

Space Program Operations Contract

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

FLIGHT CONTROL ORBIT DAP

**Prepared By The Boeing Company
Space Exploration**

Under Subcontract 6000132079, PDRD P1433q

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| | |
|-------|------------------|
| G4.35 | ONORBIT DAP |
| G5.8 | ORB DAP CONFIG |
| G4.97 | ONORBIT ATT PROC |

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FOREWORD

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

Level A CPDS – System-level constraints and capabilities

Level B CPDS – Functional requirements

Level C FSSR – Detailed-level requirements

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

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DOCUMENT CHANGE RECORD

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

| DOCUMENT CHANGE RECORD | | | |
|------------------------------------|--|-----------|--|
| Issue and Date | Change Summary/Effectivity | | |
| OI-34 Release December 14, 2007 | This baseline release for effectivity OI-34 and subs includes: | | |
| | <u>SCR</u> | <u>OI</u> | <u>Title</u> |
| | 93017G | 33 | Baseline RSS99D0100 with Expanded Downlist |

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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 software change requests (SCRs) to this document are indicated by a change bar in the outer margin of the changed page.

| CHANGE REQUEST SUMMARY | | | |
|------------------------|---------|----|--|
| Paragraph | SCR No. | OI | SCR Title |
| 1.3-1.(T) | 93017G | 33 | Baseline RSS99D0100 with Expanded Downlist |
| 4.2.4-1.(T) | 93017G | 33 | Baseline RSS99D0100 with Expanded Downlist |
| 4.2.4-2.(T) | 93017G | 33 | Baseline RSS99D0100 with Expanded Downlist |
| 4.3.11-1.(T) | 93017G | 33 | Baseline RSS99D0100 with Expanded Downlist |
| 4.3.11-2.(T) | 93017G | 33 | Baseline RSS99D0100 with Expanded Downlist |
| 4.4.4-1.(T) | 93017G | 33 | Baseline RSS99D0100 with Expanded Downlist |
| 4.4.4-2.(T) | 93017G | 33 | Baseline RSS99D0100 with Expanded Downlist |

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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of the Flight Control (FC) Level C document is to present the requirement details and formulations of the FC Level B functional requirements for the orbiter GN&C flight software.

1.2 SCOPE

This document contains the requirement details and formulation for those FC functions that are operative during the on-orbit phase of flight. The FC functions are those specified in the GN&C Level B functional requirements.

1.3 ORGANIZATION

This document is organized into the following sections:

1. Introduction
2. Applicable Documents
3. Overview
4. Functional Requirements

Section 1 contains the purpose, scope, and organization. Section 2 lists the applicable documents. Section 3 provides an overview of the software functions. Section 4 specifies FC requirements details. 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.

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 | * See reference (1) for valid I-Load, K-Load and Constant data types. * See reference (2) for valid IDD data types for parameters with destination TLM. * See reference (3) for valid IDD data types for all other parameters. |
| ENG UNITS or UNITS | Engineering Units | * See reference (1) for valid I-Load, K-Load and Constant units. * See reference (2) for valid IDD units for parameters with destination TLM. * See reference (3) for valid IDD units for all other parameters. |
| FSSR NAME | Requirements parameter name | A string (with no embedded blanks) of ≤ 32 characters consisting of alphanumerics, underscores, parenthesis, commas and slashes. Parenthesis are used for array elements. Commas separate the different indices of multidimensional arrays. Slashes are used to separate multiple names used for a single MSID. |
| LAST CR | The last CR affecting the parameter | 5 digit number with an alphabetic revision letter. |
| MC | Memory Configuration | 00=Generic 05 = SM4 Orbit P/L 01=GN1 Ascent/GN6 RTLS 06 = P/L9 MMU 02=GN2 Orbit 07 = Not Assigned 03=GN3 Entry 08 = GN8 On-Orbit C/O 04=SM2 On-Orbit 09 = GN9 Preflight |
| MSID or M/S ID | Measurement/Stimulus Identification | Maximum of 10 alphanumeric characters. * See reference (3) for specifications |
| NOMENCLATURE | Parameter description of the IDD parameter. | String of ≤ 34 characters (including underscores and blank spaces). |
| PR or PREC | Precision | D, DP =Double S, SP = Single |
| SOURCE | Origin of the input parameter | Abbreviated functional titles. |
| S | Software Utilization | C = Common B = BFS Unique P = Primary X = BFS Derived A = BFS Converted |

| Table 1.3-1. Parameter Element Description | | |
|--|--|---|
| Title | Definition | Valid Entries |
| 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 Systems Level Requirements, Software

2.2 LEVEL B DOCUMENTS

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

2.3 LEVEL C DOCUMENTS

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

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| | |
|-------------|--|
| STS 83-0013 | Operational Flight Level C, Functional Subsystem Software Requirements; Guidance, Navigation, and Control, Part E, Inertial Measurement Unit Subsystem Operating Program |
| STS 83-0014 | Operational Flight Level C, Functional Subsystem Software Requirements; Guidance, Navigation, and Control, Part E, Volume 1, Navigation Aids Subsystem Operating Program, Volume 2, Star Tracker Subsystem Operating Program |
| STS 83-0015 | Operational Flight Level C, Functional Subsystem Software Requirements; Guidance, Navigation, and Control, Part E, Subsystem Operating Programs, FC Sensor/Controller |
| STS 83-0016 | Operational Flight Level C, Functional Subsystem Software Requirements; Guidance, Navigation, and Control, Part E, Subsystem Operating Programs, FC Effector |
| STS 87-0017 | Operational Flight Level C, Functional Subsystem Software Requirements; Remote Manipulator System |
| STS 83-0020 | Operational Flight Level C, Functional Subsystem Software Requirements; Displays and Controls |
| STS 83-0026 | Operational Flight Level C, Functional Subsystem Software Requirements; Guidance, Navigation, and Control, Sequencing |
| JSC-19350 | Shuttle Flight Software Initialization 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 INTERFACE CONTROL 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 RELATIONSHIP TO OTHER GN&C FUNCTIONS

The GN&C on-orbit digital auto pilot (DAP) (principal function 4.35) is contained in a software module referred to as the flight control (FC) or on-orbit flight control (OFC) module. Figure 3.1-1 shows the relationship of the FC module to other GN&C major functions.

Table 3.1-1 shows the traceability of the software paragraphs in the FSSR with respect to the corresponding Sections of the Level B CPDS' documentation. In addition, Table 3.1-2 shows the traceability of the PASS GN&C principal functions located in this FSSR with respect to the applicable BFS paragraphs in the Level C PRD specifications. These tables are provided for information only.

| Table 3.1-1. Level B to Level C Traceability | | |
|--|---|--------------------------|
| Level B PF No. | Level B PF Name (Acronym) | Level C FSSR Section No. |
| 4.35 | On-Orbit Digital Autopilot (DAP) (ORB DAP) | 4.2 |
| 4.97 | On-Orbit Attitude Processor (ORB ATT PROC) | 4.3 |
| 5.8 | Orbital DAP Configuration (ORB DAP CONFIG SPEC) | 4.4 |

| Table 3.1-2. On-Orbit Digital Autopilot FSSR/PRD Correlation | | | | | |
|--|----------------|---|---------|---------------|-----------|
| Principal Function | FSSR Paragraph | FSSR Title | BFS PRD | PRD Paragraph | BFS Title |
| G4.35 | 4.2 | On-Orbit Digital Autopilot | N/A | N/A | N/A |
| G4.97 | 4.3 | On-Orbit Attitude Processor | N/A | N/A | N/A |
| G5.8 | 4.4 | Orbit DAP Configuration Specialist Function | N/A | N/A | N/A |

3.2 ON-ORBIT FLIGHT CONTROL MODULE OVERVIEW

Figure 3.2-1 illustrates the interface categories of the FC module and indicates the general functional relationship of the reconfiguration logic and control law implementation within the FC module. The organization of Section 4, Functional Requirements, is based on this overview. Subsection 4.1 describes the interface. Subsection 4.2.1 describes the part of the reconfiguration logic responsible for setting up and executing the control law modules in the required sequence. Subsection 4.2.2 describes the control law modules and their interrelations. Subsection 4.2.3 describes the part of the reconfiguration logic that reads the panel switches, selects control law parameter groups (DAPLOADs) as a function of the switch settings, illuminates switch lamps according to the moding in effect and determines the firing pattern for post contact thrusting.

