U3472CA	CLUSTER TO M50/IMU-2 COMPONENT 3,2	IMU ORB A/CAL				93017G	*	
T_CLUSTER_M50(2,3,2)	V99U3472CB	CLUSTER TO M50/IMU-2 COMPONENT 3,2	IMU GC ALIGN				93017G	*	
T_CLUSTER_M50(2,3,3)	V99U3475CA	CLUSTER TO M50/IMU-2 COMPONENT 3,3	IMU ORB A/CAL				93017G	*	
T_CLUSTER_M50(2,3,3)	V99U3475CB	CLUSTER TO M50/IMU-2 COMPONENT 3,3	IMU GC ALIGN				93017G	*	
T_CLUSTER_M50(3,1,1)	V99U3452CA	CLUSTER TO M50/IMU-3 COMPONENT 1,1	IMU ORB A/CAL				93017G	*	
T_CLUSTER_M50(3,1,1)	V99U3452CB	CLUSTER TO M50/IMU-3 COMPONENT 1,1	IMU GC ALIGN				93017G	*	
T_CLUSTER_M50(3,1,2)	V99U3455CA	CLUSTER TO M50/IMU-3 COMPONENT 1,2	IMU ORB A/CAL				93017G	*	
T_CLUSTER_M50(3,1,2)	V99U3455CB	CLUSTER TO M50/IMU-3 COMPONENT 1,2	IMU GC ALIGN				93017G	*	
T_CLUSTER_M50(3,1,3)	V99U3458CA	CLUSTER TO M50/IMU-3 COMPONENT 1,3	IMU ORB A/CAL				93017G	*	
T_CLUSTER_M50(3,1,3)	V99U3458CB	CLUSTER TO M50/IMU-3 COMPONENT 1,3	IMU GC ALIGN				93017G	*	
T_CLUSTER_M50(3,2,1)	V99U3461CA	CLUSTER TO M50/IMU-3 COMPONENT 2,1	IMU ORB A/CAL				93017G	*	
T_CLUSTER_M50(3,2,1)	V99U3461CB	CLUSTER TO M50/IMU-3 COMPONENT 2,1	IMU GC ALIGN				93017G	*	
T_CLUSTER_M50(3,2,2)	V99U3464CA	CLUSTER TO M50/IMU-3 COMPONENT 2,2	IMU ORB A/CAL				93017G	*	
T_CLUSTER_M50(3,2,2)	V99U3464CB	CLUSTER TO M50/IMU-3 COMPONENT 2,2	IMU GC ALIGN				93017G	*	
T_CLUSTER_M50(3,2,3)	V99U3467CA	CLUSTER TO M50/IMU-3 COMPONENT 2,3	IMU ORB A/CAL				93017G	*	
T_CLUSTER_M50(3,2,3)	V99U3467CB	CLUSTER TO M50/IMU-3 COMPONENT 2,3	IMU GC ALIGN				93017G	*	
T_CLUSTER_M50(3,3,1)	V99U3470CA	CLUSTER TO M50/IMU-3 COMPONENT 3,1	IMU ORB A/CAL				93017G	*	
T_CLUSTER_M50(3,3,1)	V99U3470CB	CLUSTER TO M50/IMU-3 COMPONENT 3,1	IMU GC ALIGN				93017G	*	
T_CLUSTER_M50(3,3,2)	V99U3473CA	CLUSTER TO M50/IMU-3 COMPONENT 3,2	IMU ORB A/CAL				93017G	*	
T_CLUSTER_M50(3,3,2)	V99U3473CB	CLUSTER TO M50/IMU-3 COMPONENT 3,2	IMU GC ALIGN				93017G	*	
T_CLUSTER_M50(3,3,3)	V99U3476CA	CLUSTER TO M50/IMU-3 COMPONENT 3,3	IMU ORB A/CAL				93017G	*	
T_CLUSTER_M50(3,3,3)	V99U3476CB	CLUSTER TO M50/IMU-3 COMPONENT 3,3	IMU GC ALIGN				93017G	*	
T_IMUS	V95W0002C	IMU INPUT TRANS TIME TAG	IMU INT PROC	S	DPL		93017G	*	
UPDATE(1)	V93X6650X	COAS -Z CALIBRATE UPDATE	STAR TRKR/COAS DISP		BD		89673B		
UPDATE(2)	V93X6649X	COAS +X CALIBRATE UPDATE	STAR TRKR/COAS DISP		BD		89673B		
VERT_ANG(1)	V71H5061B	-Z ST VERTICAL POS WD3 B0-11	ST 1	DEG	BSS		93017G	*	
VERT_ANG(2)	V71H5561B	-Y ST VERTICAL POS WD3 B0-11	ST 2	DEG	BSS		93017G	*	
V_AVGG(1)	V95L0190CC	X-COMP OF CUR SHUTTLE VEL VCTR M50	ENT UPP		FT/S		93017G	*	
V_AVGG(1)	V95L0190CF	X-COMP OF CUR SHUTTLE VEL VCTR M50	ORB UPP		FT/S		93017G	*	
V_AVGG(2)	V95L0191CC	Y-COMP OF CUR SHUTTLE VEL VCTR M50	ENT UPP		FT/S		93017G	*	
V_AVGG(2)	V95L0191CF	Y-COMP OF CUR SHUTTLE VEL VCTR M50	ORB UPP		FT/S		93017G	*	
V_AVGG(3)	V95L0192CC	Z-COMP OF CUR SHUTTLE VEL VCTR M50	ENT UPP		FT/S		93017G	*	

TABLE 4.66.5-1. INPUT FUNCTIONAL PARAMETERS FOR STAR TRACKER SUBSYSTEM OPERATING PROGRAM (G4.66)

FSSR NAME	M/S ID	NOMENCLATURE	SOURCE	UNITS	DATA TYPE	P R E C	L A S T	C R E V
V_AVGG(3)	V95L0192CF	Z-COMP OF CUR SHUTTLE VEL VCTR M50	ORB UPP	FT/S	SPL		93017G	*
XPOS	V93X6640X	COAS +X LOC CMD	STAR TRKR/COAS DISP	BD				
YPOS	V93X6641X	COAS -Z LOC CMD	STAR TRKR/COAS DISP	BD				
	V71X5022B	-Z ST TGT SUPPRES/HI BACKGRD WD1B1	ST 1		BD		93017G	*
	V71X5023B	-Z ST TRANSMISSION WORD GOOD WD1B2	ST 1		BD		93017G	*
	V71X5027B	-Z ST TEMP /CCD TEMP MSB	WD1B6	ST 1			93017G	*
	V71X5028B	-Z ST TEMP /CCD TEMP LSB	WD1B7	ST 1			93017G	*
	V71X5053B	-Z ST BIT ERR/EEPROM MISCOMPWD2B12	ST 1		BD		93017G	*
	V71X5054B	-Z ST MANCH NV/RAM-ROM FAIL WD2B13	ST 1		BD		93017G	*
	V71X5055B	-Z ST PAR ERR/WDOG TIME-OUT WD2B14	ST 1		BD		93017G	*
	V71X5056B	-Z ST PRESSURE FAIL	WD2 B15	ST 1			93017G	*
	V71X5073B	-Z ST SELF TEST ANGLE ERR	WD3 B12	ST 1			93017G	*
	V71X5074B	-Z ST SELF TEST MAGTD ERR	WD3 B13	ST 1			93017G	*
	V71X5522B	-Y ST TGT SUPPRES/HI BACKGRD WD1B1	ST 2		BD		93017G	*
	V71X5523B	-Y ST TRANSMISSION WORD GOOD WD1B2	ST 2		BD		93017G	*
	V71X5527B	-Y ST TEMP /CCD TEMP MSB	WD1B6	ST 2			93017G	*
	V71X5528B	-Y ST TEMP /CCD TEMP LSB	WD1B7	ST 2			93017G	*
	V71X5533B	-Y ST BIT ERR/EEPROM MISCOMPWD2B12	ST 2		BD		93017G	*
	V71X5544B	-Y ST MANCH NV/RAM-ROM FAIL WD2B13	ST 2		BD		93017G	*
	V71X5555B	-Y ST PAR ERR/WDOG TIME-OUT WD2B14	ST 2		BD		93017G	*
	V71X5556B	-Y ST PRESSURE FAIL	WD2 B15	ST 2			93017G	*
	V71X5573B	-Y ST SELF TEST ANGLE ERR	WD3 B12	ST 2			93017G	*
	V71X5574B	-Y ST SELF TEST MAGTD ERR	WD3 B13	ST 2			93017G	*

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

TABLE 4.66.5-2. OUTPUT FUNCTIONAL PARAMETERS FROM STAR TRACKER SUBSYSTEM OPERATING PROGRAM (G4.66)

FSSR NAME	M/S ID	NOMENCLATURE	DESTINATION	UNITS	DATA TYPE	P R E C	L A S T C R	R E V	
ALIGN_COMP	V95X4986X	ST BASED ALIGN COMPLETE	IMU ORB A/CAL						
AL_ENABLE	V95X4995X	ALIGN ENABLE FLAG	IMU ALIGN DISP TLM				BD		
ANGDIF1	V95U4949C	STAR 1 ANGULAR DIFFERENCE	DL FMT 22/1 DL FMT 23/1 STAR TRKR/COAS DISP	DEG	SPL		93017G	*	
ANGDIF2	V95U4950C	STAR 2 ANGULAR DIFFERENCE	DL FMT 22/1 DL FMT 23/1 STAR TRKR/COAS DISP	DEG	SPL		93017G	*	
ANGDIF3	V95U4951C	STAR 3 ANGULAR DIFFERENCE	DL FMT 22/1 DL FMT 23/1 STAR TRKR/COAS DISP	DEG	SPL		93017G	*	
ANGERR1	V95U4952C	STAR 1 ANGULAR ERROR	DL FMT 22/1 DL FMT 23/1 STAR TRKR/COAS DISP	DEG	SPL		93017G	*	
ANGERR2	V95U4953C	STAR 2 ANGULAR ERROR	DL FMT 22/1 DL FMT 23/1 STAR TRKR/COAS DISP	DEG	SPL		93017G	*	
ANGERR3	V95U4954C	STAR 3 ANGULAR ERROR	DL FMT 22/1 DL FMT 23/1 STAR TRKR/COAS DISP	DEG	SPL		93017G	*	
AXN	V95X4972X	SELECTED COAS AXIS X OR -Z	DL FMT 22/1 DL FMT 23/1 ORB/RND NAV		HXS		93017G	*	
BIAS(1)	V95U4966C	-Z COAS ANG DIFF-OLD TO NEW AXIS	DL FMT 22/1 STAR TRKR/COAS DISP	DEG	DPL		93017G	*	
BIAS(2)	V95U4965C	+X COAS ANG DIFF-OLD TO NEW AXIS	DL FMT 22/1 STAR TRKR/COAS DISP	DEG	DPL		93017G	*	
BITE_I(1)	V95X4927X	-Z ST BITE INDICATION	STAR TRKR/COAS DISP				BD		
BITE_I(2)	V95X4928X	-Y ST BITE INDICATION	STAR TRKR/COAS DISP				BD		
BITE_II	V95X4731X	ST IN TGT TRK BITE IND	REL NAV DISP				BD		
BREAK_T(1)	V71K5323B	-Z ST BREAK TRACK CMD	WD1 B2	DL FMT 22/1 DL FMT 23/1 ST 1			BD	93017G	*
BREAK_T(2)	V71K5823B	-Y ST BREAK TRACK CMD	WD1 B2	DL FMT 22/1 DL FMT 23/1 ST 2			BD	93017G	*
CAL_I	V95X4964X	CALIB MODE INDICATION	DL FMT 22/1 STAR TRKR/COAS DISP				BD	93017G	*
CMD_WORD(1)	V71M5320P	-Z ST COMMAND WORD	DL FMT 22/1 DL FMT 23/1 ST 1		HMD		93017G	*	
CMD_WORD(2)	V71M5820P	-Y ST COMMAND WORD	DL FMT 22/1 DL FMT 23/1 ST 2		HMD		93017G	*	

TABLE 4.66.5-2. OUTPUT FUNCTIONAL PARAMETERS FROM STAR TRACKER SUBSYSTEM OPERATING PROGRAM (G4.66)

FSSR NAME	M/S ID	NOMENCLATURE	DESTINATION	UNITS	DATA TYPE	P R E C	L A S T C R	R E V
COAS_HORIZ(+X)	V95U4968C	COAS +X HORIZ CALIBRATION ANGLE	ORB/RND NAV TLM	RAD				
COAS_HORIZ(-Z)	V95U4969C	COAS -Z HORIZ CALIBRATION ANGLE	ORB/RND NAV TLM	RAD				
COAS_VERT(+X)	V95U4993C	COAS +X VERT CALIBRATION ANGLE	ORB/RND NAV TLM	RAD				
COAS_VERT(-Z)	V95U4992C	COAS -Z VERT CALIBRATION ANGLE	ORB/RND NAV TLM	RAD				
DATA_GOOD	V95X4771X	DATA GOOD FLAG	ORB/RND NAV TLM					
D_ANG(1)	V95U4960C	-Z ST OUTPUT DELTA ANGLE	DL FMT 22/1 DL FMT 23/1 STAR TRKR/COAS DISP	DEG	SPL	93017G	*	
D_ANG(2)	V95U4961C	-Y ST OUTPUT DELTA ANGLE	DL FMT 22/1 DL FMT 23/1 STAR TRKR/COAS DISP	DEG	SPL	93017G	*	
D_TIME1	V95W4946C	STAR 1 DELTA TIME	DL FMT 22/1 STAR TRKR/COAS DISP	MIN	DPL	93017G	*	
D_TIME2	V95W4947C	STAR 2 DELTA TIME	DL FMT 22/1 STAR TRKR/COAS DISP	MIN	DPL	93017G	*	
D_TIME3	V95W4948C	STAR 3 DELTA TIME	DL FMT 22/1 DL FMT 23/1 STAR TRKR/COAS DISP	MIN	DPL	93017G	*	
H_ANG(1)	V95H4825C	-Z ST HORIZ ANGLE OFFSET	TLM	RAD			89939A	
H_ANG(2)	V95H4826C	-Y ST HORIZ ANGLE OFFSET	TLM	RAD			89939A	
H_ANG_CMD(1)	V71K5327B	-Z ST HORIZ OFFSET CMD	WD1 B6-10 DL FMT 22/1 DL FMT 23/1 ST 1	DEG	BMD	93017G	*	
H_ANG_CMD(2)	V71K5827B	-Y ST HORIZ OFFSET CMD	WD1 B6-10 DL FMT 22/1 DL FMT 23/1 ST 2	DEG	BMD	93017G	*	
H_COAS	V95H4941C	HORIZ OFFSET OF -Z COAS IND	DL FMT 22/1 REL NAV DISP STAR TRKR/COAS DISP	DEG	SPL	93017G	*	
H_NAV	V95H4753C	SEL ST AVERAGE HORIZONTAL ANGLE	ORB/RND NAV TLM	RAD				
I_CO(1,1)	V95U4850C	COAS -Z CUR LOS UNIT VECT/COMP 1,1	DL FMT 22/1	ND	SPL	93017G	*	
I_CO(1,2)	V95U4851C	COAS -Z CUR LOS UNIT VECT/COMP 1,2	DL FMT 22/1	ND	SPL	93017G	*	
I_CO(1,3)	V95U4852C	COAS -Z CUR LOS UNIT VECT/COMP 1,3	DL FMT 22/1	ND	SPL	93017G	*	
I_CO(2,1)	V95U4853C	COAS +X CUR LOS UNIT VECT/COMP 2,1	DL FMT 22/1	ND	SPL	93017G	*	
I_CO(2,2)	V95U4854C	COAS +X CUR LOS UNIT VECT/COMP 2,2	DL FMT 22/1	ND	SPL	93017G	*	
I_CO(2,3)	V95U4855C	COAS +X CUR LOS UNIT VECT/COMP 2,3	DL FMT 22/1	ND	SPL	93017G	*	
I_COAS(1,1)	V99U5610C	COAS -Z LOS UNIT VECT/COMP 1,1	DL FMT 22/1	ND	SPL	93017G	*	
I_COAS(1,2)	V99U5611C	COAS -Z LOS UNIT VECT/COMP 1,2	DL FMT 22/1	ND	SPL	93017G	*	
I_COAS(1,3)	V99U5612C	COAS -Z LOS UNIT VECT/COMP 1,3	DL FMT 22/1	ND	SPL	93017G	*	
I_COAS(2,1)	V99U5613C	COAS +X LOS UNIT VECT/COMP 2,1	DL FMT 22/1	ND	SPL	93017G	*	

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TABLE 4.66.5-2. OUTPUT FUNCTIONAL PARAMETERS FROM STAR TRACKER SUBSYSTEM OPERATING PROGRAM (G4.66)

FSSR NAME	M/S ID	NOMENCLATURE	DESTINATION	UNITS	DATA TYPE	P R E C	L A S T	C R E V	R E C
I_COAS(2,2)	V99U5614C	COAS +X LOS UNIT VECT/COMP 2,2	DL FMT 22/1	ND	SPL		93017G	*	
I_COAS(2,3)	V99U5615C	COAS +X LOS UNIT VECT/COMP 2,3	DL FMT 22/1	ND	SPL		93017G	*	
I_STAR_SEL(101)X	V97U2721CB	STAR 101 UNIT VECT X COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(101)Y	V97U2722CB	STAR 101 UNIT VECT Y COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(101)Z	V97U2723CB	STAR 101 UNIT VECT Z COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(102)X	V97U2724CB	STAR 102 UNIT VECT X COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(102)Y	V97U2725CB	STAR 102 UNIT VECT Y COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(102)Z	V97U2726CB	STAR 102 UNIT VECT Z COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(103)X	V97U2727CB	STAR 103 UNIT VECT X COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(103)Y	V97U2728CB	STAR 103 UNIT VECT Y COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(103)Z	V97U2729CB	STAR 103 UNIT VECT Z COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(104)X	V97U2730CB	STAR 104 UNIT VECT X COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(104)Y	V97U2731CB	STAR 104 UNIT VECT Y COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(104)Z	V97U2732CB	STAR 104 UNIT VECT Z COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(105)X	V97U2733CB	STAR 105 UNIT VECT X COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(105)Y	V97U2734CB	STAR 105 UNIT VECT Y COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(105)Z	V97U2735CB	STAR 105 UNIT VECT Z COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(106)X	V97U2736CB	STAR 106 UNIT VECT X COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(106)Y	V97U2737CB	STAR 106 UNIT VECT Y COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(106)Z	V97U2738CB	STAR 106 UNIT VECT Z COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(107)X	V97U2739CB	STAR 107 UNIT VECT X COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(107)Y	V97U2740CB	STAR 107 UNIT VECT Y COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(107)Z	V97U2741CB	STAR 107 UNIT VECT Z COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(108)X	V97U2742CB	STAR 108 UNIT VECT X COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(108)Y	V97U2743CB	STAR 108 UNIT VECT Y COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(108)Z	V97U2744CB	STAR 108 UNIT VECT Z COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(109)X	V97U2745CB	STAR 109 UNIT VECT X COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(109)Y	V97U2746CB	STAR 109 UNIT VECT Y COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(109)Z	V97U2747CB	STAR 109 UNIT VECT Z COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(110)X	V97U2748CB	STAR 110 UNIT VECT X COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(110)Y	V97U2749CB	STAR 110 UNIT VECT Y COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL(110)Z	V97U2750CB	STAR 110 UNIT VECT Z COMP	DL FMT 22/1	ND	SPL	S	93017G	*	
I_STAR_SEL1(1)	V95H4732C	X-COMP UNIT LOS VECT-SEL STAR1-M50	IMU ORB A/CAL						
I_STAR_SEL1(2)	V95H4733C	Y-COMP UNIT LOS VECT-SEL STAR1-M50	IMU ORB A/CAL						
I_STAR_SEL1(3)	V95H4734C	Z-COMP UNIT LOS VECT-SEL STAR1-M50	IMU ORB A/CAL						
I_STAR_SEL2(1)	V95H4748C	X-COMP UNIT LOS VECT-SEL STAR2-M50	IMU ORB A/CAL						
I_STAR_SEL2(2)	V95H4749C	Y-COMP UNIT LOS VECT-SEL STAR2-M50	IMU ORB A/CAL						
I_STAR_SEL2(3)	V95H4750C	Z-COMP UNIT LOS VECT-SEL STAR2-M50	IMU ORB A/CAL						
I_STAR_SELC(1,1)X	V95H4721C	X-COMP MEAS LOS VECT STAR 1-IMU 1	DL FMT 22/1 IMU ORB A/CAL		SPL		93017G	*	
I_STAR_SELC(1,1)Y	V95H4722C	Y-COMP MEAS LOS VECT STAR 1-IMU 1	DL FMT 22/1 IMU ORB A/CAL		SPL		93017G	*	
I_STAR_SELC(1,1)Z	V95H4723C	Z-COMP MEAS LOS VECT STAR 1-IMU 1	DL FMT 22/1 IMU ORB A/CAL		SPL		93017G	*	
I_STAR_SELC(1,2)X	V95H4724C	X-COMP MEAS LOS VECT STAR 1-IMU 2	DL FMT 22/1 IMU ORB A/CAL		SPL		93017G	*	

TABLE 4.66.5-2. OUTPUT FUNCTIONAL PARAMETERS FROM STAR TRACKER SUBSYSTEM OPERATING PROGRAM (G4.66)