3.3 ATTITUDE PROCESSOR MODULE

The orbit attitude processor (principal function 4.97) is described in Subsection 4.3.

3.4 DAP CONFIGURATION MODULE

The orbit DAP configuration specialist function (principal function 5.8) is described in Subsection 4.4.

3.5 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.

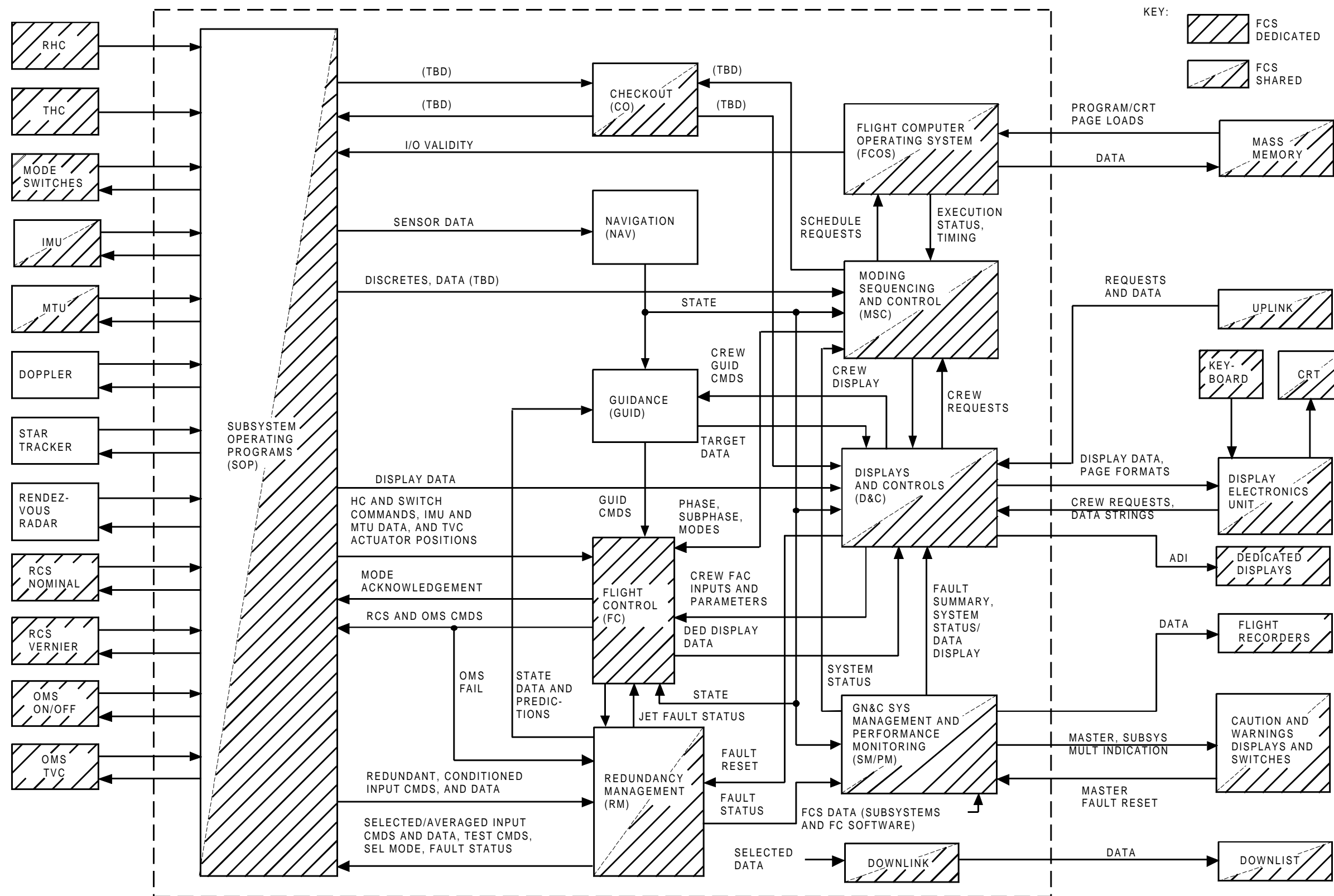


FIGURE 3.1-1. Relationship of FC Module to Other GN&C Major Functions

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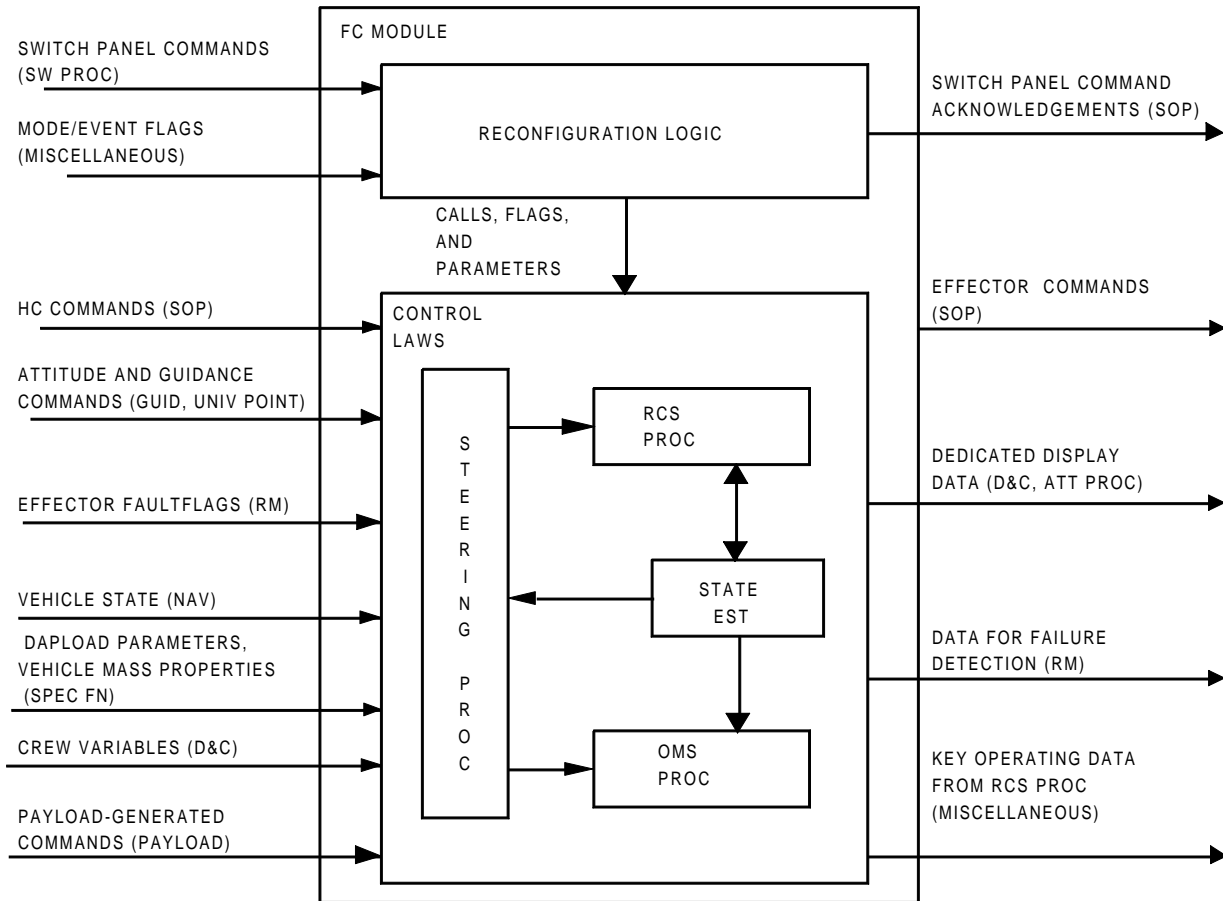


FIGURE 3.2-1. Relationship of FC Module Reconfiguration Logic and Control Laws

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4.0 ON-ORBIT FLIGHT CONTROL FUNCTIONAL REQUIREMENTS

4.1 INTERFACE, I-LOAD, AND CARRYOVER REQUIREMENTS

The interface requirements for the on-orbit DAP are given in Tables 4.1-1 through 4.1-6. Table 4.1-1 lists input variables and includes some inputs that are carryovers from the insertion phase (OPS1). Table 4.1-2 lists output variables. Update rates and sample rates in Tables 4.1-1 and 4.1-2 mean, respectively, the rate at which a parameter is assigned and the rate at which it is referenced. Thus the update rates in Table 4.1-1 and the sample rates in Table 4.1-2 are rates at which functions interfacing with the DAP are expected to perform their I/O operations. In both these tables, the MSID column gives an identifying alpha numeric code. For multi-element variables (such as vectors, structures, and one-dimensional arrays) of reasonable size, as many codes are listed as there are elements. The order in which the codes are listed is either (a) understood to be X, Y, and Z or roll, pitch, and yaw, as applicable; (b) included in the description of the variable; or (c) given in the MSID column along with the codes. For large arrays and for two dimensional arrays, Tables 4.1-3 through 4.1-6 relate the codes to the elements. Variables within these tables which are downlisted/uplinked do not show TLM/UL as a destination/source. This information is contained in the corresponding interface table (Table 4.2.4-1).

The ordering of arrays, vectors and structures, the dimensioning of arrays, the significance of logic levels and integer values, and the sense of bipolar signals are given as needed for consistency in this document, and should not be construed as a specification. If not explicitly stated, arrays and vectors are understood to be ordered X, Y, and Z or roll, pitch, and yaw, as applicable.

Requirements precedence in this document shall be as follows:

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

Table 4.1-7 lists the mission-dependent I-load parameters. Table 4.1-8 lists the design-dependent I-load parameters. Mission-dependent and design dependent I-load parameters are also listed in the I-load tables for the individual modules comprising the on-orbit DAP. Table 4.1-9 lists parameters that must be carried across the various transitions. The parameter PHASE_PLANE_ACCEL is computed using the following equation immediately after the orbit DAP has been deactivated.

$$[\text{PHASE_PLANE_ACCEL}] = [\text{MAG_CONTROL_ACCEL_REF_PRIM}] \\ \text{PHASE_PLANE_ACCEL_SCALE_FACTOR}$$

This computation eliminates the possibility of carrying the vernier jet phase plane acceleration across the OPS transition and also computes the most current value for the primary jet PHASE_PLANE_ACCEL.

| Table 4.1-1. Input Parameters for the On-Orbit DAP Principal Function (4.35) | | | | | | | | |
|--|--|--|--|---------------------|--------------------|-------|------------------|-----------------------|
| Name | Description | MSID | Source | Type | Range | Unit | Sample Rate (Hz) | Update Rate Reqd (Hz) |
| ATTITUDE COMMANDS | | | | | | | | |
| Q_B_M50_CMD | Commanded vehicle attitude with respect to reference attitude, during coasting flight, given as the M50-to-body quaternion | V95U2209C V95U2210C V95U2211C V95U2212C | UNIV POINT PROC (4.213) | Struct: S; V(3)S | 0 to 1; -1 to 1 | none | 1.04 | 0.52 |
| Q_B_M50_CMD_PREBURN | Commanded preburn vehicle attitude with respect to reference attitude, given as the M50-to-body quaternion | V94U3980C V94U3981C V94U3982C V94U3983C | ORBIT MNV DIP (4.158), ORB GUID (4.7) | Struct: S; V(3)S | 0 to 1; -1 to 1 | none | 1.04 | 1/maneuver |
| T_CMD | Time at which commanded attitude and angular rate are desired, expressed as mission elapsed time | V95W2201C | UNIV POINT PROC (4.213) | S | | sec | 1.04 | 0.52 |
| TRACK_RATE_CMD | Body axis components of commanded angular rate in automatic tracking mode; orbital rate, in body axes, in manual LVLH mode | V95R2216C V95R2217C V95R2218C | UNIV POINT PROC (4.213) | V(3)S | -9.9 to 9.9 | deg/s | 1.04 | 0.52 |
| CREW VARIABLES | | | | | | | | |
| OMS_PITCH_TRIM | OMS engines pitch trim angle with respect to center of gimbal travel | V93H6915C | Carryover value from Insertion phase; MNVR EXEC (6.35), U/L, TRANS DAP (4.201) | S | -6 to 6 | deg | 12.5 | On demand |
| OMS_YAW_TRIM | Left and right OMS engines yaw trim angles with respect to center of gimbal travel | V93H6916C V93H6918C | Carryover value from insertion phase; MNVR EXEC (6.35), U/L, TRANS DAP (4.201) | A(2)S | -8 to 8 | deg | 12.5 | On demand |
| RBST_INTERVAL_DISP | Reference Interval between reboost firings | V94W0219C | ORB DAP CONFIG DISP (6.1) | S | 0.08 - 999.99 | sec | On demand | On demand |