FSSR NAME	M/S ID	NOMENCLATURE	DESTINATION	UNITS	DATA TYPE	P R E C	L A S T C R	R E V
I_STAR_SEL(1,2)Y	V95H4725C	Y-COMP MEAS LOS VECT STAR 1-IMU 2	DL FMT 22/1 IMU ORB A/CAL		SPL		93017G	*
I_STAR_SEL(1,2)Z	V95H4726C	Z-COMP MEAS LOS VECT STAR 1-IMU 2	DL FMT 22/1 IMU ORB A/CAL		SPL		93017G	*
I_STAR_SEL(1,3)X	V95H4727C	X-COMP MEAS LOS VECT STAR 1-IMU 3	DL FMT 22/1 IMU ORB A/CAL		SPL		93017G	*
I_STAR_SEL(1,3)Y	V95H4728C	Y-COMP MEAS LOS VECT STAR 1-IMU 3	DL FMT 22/1 IMU ORB A/CAL		SPL		93017G	*
I_STAR_SEL(1,3)Z	V95H4729C	Z-COMP MEAS LOS VECT STAR 1-IMU 3	DL FMT 22/1 IMU ORB A/CAL		SPL		93017G	*
I_STAR_SEL(2,1)X	V95H4738C	X-COMP MEAS LOS VECT STAR 2-IMU 1	DL FMT 22/1 IMU ORB A/CAL		SPL		93017G	*
I_STAR_SEL(2,1)Y	V95H4739C	Y-COMP MEAS LOS VECT STAR 2-IMU 1	DL FMT 22/1 IMU ORB A/CAL		SPL		93017G	*
I_STAR_SEL(2,1)Z	V95H4740C	Z-COMP MEAS LOS VECT STAR 2-IMU 1	DL FMT 22/1 IMU ORB A/CAL		SPL		93017G	*
I_STAR_SEL(2,2)X	V95H4741C	X-COMP MEAS LOS VECT STAR 2-IMU 2	DL FMT 22/1 IMU ORB A/CAL		SPL		93017G	*
I_STAR_SEL(2,2)Y	V95H4742C	Y-COMP MEAS LOS VECT STAR 2-IMU 2	DL FMT 22/1 IMU ORB A/CAL		SPL		93017G	*
I_STAR_SEL(2,2)Z	V95H4743C	Z-COMP MEAS LOS VECT STAR 2-IMU 2	DL FMT 22/1 IMU ORB A/CAL		SPL		93017G	*
I_STAR_SEL(2,3)X	V95H4744C	X-COMP MEAS LOS VECT STAR 2-IMU 3	DL FMT 22/1 IMU ORB A/CAL		SPL		93017G	*
I_STAR_SEL(2,3)Y	V95H4745C	Y-COMP MEAS LOS VECT STAR 2-IMU 3	DL FMT 22/1 IMU ORB A/CAL		SPL		93017G	*
I_STAR_SEL(2,3)Z	V95H4746C	Z-COMP MEAS LOS VECT STAR 2-IMU 3	DL FMT 22/1 IMU ORB A/CAL		SPL		93017G	*
I_STAR_SEL(3,1)X	V95H4790C	X-COMP MEAS LOS VECT STAR 3-IMU 1	IMU ORB A/CAL				92354	
I_STAR_SEL(3,1)Y	V95H4791C	Y-COMP MEAS LOS VECT STAR 3-IMU 1	IMU ORB A/CAL				92354	
I_STAR_SEL(3,1)Z	V95H4792C	Z-COMP MEAS LOS VECT STAR 3-IMU 1	IMU ORB A/CAL				92354	
I_STAR_SEL(3,2)X	V95H4793C	X-COMP MEAS LOS VECT STAR 3-IMU 2	IMU ORB A/CAL				92354	
I_STAR_SEL(3,2)Y	V95H4794C	Y-COMP MEAS LOS VECT STAR 3-IMU 2	IMU ORB A/CAL				92354	
I_STAR_SEL(3,2)Z	V95H4795C	Z-COMP MEAS LOS VECT STAR 3-IMU 2	IMU ORB A/CAL				92354	
I_STAR_SEL(3,3)X	V95H4796C	X-COMP MEAS LOS VECT STAR 3-IMU 3	IMU ORB A/CAL				92354	
I_STAR_SEL(3,3)Y	V95H4797C	Y-COMP MEAS LOS VECT STAR 3-IMU 3	IMU ORB A/CAL				92354	
I_STAR_SEL(3,3)Z	V95H4798C	Z-COMP MEAS LOS VECT STAR 3-IMU 3	IMU ORB A/CAL				92354	
NAV_SIGHT	V95X4779X	NAVIGATION SIGHTING FLAG COAS	ORB/RND NAV TLM					
NAV_TARGET	V95X4778X	NAV TARGET TRACK MODE FLAG	ORB/RND NAV TLM					
OFF_CMD(1)	V71K5321B	-Z ST OFFSET MODE CMD	WD1 B0	DL FMT 22/1 DL FMT 23/1 ST 1	BD		93017G	*

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TABLE 4.66.5-2. OUTPUT FUNCTIONAL PARAMETERS FROM STAR TRACKER SUBSYSTEM OPERATING PROGRAM (G4.66)

FSSR NAME	M/S ID	NOMENCLATURE	DESTINATION	UNITS	DATA TYPE	P R E C	L A S T	C R E V
OFF_CMD(2)	V71K5821B	-Y ST OFFSET MODE CMD	WD1 B0	DL FMT 22/1 DL FMT 23/1 ST 2		BD	93017G	*
SELF_T_I(1)	V95X4912X	-Z ST SELF TEST INDICATION		STAR TRKR/COAS DISP TLM		BD		
SELF_T_I(2)	V95X4913X	-Y ST SELF TEST INDICATION		STAR TRKR/COAS DISP TLM		BD		
SEL_I1	V95X4955X	STAR 1 SELECT INDICATION		DL FMT 22/1 DL FMT 23/1		BD	93017G	*
SEL_I2	V95X4956X	STAR 2 SELECT INDICATION		STAR TRKR/COAS DISP DL FMT 22/1 DL FMT 23/1		BD	93017G	*
SEL_I3	V95X4957X	STAR 3 SELECT INDICATION		STAR TRKR/COAS DISP DL FMT 22/1 DL FMT 23/1		BD	93017G	*
SHUTR_MAN_IND_Y	V93X6629XB	Y A/F SHTR OP CMD		STAR TRKR/COAS DISP				
SHUTR_MAN_IND_Z	V93X6630XB	Z A/F SHTR OP CMD		STAR TRKR/COAS DISP				
SHUT_IND(1)	V95X4935X	-Z ST SHUTTER CLOSE INDICATION		STAR TRKR/COAS DISP		BD	92354	
SHUT_IND(2)	V95X4936X	-Y ST SHUTTER CLOSE INDICATION		STAR TRKR/COAS DISP		BD	92354	
SHUT_OPEN(1)	V71K5324B	-Z ST SHUTTER OPEN CMD	WD1 B3	DL FMT 22/1 DL FMT 23/1 ST 1		BD	93017G	*
SHUT_OPEN(2)	V71K5824B	-Y ST SHUTTER OPEN CMD	WD1 B3	DL FMT 22/1 DL FMT 23/1 ST 2		BD	93017G	*
SIGHT_I	V95X4963X	SIGHT MODE INDICATION		DL FMT 22/1 DL FMT 23/1		BD	93017G	*
STAR_I(1)	V95X4906X	-Z ST STAR PRESENT INDICATION		STAR TRKR/COAS DISP		BD	92354	
STAR_I(2)	V95X4907X	-Y ST STAR PRESENT INDICATION		STAR TRKR/COAS DISP		BD	92354	
STAR_ID_I(1)	V95J4925C	-Z ST STAR IDENT INDICATION		DL FMT 22/1 DL FMT 23/1		HXS	93017G	*
STAR_ID_I(2)	V95J4926C	-Y ST STAR IDENT INDICATION		STAR TRKR/COAS DISP DL FMT 22/1 DL FMT 23/1		HXS	93017G	*
STAR_T_I(1)	V95X4902X	-Z ST STAR TRACK INDICATION		STAR TRKR/COAS DISP STAR TRKR/COAS DISP TLM		BD		
STAR_T_I(2)	V95X4903X	-Y ST STAR TRACK INDICATION		STAR TRKR/COAS DISP TLM		BD		
STAT_STATUS(1)	V95J4909C	ST IN TGT TRK STATUS IND		REL NAV DISP		VAR		
	V95J4929C	-Z ST STATUS INDICATION		DL FMT 22/1 DL FMT 23/1 REL NAV DISP		HXS	93017G	*
				STAR TRKR/COAS DISP				

TABLE 4.66.5-2. OUTPUT FUNCTIONAL PARAMETERS FROM STAR TRACKER SUBSYSTEM OPERATING PROGRAM (G4.66)

FSSR NAME	M/S ID	NOMENCLATURE	DESTINATION	UNITS	DATA TYPE	P R E C	L A S T C R	R E V C
STATUS(2)	V95J4930C	-Y ST STATUS INDICATION	DL FMT 22/1 DL FMT 23/1 REL NAV DISP STAR TRKR/COAS DISP		HXS		93017G	*
STSELF(1)	V95X4973X	-Z ST SELF TEST CMD	FCOS					
STSELF(2)	V95X4974X	-Y ST SELF TEST CMD	FCOS					
STSTARTR(1)	V95X4979X	-Z ST STAR TRACK CMD	FCOS					
STSTARTR(2)	V95X4980X	-Y ST STAR TRACK CMD	FCOS					
STTARGETR(1)	V95X4981X	-Z ST TARGET TRACK CMD	FCOS					
STTARGETR(2)	V95X4982X	-Y ST TARGET TRACK CMD	FCOS					
STERMCOM(1)	V95X4977X	-Z ST TERM/IDLE CMD	FCOS					
STERMCOM(2)	V95X4978X	-Y ST TERM/IDLE CMD	FCOS					
ST_CMD(1)	V71K5322B	-Z ST SELF TEST CMD	WD1 B1	DL FMT 22/1 DL FMT 23/1 ST 1		BD	93017G	*
ST_CMD(2)	V71K5822B	-Y ST SELF TEST CMD	WD1 B1	DL FMT 22/1 DL FMT 23/1 ST 2		BD	93017G	*
TAR_T_I(1)	V95X4914X	-Z ST TARGET TRACK INDICATION	STAR TRKR/COAS DISP TLM			BD		
TAR_T_I(2)	V95X4915X	-Y ST TARGET TRACK INDICATION	STAR TRKR/COAS DISP TLM			BD		
TERM_I(1)	V95X4900X	-Z ST TERM/IDLE INDICATION	STAR TRKR/COAS DISP TLM			BD		
TERM_I(2)	V95X4901X	-Y ST TERM/IDLE INDICATION	STAR TRKR/COAS DISP TLM			BD	89673B	
THOLD(1)_SET1	V71K5325B	-Z ST THRESHOLD SET 1 MSB	WD1 B4	DL FMT 22/1 DL FMT 23/1 ST 1		BD	93017G	*
THOLD(1)_SET2	V71K5326B	-Z ST THRESHOLD SET 2 LSB	WD1 B5	DL FMT 22/1 DL FMT 23/1 ST 1		BD	93017G	*
THOLD(2)_SET1	V71K5825B	-Y ST THRESHOLD SET 1 MSB	WD1 B4	DL FMT 22/1 DL FMT 23/1 ST 2		BD	93017G	*
THOLD(2)_SET2	V71K5826B	-Y ST THRESHOLD SET 2 LSB	WD1 B5	DL FMT 22/1 DL FMT 23/1 ST 2		BD	93017G	*
TIME1	V95W4761C	STAR 1 TIME TAG	TLM	S			89673B	
TIME2	V95W4762C	STAR 2 TIME TAG	TLM	S			89673B	
TIME3	V95W4763C	STAR 3 TIME TAG	TLM	S			89673B	
TRK_ID1	V95U4942C	STAR 1 ID FROM SIGHTING TABLE	DL FMT 22/1 DL FMT 23/1 STAR TRKR/COAS DISP		HXS		93017G	*

TABLE 4.66.5-2. OUTPUT FUNCTIONAL PARAMETERS FROM STAR TRACKER SUBSYSTEM OPERATING PROGRAM (G4.66)

FSSR NAME	M/S ID	NOMENCLATURE	DESTINATION	UNITS	DATA TYPE	P R E C	L A S T	C R E V
TRK_ID2	V95U4943C	STAR 2 ID FROM SIGHTING TABLE	DL FMT 22/1 DL FMT 23/1 STAR TRKR/COAS DISP	HXS			93017G	*
TRK_ID3	V95U4944C	STAR 3 ID FROM SIGHTING TABLE	DL FMT 22/1 DL FMT 23/1 STAR TRKR/COAS DISP	HXS			93017G	*
T_M50_BODY(1,1)	V95U4809C	M50 TO BODY/COMPONENT 1,1	ORB/RND NAV TLM					
T_M50_BODY(1,2)	V95U4810C	M50 TO BODY/COMPONENT 1,2	ORB/RND NAV TLM					
T_M50_BODY(1,3)	V95U4811C	M50 TO BODY/COMPONENT 1,3	ORB/RND NAV TLM					
T_M50_BODY(2,1)	V95U4812C	M50 TO BODY/COMPONENT 2,1	ORB/RND NAV TLM					
T_M50_BODY(2,2)	V95U4813C	M50 TO BODY/COMPONENT 2,2	ORB/RND NAV TLM					
T_M50_BODY(2,3)	V95U4814C	M50 TO BODY/COMPONENT 2,3	ORB/RND NAV TLM					
T_M50_BODY(3,1)	V95U4815C	M50 TO BODY/COMPONENT 3,1	ORB/RND NAV TLM					
T_M50_BODY(3,2)	V95U4816C	M50 TO BODY/COMPONENT 3,2	ORB/RND NAV TLM					
T_M50_BODY(3,3)	V95U4817C	M50 TO BODY/COMPONENT 3,3	ORB/RND NAV TLM					
T_M50_ST(1,1)	V95U4800C	M50 TO SEL ST/COMPONENT 1,1	ORB/RND NAV TLM					
T_M50_ST(1,2)	V95U4801C	M50 TO SEL ST/COMPONENT 1,2	ORB/RND NAV TLM					
T_M50_ST(1,3)	V95U4802C	M50 TO SEL ST/COMPONENT 1,3	ORB/RND NAV TLM					
T_M50_ST(2,1)	V95U4803C	M50 TO SEL ST/COMPONENT 2,1	ORB/RND NAV TLM					
T_M50_ST(2,2)	V95U4804C	M50 TO SEL ST/COMPONENT 2,2	ORB/RND NAV TLM					
T_M50_ST(2,3)	V95U4805C	M50 TO SEL ST/COMPONENT 2,3	ORB/RND NAV TLM					
T_M50_ST(3,1)	V95U4806C	M50 TO SEL ST/COMPONENT 3,1	ORB/RND NAV TLM					
T_M50_ST(3,2)	V95U4807C	M50 TO SEL ST/COMPONENT 3,2	ORB/RND NAV TLM					
T_M50_ST(3,3)	V95U4808C	M50 TO SEL ST/COMPONENT 3,3	ORB/RND NAV TLM					
T_NAV	V95W4760C	TIME TAG FOR TARGET SIGHTING DATA	ORB/RND NAV TLM	S			89673B	
T_TARLOS	V95W4985C	TIME OF TARGET SIGHTING(COAS)	ORB/RND NAV TLM	S			89673B	

TABLE 4.66.5-2. OUTPUT FUNCTIONAL PARAMETERS FROM STAR TRACKER SUBSYSTEM OPERATING PROGRAM (G4.66)

FSSR NAME	M/S ID	NOMENCLATURE	DESTINATION	UNITS	DATA TYPE	P R E C	L A S T C R	R E V
VST(1)	V95U4820C	X COMP SEL UNIT VECT TO FOV TEST	TLM					
VST(2)	V95U4821C	Y COMP SEL UNIT VECT TO FOV TEST	TLM					
VST(3)	V95U4822C	Z COMP SEL UNIT VECT TO FOV TEST	TLM					
V_ANG(1)	V95H4827C	-Z ST VERT ANGLE OFFSET	TLM	RAD			89939A	
V_ANG(2)	V95H4828C	-Y ST VERT ANGLE OFFSET	TLM	RAD			89939A	
V_ANG_CMD(1)	V71K5332B	-Z ST VERT OFFSET CMD	WD1 B11-15	DL FMT 22/1 DL FMT 23/1 ST 1	DEG	BMD	93017G	*
V_ANG_CMD(2)	V71K5832B	-Y ST VERT OFFSET CMD	WD1 B11-15	DL FMT 22/1 DL FMT 23/1 ST 2	DEG	BMD	93017G	*
V_COAS	V95H4940C	VERTICAL OFFSET OF -Z COAS IND	DL FMT 22/1 REL NAV DISP	DEG	SPL		93017G	*
V_NAV	V95H4754C	SEL ST AVERAGE VERTICAL ANGLE	STAR TRKR/COAS DISP ORB/RND NAV TLM	RAD				
XZPOS_I	V95X4962X V95M2861P	COAS POSITION INDICATION X OR -Z CGZB_SELECT	STAR TRKR/COAS DISP DL FMT 22/1 DL FMT 23/1		BD		93017G	*
	V95M2880P	CGYB_ST_DISP_FLAG 1	DL FMT 22/1 DL FMT 23/1				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 4.66.5-3. STAR TRACKER SUBSYSTEM OPERATING PROGRAM (G4.66) I-LOADS

FSSR NAME	MSID	ENG UNITS	DT	PR	D	S	PR FCTN	MC	CAT	LAST CR	R E V
I_COAS(1,1)	V99U5610C	ND			F	S	L P G4.66	00	STT	DC0599	
I_COAS(1,2)	V99U5611C	ND			F	S	L P G4.66	00	STT	DC0599	
I_COAS(1,3)	V99U5612C	ND			F	S	L P G4.66	00	STT	DC0599	
I_COAS(2,1)	V99U5613C	ND			F	S	L P G4.66	00	STT	DC0599	
I_COAS(2,2)	V99U5614C	ND			F	S	L P G4.66	00	STT	DC0599	
I_COAS(2,3)	V99U5615C	ND			F	S	L P G4.66	00	STT	DC0599	
LOSK1	V96U9123C	ND			F	D	M P G4.126	00	EPH	92537A	
							G4.66				
LOSK3	V96U9124C	ND			F	D	M P G4.126	00	EPH	92537A	
							G4.66				
LOS_ZERO	V96U9126C	RAD			F	D	M P G4.126	00	EPH	92537A	
							G4.66				
TNBODY(1,1)	V96U7096C	ND			F	S	L P G4.226	00	IPR	DC0599	
							G4.66				
							G4.97				
							V4.9A				
TNBODY(1,2)	V96U7097C	ND			F	S	L P G4.226	00	IPR	DC0599	
							G4.66				
							G4.97				
							V4.9A				
TNBODY(1,3)	V96U7098C	ND			F	S	L P G4.226	00	IPR	DC0599	
							G4.66				
							G4.97				
							V4.9A				
TNBODY(2,1)	V96U7099C	ND			F	S	L P G4.226	00	IPR	DC0599	
							G4.66				
							G4.97				
							V4.9A				
TNBODY(2,2)	V96U7100C	ND			F	S	L P G4.226	00	IPR	DC0599	
							G4.66				
							G4.97				
							V4.9A				
TNBODY(2,3)	V96U7101C	ND			F	S	L P G4.226	00	IPR	DC0599	
							G4.66				
							G4.97				
							V4.9A				
TNBODY(3,1)	V96U7102C	ND			F	S	L P G4.226	00	IPR	DC0599	
							G4.66				
							G4.97				
							V4.9A				
TNBODY(3,2)	V96U7103C	ND			F	S	L P G4.226	00	IPR	DC0599	
							G4.66				
							G4.97				
							V4.9A				

TABLE 4.66.5-3. STAR TRACKER SUBSYSTEM OPERATING PROGRAM (G4.66) I-LOADS

FSSR NAME	MSID	ENG UNITS	DT	PR	D	S	PR FCTN	MC	CAT	LAST CR	R E V
TNBBODY(3,3)	V96U7104C	ND			F	S	L P G4.226 G4.66 G4.97 V4.9A	00	IPR	DC0599	
TOL10	V99U5698C	RAD			F	S	D P G4.66	00	ZFC	DC0599	
TOL12	V99U5699C	ND			F	S	D P G4.66	00	ZFC	DC0599	
TOL14	V99U5701C	ND			F	S	D P G4.66	00	ZFC	DC0599	
TOL6	V99U5706C	DEG			F	S	D P G4.66	00	ZFC	DC0599	
TOL9	V96U9706C	DEG			F	S	D P G4.66	00	ZFC	DC0599	
T_LIM1	V99U5638C	DEG			F	S	D P G4.66	00	ZFC	DC0599	
T_LIM2	V99U5639C	DEG			F	S	D P G4.66	00	ZFC	DC0599	
T_NB_ST1(1,1)	V99U5676C	ND			F	S	L P G4.66	00	STT	DC0599	
T_NB_ST1(1,2)	V99U5677C	ND			F	S	L P G4.66	00	STT	DC0599	
T_NB_ST1(1,3)	V99U5678C	ND			F	S	L P G4.66	00	STT	DC0599	
T_NB_ST1(2,1)	V99U5679C	ND			F	S	L P G4.66	00	STT	DC0599	
T_NB_ST1(2,2)	V99U5680C	ND			F	S	L P G4.66	00	STT	DC0599	
T_NB_ST1(2,3)	V99U5681C	ND			F	S	L P G4.66	00	STT	DC0599	
T_NB_ST1(3,1)	V99U5682C	ND			F	S	L P G4.66	00	STT	DC0599	
T_NB_ST1(3,2)	V99U5683C	ND			F	S	L P G4.66	00	STT	DC0599	
T_NB_ST1(3,3)	V99U5684C	ND			F	S	L P G4.66	00	STT	DC0599	
T_NB_ST2(1,1)	V99U5685C	ND			F	S	L P G4.66	00	STT	DC0599	
T_NB_ST2(1,2)	V99U5686C	ND			F	S	L P G4.66	00	STT	DC0599	
T_NB_ST2(1,3)	V99U5687C	ND			F	S	L P G4.66	00	STT	DC0599	
T_NB_ST2(2,1)	V99U5688C	ND			F	S	L P G4.66	00	STT	DC0599	
T_NB_ST2(2,2)	V99U5689C	ND			F	S	L P G4.66	00	STT	DC0599	
T_NB_ST2(2,3)	V99U5690C	ND			F	S	L P G4.66	00	STT	DC0599	
T_NB_ST2(3,1)	V99U5691C	ND			F	S	L P G4.66	00	STT	DC0599	
T_NB_ST2(3,2)	V99U5692C	ND			F	S	L P G4.66	00	STT	DC0599	
T_NB_ST2(3,3)	V99U5693C	ND			F	S	L P G4.66	00	STT	DC0599	