| Table 4.1-1. Input Parameters for the On-Orbit DAP Principal Function (4.35) | | | | | | | | |
|--|--|--|--|-------|-----------------|-------|------------------|-----------------------|
| Name | Description | MSID | Source | Type | Range | Unit | Sample Rate (Hz) | Update Rate Reqd (Hz) |
| RBST_CONF | Selected reboost configuration | V94U0218C | ORB DAP CONFIG DISP (6.1) | I | 1-4 | none | On demand | On demand |
| RBST_DURATION | Duration of reboost from display | V94W0213C | UNIV PTG DISP (6.27) | S | 0- 86,400 | sec | On demand | On demand |
| DAPLOAD PARAMETERS | | | | | | | | |
| ARRAY_ALT_DELAY_TIME | Array of requested minimum time between firings in ALT mode | V93W1955C, V93W1960C (DAPs A, B) | ORBIT DAP CONFIG (6.1), ORBIT DAP CONFIG SPEC (5.8) | A(2)S | 0 to 99.99 | sec | 12.5 | 12.5 |
| ARRAY_ALT_JET_OPTION | Array of ALT mode jet options (1 = FWD and AFT, 3 = AFT only) | V93U1952C, V93U1957C (DAPs A, B) | ORBIT DAP CONFIG (6.1), ORBIT DAP CONFIG SPEC (5.8) | A(2)I | 1, 3 | none | 12.5 | 12.5 |
| ARRAY_ALT_MAX_JETS | Array of maximum number of jets to be commanded ON in ALT mode | V93U1953C, V93U1958C (DAPs A, B) | ORBIT DAP CONFIG (6.1), ORBIT DAP CONFIG SPEC (5.8) | A(2)I | 1, 2, 3 | none | 12.5 | 12.5 |
| ARRAY_ALT_ON_TIME | Array of requested maximum firing duration in ALT mode | V93W1954C, V93W1959C (DAPs A, B) | ORBIT DAP CONFIG (6.1), ORBIT DAP CONFIG SPEC (5.8) | A(2)S | 0.08 to 9.99 | sec | 12.5 | 12.5 |
| ARRAY_ALT_RATE_LIMIT | Array of requested rate limit in ALT mode | V93R1951C, V93R1956C (DAPs A, B) | ORBIT DAP CONFIG (6.1), ORBIT DAP CONFIG SPEC (5.8) | A(2)S | 0.05 to 5.0 | deg/s | 12.5 | 12.5 |

| Table 4.1-1. Input Parameters for the On-Orbit DAP Principal Function (4.35) | | | | | | | | |
|--|---|---------------------------------------|---|---------|-----------------------------|-------|------------------|-----------------------|
| Name | Description | MSID | Source | Type | Range | Unit | Sample Rate (Hz) | Update Rate Reqd (Hz) |
| ARRAY_ COMP_ THRESHOLD | Array of magnitudes of rotation compensation thresholds (0. = disable compensation) | See Table 4.1-3a | ORBIT DAP CONFIG (6.1), ORBIT DAP CONFIG SPEC (5.8) | A(2,2)S | ≥ 0 | deg/s | On demand | On demand |
| ARRAY_DB | Array of magnitudes of phase plane attitude deadband requests | See Table 4.1-3b | ORBIT DAP CONFIG (6.1), ORBIT DAP CONFIG SPEC (5.8) | A(2,2)S | > 0 | deg | On demand | On demand |
| ARRAY_ MNVR_RATE | Array of magnitudes of discrete maneuver rates (about body axes for manual discrete rate submodule; about eigen axis for auto mode) | See Table 4.1-3c | ORBIT DAP CONFIG (6.1), ORBIT DAP CONFIG SPEC (5.8) | A(2,2)S | > 0 | deg/s | On demand | On demand |
| ARRAY_ NOM_NOSE_ TAIL_PITCH | Array of pitch acceleration options (1=nominal; 2=low nose; 3=low tail) | V93J5750C, V93J5751C (DAPs A,B) | ORBIT DAP CONFIG (6.1), ORBIT DAP CONFIG SPEC (5.8) | A(2)I | 1,2,3 | none | On demand | On demand |
| ARRAY_ NOM_NOSE_ TAIL_YAW | Array of yaw acceleration options (1=nominal; 2=low nose; 3=low tail) | V93J5754C V93J5755C (DAPs A,B) | ORBIT DAP CONFIG (6.1), ORBIT DAP CONFIG SPEC (5.8) | A(2)I | 1,2,3 | none | On demand | On demand |
| ARRAY_ PAYLOAD_ EXTENDED | Array of payload extended flags (0=payload not extended; 1 through 9=selected payloads) | V93J5758C V93J5759C (DAPs A,B) | ORBIT DAP CONFIG (6.1), ORBIT DAP CONFIG SPEC (5.8) | A(2)I | 0,1,2, 3,4,5, 6,7,8,9 | none | On demand | On demand |

| Table 4.1-1. Input Parameters for the On-Orbit DAP Principal Function (4.35) | | | | | | | | |
|--|---|--------------------------------------|---|---------|---------|-------|------------------|-----------------------|
| Name | Description | MSID | Source | Type | Range | Unit | Sample Rate (Hz) | Update Rate Reqd (Hz) |
| ARRAY_RATE_LIMIT | Array of magnitudes of phase plane rate error limit requests | See Table 4.1-3d | ORBIT DAP CONFIG (6.1), ORBIT DAP CONFIG SPEC (5.8) | A(2,2)S | > 0 | deg/s | On demand | On demand |
| ARRAY_ROT_PULSE | Array of magnitudes of rotation pulses | See Table 4.1-3e | ORBIT DAP CONFIG (6.1), ORBIT DAP CONFIG SPEC (5.8) | A(2,2)S | > 0 | deg/s | On demand | On demand |
| ARRAY_TRANS_PULSE | Array of magnitudes of translation pulses | V93R5700C V93R5701C (DAPs A,B) | ORBIT DAP CONFIG (6.1), ORBIT DAP CONFIG SPEC (5.8) | A(2)S | > 0 | ft/s | On demand | On demand |
| EFFECTOR FLAGS | | | | | | | | |
| AUTO_MANF_CLOSE | Flag indicating that RCS RM issued an RCS manifold close command due to a failed-on jet | V90X0434X | RCS RM (4.91) | B | 0,1 | none | 12.5 | 12.5 |
| AVAILABLE_JET_AFT | List of available aft RCS jets (1=available) | V90X4520X to V90X4547X | Carryover value from insertion phase (PRCS); also RCS RM (4.91) | A(28)B | 0,1 | none | 12.5 | 12.5 |
| AVAILABLE_JET_FWD | List of available forward RCS jets (1=available) | V90X4548X to V90X4563X | Carryover value from insertion phase (PRCS); also RCS RM (4.91) | A(16)B | 0,1 | none | 12.5 | 12.5 |
| JET_MAP | Mapping of jet use preference within group | V90J5727C to V90J5764C | RCS RM (4.91) or carryover from previous OPS | A(38)I | 1 to 28 | none | 12.5 | 12.5 |
| JET_STATUS_CHANGE | Flag signifying change in AVAILABLE_JET (1=changed) | V90X4619X | RCS (4.91) | B | 0,1 | none | 12.5 | 12.5 |