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

TABLE 4.66.5-4. STAR TRACKER SUBSYSTEM OPERATING PROGRAM (G4.66) K-LOADS

TABLE 4.66.5-4. STAR TRACKER SUBSYSTEM OPERATING PROGRAM (G4.66) K-LOADS

FSSR NAME DESCRIPTION	MSID	MC	KLOAD VALUE	ENG UNITS	DT	P R	S	PR FCTN	LAST CR	R E V
I_STAR_SEL(107)Y STAR 107 UNIT VECT Y COMP	V97U2740C	00	+7.7919393	E-01	ND		F	S P G4.66	91044C	
I_STAR_SEL(107)Z STAR 107 UNIT VECT Z COMP	V97U2741C	00	-4.0925859	E-01	ND		F	S P G4.66	91044C	
I_STAR_SEL(108)X STAR 108 UNIT VECT X COMP	V97U2742C	00	+6.9948775	E-01	ND		F	S P G4.66	91044C	
I_STAR_SEL(108)Y STAR 108 UNIT VECT Y COMP	V97U2743C	00	+4.3104581	E-01	ND		F	S P G4.66	91044C	
I_STAR_SEL(108)Z STAR 108 UNIT VECT Z COMP	V97U2744C	00	+5.7001438	E-01	ND		F	S P G4.66	91044C	
I_STAR_SEL(109)X STAR 109 UNIT VECT X COMP	V97U2745C	00	+2.6804536	E-01	ND		F	S P G4.66	91044C	
I_STAR_SEL(109)Y STAR 109 UNIT VECT Y COMP	V97U2746C	00	-8.9358349	E-01	ND		F	S P G4.66	91044C	
I_STAR_SEL(109)Z STAR 109 UNIT VECT Z COMP	V97U2747C	00	-3.6008364	E-01	ND		F	S P G4.66	91044C	
I_STAR_SEL(110)X STAR 110 UNIT VECT X COMP	V97U2748C	00	-2.9321158	E-01	ND		F	S P G4.66	91044C	
I_STAR_SEL(110)Y STAR 110 UNIT VECT Y COMP	V97U2749C	00	-7.9870792	E-01	ND		F	S P G4.66	91044C	
I_STAR_SEL(110)Z STAR 110 UNIT VECT Z COMP	V97U2750C	00	+5.2544517	E-01	ND		F	S P G4.66	91044C	
LOS_R MEAN MOTION OF EARTH	V96U9125C	00	+1.990986594	E-07	RAD/SEC		F	D P G4.126 G4.66	92537A	
TOL13 OLD DATA AGE LIMIT	V99U5700C	00	+6.0	E+01	MIN		F	S P G4.66	59954	
TOL8 ANGULAR BODY RATE LIMIT	V99U5708C	00	+7.5	E-01	DEG/SEC		F	S P G4.66	59954	
V_SIM_ST(1) -Z ST VERTICAL COORDINATE FOR SIMULATED STAR	V99U5711C	00	-4.137	E+00	DEG		F	S P G4.66	79915H	
V_SIM_ST(2) -Y ST VERTICAL COORDINATE FOR SIMULATED STAR	V99U5712C	00	-4.137	E+00	DEG		F	S P G4.66	79915H	

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

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TABLE 4.66.5-5. STAR TRACKER SUBSYSTEM OPERATING PROGRAM (G4.66) CONSTANTS

FSSR NAME DESCRIPTION	MSID	MC	CONSTANT VALUE	ENG UNITS	DT	P R	S	PR FCTN	LAST CR	R E V
ABER CONSTANT OF ABERRATION	V99U5600C	00	+9.935105	E-05	RAD	F	S	C A6.9 G4.66	90374C	
C_LIGHT SPEED OF LIGHT IN A VACUUM	V99U5603C	00	+9.8357119	E+08	FT/SEC	F	S	C A6.9 G4.66	90374C	
DEG_PER_RAD RADIAN TO DEGREE CONVERSION FACTOR	V97U0112C	00	+5.72957795131E+01	DEG/RAD		F	S	C A6.9 G4.10 G4.126 G4.127 G4.128 G4.175 G4.20 G4.201 G4.204 G4.208 G4.21 G4.213 G4.220 G4.226 G4.227 G4.23 G4.234 G4.237 G4.24 G4.25 G4.35 G4.36 G4.5 G4.6 G4.66 G4.8 G4.9 G4.97 G5.26 G5.27 V4.10 V4.11 V4.11B V4.11C V4.9A	93090E	

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

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5.0 SUPPLEMENTARY MATERIAL

5.1 COORDINATE SYSTEMS

This section contains the various coordinate systems that will be used in performing ST SOP functions. The coordinate systems and the associated figures are as follows:

1. Navigation base coordinate system (Figure 5.1–1)
2. Body axis coordinate system (Figure 5.1–2)
3. Aries mean of 1950 Cartesian coordinate system (Figure 5.1–3)
4. IMU cluster coordinate system (Figure 5.1–4)
5. Star tracker coordinate system (Figure 5.1–5)
6. COAS coordinate system (Figure 5.1–6)

5.2 SHUTTLE STAR CATALOG

This section contains the parametric data associated with 100 predefined navigation stars that have been selected for use with the Shuttle ST. The stars are listed in Table 5.2–1. The parameters listed for each star include (1) the star number, (2) IDT and SSST predicted magnitudes, (3) the star unit vector components in M50 coordinates (epoch 2005), and (4) the common name. Star data for the catalog stars (unit vectors) are required to be available to the ST SOP whenever ST SOP functions are being performed. The star catalog contains 110 entries which presently are ordered as follows:

1	Other orbiting vehicle
2	Center of earth
3	Earth site
4	Center of sun
5	MEDABLE STAR (manually entered data)
6–10	Unassigned
11–110	Navstars (mission independent)

Entries 1 through 5 are used to support the universal pointing spec functions.

Entries 1 through 60 are available in OPS 2, 3, and 8.

NAV STARS 61 through 110 are available in OPS 2 and 8 only.

Unit vector components of stars 101-110 are K-Load parameters and can be changed by uplink in OPS 2.

Table 5.2-2 contains the parametric data of 849 stars that have been approved for uplink capability according to the criteria specified in JSC-27022, “Shuttle Star Catalog Uplink Capability”. The parameters listed for each star include (1) the star number, (2) IDT and SSST predicted magnitudes, (3) the star unit vector components in M50 coordinates (epoch 2005) and (4) the Skymap name, if available.

Table 5.2-1. Orbiter Star Catalog (2005)

No.	IDT Mag.	SSST Mag.	X Component	Y Component	Z Component	Name
11	-1.2	-0.8	-0.17832207	0.94125671	-0.28677002	SIRIUS
12	-0.4	-0.1	-0.06034819	0.60343258	-0.79512717	CANOPUS
13	0.4	0.8	0.20519417	0.96812469	-0.14363125	RIGEL
14	0.3	0.7	0.11952813	-0.77077704	0.62579212	VEGA
15	0.8	1.3	-0.43097192	-0.24950595	-0.86718509	HADAR
16	0.7	1.2	0.49110034	0.21831070	-0.84330356	ACHERNAR
17	1.7	2.0	-0.45429068	-0.04734275	-0.88959465	ACRUX
18	0.5	0.3	0.14161225	0.68080206	0.71864770	CAPELLA
19	1.2	1.7	-0.91893789	-0.34610246	-0.18911963	SPICA
20	0.3	-0.3	-0.78805309	-0.51818631	0.33234812	ARCTURUS
21	0.8	0.9	-0.40751776	0.90844446	0.09304804	PROCYON
22	1.1	1.4	0.45016200	-0.87992095	0.15196478	ALTAIR
23	0.6	-0.6	0.03259720	0.99113628	0.12878779	BETELGEUSE
24	1.8	2.4	0.16213895	0.98063616	0.10983478	BELLATRIX
25	1.6	2.0	-0.85830865	0.46750225	0.21153699	REGULUS
26	1.5	1.8	0.83225657	-0.24291443	-0.49833882	FOMALHAUT
27	1.6	1.9	0.45307092	-0.54126344	0.70835064	DENEBO
28	2.0	2.4	0.59576015	-0.32649842	-0.73380421	AL NA IR
29	2.1	2.6	-0.58103162	-0.28829966	0.76110811	ALKAID
30	1.1	-0.1	-0.35619493	-0.82249138	-0.44343331	ANTARES
31	1.9	2.2	-0.32931554	0.78151528	0.52989163	CASTOR
32	1.1	0.2	0.35526295	0.89106705	0.28246724	ALDEBARAN
33	2.2	2.7	0.31656450	-0.44501485	-0.83770442	PEACOCK
34	2.0	2.3	-0.26078787	0.23350980	-0.93672987	MIAPLACIDUS
35	2.2	2.7	0.20219131	-0.87289990	-0.44403202	NUNKI
36	2.1	2.5	0.07495073	-0.82158235	-0.56514142	KAUS AUSTRALIS
37	2.3	2.8	0.87592386	0.02219762	0.48193843	ALPHERATZ
38	2.7	3.2	0.47977073	0.11446368	0.86989546	NAVI
39	2.2	2.6	-0.14518190	0.94804966	0.28306193	ALHENA
40	2.2	2.2	0.41427024	0.49697197	0.76249526	MIRFAK
41	2.5	2.8	-0.96491928	0.05699471	0.25628574	DENEBOLA
42	2.5	2.9	-0.53499327	-0.71369430	0.45213122	ALPHECCA
43	2.4	2.7	-0.11632329	-0.96899192	0.21799897	RASALHAGUE
44	2.7	3.0	-0.53027933	0.14495217	0.83533987	MERAK
45	2.4	2.4	0.01507040	0.00776003	0.99985632	POLARIS

Table 5.2-1. Orbiter Star Catalog (2005)

No.	IDT Mag.	SSST Mag.	X Component	Y Component	Z Component	Name
46	2.7	3.1	-0.58773612	0.02252910	0.80873895	PHECDA
47	2.8	3.3	-0.95335843	-0.05505503	-0.29677710	GIENAH
48	2.9	3.3	-0.65310866	-0.74019374	-0.15988216	ZUBENESCHEMALI
49	2.4	1.6	-0.19811113	-0.18284260	0.96297485	KOCHAB
50	2.2	1.6	-0.29512575	0.41571808	-0.86027860	AVIOR
51	2.2	1.4	-0.11794993	-0.33944810	-0.93320030	ATRIA
52	2.4	1.9	0.78696044	0.47454258	0.39433818	HAMAL
53	2.5	2.1	-0.69285107	-0.41504028	-0.58966003	MENKENT
54	2.4	2.0	0.93441741	0.16936987	-0.31333360	DIPHDA
55	2.3	1.5	-0.77178538	0.61870987	-0.14678359	ALPHARD
56	2.4	1.4	-0.52885318	0.50119057	-0.68492505	SUHAIL
57	3.2	3.5	0.54610526	0.52907757	-0.64949670	ACAMAR
58	3.2	3.4	0.79617355	-0.53551156	-0.28166477	DENEB ALGEIDI
59	2.6	1.6	0.85567644	-0.22384962	0.46659316	SCHEAT
60	2.6	1.8	0.81181910	-0.55935608	0.16754260	ENIF
61	1.9	2.4	0.11458898	0.99318016	-0.02150661	ALNILAM
62	1.9	2.3	0.14068485	0.86693918	0.47814666	EL NATH
63	2.4	3.0	-0.38907721	0.66168632	-0.64092912	NAOS
64	2.3	2.8	0.06282522	0.98374030	-0.16824984	SAIPH
65	2.1	2.4	-0.54168668	-0.12467690	0.83128287	ALIOTH
66	2.7	2.2	-0.25941520	-0.78525992	-0.56220157	EPSILON SCORPII
67	2.5	3.0	-0.58552119	-0.45877181	-0.66835122	ETA CENTAURI
68	2.0	2.5	-0.36010472	0.57634016	-0.73359158	REGOR
69	2.4	2.8	0.52397439	0.54690297	0.65295327	BATEN KAITOS
70	2.2	1.8	-0.84631863	0.40710777	0.34352298	ALGIEBA
71	2.8	3.3	-0.60111267	-0.32097512	-0.73187330	ZETA CENTAURI
72	2.7	3.1	-0.30610241	0.81745302	-0.48792609	ALUDRA
73	3.2	3.7	0.10295631	0.92716944	0.36021775	ZETA TAURI
74	3.0	3.5	-0.41074200	0.14713840	-0.89980070	THETA CARINAE
75	2.9	3.2	-0.35879265	-0.91556748	-0.18167009	ZETA OPHIUCHI
76	2.5	3.0	-0.54631757	-0.24524685	-0.80086896	EPSILON CENTAURI
77	3.0	3.5	0.96530631	0.04492224	0.25722698	ALGENIB
78	3.0	3.5	-0.45471939	-0.60233174	-0.65606916	GAMMA LUPI
79	2.8	3.2	0.93572707	-0.24081303	0.25772841	MARKAB
80	3.1	3.6	0.39963028	0.65528951	0.64100803	EPSILON PERSEI
81	2.9	3.3	0.07995252	0.82419123	-0.56063928	PHACT

Table 5.2-1. Orbiter Star Catalog (2005)

No.	IDT Mag.	SSST Mag.	X Component	Y Component	Z Component	Name
82	2.7	3.1	-0.21860612	-0.93772094	-0.26998296	SABIK
83	2.9	3.3	0.01280814	0.79632294	0.60473608	THETA AURIGAE
84	3.2	3.7	-0.08984194	-0.63863746	-0.76424513	ALPHA ARAE
85	2.7	3.2	-0.44252220	0.36946979	-0.81710842	KAPPA VELORUM
86	2.8	3.0	0.35181628	-0.30206175	0.88599323	ALDERAMIN
87	2.9	3.2	-0.91396267	0.19651867	0.35503894	ZOZCA
88	3.2	3.7	-0.06939918	0.86289122	-0.50060213	ZETA CANIS MAJORIS
89	2.9	3.2	0.12208503	0.94396450	-0.30663703	ARNEB
90	3.2	3.5	0.45387813	0.71923694	0.52601603	ZETA PERSEI
91	3.4	3.9	0.26512235	-0.20709268	0.94171267	ALPHIRK
92	2.3	1.4	0.78104875	0.23483775	0.57863121	MIRACH
93	3.1	3.4	-0.75852325	-0.26768448	-0.59412751	IOTA CENTAURI
94	3.1	3.6	-0.76030539	-0.18138548	0.62372672	COR CAROLI
95	2.3	1.4	0.63880378	-0.23344408	-0.73309862	BETA GRUIS
96	3.2	3.5	0.30830730	-0.63623698	0.70721221	DELTA CYGNI
97	2.5	1.9	0.64133329	0.37335250	0.67029808	ALMACH
98	3.1	3.4	-0.71465595	-0.64404827	-0.27288953	ZUBENELGENUBI
99	3.3	3.7	0.66989364	-0.42301798	-0.61016251	GAMMA GRUIS
100	3.2	3.6	-0.24264016	-0.27473638	-0.93040081	GAMMA TRI AUSTR
101	2.6	3.0	-0.47114980	-0.79485983	-0.38238163	DSCHUBBA
102	2.5	1.7	-0.01238391	-0.62247755	0.78253967	ETAMIN
103	3.1	3.3	-0.98528242	-0.16969931	-0.02051090	ARICH
104	3.3	3.7	0.26406882	-0.93460184	0.23830035	ZETA AQUILAE
105	3.3	3.7	-0.24048891	0.88308784	-0.40289074	OMICRON-2 CANIS MAJORIS
106	2.8	2.3	0.73231561	0.07643439	-0.67666212	ANKAA
107	3.2	3.3	-0.47472542	0.77919393	-0.40925859	RHO PUPPIS
108	3.3	3.6	0.69948775	0.43104581	0.57001438	BETA TRIANGULI
109	3.3	3.4	0.26804536	-0.89358349	-0.36008364	PI SAGITTARII
110	3.2	3.1	-0.29321158	-0.79870792	0.52544517	ZETA HERCULIS

Table 5.2-2. Orbiter Uplinkable Stars (2005)

No.	IDT Mag.	SSST Mag.	X Component	Y Component	Z Component	Skymap Name		
101	2.6	3.0	-0.47114980	-0.79485983	-0.38238163	7	DLT	SCO
102	2.5	1.7	-0.01238391	-0.62247755	0.78253967	33	GAM	DRA
103	3.1	3.3	-0.98528242	-0.16969931	-0.02051090	29	GAM	VIR
104	3.3	3.7	0.26406882	-0.93460184	0.23830035	17	ZET	AQL
105	3.3	3.7	-0.24048891	0.88308784	-0.40289074	24	OMI2	CMA
106	2.8	2.3	0.73231561	0.07643439	-0.67666212		ALF	PHE
107	3.2	3.3	-0.47472542	0.77919393	-0.40925859	15	RHO	PUP
108	3.3	3.6	0.69948775	0.43104581	0.57001438	4	BET	TRI
109	3.3	3.4	0.26804536	-0.89358349	-0.36008364	41	PI	SGR
110	3.2	3.1	-0.29321158	-0.79870792	0.52544517	40	ZET	HER
111	5.1	4.5	0.21909006	-0.00091662	-0.97570421		THT	OCT
112	2.7	2.8	0.51674908	0.01478988	0.85600914	11	BET	CAS
113	4.3	3.9	0.69401921	0.02087345	-0.71965383		EPS	PHE
114	5.3	4.4	0.98878969	0.05141436	-0.14018385			
115	5.0	4.2	0.93882434	0.04927275	0.34085342	89	CHI	PEG
116	3.9	3.4	0.98473324	0.07265303	-0.15818335	8	IOT	CET
117	4.6	4.6	0.41897689	0.03247465	-0.90741598		ZET	TUC
118	5.2	4.1	0.93437223	0.07865230	-0.34750877		T	CET
119	3.2	3.1	0.21475452	0.02237022	-0.97641183		BET	HYI
120	4.3	4.5	0.71600201	0.07448853	-0.69411280		KAP	PHE
121	5.0	4.1	0.83081459	0.09264120	-0.54878477		ETA	SCL
122	5.4	4.5	0.94723365	0.10560292	0.30264902	47	TV	PSC
123	5.7	4.8	0.75898675	0.08644000	-0.64534273			
124	4.5	4.8	0.45536339	0.06023154	0.88826592	15	KAP	CAS
125	5.3	4.4	0.70885021	0.10608234	0.69733630			
126	3.9	4.4	0.58652918	0.08811356	0.80512081	17	ZET	CAS
127	4.8	4.5	0.86360880	0.13636223	0.48537118	30	EPS	AND
128	3.6	3.0	0.84987422	0.13710674	0.50883745	31	DLT	AND
129	2.6	2.1	0.54789864	0.09085394	0.83159644	18	ALF	CAS
130	5.0	4.6	0.68018530	0.11677236	-0.72367960		MU	PHE
131	5.1	4.8	0.96582989	0.17755196	-0.18880656	17	PHI1	CET
132	4.4	4.0	0.89628250	0.17696537	0.40664596	34	ZET	AND
133	5.4	4.7	0.25018606	0.05191921	-0.96680470		LAM	HYI
134	4.7	3.9	0.97187644	0.19812952	0.12728267	63	DLT	PSC
135	3.9	3.8	0.52580658	0.10742156	0.84379384	24	ETA	CAS
136	5.0	4.1	0.97557019	0.21829451	-0.02470433	20		CET

Table 5.2-2. Orbiter Uplinkable Stars (2005)

No.	IDT Mag.	SSST Mag.	X Component	Y Component	Z Component	Skymap Name		
137	5.6	4.7	0.95320499	0.22671452	-0.20000192	22	PHI3	CET
138	4.2	4.5	0.76385260	0.18331784	0.61880835	37	MU	AND
139	4.8	4.5	0.89359113	0.21671632	0.39310167	38	ETA	AND
140	4.7	4.3	0.95701050	0.25795181	0.13263392	71	EPS	PSC
141	3.7	3.4	0.65587178	0.18761413	-0.73118612		BET	PHE
142	4.2	4.6	0.54270899	0.16150444	-0.82424709		ZET	PHE
143	3.8	3.3	0.94281391	0.27966315	-0.18135722	31	ETA	CET
144	4.6	4.1	0.06742098	0.01856578	0.99755186			
145	5.1	4.7	0.89324572	0.27634712	0.35460450	84	PSI	PSC
146	4.9	4.4	0.82863955	0.25692168	0.49734067	83	TAU	PSC
147	5.0	4.6	0.86785200	0.27792116	0.41181638	85	PHI	PSC
148	4.0	3.6	0.92724494	0.34446029	-0.14684662	45	THT	CET
149	5.2	4.7	0.90362251	0.34308527	-0.25643489	46		CET
150	3.0	3.3	0.46825198	0.17638088	0.86581168	37	DLT	CAS
151	5.1	4.7	0.35262623	0.13251395	0.92633406	36	PSI	CAS
152	3.6	2.8	0.67381345	0.26608486	-0.68932886		GAM	PHE
153	5.1	4.5	0.92297687	0.37094083	0.10255046	98	MU	PSC
154	4.3	4.0	0.60298207	0.24725432	-0.75847078		DLT	PHE
155	4.0	3.7	0.89394257	0.36483357	0.26031354	99	ETA	PSC
156	5.1	4.7	0.47561144	0.19856261	0.85695195	39	CHI	CAS
157	4.5	4.5	0.69074487	0.29976549	0.65803660	50	UPS	AND
158	3.9	3.3	0.60810676	0.26730880	0.74749727	51		AND
159	4.8	4.1	0.90467358	0.41622054	0.09124785	106	NU	PSC
160	5.3	4.6	0.90380602	0.42238477	-0.06874431			
161	4.3	4.7	0.57663847	0.27046983	0.77093070		PHI	PER
162	3.9	3.8	0.86746152	0.41206324	-0.27877301	52	TAU	CET
163	4.7	4.3	0.89029550	0.42825003	0.15484130	110	OMI	PSC
164	5.6	4.8	0.89489516	0.43393222	-0.10423761			
165	4.1	3.6	0.87391163	0.45006018	-0.18364176	55	ZET	CET
166	3.8	3.8	0.77289264	0.40330636	0.48987850	2	ALF	TRI
167	4.2	4.6	0.83693117	0.43933272	0.32639389	5	GAM1	ARI
168	5.0	4.7	0.88389195	0.46486652	0.05132379	111	XI	PSC
169	4.6	3.7	0.60775593	0.32190968	-0.72595240		PSI	PHE
170	3.6	4.1	0.39612140	0.20791826	0.89434771	45	EPS	CAS
171	3.0	3.3	0.82692528	0.43912268	0.35123475	6	BET	ARI
172	5.1	4.8	0.33100210	0.17911779	-0.92647419		ETA2	HYI

Table 5.2-2. Orbiter Uplinkable Stars (2005)

No.	IDT Mag.	SSST Mag.	X Component	Y Component	Z Component	Skymap Name		
173	4.1	3.9	0.54273043	0.29492642	-0.78642360	CHI	ERI	
174	5.3	4.3	0.80968621	0.44114338	-0.38704103	56	CET	
175	3.2	3.4	0.41190461	0.23122092	-0.88140313	ALF	HYI	
176	4.2	3.4	0.81147959	0.45751120	-0.36357169	59	UPS	CET
177	5.4	4.6	0.61332544	0.35303350	-0.70654034	CHI	PHE	
178	4.1	4.4	0.86636415	0.49746880	0.04402218	113	ALF	PSC
179	4.3	4.6	0.26560134	0.15197401	0.95202932	50		CAS
180	4.8	4.5	0.83308127	0.53249121	0.14976217	65	XI1	CET
181	5.1	4.3	0.60658238	0.38670529	0.69463431	60		AND
182	3.8	4.3	0.51523427	0.34340074	-0.78524491	PHI	ERI	
183	4.3	4.7	0.69375241	0.46065320	0.55363004	9	GAM	TRI
184	3.3	2.6	0.82574476	0.56126233	-0.05594808	68	OMI	CET
185	4.4	4.7	0.29430789	0.20769984	-0.93286850	DLT	HYI	
186	5.5	4.5	0.82070265	0.57134802	0.00293263	69		CET
187	5.0	4.1	0.52227082	0.37348429	0.76664377	65		AND
188	5.4	4.6	0.64447694	0.49027540	0.58675336	14		TRI
189	4.3	4.8	0.77462047	0.63242326	0.00198687	82	DLT	CET
190	4.4	4.8	0.28219802	0.23434530	-0.93029380	EPS	HYI	
191	4.5	4.1	0.58900335	0.48858466	-0.64370807	IOT	ERI	
192	3.8	4.1	0.76301954	0.64421926	0.05275146	86	GAM	CET
193	4.5	4.6	0.50091824	0.42331825	0.75490567	13	THT	PER
194	4.9	4.4	0.65749037	0.57627286	0.48540292	39		ARI
195	4.9	4.5	0.62842048	0.56090497	-0.53895576	BET	FOR	
196	3.9	4.3	0.66432281	0.59313157	0.45482979	41		ARI
197	5.1	4.4	0.18686968	0.17238507	-0.96714172	NU	HYI	
198	4.6	4.8	0.58600905	0.52502203	0.61720763	16		PER
199	3.9	3.0	0.42048104	0.37540729	0.82599337	15	ETA	PER
200	4.8	3.9	0.60880680	0.55022788	0.57149239	17		PER
201	4.4	4.2	0.44696732	0.41208005	0.79398378	18	TAU	PER
202	4.3	3.8	0.71628431	0.67965138	-0.15814799	3	ETA	ERI
203	5.3	4.7	0.58948315	0.56901493	0.57335122	24		PER
204	2.7	1.8	0.70651538	0.70443236	0.06790484	92	ALF	CET
205	4.4	4.7	0.64637573	0.64737022	-0.40386905	11	TAU3	ERI
206	3.3	3.2	0.42031956	0.42459628	0.80190365	23	GAM	PER
207	3.6	2.6	0.54748515	0.55699531	0.62451279	25	RHO	PER
208	5.2	4.8	0.38713604	0.39314295	0.83400498			

Table 5.2-2. Orbiter Uplinkable Stars (2005)

No.	IDT Mag.	SSST Mag.	X Component	Y Component	Z Component	Skymap Name	
209	5.5	4.6	0.69023185	0.71526990	-0.10940275		
210	4.5	4.4	0.44865232	0.47098285	0.75953028	IOT	PER
211	4.2	3.8	0.48927191	0.51616074	0.70298726	27	KAP PER
212	5.0	4.5	0.52670204	0.56507047	0.63504356	28	OMG PER
213	4.7	4.3	0.64039237	0.69140734	0.33444506	57	DLT ARI
214	4.3	4.3	0.58997717	0.64367372	-0.48745367		ALF FOR
215	5.1	4.3	0.54473813	0.62441900	0.55978681		
216	3.9	3.0	0.60458858	0.70348450	-0.37360702	16	TAU4 ERI
217	4.7	4.6	0.47260154	0.55425500	-0.68516361		
218	4.7	3.9	0.57075099	0.66418963	0.48279958		
219	4.6	4.7	0.31515102	0.39267466	0.86399447		
220	4.5	4.0	0.60007329	0.76881655	0.22098225	5	TAU
221	4.1	3.9	0.59844224	0.78352130	-0.16721620	18	EPS ERI
222	4.7	4.7	0.59375100	0.80463821	0.00413533	10	TAU
223	5.0	4.6	0.44925363	0.61437389	-0.64862616		
224	5.3	4.4	0.26345081	0.36863782	0.89145938		
225	4.9	4.4	0.45246193	0.65205084	-0.60836494		
226	3.3	3.7	0.38809788	0.55096234	0.73879668	39	DLT PER
227	3.9	3.6	0.56202481	0.80898091	-0.17227303	23	DLT ERI
228	4.2	3.7	0.23724963	0.35045359	-0.90603250		BET RET
229	4.1	4.5	0.48215333	0.69616857	0.53186228	38	OMI PER
230	4.2	4.2	0.41868181	0.60797397	0.67459113	41	NU PER
231	4.6	3.7	0.54723152	0.80961269	-0.21228508	26	PI ERI
232	4.6	4.7	0.51091083	0.76235708	-0.39721758	27	TAU6 ERI
233	3.4	2.5	0.14654527	0.22566663	-0.96311944		GAM HYI
234	4.6	4.2	0.43989468	0.67465364	-0.59273530		
235	4.5	3.4	0.23162884	0.34638964	0.90904471		
236	4.9	4.8	0.52995783	0.84629668	-0.05409831	32	ERI
237	5.3	4.5	0.25565746	0.41255871	0.87431949		
238	3.2	2.3	0.50158594	0.83229246	-0.23601018	34	GAM ERI
239	4.3	4.7	0.41939057	0.69601310	0.58281842	46	XI PER
240	3.7	4.2	0.49613802	0.84148548	0.21389073	35	LAM TAU
241	4.2	4.6	0.49553886	0.86258055	0.10196091	38	NU TAU
242	4.7	4.3	0.45765469	0.80676860	0.37373334	37	TAU
243	4.3	4.7	0.32439151	0.59143170	0.73822672	48	PER
244	4.2	3.8	0.33415054	0.65826612	-0.67455847		ALF HOR

Table 5.2-2. Orbiter Uplinkable Stars (2005)

No.	IDT Mag.	SSST Mag.	X Component	Y Component	Z Component	Skymap Name	
245	5.2	4.7	0.44650817	0.87644553	-0.18020456	39	ERI
246	3.8	3.5	0.20574714	0.41168285	-0.88779803	ALF	RET
247	5.1	4.7	0.34748452	0.67816476	0.64757012	52	PER
248	4.5	4.2	0.30412563	0.59187440	0.74645314	51	MU PER
249	4.6	4.8	0.27534090	0.55664971	-0.78379110	GAM	DOR
250	4.8	4.4	0.22376864	0.45681627	-0.86095673	EPS	RET
251	3.8	4.3	0.36375490	0.74584806	-0.55802602	41	ERI
252	4.0	3.7	0.41881234	0.86781721	0.26737523	54	GAM TAU
253	4.2	3.8	0.40301685	0.86480531	0.29948154	61	DLT TAU
254	4.2	3.4	0.34273430	0.75346712	-0.56108867	43	ERI
255	5.1	4.7	0.39445613	0.88365714	0.25210002	73	PI TAU
256	3.9	3.5	0.37799776	0.86623483	0.32673370	74	EPS TAU
257	5.2	4.6	0.38543166	0.92273267	-0.00261632	45	ERI
258	3.5	4.0	0.21194786	0.53070527	-0.82062782	ALF	DOR
259	4.1	4.6	0.36657374	0.92843715	-0.06023409	48	NU ERI
260	4.6	4.0	0.27830314	0.69950151	0.65821349	58	PER
261	5.6	4.7	0.16695319	0.43586456	-0.88439172	R	DOR
262	4.3	3.8	0.34756479	0.90406196	-0.24873819	53	ERI
263	4.5	3.6	0.32859519	0.88183971	-0.33820692	54	ERI
264	4.3	4.7	0.32912625	0.94248156	-0.05834741	57	MU ERI
265	3.6	3.7	0.31028737	0.94307436	0.11971841	1	PI3 ORI
266	3.9	4.4	0.30535135	0.94736653	0.09621440	3	PI4 ORI
267	2.9	2.1	0.23888996	0.80304779	0.54593574	3	IOT AUR
268	4.8	4.0	0.27571723	0.96081323	0.02859973	10	PI6 ORI
269	3.4	3.4	0.19189754	0.69639065	0.69153119	7	EPS AUR
270	4.4	4.1	0.13011884	0.47694201	0.86924991	10	BET CAM
271	4.9	4.4	0.20159199	0.78822589	-0.58142980	GAM	CAE
272	5.3	4.5	0.15754076	0.62806712	-0.76204501	ETA2	PIC
273	3.5	2.7	0.22617300	0.89619394	-0.38168337	2	EPS LEP
274	3.1	3.4	0.23510723	0.96781430	-0.08977784	67	BET ERI
275	5.4	4.6	0.21290380	0.93745825	0.27539789		
276	3.6	4.0	0.20497326	0.93784492	-0.28005868	5	MU LEP
277	4.8	4.3	0.21330920	0.97575999	0.04890421	17	RHO ORI
278	5.2	4.6	0.07746992	0.37901829	-0.92214074	THT	DOR
279	3.8	4.3	0.19293280	0.97383574	-0.12008695	20	TAU ORI
280	4.9	4.3	0.16339224	0.81949576	0.54929925	16	AUR

Table 5.2-2. Orbiter Uplinkable Stars (2005)

No.	IDT Mag.	SSST Mag.	X Component	Y Component	Z Component	Skymap Name	
281	4.5	4.2	0.16548116	0.97670206	-0.13663481	29	ORI
282	3.6	4.1	0.16506521	0.98536227	-0.04259898	28	ETA ORI
283	5.3	4.5	0.13378263	0.78370744	0.60655161	21	SIG AUR
284	3.3	3.0	0.13776902	0.92462197	-0.35509704	9	BET LEP
285	4.2	3.8	0.10823414	0.80682068	-0.58079752		EPS COL
286	4.3	3.0	0.12669312	0.93949318	0.31827883	119	TAU
287	4.1	4.2	0.05385440	0.45825136	-0.88718960		BET DOR
288	5.3	4.8	0.08762283	0.99583148	0.02533563	51	ORI
289	4.0	4.0	0.07106309	0.92134937	-0.38218500	13	GAM LEP
290	3.9	4.2	0.06453957	0.96449123	-0.25610800	14	ZET LEP
291	4.2	4.5	0.03807915	0.62704581	-0.77805111		BET PIC
292	4.9	4.4	0.02688435	0.55594001	-0.83078754		GAM PIC
293	3.5	3.0	0.03821848	0.81036870	-0.58467248		BET COL
294	4.9	4.0	0.04291175	0.79439297	0.60588645	31	UPS AUR
295	4.2	3.8	0.04407177	0.93321461	-0.35660646	15	DLT LEP
296	5.1	4.4	0.04428416	0.99850039	0.03218502	56	ORI
297	5.0	4.6	0.01236553	0.45232177	-0.89176909		
298	4.1	4.2	0.02486051	0.96924026	-0.24485764	16	ETA LEP
299	4.3	3.8	0.00762971	0.73348567	-0.67966209		ETA COL
300	4.1	3.7	0.01167233	0.58368695	0.81189488	33	DLT AUR
301	4.9	4.3	0.01066061	0.99850253	-0.05365677		
302	4.5	4.7	0.00158285	0.98585274	0.16760626	61	MU ORI
303	5.4	4.7	-0.00487593	0.89661612	-0.44278184		
304	4.6	4.4	-0.00432592	0.91866838	0.39500593	1	GEM
305	5.5	4.5	-0.02273967	0.94434406	-0.32817252	19	LEP
306	5.2	4.3	-0.02008616	0.41300123	-0.91050894		ETA2 DOR
307	4.3	3.7	-0.05382147	0.99258243	-0.10901082	5	GAM MON
308	3.5	2.6	-0.04775555	0.92249125	0.38305260	7	ETA GEM
309	4.7	4.4	-0.04625045	0.86900241	0.49264156	44	KAP AUR
310	4.8	4.4	-0.05267694	0.81623569	-0.57531247		KAP COL
311	5.4	4.4	-0.02765487	0.47583043	0.87910216	1	LYN
312	5.1	4.2	-0.07612640	0.99579456	-0.05097024		
313	4.3	4.0	-0.07377785	0.83147675	-0.55063894		DLT COL
314	2.2	2.7	-0.08497229	0.94763210	-0.30785242	2	BET CMA
315	3.1	2.1	-0.08025156	0.92012316	0.38331848	13	MU GEM
316	4.9	3.7	-0.05978460	0.64914226	0.75831400	46	PSI1 AUR

Table 5.2-2. Orbiter Uplinkable Stars (2005)

No.	IDT Mag.	SSST Mag.	X Component	Y Component	Z Component	Skymap Name	
317	5.5	4.6	-0.05118028	0.52077724	0.85215705	5	LYN
318	4.0	4.5	-0.11403494	0.98597459	-0.12186115	11	BET MON
319	5.5	4.8	-0.10554237	0.78459734	-0.61095648		
320	3.4	3.9	-0.11484827	0.72045508	-0.68392569	NU	PUP
321	5.1	4.3	-0.15586654	0.95726702	-0.24360926		
322	5.1	4.6	-0.11451731	0.72792216	0.67602893	50	PSI2 AUR
323	5.4	4.6	-0.16956428	0.97269440	-0.15847256		
324	5.3	4.5	-0.12198796	0.70181866	0.70183296	55	PSI4 AUR
325	3.3	2.6	-0.16047083	0.89061743	0.42549936	27	EPS GEM
326	5.1	4.3	-0.19150813	0.97134318	0.14077308	17	MON
327	5.2	4.1	-0.19368390	0.96867130	-0.15544278		
328	4.8	4.4	-0.19598453	0.97966083	0.04306648	18	MON
329	3.6	3.9	-0.09731779	0.46111231	-0.88198905		ALF PIC
330	4.2	4.7	-0.17534536	0.82544562	-0.53655711	13	KAP CMA
331	4.8	4.5	-0.12543502	0.58054716	-0.80450671		
332	3.3	2.7	-0.13398455	0.62104278	-0.77223960		TAU PUP
333	5.4	4.8	-0.15244678	0.72924318	0.66705649	58	PSI7 AUR
334	5.3	4.6	-0.17545122	0.80718077	-0.56362760		
335	3.9	4.2	-0.17760265	0.80956335	0.55952165	34	THT GEM
336	4.0	3.0	-0.20552483	0.88924970	-0.40864962	16	OMI1 CMA
337	4.4	3.6	-0.21946115	0.95330366	-0.20748236	14	THT CMA
338	5.1	4.1	-0.15683341	0.64171574	-0.75073576		
339	4.8	4.5	-0.11968816	0.50877771	0.85253738	15	LYN
340	1.7	2.2	-0.21423271	0.84882362	-0.48332474	21	EPS CMA
341	5.5	4.7	-0.09749116	0.36430926	-0.92616102		
342	4.9	4.2	-0.05121645	0.21825167	0.97454763		
343	3.6	2.6	-0.22779409	0.85422498	-0.46734306	22	SIG CMA
344	5.4	4.4	-0.25539685	0.96181171	-0.09844123		
345	5.4	4.7	-0.25760948	0.94713107	0.19125922		
346	4.2	4.0	-0.24670314	0.90267557	0.35258243	43	ZET GEM
347	2.3	2.2	-0.25592561	0.85907851	-0.44326763	25	DLT CMA
348	4.0	3.7	-0.09959789	0.32007329	-0.94214295		GAM1 VOL
349	4.8	4.2	-0.25220212	0.82547819	0.50495529	46	TAU GEM
350	5.2	4.4	-0.22662869	0.73870573	0.63478601	63	AUR
351	5.3	4.5	-0.22026979	0.67771328	-0.70155964		
352	4.9	4.4	-0.29350369	0.87082891	-0.39435085		

Table 5.2-2. Orbiter Uplinkable Stars (2005)

No.	IDT Mag.	SSST Mag.	X Component	Y Component	Z Component	Skymap Name	
353	4.4	4.2	-0.12400204	0.35578625	-0.92630429		DLT VOL
354	2.9	2.0	-0.25792672	0.75576629	-0.60190624		PI PUP
355	3.9	4.1	-0.30603902	0.87469350	0.37583427	55	DLT GEM
356	5.4	4.5	-0.31641235	0.88135656	0.35084731	56	GEM
357	5.6	4.8	-0.30805973	0.82976068	-0.46539920		
358	4.2	3.8	-0.31172558	0.82698242	0.46789661	60	IOT GEM
359	3.5	2.7	-0.27202629	0.67635700	-0.68450194		SIG PUP
360	4.9	4.3	-0.36236365	0.90811445	0.20981117	6	CMI
361	5.1	4.7	-0.32422914	0.79487440	-0.51288415		
362	5.1	4.2	-0.04492807	0.12230371	0.99147530		
363	5.1	4.2	-0.37648509	0.89235102	-0.24893499		
364	5.2	4.5	-0.24421503	0.55880984	-0.79252166		
365	4.3	3.5	-0.35112940	0.81884234	0.45409841	69	UPS GEM
366	5.3	4.4	-0.38952838	0.86886102	0.30552932	74	
367	5.3	4.3	-0.01669751	0.04728365	0.99874193		
368	4.3	3.9	-0.41242246	0.89612677	-0.16390401	26	ALF MON
369	4.3	3.9	-0.13009707	0.27136401	-0.95364371		ZET VOL
370	5.6	4.7	-0.38394194	0.81346663	0.43687598	76	
371	4.0	3.7	-0.38964190	0.82216880	0.41499114	77	KAP GEM
372	5.2	4.4	-0.41251493	0.85308356	0.31949940	81	
373	5.5	4.6	-0.34502570	0.71273895	0.61070488		
374	5.4	4.5	-0.36631232	0.74869493	0.55251351	80	PI GEM
375	4.1	3.7	-0.35285914	0.67427013	-0.64872969		
376	3.7	4.2	-0.29165420	0.52885504	-0.79702583		CHI CAR
377	4.6	4.5	-0.44254498	0.80911404	-0.38663730	11	
378	5.3	4.3	-0.24431390	0.42843927	-0.86991408		
379	5.3	4.7	-0.48857669	0.87033084	-0.06178221	27	
380	4.9	4.1	-0.49489078	0.86867975	-0.02187710	28	
381	4.7	4.1	-0.49825844	0.86595272	0.04317884		
382	5.3	4.5	-0.36622759	0.60313106	-0.70859740		
383	4.7	4.4	-0.52215351	0.85141408	-0.04949513	29	ZET MON
384	5.1	4.8	-0.52012316	0.82496022	-0.22116178	19	
385	3.8	3.0	-0.54390842	0.82330039	0.16229631	17	BET CNC
386	5.1	4.3	-0.47985180	0.68905418	-0.54308985		
387	4.5	3.6	-0.41558419	0.59673699	0.68643626	31	
388	5.5	4.8	-0.53390162	0.74231732	-0.40486300		LYN

Table 5.2-2. Orbiter Uplinkable Stars (2005)

No.	IDT Mag.	SSST Mag.	X Component	Y Component	Z Component	Skymap Name	
389	4.1	3.7	-0.24104818	0.32816402	-0.91334777		BET VOL
390	3.8	3.5	-0.28960175	0.39097938	0.87365093	1	OMI UMA
391	5.6	4.7	-0.57395355	0.75654584	0.31339386	31	THT CNC
392	5.3	4.7	-0.40028361	0.50684375	-0.76346738		
393	4.5	4.8	-0.46136228	0.57032818	-0.67961063		
394	4.8	4.2	-0.62861925	0.77528884	0.06136002	5	SIG HYA
395	5.3	4.5	-0.62032853	0.75486959	-0.21298924	6	HYA
396	4.4	4.1	-0.52061445	0.63074203	-0.57543469		BET PYX
397	5.0	4.4	-0.27067281	0.33467502	0.90262332	4	PI2 UMA
398	3.8	4.3	-0.38682036	0.46568593	-0.79593129		OMI VEL
399	3.9	4.4	-0.54347298	0.63868978	-0.54471321		ALF PYX
400	5.0	4.8	-0.64195268	0.75685009	-0.12277904		
401	4.5	4.2	-0.48056689	0.55964823	-0.67516614		
402	4.3	3.9	-0.61598499	0.72221743	0.31458619	47	DLT CNC
403	2.3	2.6	-0.37944436	0.43910563	-0.81437597		DLT VEL
404	4.7	4.4	-0.63833556	0.73423647	-0.23113744	12	HYA
405	4.4	4.0	-0.57317411	0.66126140	0.48394710	48	IOT CNC
406	3.8	3.7	-0.65209189	0.74937000	0.11498160	11	EPS HYA
407	4.3	3.7	-0.59455433	0.65800853	-0.46209298		GAM PYX
408	4.1	4.5	-0.33932131	0.35784414	-0.86994748		
409	3.5	3.1	-0.68045103	0.72495302	0.10690890	16	ZET HYA
410	4.9	4.8	-0.52903194	0.53732101	-0.65681910		
411	4.4	4.4	-0.51958420	0.53167111	0.66884833		
412	4.3	4.6	-0.28744041	0.28329674	-0.91494315		ALF VOL
413	4.1	3.6	-0.48824707	0.47802731	-0.73014018		
414	5.3	4.8	-0.71427783	0.69375560	0.09225155	18	OMG HYA
415	5.0	4.5	-0.56022878	0.54407166	0.62460366		
416	4.8	3.9	-0.65346671	0.62090733	-0.43296113		KAP PYX
417	5.3	4.4	-0.62483933	0.58457477	0.51754048		RS CNC
418	4.2	4.7	-0.34505589	0.31580300	-0.88385796		
419	4.1	4.6	-0.74175839	0.66922265	0.04399463	22	THT HYA
420	5.5	4.6	-0.40551591	0.36468202	0.83819083	17	UMA
421	4.5	3.6	-0.40549690	0.35627445	-0.84180804		
422	5.3	4.3	-0.53934926	0.47494516	-0.69536283		
423	4.1	4.5	-0.60202950	0.52455070	0.60200252	38	LYN
424	3.4	2.5	-0.62587284	0.53455611	0.56791984	40	ALF LYN