| Table 4.1-1. Input Parameters for the On-Orbit DAP Principal Function (4.35) | | | | | | | | |
|--|---|-------------------------------------|--|-------|--|------|------------------|-----------------------|
| Name | Description | MSID | Source | Type | Range | Unit | Sample Rate (Hz) | Update Rate Reqd (Hz) |
| GUIDANCE COMMANDS | | | | | | | | |
| LAMC | Commanded thrust direction unit vector in reference (M50) coordinates | V90U1954C V90U1955C V90U1956C | ON-ORB GUID (4.7) | V(3)S | -1 to 1 | none | 1.04 | 0.52 |
| HC COMMANDS | | | | | | | | |
| RHC | Rotational hand controller deflection | V96H0004C V96H0005C V96H0007C | ORB 3-AX RHC SOP (4.199) | A(3)S | -65.55 to 65.55 (roll, pitch); -46.55 to 46.55 (yaw) | deg | 12.5 | 12.5 |
| RHC_STATE | Rotational hand controller out-of-detent indication | V96J0015C V96J0017C V96J0019C | ORB 3-AX RHC SOP (4.199) | A(3)I | -1,0,1 | none | 12.5 | 12.5 |
| SOFT_STOP | Flag indicating rotational hand controller is deflected beyond soft stop (1=beyond soft stop) | V96X1069X V96X1070X V96X1071X | ORB 3-AX RHC SOP (4.199) | A(3)B | 0,1 | none | 12.5 | 12.5 |
| THC | Translational hand controller command | V96J0401C V96J0402C V96J0403C | THC SOP (4.54) | A(3)I | -1,0,1 | none | 12.5 | 6.25 |
| IMU-MTU DATA | | | | | | | | |
| ATT_DG | IMU data good (1=data good) | V90X2555X | IMU RM (4.72) | B | 0,1 | none | 12.5 | 1.04 |
| T_NOW | IMU attitude data time tag, expressed as mission elapsed time | V90W2310C | ORB ATT PROC (4.97) | S | | sec | 1.04 | 6.25 |
| MODE/EVENT FLAGS | | | | | | | | |
| CROSSFEED_OPEN_LEFT | Left crossfeed between aft RCS tanks is open (1=open) | V90X7501X | Carryover value from insertion phase; also GN&C SW PROC (4.180) | B | 0,1 | none | 12.5 | 12.5 |
| CROSSFEED_OPEN_RIGHT | Right crossfeed between aft RCS tanks is open (1=open) | V90X7502X | Carryover value from insertion phase; also GN&C SW PROC (4.180) | B | 0,1 | none | 12.5 | 12.5 |
| DAP_DATA_CHANGE | Flag signifying change in one or more DAPLOAD parameters | V93X5774X | ORBIT DAP CONFIG (6.1), ORBIT DAP CONFIG SPEC (5.8) | B | 0,1 | none | 12.5 | On demand |

| Table 4.1-1. Input Parameters for the On-Orbit DAP Principal Function (4.35) | | | | | | | | |
|--|---|-----------|---|------|------------------|------|------------------|-----------------------|
| Name | Description | MSID | Source | Type | Range | Unit | Sample Rate (Hz) | Update Rate Reqd (Hz) |
| DAPLOAD_CHANGE | Flag signifying change in one or both DAPLOAD selection parameters. (bit 1 ON = DAPLOAD has changed, bit 2 ON = PRIMARY_VERNIER_SW has changed) | V93X3656X | ORBIT DAP CONFIG SPEC (5.8) | B(2) | 0,1 for each bit | none | 12.5 | |
| ENABLE_NF | Flag to enable/disable notch filter (1 = enable) | V93X5344X | ORBIT DAP CONFIG (6.1) | B | 0,1 | none | On demand | On demand |
| GUIDED_DELTA_V_BURN | Flag indicating RCS or OMS delta-V burn is in progress (1=burn in progress: from ignition time to burn cutoff) | V90X8647X | MSC | B | 0,1 | none | 12.5 | On demand |
| MM_202 | Major mode 202 (maneuver execute) flag (1=major mode 202) | V90X8646X | MSC | B | 0,1 | none | 12.5 | 12.5 |
| OPS_2_INDICATOR | Operational Sequence 2 Flag | V90X8633X | MSC | B | 0,1 | none | 12.5 | 12.5 |
| MNVR_TRACK_OPTION | Maneuver-track option select enable (1=enable) | V95X2222X | UNIV POINT PROC (4.213) | B | 0,1 | none | 12.5 | 0.52 |
| OMSL_ON_CMD | Left OMS engine turn-on command (1=on) | V90X8271X | OMS FIRE SEQ (4.182) | B | 0,1 | none | 12.5 | 12.5 |
| OMSR_ON_CMD | Right OMS engine turn-on command (1=on) | V90X8272X | OMS FIRE SEQ (4.182) | B | 0,1 | none | 12.5 | 12.5 |
| PREBURN_MNVR | OMS pre-thrust maneuver command (1=maneuver) | V93X6912X | MNVR EXEC (6.35) | B | 0,1 | none | 12.5 | 1/maneuver |
| RBST_CNCL | Reboost cancel | V94X0217X | UNIV POINT PROC (4.213), UNIV PTG DISP (6.27) | B | 0 | none | 12.5 | On demand |
| RBST_ENA | Reboost enable flag | V90X0442X | UNIV POINT PROC (4.213) | B | 0,1 | none | 12.5 | 0.52 |
| RCS_NORM | Flag indicating that both OMS to Aft RCS interconnects are closed (1=both closed; 0=at least one open) | V93X5117X | RCS DISP (6.7) | B | 0,1 | none | 12.5 | 12.5 |
| TRIM_OMS_GIMBALS | OMS gimbal pre-thrust trim command (1=trim) | V90X8643X | MSC | B | 0,1 | none | 12.5 | 1/maneuver |

| Table 4.1-1. Input Parameters for the On-Orbit DAP Principal Function (4.35) | | | | | | | | |
|--|--|-------------------------------------|---|---------|---------------------------|----------------------|------------------|-----------------------|
| Name | Description | MSID | Source | Type | Range | Unit | Sample Rate (Hz) | Update Rate Reqd (Hz) |
| UP_OP_CODE | Uplinked operation code (0110011 – Notch Filter/Mass Properties Update) | V96J3521C | UPLINK | B(7) | | none | 12.5 | On demand |
| XJETS_ACTIVE | XJETS active indicator (1 = active) | V93X0992X | ORBIT DAP CONFIG (6.1) | B | 0,1 | none | On demand | On demand |
| PANEL SWITCH-DERIVED COMMANDS | | | | | | | | |
| NEW_PANEL_SW_WORD | Control panel switch states (1=pressed) | See Table 4.1-4 | FC SWIT PROC (4.216) | A(24)B | 0,1 | none | 12.5 | 12.5 |
| LH_AUTMANBF | SEL LH AUTO/MAN BODY FLAP SW | V90X6501X | GN&C SW RM (4.180) | B | 0,1 | none | 12.5 | |
| LH_AUTOSB | SEL LH SPD BK/THROT AUTO/MAN | V90U6811C | GN&C SW RM (4.180) | B | 0,1 | none | 12.5 | |
| RH_AUTOSB | SEL RH SPD BK/THROT AUTO/MAN | V90U6911C | GN&C SW RM (4.180) | B | 0,1 | none | 12.5 | |
| UPLINK DATA | | | | | | | | |
| CG_UL | Uplinked center of gravity | V96U1585C V96U1586C V96U1587C | UPLINK | A(3)S | | inches | On demand | On demand |
| MOMENTS_OF_INERTIA_UL | Uplinked moments of inertia | V96U1588C V96U1589C V96U1590C | UPLINK | A(3)S | | slug-ft ² | On demand | On demand |
| NF_FREQS_UL | Lower, upper frequency pair for up to six filter notches for current notch filter parameter load | V96F1603C– V96F1614C | UPLINK | A(6,2)S | ≥ 0 | Hz | On demand | On demand |
| N_FILTERS_UL | Absolute value is number of notch filters active for current notch filter/mass properties update | V96J1602C | UPLINK | I | –6 to 6 | none | On demand | On demand |
| PAYLOAD_EXTENDED_UL | Payload extended slot for uplink | V96J1601C | UPLINK | I | 1,2,3, 4,5,6, 7,8,9 | none | On demand | On demand |
| PRODUCTS_OF_INERTIA_UL | Uplinked products of inertia | V96U1591C V96U1592C V96U1593C | UPLINK | A(3)S | | slug-ft ² | On demand | On demand |
| VEHICLE MASS PROPERTY DEPENDENT PARAMETERS | | | | | | | | |
| KP2 | Pitch filter gain for TVC (two engines) | V97U2354C | K-load; also carryover from previous OPS, also ORBIT DAP CONFIG (5.8) | S | ≥ 0 | deg/(deg/s) | 1/maneuver | On demand |