Table 5.2-2. Orbiter Uplinkable Stars (2005)

No.	IDT Mag.	SSST Mag.	X Component	Y Component	Z Component	Skymap Name	
425	4.9	4.0	-0.68813468	0.58112178	-0.43447455	THT	PYX
426	5.1	4.8	-0.67497453	0.56123559	-0.47898225	LAM	PYX
427	4.8	4.2	-0.69052933	0.57052388	0.44460290	1	KAP LEO
428	5.1	4.6	-0.72252304	0.57974064	-0.37664472		
429	4.8	4.0	-0.63787548	0.50206069	-0.58399480	EPS	ANT
430	4.0	4.1	-0.60293019	0.46804783	-0.64606997	PSI	VEL
431	3.4	2.5	-0.43381759	0.33379108	-0.83689056	N	VEL
432	4.1	4.2	-0.35382987	0.27737822	0.89323331	23	UMA
433	5.6	4.8	-0.64402745	0.50091712	0.57819605	8	LMI
434	4.6	3.7	-0.72648998	0.56317222	0.39376306	4	LAM LEO
435	5.4	4.7	-0.77956541	0.60207915	0.17256438	6	LEO
436	4.0	3.1	-0.36670868	0.27889633	-0.88754807	R	CAR
437	3.6	3.6	-0.48861254	0.37685851	0.78691514	25	THT UMA
438	5.0	4.7	-0.63922968	0.48534911	0.59650788	10	LMI
439	4.4	4.7	-0.41259569	0.30812255	-0.85721951		
440	5.0	4.8	-0.27073132	0.20757840	0.94000838	24	UMA
441	4.6	3.8	-0.11662792	0.08939785	0.98914405		
442	5.0	4.4	-0.80567506	0.58622975	0.08498455		
443	4.2	3.6	-0.81224761	0.58309371	-0.01598567	35	IOT HYA
444	3.9	4.0	-0.80263169	0.57000681	0.17571171	14	OMI LEO
445	5.6	4.6	-0.79638649	0.55241866	0.24617510	16	PSI LEO
446	4.5	4.3	-0.38552202	0.26035559	-0.88520491	L	CAR
447	3.4	3.2	-0.75512705	0.51408307	0.40681904	17	EPS LEO
448	5.4	4.5	-0.44584104	0.30355488	0.84206900		
449	3.3	3.5	-0.35438039	0.23488974	-0.90511952	UPS	CAR
450	5.1	4.2	-0.81400128	0.54456388	0.20211901	R	LEO
451	4.2	4.4	-0.42781081	0.27937439	0.85960913	29	UPS UMA
452	4.5	4.2	-0.81400373	0.52322040	-0.25226640	39	UPS1 HYA
453	4.9	4.4	-0.58213396	0.37177929	-0.72311839		
454	4.2	3.7	-0.75627370	0.48222009	0.44216950	24	MU LEO
455	5.2	4.7	-0.76403073	0.47776745	-0.43358425		
456	5.2	4.3	-0.80404331	0.49995351	-0.32180870		
457	3.8	4.2	-0.49866009	0.30228848	-0.81237909	PHI	VEL
458	4.9	4.0	-0.85169497	0.50383945	0.14408846	29	PI LEO
459	3.8	4.2	-0.83759920	0.46138485	0.29249205	30	ETA LEO
460	4.6	3.9	-0.86326501	0.47239394	0.17781307	31	LEO

Table 5.2-2. Orbiter Uplinkable Stars (2005)

No.	IDT Mag.	SSST Mag.	X Component	Y Component	Z Component	Skymap Name		
461	4.0	3.6	-0.86357912	0.45851469	-0.20975076	41	LAM	HYA
462	3.6	4.0	-0.30819335	0.15611021	-0.93842765		OMG	CAR
463	4.2	4.5	-0.66437898	0.33625405	-0.66748317			
464	3.8	4.0	-0.81951084	0.40897865	0.40142053	36	ZET	LEO
465	3.8	4.1	-0.65286808	0.32524019	0.68409216	33	LAM	UMA
466	4.8	3.9	-0.52027009	0.24890985	-0.81692283			
467	3.3	2.4	-0.67523902	0.31720082	0.66590983	34	MU	UMA
468	5.2	4.7	-0.68010491	0.31650519	-0.66127284			
469	4.1	3.3	-0.87497807	0.39111450	-0.28538188	42	MU	HYA
470	4.5	3.8	-0.78589549	0.34639434	-0.51222967		ALF	ANT
471	4.2	4.4	-0.47941897	0.20836480	-0.85249138			
472	4.6	4.3	-0.73134509	0.32184197	0.60129203	31	BET	LMI
473	3.6	4.0	-0.44205298	0.18256529	-0.87821357			
474	4.1	4.5	-0.91133098	0.37665365	0.16615617	47	RHO	LEO
475	5.3	4.4	-0.84981793	0.34493363	-0.39853516	44		HYA
476	4.3	3.5	-0.18819782	0.07329760	-0.97939218		GAM	CHA
477	4.7	3.7	-0.50237833	0.19875468	-0.84149426			
478	5.1	4.2	-0.82911257	0.32295793	-0.45636664			
479	4.2	4.4	-0.62423903	0.24218799	-0.74274532			
480	5.3	4.6	-0.33131761	0.12137980	0.93567921			
481	4.7	3.7	-0.46671275	0.16613387	-0.86866492			
482	3.1	2.8	-0.61894274	0.21124731	-0.75649485		MU	VEL
483	3.5	2.9	-0.91344705	0.30049704	-0.27443762		NU	HYA
484	4.2	3.8	-0.78673386	0.24606972	0.56612677	46		LMI
485	5.4	4.7	-0.54947096	0.17179753	0.81765963	44		UMA
486	5.0	4.6	-0.76743267	0.22590895	-0.60001020		IOT	ANT
487	4.5	4.0	-0.91553586	0.25689018	-0.30951820	7	ALF	CRT
488	5.2	4.7	-0.96139056	0.26671143	0.06777318	58		LEO
489	4.9	4.0	-0.96438373	0.26166671	-0.03865946	61		LEO
490	2.2	1.7	-0.45351317	0.12015326	0.88311324	50	ALF	UMA
491	5.0	4.6	-0.45346533	0.11206073	-0.88420110			
492	4.3	3.7	-0.50534369	0.12028460	-0.85449363			
493	3.4	2.9	-0.69093993	0.16316005	0.70425905	52	PSI	UMA
494	3.6	4.0	-0.94130708	0.20173962	0.27063278	70	THT	LEO
495	4.8	3.9	-0.89836724	0.18871915	0.39663759	72		LEO
496	5.4	4.6	-0.97976725	0.19613436	0.03984279	75		LEO

Table 5.2-2. Orbiter Uplinkable Stars (2005)

No.	IDT Mag.	SSST Mag.	X Component	Y Component	Z Component	Skymap Name		
497	4.2	4.2	-0.83389752	0.16402670	0.52698213	53	XI	UMA
498	3.8	3.1	-0.81966034	0.16014101	0.55001071	54	NU	UMA
499	3.9	3.5	-0.95100293	0.18128467	-0.25045816	12	DLT	CRT
500	4.1	4.6	-0.57525873	0.10476003	-0.81123531		PI	CEN
501	4.3	4.7	-0.97774420	0.17877874	0.10979272	77	SIG	LEO
502	5.3	4.5	-0.79830490	0.13796176	-0.58623872			
503	4.3	4.4	-0.96832519	0.16495711	0.18744458	78	IOT	LEO
504	5.1	4.2	-0.96956064	0.16190114	-0.18368501	14	EPS	CRT
505	4.4	4.7	-0.94136243	0.15595030	-0.29919271	15	GAM	CRT
506	5.0	4.2	-0.98899982	0.14005212	-0.04758941	87		LEO
507	4.0	3.1	-0.34516317	0.04781479	0.93732392	1	LAM	DRA
508	3.4	3.8	-0.45491442	0.05292023	-0.88896137		LAM	CEN
509	4.7	4.3	-0.99371664	0.11151735	-0.00954536	91	UPS	LEO
510	5.6	4.7	-0.98377068	0.10391495	0.14627687	1	OMG	VIR
511	5.5	4.7	-0.84251425	0.07656033	-0.53320563			
512	5.1	4.8	-0.94780408	0.07364900	-0.31023095	27	ZET	CRT
513	4.3	3.5	-0.99031270	0.07234362	0.11852068	3	NU	VIR
514	4.1	3.5	-0.66663842	0.04835683	0.74381102	63	CHI	UMA
515	4.5	4.2	-0.48515309	0.03375637	-0.87377742			
516	5.3	4.4	-0.89353591	0.05379282	-0.44575768			
517	5.3	4.5	-0.34237100	0.01864946	-0.93937974			
518	4.0	4.0	-0.99802573	0.05171547	0.03563912	5	BET	VIR
519	4.8	4.2	-0.70752397	0.03513056	-0.70581561			
520	5.3	4.5	-0.23783432	-0.00222359	-0.97130319		KAP	CHA
521	4.5	4.2	-0.98759166	-0.01141070	0.15662857	9	OMI	VIR
522	4.5	4.7	-0.43302753	-0.00805521	-0.90134470		ETA	CRU
523	4.4	4.6	-0.91002283	-0.02317366	-0.41390993	1	ALF	CRV
524	3.3	2.7	-0.92443328	-0.03044043	-0.38012694	2	EPS	CRV
525	4.2	4.7	-0.61394125	-0.02418768	-0.78898105		RHO	CEN
526	3.0	3.5	-0.52215660	-0.02844414	-0.85237516		DLT	CRU
527	3.6	3.9	-0.53922475	-0.03055124	0.84160756	69	DLT	UMA
528	4.3	3.5	-0.37893669	-0.02452415	-0.92509759		EPS	MUS
529	4.3	4.7	-0.44163429	-0.03030943	-0.89668305		ZET	CRU
530	5.2	4.3	-0.57404084	-0.04092175	-0.81780347			
531	5.5	4.5	-0.65073728	-0.04936788	0.75769638	3		CVN
532	4.2	4.5	-0.99711544	-0.07559493	-0.00679698	15	ETA	VIR

Table 5.2-2. Orbiter Uplinkable Stars (2005)

No.	IDT Mag.	SSST Mag.	X Component	Y Component	Z Component	Skymap Name	
533	5.1	4.8	-0.94768599	-0.07534983	0.31018328	11	COM
534	3.9	3.1	-0.49648429	-0.04043738	-0.86710332		EPS CRU
535	4.7	4.2	-0.87345295	-0.09350749	0.47784547	15	GAM COM
536	5.5	4.6	-0.51627801	-0.05587326	-0.85459651		
537	4.1	4.6	-0.63947585	-0.07094488	-0.76553083		SIG CEN
538	3.2	3.6	-0.95331843	-0.11392614	-0.27965121	7	DLT CRV
539	1.9	1.0	-0.54282648	-0.06756922	-0.83712234		GAM CRU
540	4.1	4.6	-0.30882106	-0.03989483	-0.95028309		GAM MUS
541	4.7	4.6	-0.74044655	-0.10180304	0.66436063	8	BET CVN
542	3.1	2.8	-0.91086140	-0.12702309	-0.39267880	9	BET CRV
543	5.6	4.7	-0.49802699	-0.07468973	0.86393898		T UMA
544	2.9	3.4	-0.35663962	-0.05357249	-0.93270476		ALF MUS
545	5.0	4.4	-0.97828478	-0.15782372	-0.13435238	26	CHI VIR
546	5.1	4.7	-0.48079745	-0.09060525	-0.87213789		IOT CRU
547	3.3	3.8	-0.37059562	-0.07067221	-0.92610168		BET MUS
548	5.4	4.8	-0.93936315	-0.18322559	0.28987110	27	COM
549	5.7	4.8	-0.38205313	-0.07692530	0.92093317	7	DRA
550	1.4	2.0	-0.49912051	-0.09878183	-0.86088377		BET CRU
551	4.6	3.9	-0.64455090	-0.14367889	-0.75093975		
552	5.0	4.1	-0.96189421	-0.22095478	-0.16105438	40	PSI VIR
553	4.3	4.7	-0.53220326	-0.12198060	-0.83778304		MU1 CRU
554	3.6	2.7	-0.97133110	-0.22896134	0.06397342	43	DLT VIR
555	5.0	4.1	-0.92401886	-0.23230914	0.30368011	36	COM
556	5.3	4.7	-0.82950377	-0.21406744	0.51584748	37	COM
557	3.2	2.9	-0.94780377	-0.25249982	0.19470966	47	EPS VIR
558	4.0	3.5	-0.31041574	-0.08150980	-0.94709990		DLT MUS
559	4.7	4.8	-0.91112135	-0.27650483	0.30561898	42	ALF COM
560	5.1	4.3	-0.37793359	-0.12612579	-0.91720144		
561	5.0	4.0	-0.94208553	-0.32015056	0.09989230	60	SIG VIR
562	3.4	3.1	-0.87067526	-0.30065578	-0.38926942	46	GAM HYA
563	4.9	4.7	-0.40746316	-0.14957459	-0.90088912		
564	5.5	4.7	-0.91153257	-0.35020216	-0.21556164	68	VIR
565	5.1	4.7	-0.89751640	-0.34800404	-0.27084589	69	VIR
566	5.2	4.3	-0.85486889	-0.34093304	-0.39110591	R	HYA
567	4.2	3.7	-0.71885557	-0.29092741	-0.63135403		
568	4.9	4.0	-0.91988638	-0.37800320	-0.10451137	74	VIR

Table 5.2-2. Orbiter Uplinkable Stars (2005)

No.	IDT Mag.	SSST Mag.	X Component	Y Component	Z Component	Skymap Name		
569	3.7	4.0	-0.92027560	-0.39122566	-0.00594163	79	ZET	VIR
570	4.9	3.9	-0.52191488	-0.24016416	0.81849009	83		UMA
571	5.2	4.3	-0.89832279	-0.41402721	-0.14696133	82		VIR
572	4.6	4.7	-0.75742575	-0.36468063	-0.54158496	1		CEN
573	5.1	4.7	-0.56401710	-0.27350075	-0.77915470			
574	4.4	3.6	-0.73929095	-0.37076293	-0.56212431	2		CEN
575	4.3	3.5	-0.85807938	-0.43278169	0.27640511	5	UPS	BOO
576	5.2	4.5	-0.83013632	-0.42001199	0.36669281	6		BOO
577	4.9	4.0	-0.37531900	-0.19531599	0.90608350	10		DRA
578	4.9	4.0	-0.73002036	-0.37834319	0.56914559			
579	3.1	3.1	-0.83604245	-0.44593023	0.31965489	8	ETA	BOO
580	5.3	4.6	-0.77731333	-0.42331152	0.46539375	9		BOO
581	5.1	4.6	-0.39290691	-0.21333497	-0.89448999			
582	4.0	4.5	-0.65264635	-0.35886620	-0.66728389		PHI	CEN
583	3.9	4.3	-0.36840931	-0.21923380	0.90344403	11	ALF	DRA
584	3.6	3.2	-0.76844249	-0.45953963	-0.44533073	49	PI	HYA
585	5.5	4.6	-0.61250805	-0.37509209	0.69580156			
586	5.4	4.5	-0.55092820	-0.33897822	0.76260860	13		BOO
587	5.1	4.4	-0.17897089	-0.11292146	0.97735263	4		UMI
588	5.1	4.1	-0.81468759	-0.50959645	-0.27675907			
589	5.4	4.5	-0.29214899	-0.18814346	0.93768385			
590	4.5	3.9	-0.82995818	-0.52988448	-0.17433258	98	KAP	VIR
591	4.5	4.5	-0.83112364	-0.54692616	-0.10052495	99	IOT	VIR
592	5.4	4.5	-0.42221637	-0.27667705	-0.86323991		R	CEN
593	5.2	4.8	-0.67314673	-0.45354000	0.58410183			
594	3.8	4.3	-0.57735965	-0.39012944	-0.71725508		IOT	LUP
595	5.2	4.6	-0.79151643	-0.54082899	0.28461508	20		BOO
596	4.3	4.7	-0.65342373	-0.44699472	-0.61092810		PSI	CEN
597	5.1	4.5	-0.72598415	-0.50926088	-0.46216920	51		HYA
598	4.5	4.5	-0.49807958	-0.36011758	0.78881687	23	THT	BOO
599	4.6	4.0	-0.09395872	-0.06493789	-0.99345600		DLT	OCT
600	4.5	3.8	-0.19456184	-0.14608691	0.96995067	5		UMI
601	3.9	3.3	-0.68369174	-0.52303740	0.50891795	25	RHO	BOO
602	3.4	3.6	-0.62052589	-0.47638263	0.62290224	27	GAM	BOO
603	4.3	4.8	-0.51037353	-0.40781681	-0.75710257		RHO	LUP
604	0.6	0.5	-0.38162815	-0.30831488	-0.87137930		ALF	CEN

Table 5.2-2. Orbiter Uplinkable Stars (2005)

No.	IDT Mag.	SSST Mag.	X Component	Y Component	Z Component	Skymap Name		
605	4.1	4.4	-0.74683728	-0.61982772	0.24093085	30	ZET	BOO
606	2.5	3.0	-0.52340403	-0.43373029	-0.73343456		ALF	LUP
607	4.2	4.7	-0.60965085	-0.50633496	-0.60987765			
608	3.6	3.8	-0.32850785	-0.27179643	-0.90454922		ALF	CIR
609	4.3	4.4	-0.76139023	-0.64130712	-0.09492152	107	MU	VIR
610	4.4	3.7	-0.62644708	-0.52838411	-0.57303951			
611	5.0	4.6	-0.72405224	-0.62334539	0.29527762	35	OMI	BOO
612	4.0	4.4	-0.75502781	-0.65466607	0.03667891	109		VIR
613	4.1	3.4	-0.14748608	-0.12546411	-0.98107421		ALF	APS
614	4.7	4.0	-0.65938011	-0.59022022	-0.46568010	58		HYA
615	5.0	4.8	-0.69834851	-0.63482673	0.33061213	37	XI	BOO
616	4.8	3.9	-0.29012998	-0.28205840	0.91447671			
617	3.9	3.6	-0.53686032	-0.53712978	0.65059403	42	BET	BOO
618	5.1	4.3	-0.64002251	-0.63955369	0.42584300	41	OMG	BOO
619	4.8	4.4	-0.70540899	-0.70767666	0.03989857	110		VIR
620	3.5	2.5	-0.63722801	-0.64355577	-0.42400051	20	SIG	LIB
621	4.9	4.3	-0.62292491	-0.63549672	0.45618907	43	PSI	BOO
622	4.1	4.6	-0.47993070	-0.48710846	-0.72965188		PI	LUP
623	5.4	4.7	-0.66804734	-0.69075205	-0.27672072	21	NU	LIB
624	4.3	4.8	-0.48717999	-0.51097766	-0.70820723		LAM	LUP
625	3.8	3.5	-0.41939130	-0.45238066	-0.78705951		ZET	LUP
626	3.9	3.5	-0.55394373	-0.62332625	0.55191550	49	DLT	BOO
627	4.4	4.7	-0.34578156	-0.38936049	-0.85371747		BET	CIR
628	5.2	4.6	-0.29728435	-0.33425634	-0.89436833		EPS	CIR
629	4.7	4.3	-0.57182716	-0.65078568	-0.49949143	2		LUP
630	3.8	3.0	-0.52320287	-0.61594912	-0.58895283		PHI1	LUP
631	3.6	4.1	-0.46010797	-0.54481875	-0.70105148		EPS	LUP
632	3.7	3.2	-0.32312675	-0.39835457	0.85843039	12	IOT	DRA
633	5.4	4.4	-0.60786796	-0.74709832	0.26896215	9	TAU1	SER
634	4.1	4.2	-0.54372671	-0.68204817	0.48905169	3	BET	CRB
635	5.4	4.4	-0.42823433	-0.53794338	-0.72610762			
636	5.2	4.3	-0.46168584	-0.59698444	0.65609127	52	NU1	BOO
637	5.5	4.7	-0.12945289	-0.17310516	0.97635882	15	THT	UMI
638	5.0	4.6	-0.59470884	-0.78534866	-0.17189787	37		LIB
639	4.2	4.4	-0.58994812	-0.78578391	0.18575481	13	DLT	SER
640	5.3	4.4	-0.46271040	-0.62198455	0.63169162	6	MU	CRB

Table 5.2-2. Orbiter Uplinkable Stars (2005)

No.	IDT Mag.	SSST Mag.	X Component	Y Component	Z Component	Skymap Name		
641	4.3	3.9	-0.57985907	-0.77460872	-0.25247730	38	GAM	LIB
642	4.5	4.0	-0.24314685	-0.32302677	-0.91462195		EPS	TRA
643	4.6	3.9	-0.43750116	-0.59484534	-0.67435284		OMG	LUP
644	3.9	4.4	-0.51229299	-0.70238616	-0.49417565	40	TAU	LIB
645	5.1	4.7	-0.48414737	-0.66996219	-0.56280723	3	PSI1	LUP
646	5.3	4.6	-0.53411700	-0.74411302	-0.40126654	42		LIB
647	5.0	4.1	-0.54377966	-0.76984327	-0.33413323	43	KAP	LIB
648	5.5	4.6	-0.45824103	-0.65066118	-0.60552059			
649	4.1	4.5	-0.51149003	-0.73480102	0.44547212	8	GAM	CRB
650	4.0	4.3	-0.53906565	-0.79831320	0.26852236	28	BET	SER
651	4.3	3.4	-0.52237113	-0.79284659	0.31388323	35	KAP	SER
652	3.8	4.2	-0.54738922	-0.83492118	-0.05719847	32	MU	SER
653	4.1	4.3	-0.54166465	-0.83671359	0.08068317	37	EPS	SER
654	4.2	4.6	-0.45497780	-0.69909252	-0.55160207	5	CHI	LUP
655	5.0	4.2	-0.50439317	-0.78464659	0.36044036	38	RHO	SER
656	4.5	4.2	-0.51149231	-0.81051127	-0.28538937	46	THT	LIB
657	3.2	3.4	-0.24040416	-0.37988136	-0.89325024		BET	TRA
658	4.3	4.3	-0.50217437	-0.82076125	0.27234513	41	GAM	SER
659	4.1	4.6	-0.45735774	-0.74481496	-0.48587505	5	RHO	SCO
660	4.5	3.9	-0.46045051	-0.76261915	0.45430976	13	EPS	CRB
661	3.1	3.6	-0.46362503	-0.77023765	-0.43793354	6	PI	SCO
662	3.6	4.1	-0.40208643	-0.67449770	-0.61917635		ETA	LUP
663	4.4	4.4	-0.25794833	-0.45090027	0.85448909	13	THT	DRA
664	5.1	4.8	-0.32858320	-0.56644158	-0.75576254		ETA	NOR
665	4.6	4.6	-0.48443205	-0.85284861	-0.19487131		XI	SCO
666	5.2	4.8	-0.37945956	-0.70722119	0.59653049	16	TAU	CRB
667	3.0	2.1	-0.45419954	-0.88872210	-0.06225597	1	DLT	OPH
668	4.2	3.8	-0.20409433	-0.39572108	-0.89540512		DLT	TRA
669	3.6	3.3	-0.43823723	-0.89531867	-0.07970325	2	EPS	OPH
670	4.1	4.6	-0.29607955	-0.62237685	0.72455776	22	TAU	HER
671	4.4	4.0	-0.28138380	-0.57739483	-0.76644528		GAM2	NOR
672	5.0	4.7	-0.39449253	-0.82357768	-0.40754809	19	OMI	SCO
673	3.2	3.5	-0.38814315	-0.81507431	-0.43011482	20	SIG	SCO
674	4.1	4.3	-0.40002568	-0.85502509	0.33001750	20	GAM	HER
675	5.3	4.4	-0.34916341	-0.75283673	0.55796215	20	NU1	CRB
676	4.9	4.5	-0.39296711	-0.85408674	-0.34075312	4	PSI	OPH

Table 5.2-2. Orbiter Uplinkable Stars (2005)

No.	IDT Mag.	SSST Mag.	X Component	Y Component	Z Component	Skymap Name		
677	5.4	4.4	-0.39920395	-0.90755443	-0.13031177			
678	5.3	4.5	-0.29339752	-0.68289407	0.66900940	30	G	HER
679	3.2	2.9	-0.36306874	-0.85597941	0.36807654	27	BET	HER
680	4.1	4.5	-0.38891732	-0.92054996	0.03648409	10	LAM	OPH
681	4.7	4.4	-0.37359148	-0.88301122	-0.28411369	8	PHI	OPH
682	5.1	4.3	-0.37388245	-0.90544421	0.20095446	29		HER
683	3.0	3.5	-0.32767596	-0.81888202	-0.47123317	23	TAU	SCO
684	4.4	3.5	-0.30270229	-0.75950398	-0.57578210			
685	5.1	4.3	-0.23129186	-0.61357316	0.75500467	42		HER
686	5.2	4.6	-0.14526360	-0.40219132	0.90395831	18		DRA
687	3.9	3.6	-0.26197334	-0.73148419	0.62952430	44	ETA	HER
688	4.6	4.2	-0.07821356	-0.20323809	-0.97600047		BET	APS
689	5.4	4.6	-0.32417611	-0.93390218	0.15078649	43		HER
690	4.6	4.4	-0.04063053	-0.13089192	0.99056371	22	EPS	UMI
691	4.0	3.1	-0.16478602	-0.48867574	-0.85676227		ETA	ARA
692	5.4	4.8	-0.27431495	-0.86580456	0.41848987	51		HER
693	5.6	4.7	-0.24673051	-0.82552314	-0.50757817			
694	3.6	3.1	-0.27486935	-0.94735578	0.16420676	27	KAP	OPH
695	3.3	2.4	-0.15806508	-0.53768392	-0.82819770		ZET	ARA
696	4.3	3.6	-0.16658154	-0.57705885	-0.79953341		EPS1	ARA
697	4.2	4.6	-0.22773259	-0.82636893	0.51502646	58	EPS	HER
698	5.1	4.3	-0.26478608	-0.96158740	-0.07237405	30		OPH
699	5.2	4.3	-0.24752352	-0.93748365	0.24465590			
700	3.4	3.9	-0.09119439	-0.40003544	0.91195133	22	ZET	DRA
701	3.7	3.8	-0.16227441	-0.71092666	-0.68428817		ETA	SCO
702	3.4	2.6	-0.19980479	-0.94754559	0.24947024	64	ALF1	HER
703	3.5	3.8	-0.18482072	-0.88805598	0.42094878	65	DLT	HER
704	3.4	2.7	-0.16189759	-0.78350530	0.59992384	67	PI	HER
705	4.7	4.5	-0.18509047	-0.87520981	-0.44693322	36		OPH
706	5.1	4.6	-0.19919061	-0.97993697	-0.00682903	41		OPH
707	5.3	4.4	-0.18625007	-0.96408026	0.18936780			
708	5.2	4.3	-0.17276781	-0.93464811	0.31077997			
709	5.1	4.6	-0.07112002	-0.37238198	-0.92535053		ZET	APS
710	3.5	4.0	-0.16158652	-0.89214829	-0.42185450	42	THT	OPH
711	4.5	4.7	-0.14546089	-0.90093251	-0.40885418	44		OPH
712	4.6	3.8	-0.15588318	-0.98507940	0.07293154	49	SIG	OPH

Table 5.2-2. Orbiter Uplinkable Stars (2005)

No.	IDT Mag.	SSST Mag.	X Component	Y Component	Z Component	Skymap Name	
713	4.7	4.8	-0.13511554	-0.85695488	-0.49736518	45	OPH
714	3.2	2.8	-0.08160740	-0.60552917	0.79162785	23	BET DRA
715	4.7	3.9	-0.12215269	-0.88931336	0.44068182	76	LAM HER
716	3.9	4.3	-0.07124613	-0.48499707	-0.87160876		DLT ARA
717	4.7	4.2	-0.09151757	-0.77608794	-0.62394875		
718	2.3	2.4	-0.08370967	-0.72692942	-0.68159101	THT	SCO
719	3.9	4.1	-0.10615269	-0.95837458	-0.26504673	55	XI SER
720	4.0	4.5	-0.06639099	-0.69107398	0.71972841	85	IOT HER
721	2.6	3.1	-0.07102018	-0.77381967	-0.62941183	KAP	SCO
722	3.1	2.6	-0.08255371	-0.99336983	0.08000790	60	BET OPH
723	4.0	3.4	-0.03571860	-0.42580730	-0.90410858	ETA	PAV
724	3.8	3.7	-0.05990002	-0.88306173	0.46541805	86	MU HER
725	3.4	3.5	-0.05306785	-0.76296791	-0.64425443	IOT1	SCO
726	4.1	4.4	-0.06367080	-0.99683923	0.04751392	62	GAM OPH
727	3.6	3.1	-0.04715087	-0.79693945	-0.60221616		
728	4.1	3.6	-0.01746954	-0.54609906	0.83753843	32	XI DRA
729	4.2	3.5	-0.01897393	-0.79571143	0.60537865	91	THT HER
730	5.2	4.7	-0.02141244	-0.71493246	-0.69886557		
731	4.1	3.8	-0.01589267	-0.87233639	0.48864777	92	XI HER
732	5.1	4.1	-0.01876277	-0.74627044	-0.66537838		
733	3.7	3.4	-0.01603395	-0.98536343	-0.16971098	64	NU OPH
734	5.2	4.3	-0.01553308	-0.86369379	-0.50377749		
735	5.0	4.4	-0.00907152	-0.95751773	0.28823168	93	HER
736	4.3	4.6	-0.00811080	-0.99865778	0.05115511	67	OPH
737	4.7	4.8	-0.00249795	-0.92980453	0.36804523	95	HER
738	4.4	4.2	0.01282645	-0.99897129	0.04349533	70	OPH
739	3.4	3.0	0.00974317	-0.86219861	-0.50647668	10	GAM SGR
740	5.4	4.5	0.01584712	-0.92565135	0.37804556	98	HER
741	3.9	4.3	0.00765610	-0.64143932	-0.76713557	THT	ARA
742	3.3	2.5	0.04973719	-0.79938766	-0.59875335	ETA	SGR
743	4.1	4.5	0.02138054	-0.87642786	0.48105829	103	OMI HER
744	5.0	4.7	0.01885547	-0.87890669	-0.47662092		
745	4.9	4.5	0.02278976	-0.69471546	-0.71892354	EPS	TEL
746	5.2	4.2	0.03730007	-0.85280865	0.52088973	104	HER
747	4.2	4.4	0.04384106	-0.93208828	-0.35956834	13	MU SGR
748	4.8	3.9	0.05794219	-0.88862434	-0.45496097		

Table 5.2-2. Orbiter Uplinkable Stars (2005)

No.	IDT Mag.	SSST Mag.	X Component	Y Component	Z Component	Skymap Name	
749	5.5	4.7	0.06794713	-0.90797235	0.41348446	105	HER
750	4.7	4.2	0.06381448	-0.80606840	0.58837186	1	KAP LYR
751	4.0	4.0	0.02857512	-0.29589396	0.95479329	44	CHI DRA
752	3.0	2.3	0.06727461	-0.86470321	-0.49775745	19	DLT SGR
753	3.7	3.3	0.08134073	-0.99538005	-0.05101217	58	ETA SER
754	5.2	4.3	0.05780806	-0.65223235	0.75581161		
755	5.3	4.5	0.06416248	-0.77798750	-0.62499490		
756	4.6	3.8	0.03869928	-0.47529076	-0.87897728	XI	PAV
757	5.1	4.8	0.09004359	-0.98368110	-0.15576790	ZET	SCT
758	5.1	4.5	0.09124569	-0.93178301	-0.35136113	21	SGR
759	5.2	4.6	0.04662542	-0.41155224	0.91019274	42	DRA
760	3.7	4.2	0.07039523	-0.69109733	-0.71932537	ALF	TEL
761	3.2	2.8	0.09783158	-0.89761484	-0.42978666	22	LAM
762	4.5	4.1	0.07125450	-0.65080182	-0.75589667	ZET	TEL
763	5.0	4.7	0.09625624	-0.73273742	-0.67366951	THT	CRA
764	4.2	3.5	0.13978612	-0.97963950	-0.14410513	ALF	SCT
765	5.5	4.7	0.11393733	-0.71962514	-0.68495105		
766	4.4	3.9	0.05134683	-0.31350979	-0.94819571	ZET	PAV
767	3.4	3.9	0.16435739	-0.87536152	-0.45467445	27	PHI
768	4.6	4.6	0.17675775	-0.91989299	0.35007654	110	HER
769	5.2	4.6	0.17082614	-0.87762294	0.44787990		
770	3.7	4.1	0.17459360	-0.81733431	0.54907349	10	BET LYR
771	5.0	4.5	0.11144110	-0.49781317	0.86009472	47	OMI DRA
772	5.6	4.7	0.14486922	-0.67091310	-0.72724722		
773	5.2	4.7	0.07650620	-0.31251711	0.94682620	52	UPS DRA
774	4.5	3.5	0.18260205	-0.77926473	0.59950227	12	DLT2 LYR
775	4.3	3.4	0.16769325	-0.70100746	0.69315764	13	R LYR
776	4.4	4.7	0.23171640	-0.97010405	0.07215007	63	THT1 SER
777	4.6	4.6	0.08649335	-0.37610480	-0.92253134	KAP	PAV
778	3.9	3.3	0.22064784	-0.90600481	-0.36120605	37	XI2 SGR
779	5.4	4.8	0.11609871	-0.48215906	-0.86835691	OMG	PAV
780	4.4	4.0	0.23919056	-0.93585207	0.25878326	13	EPS AQL
781	2.9	3.2	0.22216588	-0.83746318	-0.49929725	38	ZET SGR
782	4.2	3.8	0.24689304	-0.89494140	-0.37164999	39	OMI SGR
783	3.7	4.1	0.27290608	-0.95814694	-0.08646798	16	LAM AQL
784	5.6	4.7	0.27269026	-0.95159555	0.14179536	R	AQL

Table 5.2-2. Orbiter Uplinkable Stars (2005)

No.	IDT Mag.	SSST Mag.	X Component	Y Component	Z Component	Skymap Name		
785	3.7	3.1	0.24324969	-0.85090862	-0.46560080	40	TAU	SGR
786	5.0	4.5	0.21213375	-0.72931334	-0.65046239		DLT	CRA
787	4.5	3.9	0.22130602	-0.74010324	-0.63503609		BET	CRA
788	3.5	3.1	0.11876986	-0.36251294	0.92437984	57	DLT	DRA
789	4.8	4.2	0.09433273	-0.27205514	0.95764677	60	TAU	DRA
790	4.7	4.1	0.25194397	-0.74615393	0.61626175	21	THT	LYR
791	4.2	3.8	0.19455229	-0.56540518	0.80154001	1	KAP	CYG
792	5.3	4.7	0.30270604	-0.89549039	-0.32629129	43		SGR
793	4.3	4.5	0.32058688	-0.89572386	-0.30806300	44	RHO1	SGR
794	4.2	4.6	0.24092951	-0.67060883	-0.70159587		BET1	SGR
795	4.2	4.7	0.26057054	-0.71178068	-0.65228157		ALF	SGR
796	3.7	3.9	0.35376796	-0.93385329	0.05259524	30	DLT	AQL
797	4.7	3.9	0.33560855	-0.84533615	0.41566055	6	ALF	VUL
798	4.1	4.4	0.23368068	-0.57515369	0.78395891	10	IOT	CYG
799	5.2	4.1	0.37432700	-0.92592071	-0.05049880	36		AQL
800	4.8	4.3	0.38623121	-0.91368272	0.12652801	38	MU	AQL
801	5.1	4.7	0.35693399	-0.78868810	0.50056888	12	PHI	CYG
802	3.0	2.1	0.43058868	-0.88399398	0.18206600	50	GAM	AQL
803	4.1	3.4	0.42023542	-0.85068550	0.31581065	7	DLT	SGE
804	4.2	4.0	0.15470247	-0.30243086	0.94053321	63	EPS	DRA
805	4.3	3.2	0.38375480	-0.74800176	0.54150311		CHI	CYG
806	5.3	4.3	0.35723981	-0.69516193	0.62380254	19		CYG
807	5.4	4.8	0.27732221	-0.53631550	0.79715624	20		CYG
808	4.3	4.0	0.46140544	-0.88705771	0.01528511	55	ETA	AQL
809	4.5	4.1	0.34835951	-0.65642879	-0.66913892		IOT	SGR
810	4.1	3.9	0.46994389	-0.87590698	0.10926892	60	BET	AQL
811	5.2	4.3	0.24973433	-0.45536005	0.85456421			
812	4.3	3.9	0.39244784	-0.71960357	0.57284849	21	ETA	CYG
813	4.8	4.0	0.42359171	-0.78112177	-0.45871433	59		SGR
814	3.7	2.8	0.45933908	-0.82411339	0.33142831	12	GAM	SGE
815	4.2	4.6	0.14009304	-0.25571868	-0.95654686		EPS	PAV
816	5.4	4.5	0.21536547	-0.36947909	0.90393745	64		DRA
817	5.4	4.5	0.24893630	-0.44203995	-0.86176064			
818	4.8	3.8	0.44071153	-0.76650813	-0.46716018	62		SGR
819	4.8	4.2	0.19318397	-0.32600468	0.92541931	67	RHO	DRA
820	5.1	4.3	0.39429423	-0.68125143	-0.61678890			

Table 5.2-2. Orbiter Uplinkable Stars (2005)

No.	IDT Mag.	SSST Mag.	X Component	Y Component	Z Component	Skymap Name	
821	5.3	4.8	0.42681412	-0.73068606	-0.53284856		
822	5.1	4.2	0.30879084	-0.51613729	-0.79890582	XI	TEL
823	4.0	3.8	0.20681081	-0.34411253	-0.91586890	DLT	PAV
824	3.5	3.9	0.53253027	-0.84624130	-0.01694616	65	THT AQL
825	3.5	3.3	0.54797260	-0.79577363	-0.25781844	9	BET CAP
826	4.8	4.1	0.49190557	-0.69049211	0.53032966	39	CYG
827	4.4	4.5	0.51817279	-0.69170691	0.50302932	41	CYG
828	5.3	4.8	0.59761565	-0.80001142	-0.05326594	69	AQL
829	4.3	4.7	0.60010227	-0.77627427	0.19306870	2	EPS DEL
830	4.8	3.9	0.50371113	-0.64497649	0.57470029	47	CYG
831	5.1	4.2	0.62223220	-0.78138859	-0.04752852	70	AQL
832	4.0	3.9	0.60689836	-0.75475995	0.24902167	6	BET DEL
833	3.5	3.1	0.42097983	-0.52894394	-0.73688146	ALF	IND
834	4.7	4.4	0.62833388	-0.77762230	-0.02236254	71	AQL
835	4.0	4.5	0.61003243	-0.74452794	0.27117997	9	ALF DEL
836	5.3	4.3	0.60130372	-0.73462450	-0.31426212	15	UPS CAP
837	5.3	4.7	0.59029791	-0.68685060	0.42401017	30	VUL
838	3.8	4.0	0.25812955	-0.30634354	-0.91625475	BET	PAV
839	3.8	3.5	0.31191384	-0.35791235	0.88011846	3	ETA CEP
840	4.6	4.2	0.56391613	-0.65103250	0.50808983	52	CYG
841	4.5	4.6	0.58979543	-0.68368115	-0.42979231	16	PSI CAP
842	4.7	4.3	0.63189215	-0.72476902	0.27463098	12	GAM2 DEL
843	4.1	4.4	0.64986523	-0.74121450	-0.16815542	2	EPS AQR
844	4.6	3.7	0.65694143	-0.74844775	-0.09085110	3	AQR
845	5.1	4.3	0.45696741	-0.51626655	-0.72432702	ZET	IND
846	4.3	3.4	0.59805048	-0.65932417	-0.45566134	18	OMG CAP
847	4.0	3.4	0.35307623	-0.38222046	-0.85395825	BET	IND
848	4.2	4.6	0.52283142	-0.54469228	0.65571154	58	NU CYG
849	5.1	4.8	0.59204005	-0.60126459	-0.53662787	GAM	MIC
850	3.9	3.0	0.51786499	-0.50399897	0.69123143	62	XI CYG
851	4.4	4.7	0.68381346	-0.66531137	-0.29959962	23	THT CAP
852	4.8	3.9	0.48826637	-0.46791451	0.73664914	63	CYG
853	4.7	3.8	0.65139850	-0.62792582	-0.42589806	24	CAP
854	4.9	4.6	0.71319617	-0.67163019	-0.20065919	13	NU AQR
855	3.6	3.2	0.64042260	-0.58271210	0.50030540	64	ZET CYG
856	5.2	4.4	0.24683969	-0.22878438	-0.94166229	OMI	PAV

Table 5.2-2. Orbiter Uplinkable Stars (2005)

No.	IDT Mag.	SSST Mag.	X Component	Y Component	Z Component	Skymap Name		
857	4.1	4.2	0.58874913	-0.52638285	0.61342934	65	TAU	CYG
858	5.5	4.5	0.71929126	-0.64208725	-0.26522452	29		CAP
859	4.3	4.3	0.74411895	-0.66224825	0.08783075	8	ALF	EQU
860	4.5	4.0	0.72111414	-0.60627562	0.33529728	1		PEG
861	4.7	4.4	0.73094829	-0.61624621	-0.29318118	32	IOT	CAP
862	4.6	4.7	0.31938462	-0.26246175	-0.91055329		GAM	PAV
863	5.6	4.7	0.26962751	-0.21770264	-0.93803335		SX	PAV
864	3.3	3.1	0.78646111	-0.60933896	-0.10092053	22	BET	AQR
865	4.4	4.1	0.56124913	-0.42256887	0.71164244	73	RHO	CYG
866	4.1	4.2	0.77738302	-0.55791527	-0.29052743	40	GAM	CAP
867	5.3	4.4	0.59536847	-0.42379765	0.68259207	75		CYG
868	4.2	3.8	0.17348974	-0.12603224	-0.97673803		NU	OCT
869	4.9	4.5	0.26655667	-0.18454325	0.94598696	11		CEP
870	5.5	4.6	0.81484074	-0.57184711	0.09500237	7		PEG
871	3.8	2.2	0.42995629	-0.29557035	0.85309774		MU	CEP
872	4.7	4.2	0.78794733	-0.54082104	0.29436645	9		PEG
873	4.5	4.6	0.74522006	-0.51035652	0.42916580	10	KAP	PEG
874	4.7	4.7	0.40332580	-0.27203761	0.87368406	10	NU	CEP
875	5.1	4.7	0.47126028	-0.27210202	-0.83897213		EPS	IND
876	5.1	4.4	0.86976486	-0.48627499	0.08393880	22	NU	PEG
877	3.4	3.0	0.87291360	-0.48777567	-0.00983578	34	ALF	AQR
878	5.5	4.7	0.62092859	-0.34417417	0.70426687			
879	4.8	4.1	0.67062186	-0.37515892	-0.63993914		LAM	GRU
880	4.2	4.2	0.79336093	-0.43660613	0.42420929	24	IOT	PEG
881	5.3	4.5	0.72524129	-0.39577872	-0.56336868		UPS	PSA
882	4.7	4.7	0.74066264	-0.39480582	0.54364254	29	PI	PEG
883	3.8	4.2	0.87756106	-0.46811895	0.10368813	26	THT	PEG
884	3.6	2.7	0.46969458	-0.24681289	0.84762633	21	ZET	CEP
885	4.8	4.1	0.68744199	-0.35128807	0.63562583			
886	4.6	4.7	0.48928794	-0.24598992	0.83671158	23	EPS	CEP
887	4.4	3.6	0.70967600	-0.35465598	0.60875209	1		LAC
888	4.6	4.2	0.88654230	-0.44103641	-0.13974847	43	THT	AQR
889	3.2	2.5	0.44158416	-0.21755549	-0.87044416		ALF	TUC
890	5.4	4.6	0.14494414	-0.07182460	-0.98682948		EPS	OCT
891	4.1	4.5	0.90423565	-0.42607405	-0.02861448	48	GAM	AQR
892	4.8	4.4	0.56007642	-0.25646337	0.78774421	3	BET	LAC