| Table 4.1-1. Input Parameters for the On-Orbit DAP Principal Function (4.35) | | | | | | | | |
|--|--|---|---|------------------|-----------------|--------------|------------------|-----------------------|
| Name | Description | MSID | Source | Type | Range | Unit | Sample Rate (Hz) | Update Rate Reqd (Hz) |
| KR | Roll filter gain for TVC (two engines) | V97U2355C | K-load; also carryover from previous OPS, also ORBIT DAP CONFIG (5.8) | S | ≥ 0 | deg/ (deg/s) | 12.5 | On demand |
| KY2 | Yaw filter gain for TVC (two engines) | V97U2356C | K-load; also carryover from previous OPS, also ORBIT DAP CONFIG (5.8) | S | ≥ 0 | deg/ (deg/s) | 1/maneuver | On demand |
| VEHICLE_MASS | Current vehicle mass | V97U2910C | I-load; also ORB MNVR DIP (4.158) | S | ≥ 0 | slug | 12.5 | On demand |
| VEHICLE STATE | | | | | | | | |
| ATTITUDE_INCREMENT_6HZ | Body angle increment over sampling interval | V90H2285CA V90H2213C V90H2214C | ORB ATT PROC (4.97) | V(3)S | | deg | 6.25 | 6.25 |
| DVB_SEC | Vehicle velocity increment over the past 0.96 second | V90L2696C V90L2697C V90L2698C | ORB ATT PROC (4.97) | V(3)S | -10 to 10 | ft/s | 1.04 | 1.04 |
| Q_B_M50 | Vehicle attitude with respect to reference attitude, given as the M50-to-body quaternion | V90U2240CB V90U2241CB V90U2242CB V90U2243CB (scalar, vector) | ORB ATT PROC (4.97) | Struct: S; V(3)S | 0 to 1; -1 to 1 | none | 1.04, 12.5 | 6.25 |
| Q_M50_LVLH | LVLH-to-M50 quaternion | V90U2641CA V90U2642CA V90U2643CA V90U2644CA (scalar, vector) | ORB ATT PROC (4.97) | Struct: S; V(3)S | 0 to 1; -1 to 1 | none | 1.04 | 0.52 |

| Table 4.1-2. Output Parameters for the On-Orbit DAP Principal Function (4.35) | | | | | | | | |
|---|--|--|--|---------------------|--------------------|-------|------------------|-----------------------|
| Name | Description | MSID | Destination | Type | Range | Unit | Update Rate (Hz) | Sample Rate Reqd (Hz) |
| DISPLAY DATA | | | | | | | | |
| ATTITUDE_ERROR | Body angle error | V90H2143C V90H2141C V90H2142C | UNIV POINT PROC (4.213), ORB ADI PROC (4.169), TLM | V(3)S | | deg | 12.5 | |
| DB_REQUEST(1) | X-component of phase plane attitude deadbands requested by crew | V90H2785C | UNIV POINT PROC (4.213), TLM | S | ≥ 0 | deg | 12.5 | |
| ENABLE_NF | Flag to enable/disable notch filter (1 = enable) | V93X5344X | ORBIT DAP CONFIG (6.1), TLM | B | 0, 1 | none | On demand | On demand |
| LVLH_MODE | LVLH mode indicator (1=LVLH) | V90X2174X | ORB ATT PROC (4.97), UNIV POINT PROC (4.213) | B | 0, 1 | none | 12.5 | 6.25 |
| MNVR_CMPL_TIME_TGO | Preburn mnvr time to go | V95W7240CB | ORB MNVR DIP (4.158) | S | | sec | 1.04 | 1.04 |
| OMS_PITCH_TRIM | OMS engines pitch trim angle with respect to center of gimbal travel | V93H6915C | ON-ORB GUID (4.7), ORBIT MNVR DIP (4.158), TRANS DAP (4.201), MNVR EXEC (6.35) | S | -6 to 6 | deg | 12.5 | |
| OMS_YAW_TRIM | Left and right OMS engines yaw trim angles with respect to center of gimbal travel | V93H6916C V93H6918C | ON-ORB GUID (4.7), ORBIT MNVR DIP (4.158), TRANS DAP (4.201), MNVR EXEC (6.35) | A(2)S | -8 to 8 | deg | 12.5 | |
| PREBURN_MNVR_IN_PROGRESS | Flag indicating automatic preburn maneuver is in progress (1 = maneuver in progress) | V90X1589X | MNVR EXEC (6.35), UNIV POINT PROC (4.213), ORB MNVR DIP (4.158) | B | 0, 1 | none | 12.5 | |
| Q_B_I_CMD_DISPLAY | Commanded vehicle attitude with respect to reference attitude, given as the M50-to-body quaternion | V90H2721C V90H2722C V90H2723C V90H2724C (scalar, vector) | ORB ATT PROC (4.97) | Struct: S; V(3)S | 0 to 1; -1 to 1 | none | 12.5 | 6.25 |
| RATE_EST | Body angular rate estimate | V90R2223C V90R2224C V90R2225C | STAR TRCK SOP (4.66), GN&C/SM-PL IF (4.111), ORB ADI PROC (4.169), UNIV POINT PROC (4.213), TLM, IMU RM (4.72) | V(3)S | | deg/s | 12.5 | |
| RBST_CNCL | Reboost Cancel | V94X0217X | UNIV POINT PROC (4.213) | B | 0.1 | none | 12.5 | 0.52 |

Table 4.1-2. Output Parameters for the On-Orbit DAP Principal Function (4.35)