Table 5.2-2. Orbiter Uplinkable Stars (2005)

No.	IDT Mag.	SSST Mag.	X Component	Y Component	Z Component	Skymap Name	
893	5.2	4.8	0.91314410	-0.40021966	0.07740850	35	PEG
894	4.0	4.1	0.91750979	-0.39768395	-0.00482198	55	ZET1 AQR
895	4.5	3.6	0.62182486	-0.26573781	0.73669346	5	LAC
896	4.1	4.4	0.59272489	-0.24782547	0.76632874	7	ALF LAC
897	5.0	4.1	0.43003483	-0.17890881	-0.88490772	NU	TUC
898	4.3	4.7	0.92845191	-0.37139447	-0.00657253	62	ETA AQR
899	5.5	4.6	0.51536937	-0.19612027	0.83422494		
900	4.8	4.1	0.67396943	-0.25090349	0.69484721	11	LAC
901	3.7	4.1	0.92222939	-0.34036146	0.18343126	42	ZET PEG
902	3.4	3.1	0.81497787	-0.29399120	0.49937986	44	ETA PEG
903	5.0	4.3	0.88925737	-0.31972905	-0.32710038	66	AQR
904	5.2	4.7	0.55771102	-0.19591721	-0.80658221	ETA	GRU
905	4.5	4.7	0.13677515	-0.04907541	-0.98938575	BET	OCT
906	4.3	3.9	0.86855600	-0.29854645	0.39557615	47	LAM PEG
907	4.6	4.6	0.92545725	-0.31772583	0.20634722	46	XI PEG
908	3.8	4.1	0.58890850	-0.19831687	-0.78349039	EPS	GRU
909	4.2	3.4	0.92198364	-0.30427302	-0.23950803	71	TAU AQR
910	3.9	3.5	0.38774601	-0.12620611	0.91308545	32	IOT CEP
911	3.9	3.6	0.86604848	-0.28308527	0.41209557	48	MU PEG
912	5.2	4.3	0.69676307	-0.22041913	0.68259551	15	LAC
913	3.9	3.0	0.94479805	-0.29786458	-0.13650395	73	LAM AQR
914	3.6	3.9	0.91884966	-0.28094086	-0.27710563	76	DLT AQR
915	4.6	4.3	0.80503544	-0.24158333	-0.54180756	23	DLT PSA
916	5.1	4.0	0.62332163	-0.18394299	0.76002310		
917	5.3	4.6	0.52935621	-0.14688031	0.83558852		
918	4.5	4.2	0.57957306	-0.16091496	-0.79887511	ZET	GRU
919	3.9	4.3	0.71685658	-0.19336880	0.66986950	1	OMI AND
920	5.0	4.6	0.62508442	-0.16181462	0.76360035	3	AND
921	4.9	4.6	0.88631801	-0.22097376	-0.40695329	86	AQR
922	4.7	4.8	0.70047430	-0.17443438	-0.69203208	THT	GRU
923	5.1	4.4	0.87860484	-0.21632769	0.42574154	56	PEG
924	4.8	4.6	0.24983238	-0.05963035	0.96645124	33	PI CEP
925	4.0	3.5	0.90580047	-0.21418119	-0.36558436	88	AQR
926	4.3	3.9	0.68241177	-0.15896562	-0.71347327	IOT	GRU
927	4.5	3.6	0.97195971	-0.20777253	-0.11011311	90	PHI AQR
928	4.6	4.2	0.96626585	-0.19968872	-0.16264907		

Table 5.2-2. Orbiter Uplinkable Stars (2005)

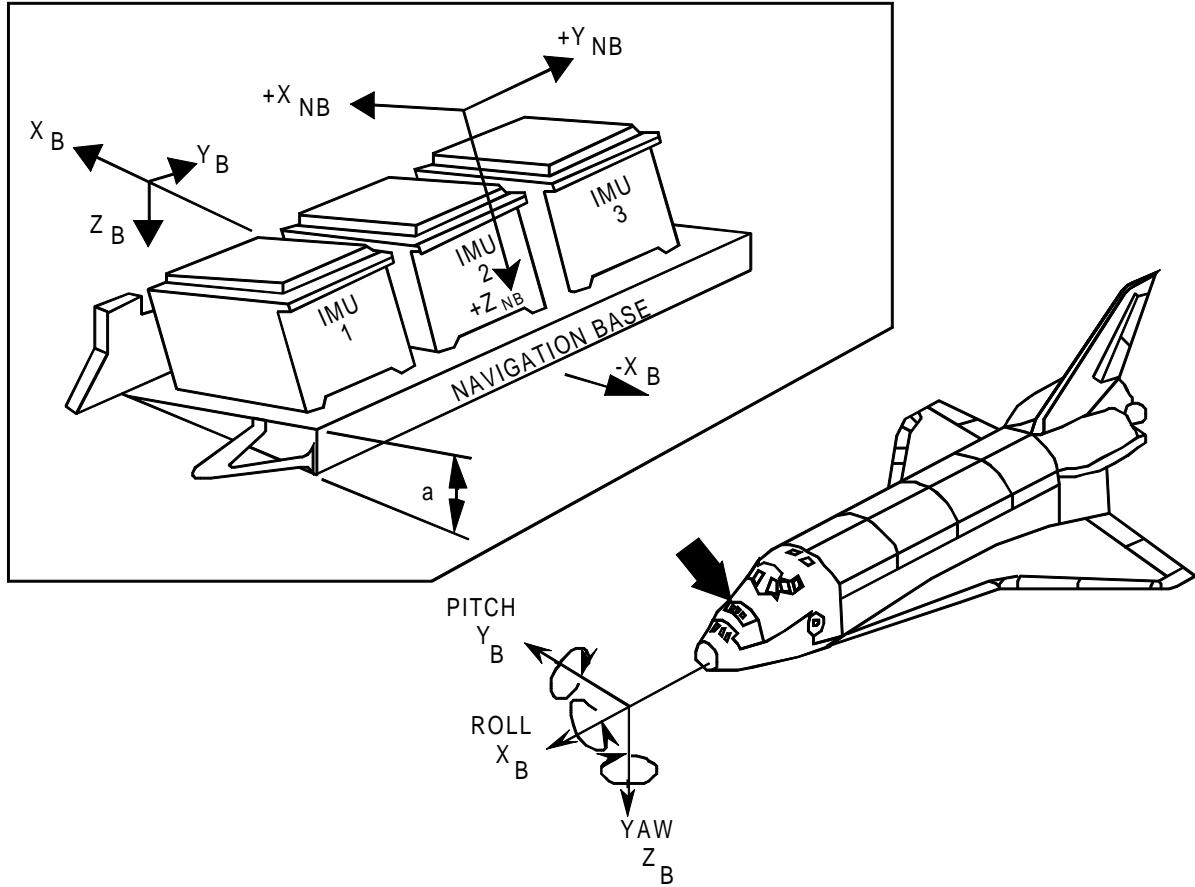
No.	IDT Mag.	SSST Mag.	X Component	Y Component	Z Component	Skymap Name		
929	5.3	4.4	0.97060856	-0.19634539	-0.13916720	92	CHI	AQR
930	4.1	3.8	0.97910657	-0.19645505	0.05249512	6	GAM	PSC
931	4.4	4.5	0.51211747	-0.10297857	-0.85271983		GAM	TUC
932	5.0	4.1	0.64701496	-0.12746350	0.75174776	8		AND
933	4.8	4.3	0.82516096	-0.15991071	-0.54179143		GAM	SCL
934	5.4	4.8	0.96355380	-0.16750286	0.20858298	66		PEG
935	5.2	4.2	0.46311483	-0.07623895	0.88301318	4		CAS
936	4.8	4.8	0.90759341	-0.14824649	0.39280679	68	UPS	PEG
937	4.7	4.2	0.98303587	-0.14945107	0.10632429	10	THT	PSC
938	5.0	4.6	0.96601908	-0.14167097	0.21618620	70		PEG
939	5.5	4.6	0.91830169	-0.11698262	0.37820242	71		PEG
940	5.3	4.6	0.85009683	-0.10637317	0.51577139	72		PEG
941	4.2	3.8	0.68831057	-0.07500978	0.72152761	16	LAM	AND
942	3.6	3.2	0.21782287	-0.02168690	0.97574734	35	GAM	CEP
943	4.5	4.6	0.99080858	-0.09802708	0.09321506	17	IOT	PSC
944	5.6	4.7	0.94541021	-0.08695519	-0.31406739	103		AQR
945	5.2	4.3	0.98119939	-0.08228327	0.17457726	77		PEG
946	5.2	4.8	0.52318555	-0.03519125	0.85149190	5	TAU	CAS
947	5.3	4.4	0.94550041	-0.04152875	0.32296182	81	PHI	PEG
948	4.9	4.0	0.90711636	-0.01898612	0.42045146	84	PSI	PEG
949	4.4	4.5	0.99330332	-0.01408422	0.11467410	28	OMG	PSC

5.3 STAR SIGHTING TABLE

The ST SOP requires the use of a table for storing sighting data for a maximum of three stars. The table shall consist of 33 data elements and shall contain the following data for each of the stored star sightings:

Star identification	(1 element)
Time tag associated with the sighting data	(1 element)
Line-of-sight (LOS) unit vector components in present cluster coordinates for IMU 1	(3 elements)
LOS unit vector components in present cluster coordinates for IMU 2	(3 elements)
LOS unit vector components in present cluster coordinates for IMU 3	(3 elements)

Sighting table data becomes invalid after the IMU's have been realigned. The sighting table should therefore be zeroed or over-written with new data after IMU alignment.



NAME: NAVIGATION BASE SYSTEM

ORIGIN: AT THE MUTUAL INTERSECTION OF:

(A) A PLANE PARALLEL TO THE ORBITER PLANE OF SYMMETRY,
14 INCHES LEFT OF CENTER

* (B) PLANE OF TOP SURFACES OF MOUNTING PADS FOR IMU 1 (LEFT)

* (C) PLANE OF VERTICAL SURFACES OF AFT PADS FOR IMU 1

ORIENTATION: Y_{NB} LIES ALONG THE INTERSECTION OF PLANES (B) AND (C),
POSITIVE OUT THE ORBITER RIGHT WING

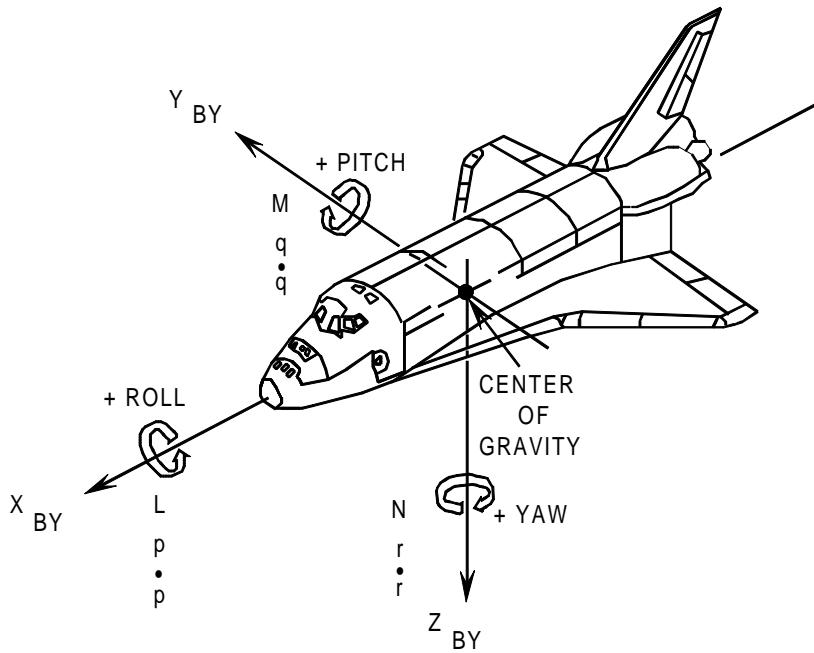
X_{NB} LIES IN PLANE (B), PERPENDICULAR TO Y_{NB} AND POSITIVE FORWARD

Z_{NB} COMPLETES THE RIGHT-HANDED SYSTEM.

CHARACTERISTICS: ROTATING, RIGHT-HANDED CARTESIAN

* AS DETERMINED BY AN ALIGNMENT FIXTURE

FIGURE 5.1-1. Navigation Base Coordinate System



NAME: BODY AXIS COORDINATE SYSTEM.

ORIGIN: CENTER OF MASS.

ORIENTATION: X_{BY} AXIS IS PARALLEL TO THE ORBITER STRUCTURAL BODY X_0 AXIS; POSITIVE TOWARD THE NOSE.

Z_{BY} AXIS IS PARALLEL TO THE ORBITER PLANE OF SYMMETRY AND IS PERPENDICULAR TO X_{BY} , POSITIVE DOWN WITH RESPECT TO THE ORBITER FUSELAGE.

Y_{BY} AXIS COMPLETES THE RIGHT-HANDED ORTHOGONAL SYSTEM.

CHARACTERISTIC: ROTATING, RIGHT-HANDED, CARTESIAN SYSTEM.

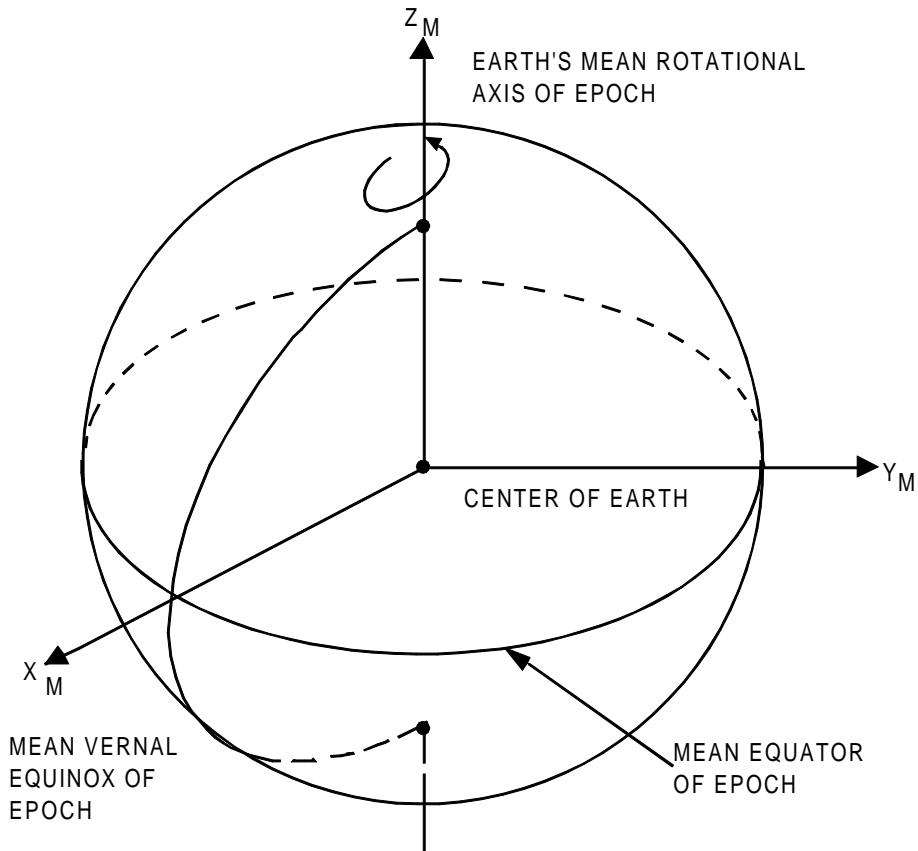
l, m, n : MOMENTS ABOUT X_{BY}, Y_{BY} , AND Z_{BY} AXES, RESPECTIVELY.

p, q, r : BODY RATES ABOUT X_{BY}, Y_{BY} , AND Z_{BY} AXES, RESPECTIVELY.

$\dot{p}, \dot{q}, \dot{r}$: ANGULAR BODY ACCELERATION ABOUT X_{BY}, Y_{BY} , AND Z_{BY} AXES, RESPECTIVELY.

THE EULER SEQUENCE THAT IS COMMONLY ASSOCIATED WITH THIS SYSTEM IS A YAW, PITCH, ROLL SEQUENCE, WHERE ψ = YAW, θ = PITCH, AND ϕ = ROLL OR BANK. THIS ATTITUDE SEQUENCE IS YAW, PITCH, AND ROLL AROUND THE Z_{BY} , Y_{BY} , AND X_{BY} AXES, RESPECTIVELY.

FIGURE 5.1-2. Body Axis Coordinate System



NAME: ARIES MEAN OF 1950, CARTESIAN, COORDINATE SYSTEM

ORIGIN: THE CENTER OF THE EARTH

ORIENTATION: THE EPOCH IS THE BEGINNING OF BESSELIAN YEAR 1950 OR JULIAN EPHemeris DATE 2433282.423357

THE X_M - Y_M PLANE IS THE MEAN EARTH'S EQUATOR OF EPOCH

THE X_M AXIS IS DIRECTED TOWARD THE MEAN VERNAL EQUINOX OF EPOCH

THE Z_M AXIS IS DIRECTED ALONG THE EARTH'S MEAN ROTATIONAL AXIS OF EPOCH AND IS POSITIVE NORTH

THE Y_M AXIS COMPLETES A RIGHT-HANDED SYSTEM

CHARACTERISTICS: INERTIAL, RIGHT-HANDED CARTESIAN SYSTEM

FIGURE 5.1-3. Aries Mean of 1950 Cartesian Coordinate System

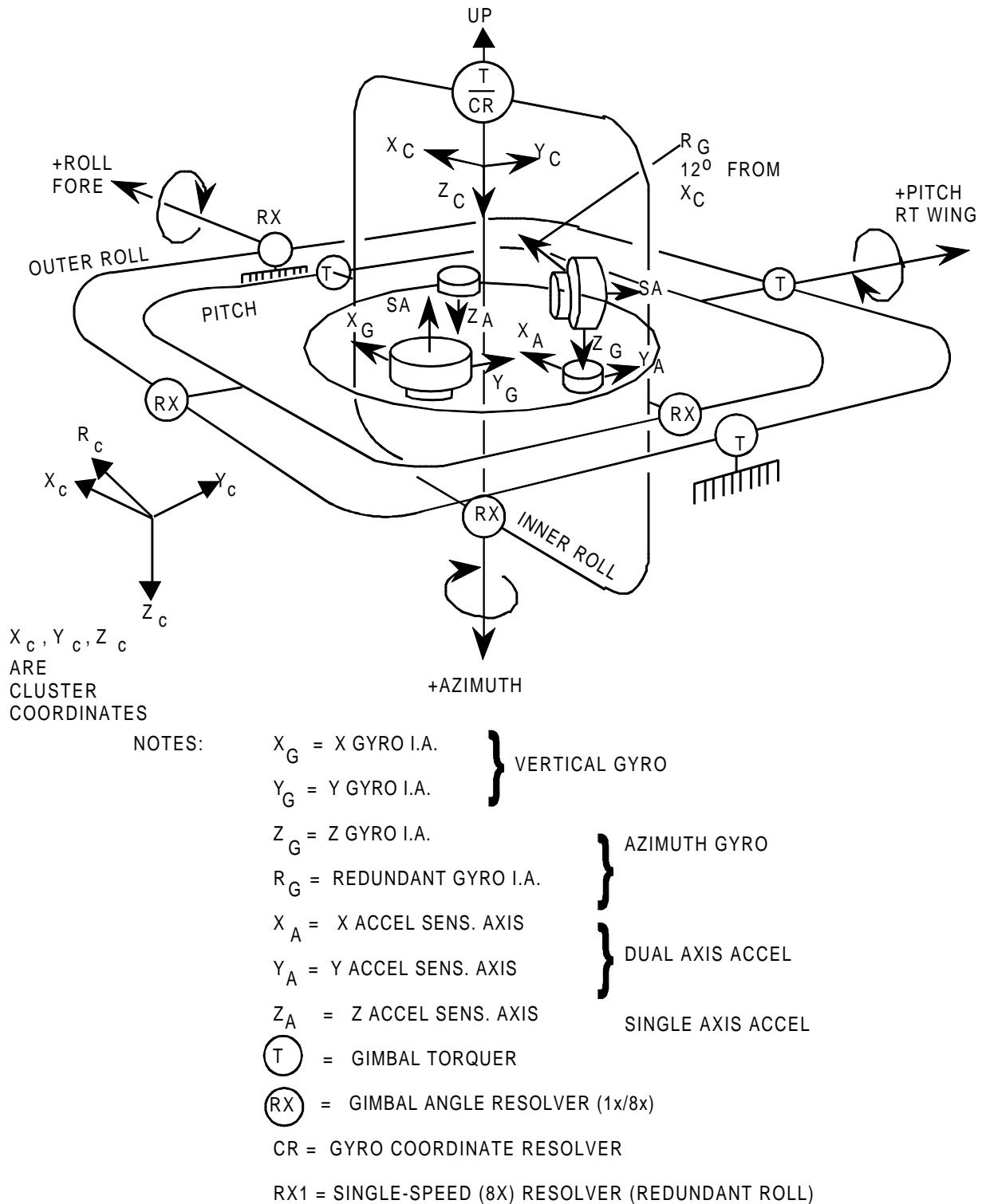


FIGURE 5.1-4.(1) IMU Cluster Coordinate System (Sheet 1 of 2)

NAME: STABLE MEMBER (IMU)

ORIGIN: THE INTERSECTION OF THE INNERMOST GIMBAL AXIS AND THE MEASUREMENT PLANE OF THE XY TWO AXIS ACCELEROMETER

ORIENTATION: THE Z_C AXIS IS COINCIDENT WITH THE INNERMOST GIMBAL AXIS

THE X_C AXIS IS DETERMINED BY THE PROJECTION OF THE X ACCELEROMETER INPUT AXIS (IA) ONTO A PLANE ORTHOGONAL TO Z_C . Y_C COMPLETES A RIGHT-HANDED TRIAD.