| Name | Description | MSID | Destination | Type | Range | Unit | Update Rate (Hz) | Sample Rate Reqd (Hz) |
|--------------------------|--|-------------------------------------|--|----------|----------|----------------------|------------------|-----------------------|
| RBST_ENA | Reboost enable flag | V90X0442X | UNIV POINT PROC (4.213), ORB DAP CONFIG DISP (6.1) | B | 0,1 | none | 12.5 | 0.52 |
| RBST_TIME_REMAINING | Time remaining in reboost burn | V90W0443C | UNIV POINT PROC (4.213) | S | 0-86,400 | sec | 12.5 | 12.5 |
| DAP_LOAD_SEL_A | ID of display requested select DAP A | V93J5779C | ORB DAP CONFIG SPEC (5.8) | I | 0 - 15 | none | On demand | On demand |
| DAP_LOAD_SEL_B | ID of display requested select DAP B | V93J5780C | ORB DAP CONFIG SPEC (5.8) | I | 0 - 15 | none | On demand | On demand |
| DAP_SEL_REQ_A | Flag requesting DAP A load selection | V93X5785X | ORB DAP CONFIG SPEC (5.8) | B | 0, 1 | none | On demand | On demand |
| DAP_SEL_REQ_B | Flag requesting DAP B load selection | V93X5786X | ORB DAP CONFIG SPEC (5.8) | B | 0, 1 | none | On demand | On demand |
| SELECTED_MNVR_TRACK_RATE | Desired body rate during maneuver-track mode | V90R2176C | UNIV POINT PROC (4.213) | S | ≥ 0 | deg/s | 1.04 | |
| XJETS_ACTIVE | XJETS active indicator (1 = active) | V93X0992X | ORBIT DAP CONFIG (6.1), TLM | B | 0,1 | none | On demand | On demand |
| DOWNLIST PARAMETERS | | | | | | | | |
| DAP_UL_STATUS | Flag indicating status of most recent notch filter or mass properties parameter load (0 = refused, 1 = notch only, 2 = mass properties only, 3 = both) | V93J5439C | TLM | I | 0,1,2,3 | none | On demand | On demand |
| MINA_JS_SEL | Flag indicating that the minimum angle jet selection logic has been selected | V90X6500X | TLM | B | 0, 1 | none | 12.5 | On demand |
| N_FILTERS | Absolute value is number of notch filters currently active | V93J5417C | TLM | I | -6 to 6 | none | On demand | On demand |
| RBST_ENA | Reboost enable flag | V90X0442X | TLM | B | 0,1 | none | 12.5 | 1.04 |
| SEL_CG | Selected values of vehicle cg. In the OV frame. | V93U5430C V93U5431C V93U5432C | TLM | A(3)S | | inches | On demand | On demand |
| SEL_MOMENTS_I | Selected values of vehicle moments of inertia. In the OV frame | V93U5436C V93U5437C V93U5438C | TLM | A(3)S | | slug-ft ² | On demand | On demand |
| SEL_NOTCH_FREQS | Lower, upper frequency pairs for up to six filter notches for selected payload-extended configuration | V93F5418C to V93F5429C | TLM | A(6, 2)S | 0 - 3.0 | Hz | On demand | On demand |

| Table 4.1-2. Output Parameters for the On-Orbit DAP Principal Function (4.35) | | | | | | | | |
|---|--|---|-------------------------|--------|--------------------------------------|----------------------|------------------|-----------------------|
| Name | Description | MSID | Destination | Type | Range | Unit | Update Rate (Hz) | Sample Rate Reqd (Hz) |
| DOCKING_ARM | Current status of DOCKING_ARM. (1 = on; 0 = off) | V90X0101X | TLM | B | 0, 1 | none | On demand | On demand |
| SEL_PRODUCTS_I | Selected values of vehicle products of inertia. In the OV frame, positive integrals. | V93U5433C V93U5434C V93U5435C | TLM | A(3)S | | slug-ft ² | On demand | On demand |
| MEASURED_ATTITUDE | Body Angles: Summation of body attitude increments (unfiltered) | V93H0997C V93H0998C V93H0999C | TLM | V(3)S | -360 to 360 | deg | 6.25 | 5 |
| XJETS_ACTIVE | XJETS Active Flag | V93X0992X | TLM | B | 0,1 | none | On demand | On demand |
| EFFECTOR COMMANDS | | | | | | | | |
| AUTO_MANF_CLOSE | Flag indicating that an RCS manifold close command was issued due to a failed-on jet (set by RCS RM and reset by On-Orbit DAP) | V90X0434X | RCS RM (4.91) | B | 0, 1 | none | 12.5 | 12.5 |
| NEW_JONLST_AFT | RCS aft jet commands (1 = on; 0 = off) | V90X1455X to V90X1457X V90X1459X V90X1673X to V90X1692X V90X2158X V90X2159X V90X2172X V90X2173X | ORB RCS CMD SOP (4.191) | A(28)B | 0, 1 | none | 12.5 | 12.5 |
| NEW_JONLST_FWD | RCS forward jet commands (1 = on; 0 = off) | V90X1441X V90X1442X to V90X1444X V90X1445X V90X1446X to V90X1448X V90X1449X V90X1450X to V90X1454X V90X2139X V90X2140X | ORB RCS CMD SOP (4.191) | A(16)B | 0, 1 | none | 12.5 | 12.5 |
| OMSL_PITCH_YAW_CMD | Left OMS engine pitch and yaw commands with respect to center of gimbal travel | V90H2180C V90H2181C | OMS TVC CMD SOP (4.64) | A(2)S | Pitch: -6 to 6 Yaw: -8 to 8 | deg | 12.5 | 12.5 |
| OMSR_PITCH_YAW_CMD | Right OMS engine pitch and yaw command with respect to center of gimbal travel | V90H2730C V90H2182C | OMS TVC CMD SOP (4.64) | A(2)S | Pitch: -6 to 6 Yaw: -8 to 8 | deg | 12.5 | 12.5 |

| Table 4.1-2. Output Parameters for the On-Orbit DAP Principal Function (4.35) | | | | | | | | |
|---|--|-------------------------------------|----------------------------|--------|---------|------|------------------|-----------------------|
| Name | Description | MSID | Destination | Type | Range | Unit | Update Rate (Hz) | Sample Rate Reqd (Hz) |
| INDICATOR LAMP DRIVES | | | | | | | | |
| LAMP_CMD | Discrete lamp commands (1 = on; 0 = off) | See Tables 4.1-5 and 4.1-6 | See Tables 4.1-5 and 4.1-6 | A(24)B | 0, 1 | none | 12.5 | |
| LAUTO_SBLAMP | Discrete lamp commands (1 = on; 0 = off) (left station speedbrake auto light) | V72X5136X | D&C PNL (panel F2) | B | 0, 1 | none | 12.5 | |
| RAUTO_SBLAMP | Discrete lamp command (1 = on; 0 = off) (right station speedbrake auto light) | V72X5134X | D&C PNL (panel F4) | B | 0, 1 | none | 12.5 | |
| LAUTO_BFLAMP | Discrete lamp command (1 = on; 0 = off) (left station body flap auto light) | V72X4996X | D&C PNL (panel F2) | B | 0, 1 | none | 12.5 | |
| ROT_COMMAND | RCS Rotation Command for output to activity lights | V90U2416C V90U2417C V90U2418C | RCS ACT LT (4.230) | A(3)S | -1 to 1 | none | 12.5 | 12.5 |
| NAVIGATION | | | | | | | | |
| JETS_ON | Flag indicating at least one RCS jet has been commanded on this pass (1 = commanded) | V90X2349X | ORB/RND NAV (4.126) | B | 0, 1 | none | 12.5 | 12.5 |

Table 4.1-3. Multidimensional Array MSID's

A. ARRAY_COMP_THRESHOLD

| | RCS | |
|-----------|-----------|-----------|
| | Primary | Vernier |
| DAPLOAD A | V93H5741C | V93H5745C |
| DAPLOAD B | V93H5742C | V93H5746C |

B. ARRAY_DB

| | Primary | Vernier |
|-----------|-----------|-----------|
| DAPLOAD A | V93H5766C | V93H5768C |
| DAPLOAD B | V93H5767C | V93H5769C |

C. ARRAY_MNVR_RATE

| | Primary | Vernier |
|-----------|-----------|-----------|
| DAPLOAD A | V93R5705C | V93R5709C |
| DAPLOAD B | V93R5706C | V93R5710C |

D. ARRAY_RATE_LIMIT

| | Primary | Vernier |
|-----------|-----------|-----------|
| DAPLOAD A | V93R5726C | V93R5730C |
| DAPLOAD B | V93R5727C | V93R5731C |