IN A PERFECT IMU, WITH ALL MISALIGNMENTS ZERO, THESE RELATIONSHIPS HOLD:

THE X ACCELEROMETER AND X GYRO IAS ARE PARALLEL TO THE X_I AXIS.

THE Y ACCELEROMETER AND Y GYRO IAS ARE PARALLEL TO THE Y_I AXIS.

THE Z ACCELEROMETER AND Z GYRO IAS ARE PARALLEL TO THE Z_I AXIS.

CHARACTERISTICS: NONROTATING, RIGHT-HANDED, CARTESIAN SYSTEM.

THE REFERENCE ALIGNMENT FOR THE GIMBAL CASE SHALL BE DEFINED WITH THE FOUR GIMBAL ANGLES AT ZERO AND WITH THE VEHICLE IN A HORIZONTAL POSITION. IN A PERFECT IMU, WITH ALL MISALIGNMENTS ZERO AND WITH ALL GIMBAL ANGLES AT ZERO, THE FOLLOWING RELATIONSHIPS HOLD.

THE OUTER ROLL AXIS AND THE X_C AXIS WILL BE PARALLEL TO X_{NB} . POSITIVE X_C WILL BE IN THE FORWARD DIRECTION. POSITIVE ROLL GIMBAL ANGLES WILL BE IN THE SENSE OF A RIGHT-HANDED ROTATION OF THE GIMBAL CASE RELATIVE TO THE PLATFORM ABOUT THE PLUS OUTER ROLL AXIS.

THE PITCH AXIS AND Y_C WILL BE PARALLEL TO Y_{NB} . POSITIVE Y_C WILL BE TO THE RIGHT OF AN OBSERVER LOOKING FORWARD IN THE VEHICLE. POSITIVE PITCH GIMBAL ANGLES WILL BE IN THE SENSE OF A RIGHT-HANDED ROTATION OF THE GIMBAL CASE RELATIVE TO THE PLATFORM ABOUT THE PLUS PITCH AXIS.

THE INNER ROLL AXIS WILL BE PARALLEL TO THE OUTER ROLL AXIS, WITH THE SENSE OF ROTATION THE SAME AS FOR THE OUTER ROLL AXIS.

THE AZIMUTH AXIS AND Z_C WILL BE PARALLEL TO Z_{NB} .

POSITIVE Z_C WILL BE DOWN RELATIVE TO AN OBSERVER STANDING IN THE VEHICLE. POSITIVE AZIMUTH GIMBAL ANGLES WILL BE IN THE SENSE OF A RIGHT-HANDED ROTATION OF THE GIMBAL CASE RELATIVE TO THE PLATFORM ABOUT THE PLUS AZIMUTH AXIS.

X_{NB} , Y_{NB} , Z_{NB} ARE CARTESIAN COMPONENTS OF THE NAVIGATION BASE COORDINATE SYSTEM.

FIGURE 5.1-4.(2) IMU Cluster Coordinate System (Sheet 2 of 2)

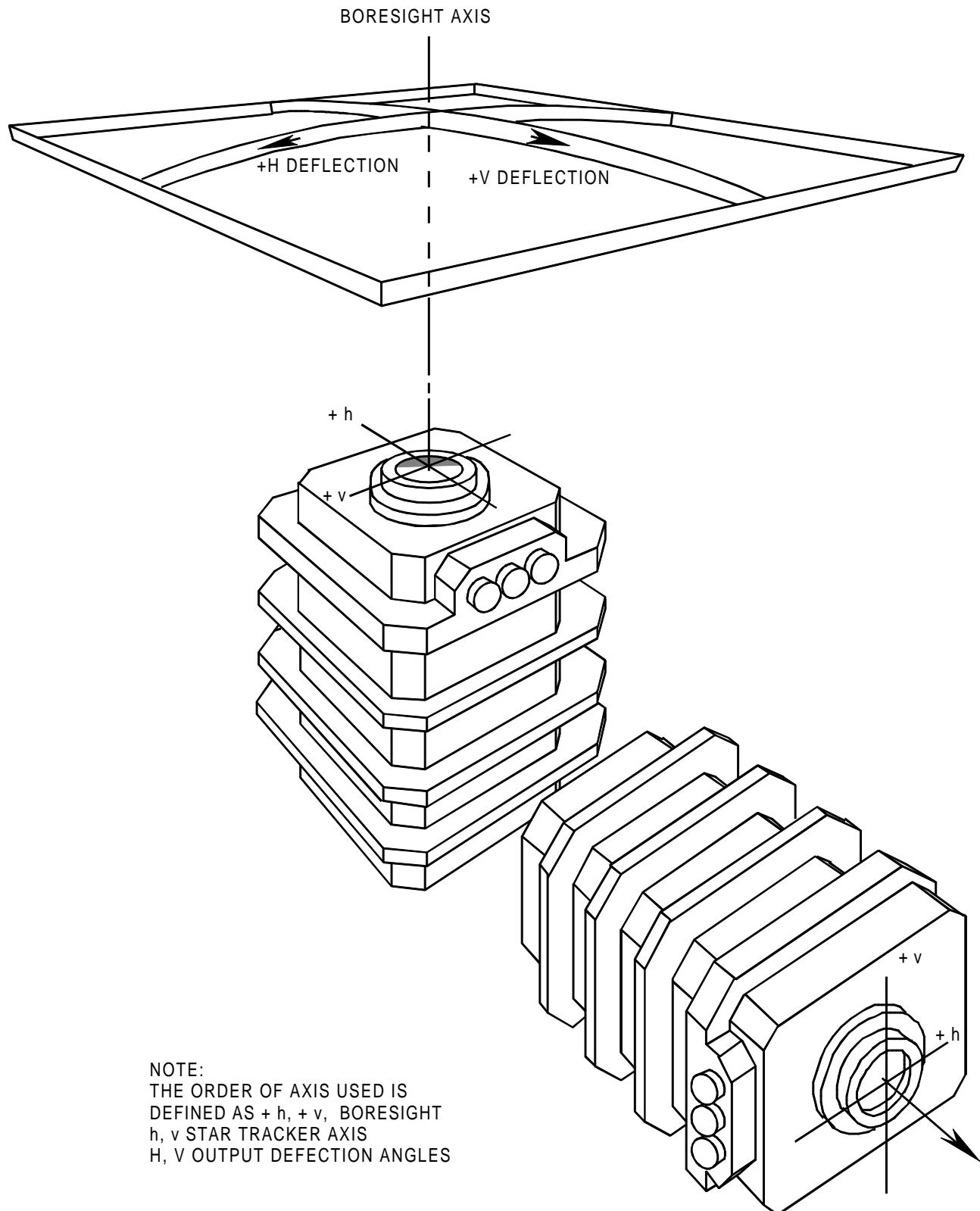
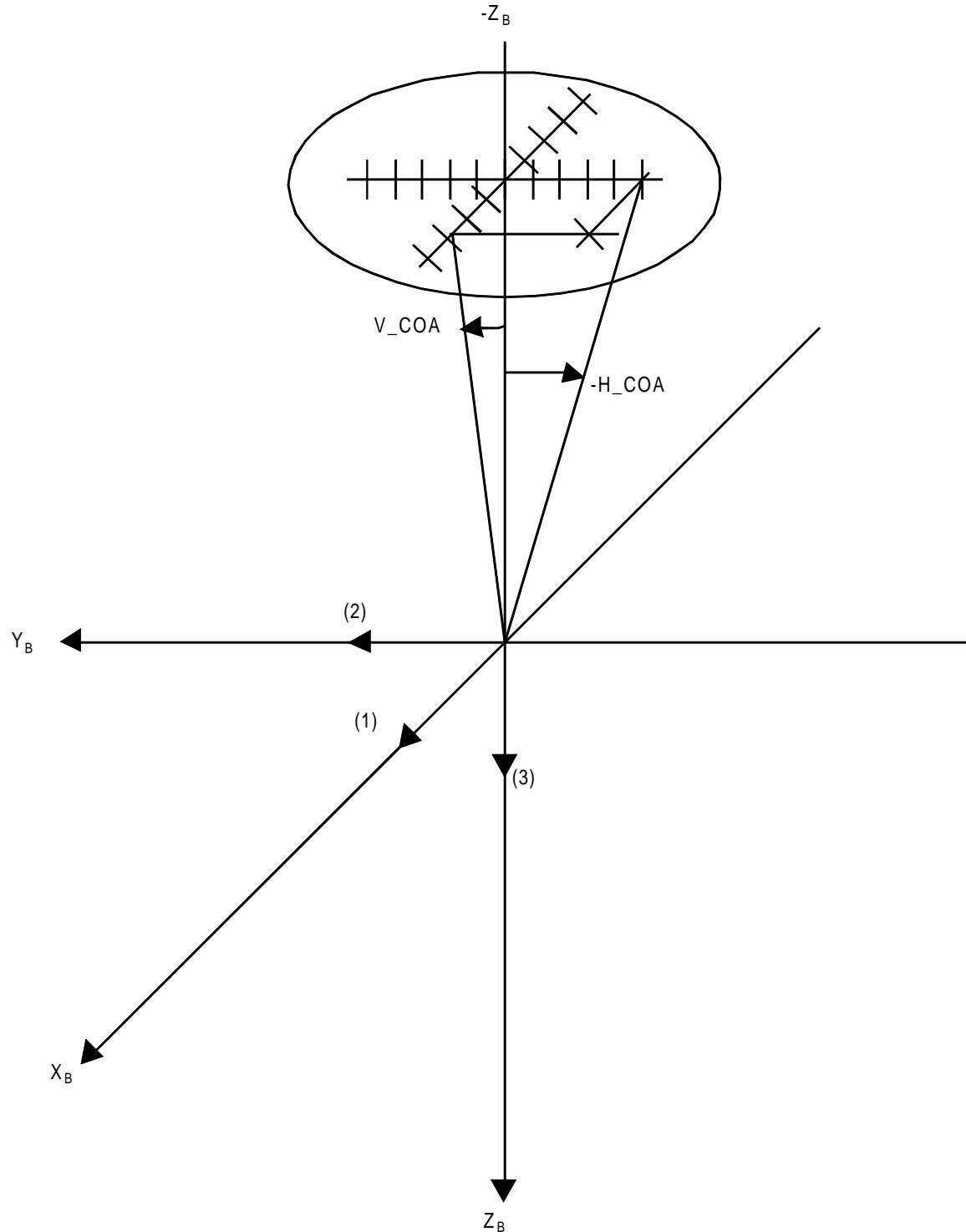


FIGURE 5.1-5. Star Tracker Coordinate System



NOTE: THE UNIT VECTOR IN BODY COORDINATES IS FORMED FROM THE BODY AXES X_B , Y_B , Z_B RESPECTIVELY.

FIGURE 5.1-6. $-Z$ COAS Coordinate System

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	92307	29	FSSR Format Change - Documentation Only
1.3-1. (T)	92103A	26B	FSSR Parameter Table Upgrade
3.5.1	92036A	26B	Star Tracking Peak Processing Relief
4.66.4.3	91044C	26	Star Catalog Uplink Capability
	92036A	26B	Star Tracking Peak Processing Relief
4.66.4.3-1. (T)	91044C	26	Star Catalog Uplink Capability
4.66.4.5	92928B	32	Star Tracker DATA_GOOD Flag Clean-up
4.66.4.5-2. (T)	91044C	26	Star Catalog Uplink Capability
	92928B	32	Star Tracker DATA_GOOD Flag Clean-up
4.66.4.7	92537A	30	Modify Star Tracker SOP to Eliminate Unnecessary I-Load/K-loads
4.66.4.7-1. (T)	92537A	30	Modify Star Tracker SOP to Eliminate Unnecessary I-Load/K-loads
4.66.4.7-1.(1) (F)	92537A	30	Modify Star Tracker SOP to Eliminate Unnecessary I-Load/K-loads
4.66.4.7-2.(T)	92354	27	Delete Erroneous TLM Destinations
4.66.4.8	92036A	26B	Star Tracking Peak Processing Relief
	92928B	32	Star Tracker DATA_GOOD Flag Clean-up
4.66.4.8-1.(T)	92928B	32	Star Tracker DATA_GOOD Flag Clean-up
4.66.4.8-1.(1)(F)	92928B	32	Star Tracker DATA_GOOD Flag Clean-up
4.66.4.8-1.(3)(T)	92928B	32	Star Tracker DATA_GOOD Flag Clean-up
4.66.4.8-2.(T)	92354	27	Delete Erroneous TLM Destinations
4.66.4.10-1.(T)	93010C	30	Downlist Documentation Cleanup
4.66.4.10-2.(T)	92354	27	Delete Erroneous TLM Destinations
4.66.4.14-1.(T)	93010C	30	Downlist Documentation Cleanup
4.66.4.14-2.(T)	93010C	30	Downlist Documentation Cleanup
4.66.4.19	92707	30	Modify IMU Alignment Illegal Entry Requirements
4.66.4.19-2.(T)	92354	27	Delete Erroneous TLM Destinations

Table R.1-1. CR Reference Summary

Paragraph	CR No.	OI	CR Title
4.66.5-1. (T)	91044C	26	Star Catalog Uplink Capability
	92522D	30	Overhaul MEDS Composite Flight Instrument Display
	92537A	30	Modify Star Tracker SOP to Eliminate Unnecessary I-Load/K-loads
	92748B	30	Make a Double Precision Copy of V_AVGG for REL NAV
	93023D	33	OI-32 remote Control Orbiter Capability
	93090E	33	Bearing Displays
4.66.5-2.(T)	92354	27	Delete Erroneous TLM Destinations
	93010C	30	Downlist Documentation Cleanup
4.66.5-3.(T)	92537A	30	Modify Star Tracker SOP to Eliminate Unnecessary I-Load/K-loads
4.66.5-4.(T)	91044C	26	Star Catalog Uplink Capability
	92537A	30	Modify Star Tracker SOP to Eliminate Unnecessary I-Load/K-loads
4.66.5-5.(T)	92522D	30	Overhaul MEDS Composite Flight Instrument Display
	93090E	33	Bearing Displays
5.2	91044C	26	Star Catalog Uplink Capability
	92255	26	Uplinkable Star Catalog Documentation Cleanup
5.2-1. (T)	91044C	26	Star Catalog Uplink Capability
5.2-2. (T)	92255	26	Uplinkable Star Catalog 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-25. 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
12019		Standardize FSSR PF I/O Tables
12109		On-Orbit I/O Update
12112		GAX Annunciation Rewrite
12186A		ST/COAS Control Display Changes
12214A		ST SOP I/O Table Update

Table R.2-1. Historical Change Request Summary

CR No.	OI	CR Title
12215B		ST SOP Rate Test
12286		Changes to Rendezvous NAV/ST I/O
12292		Simplify ST Self-Test
12297A		ST SOP Corrections
12333		Star Table Clear Command
12375		ST SOP Selected IMU
12410		Remove Data Filter Inhibit
12428A		Correct ST SOP Errors
12443		I-Load for Entry FACI
12509		IMU/ST/COAS FSSR Corrections
12668		ST SOP I/O Corrections
12748		ST IDD Table Corrections
12773		ST Break Track Command
12779A		ST Doc Cleanup – 50 Star Catalog
12812A		Relative NAV Display Changes (IDD Entry)
12825B		Delete Occultation Module
12905		ST Aberration Correction
12906		NAV Double Precision Time Tag
12918		ST Self-Test Correction
12953		COAS Angle Display
12954		Modification to CR12825B
12992		Updata ST/COAS Display IDD
12996		ST/COAS Display IDD
19006A		Reset Shutter Override CMD Asterisk
19022		Mods to MPAD I-Load
19164A		I-Load Value Updates for CYC 2 (Ref Only)
19167B		REL NAV Display Interface Correction (IDD) Only
19291A		ST SOP I-Load
19347		Zero S. TRK Required ID
19395		OV-102 IMU /ST I-Load
19398		Shutter Manual CMB ST
19409A		COAS Mark/ADI PB I/O Signals
19446A		Star Tracker SOP and Rendezvous NAV Interface Corrections
19449A		COAS CALIB Update Indexing
19455		Measurement Attribute
19571A		OPS 2 State Vector Propagation
19572		Star Tracker SOP REND Tracking Documentation Cleanup

Table R.2-1. Historical Change Request Summary

CR No.	OI	CR Title
19656B		ST to COAS Angles Computation Rate
19717A		ST Search Time Change
19718		ST Offset Command Round-Off
19785B		REL NAV SPEC and Display Req. and Interface Corrections (IDD Only)
19839B		Simultaneous ST and Target Track
19900		FSSR Update 5
2265B		Add IMU Align to OPS 3
29093E		MPAD I-Load Update 1 for Cycle 3
29056A		ST Self-Test Command
29104		Star LOS Rate Test
29149B		Add Program Interrupt Handling to LVLA
29189		COAS Processing of Accept/Update Commands
29281		Commfault Protection in ST SOP
29425A		Star Tracker SOP Commfault
29458B		RNDZ NAV False TGT Track
29471B		HFE Overrun Definition
29505A		Delete Sun/Moon I-Load – ST SOP
29577B		REQ Clarification, ST SOP/DISP
29633A		Delete Self-Test Star LOC I-Load
29800B		FSSR Update 8
29902A		Cycle 3.2.2 I/L 3–10–81 Launch (Ref Only)
29925A		ORB IMU Align Protection
39000		FSSR Update 9
39017A		ST/COAS I/L Change (Ref Only)
39052		Star Tracker R18/R19 Baseline
39184E		STS-2 Cycle 1 MPAD I-Loads (Ref Only)
39285C		Star Tracker Doc Update
39313A		Star Tracker D/L Nomenclature (STS-2 MMDB)
39400		FSSR Update 1 (R18)
39413B		Star TRK TGT Suppress Unlatch
39464F		Star Catalog Increase
39530F		STS-2 Cycle 2 I-Loads (Ref Only)
39595A		CR Implementation Baseline – August 1981
39658E		STS-4 Cycle 1 MPAD I-Loads (STS-4; Ref Only)
39697B		STS-2 CY 3 NOM-Season Update (Ref Only)
39802B		+X COAS Vector I/L (STS-3; Ref Only)
39828		Delete Star Tracker Bite MSG (STS-3)

Table R.2-1. Historical Change Request Summary

CR No.	OI	CR Title
39920A		STS-3 Cycle 3 – Seasonal Update (Ref Only)
39950		FSSR Update 12 (R18) and 3 (R19)
39980A		CR Implementation Baseline – Feb 1982
59012		STS-4 Cycle 3 CAT I I-Loads (Ref Only)
59050		FSSR Update 4 (R19) and 13 (R18)
59220B		CR Implementation Baseline – July 1982
59227B		Star Tracker/IMU Flip Protect (Supersedes 29514B & 29824)
59311		S TRK/NAV BASE I/L for OV-099 (Ref Only)
59318A		Star TRK Shutter Unlatch
59375		CR Implementation Baseline – Sept 1982
59408D		STS-8 CYC 1 NAV/ENT I-Load (I-Load Ref Only)
59633A		Rendezvous/COAS Angle Sign
59707		OV-099 COAS Vector I/L (Ref Only)
59862B		Clarify CR 39464 – Star Catalog
59875		IMU NAV Base I-Loads, OV-103 (Ref Only)
69070		FSSR Update 3 (012,3,4)
69125B		CR Implementation Baseline – Sept 1983
69140A		Doc ST TGT_TRK Execution Rate
69183A		Doc ST Commfault for TGT_TR
69197		ST TRK I-Load Change (Ref Only)
69343B		Star TRK/NAV Base I-Load OV-103 (Ref Only)
69550B		CR Implementation Baseline – March/April 1984
69700		FSSR Update 4
69890B		ASC ENT ATT PROC DOC Cleanup (IDD Ref Only)
69958		ST/NAV Base Matrix UPDT-OV-099 (Ref Only)
79146A		Correct Star Tracker SOP DOC
79201		S-TRK/NAV I/L for OV-104 (I/L Ref Only)
79425		CR Implementation Baseline – April 1985
79490A		CR Implementation Baseline – November, 1985
89269		Errata STS 83-0014A Volume 2
89328D	21	Add COAS CAL Parameters to Downlist
89366B		FSSR Errata STS 83-0008A Volume 1
89372B		Errata CR for FSSR 0010
89488		STS 83-0014B Vol. 2 Errata/Baseline
89673B		STS 83-0014B Vol. 2 PCN-1 Errata
89682A		Star TRK Auto RTN/IMU Align
89934B	22	Star Catalog Cleanup

Table R.2-1. Historical Change Request Summary

CR No.	OI	CR Title
89939A		Star Tracker SOP Documentation Changes
90067B		STS 83-0014B Vol. 2 PCN-2 Errata
90185A	20	Add CR Field to FSSR I/O Tables
90192		Star Tracker Documentation Update
90227B	21	Star Tracker MSID Description Changes
90374C	20	Automated FSSR Constants
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
90781C	24	Define Parametric Data Nomenclature(s)
90790	24	Add Memory Configuration to the FSSR I-Load Tables
90814C	24	Add Description of Database Generated FSSR Parameter Tables
90892A	24	FSSR Doc Changes Only, Star Tracker SOP
90900D	25	FSSR-9 Orbit Flight Control Documentation Changes
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