E. ARRAY_ROT_PULSE

| | Primary | Vernier |
|-----------|-----------|-----------|
| DAPLOAD A | V93R5714C | V93R5718C |
| DAPLOAD B | V93R5715C | V93R5719C |

| Table 4.1-4. Control Panel Switch Signal (NEW_PANEL_SW_WORD) MSID's | | | |
|---|-----------|---------------------|-----------|
| Panel Switch | MSID | Panel Switch | MSID |
| DAPLOAD_A | V95X2403X | ROT_DISC(1)(ROLL) | V95X2430X |
| DAPLOAD_B | V95X2404X | ROT_DISC(2)(PITCH) | V95X2431X |
| DAP_AUTO | V95X2401X | ROT_DISC(3)(YAW) | V95X2432X |
| DAP_INRTL | V95X2402X | ROT_PULSE(1)(ROLL) | V95X2439X |
| Primary RCS | V95X2409X | ROT_PULSE(2)(PITCH) | V95X2440X |
| Vernier RCS | V95X2410X | ROT_PULSE(3)(YAW) | V95X2441X |
| ALT RCS | V95X2411X | DAP_LVLH | V95X2414X |
| TRANS_NORM(1)(X) | V95X2417X | DAP_FREE | V95X2405X |
| TRANS_NORM(2)(Y) | V95X2418X | TRANS_LOW_Z | V95X2415X |
| TRANS_HIGH_Z | V95X2416X | SPARE_PBI | V95X2408X |
| TRANS_NORM(3)(Z) | V95X2419X | | |
| TRANS_PULSE(1)(X) | V95X2420X | | |
| TRANS_PULSE(2)(Y) | V95X2421X | | |
| TRANS_PULSE(3)(Z) | V95X2422X | | |

Note: Source of items (parameters) above is FC SWIT PROC (4.216).

| Table 4.1-5. Control Panel Indicator Lamp Drive Signal (LAMP_CMD) MSIDs, Forward Lamps | | | |
|--|------------|--------------------------|------------|
| Panel Lamp | MSID | Panel Lamp | MSID |
| • LAMP_DAPLOAD_A | V72X2807X | LAMP_TRANS_PULSE(1)(X) | V72X2867X |
| • LAMP_DAPLOAD_B | V72X2808X | LAMP_TRANS_PULSE(2)(Y) | V72X2877X |
| + LAMP_AUTO | V72X2850XA | LAMP_TRANS_PULSE(3)(Z) | V72X2887X |
| & LAMP_INRTL | V72X2849XA | LAMP_ROT_DISC(1)(ROLL) | V72X2790XA |
| • LAMP_PRIMARY | V72X2855X | LAMP_ROT_DISC(2)(PITCH) | V72X2793XA |
| # LAMP_VERNIER | V72X2856X | LAMP_ROT_DISC(3)(YAW) | V72X2796XA |
| LAMP_TRANS_NORM(1)(X) | V72X2866X | LAMP_ROT_PULSE(1)(ROLL) | V72X2792XA |
| LAMP_TRANS_NORM(2)(Y) | V72X2876X | LAMP_ROT_PULSE(2)(PITCH) | V72X2795XA |
| LAMP_TRANS_NORM(3)(Z) | V72X2886X | LAMP_ROT_PULSE(3)(YAW) | V72X2798XA |
| & LAMP_LVLH | V72X2868X | Spare | V72X2889X |
| LAMP_LOW_Z | V72X2878X | • LAMP_ALT | V72X2896X |
| LAMP_TRANS_HIGH_Z | V72X2888X | & LAMP_FREE | V72X2897X |
| <p>Note: Destinations of item marked with a plus (+) are forward ORB DAP panel lamps, UNIV POINT PROC (4.213), MNVR EXEC (6.35), ORB 3-AX RHC SOP (4.199), and TLM; destinations of item marked with a pound sign (#) are forward ORB DAP panel lamps, RCS RM (4.91), ORBIT DAP CONFIG (6.1) and TLM; destinations of items marked with a bullet (•) are forward ORB DAP panel lamps, Orbit DAP Config (6.1), and TLM; destinations of items marked with an ampersand (&) are forward ORB DAP panel lamps, MNVR EXEC (6.35), and TLM; destinations of all other items are forward ORB DAP panel lamps and TLM.</p> | | | |

| Table 4.1-6. Control Panel Indicator Lamp Drive Signal (LAMP_CMD) MSID's, Aft Lamps | | | |
|---|------------|------------------------|-----------|
| Panel Lamp | MSID | Panel Lamp | MSID |
| * LAMP_DAPLOAD_A | V72X6421X | LAMP_TRANS_NORM(1)(X) | V72X6540X |
| * LAMP_DAPLOAD_B | V72X6422X | LAMP_TRANS_NORM(2)(Y) | V72X6543X |
| LAMP_AUTO | V72X6498XA | LAMP_TRANS_NORM(3)(Z) | V72X6546X |
| LAMP_INRTL | V72X6499XA | LAMP_LVLH | V72X6542X |
| LAMP_PRIMARY | V72X6502X | LAMP_LOW_Z | V72X6545X |
| LAMP_VERNIER | V72X6503X | LAMP_TRANS_HIGH_Z | V72X6548X |
| LAMP_ALT | V72X6416X | LAMP_TRANS_PULSE(1)(X) | V72X6541X |
| Spare | V72X6402X | LAMP_TRANS_PULSE(2)(Y) | V72X6544X |
| LAMP_FREE | V72X6417X | LAMP_TRANS_PULSE(3)(Z) | V72X6547X |
| + ROT_DISC(1)(ROLL) | V90X2184X | | |
| + ROT_DISC(2)(PITCH) | V90X2187X | | |
| + ROT_DISC(3)(YAW) | V90X2190X | | |
| + ROT_PULSE(1)(ROLL) | V90X2186X | | |
| + ROT_PULSE(2)(PITCH) | V90X2189X | | |
| + ROT_PULSE(3)(YAW) | V90X2192X | | |
| <p>Note: Destinations of items marked with a (+) is FC SWIT PROC (4.216); destinations of items marked with an asterisk (*) are aft ORB DAP panel lamps and TLM; destinations of all other items are aft ORB DAP panel lamps.</p> | | | |

Table 4.1-7. On-Orbit DAP Mission-Dependent I-Loads

| Name | Description | Type | MSID | Unit | Module(s) Used by |
|-------------------------------|--|---------------|---|----------------------|------------------------|
| ACCEL_GAIN_UNIQUE | Mission unique acceleration gain | S | V97U2665C | none | OFC_RECON |
| ACCEL_INH_ATTITUDE_GAIN | State estimator filter 1 gain for attitude during AF inhibit | S | V97U2651C | none | PART1_FILTER |
| ACCEL_INH_RATE_GAIN | State estimator filter 1 gain for rate during AF inhibit | S | V97U2652C | none | PART1_FILTER |
| AF_OVR_DLY_COUNT | Maximum allowable duration of consecutive accel filter inhibits (0.16 sec. increments) | I | V97U3167C | none | OFC_RECON |
| ATTITUDE_GAIN1_UNIQUE | Mission unique attitude filter gain 1 | S | V97U2666C | none | OFC_RECON |
| ATTITUDE_GAIN2_UNIQUE | Mission unique attitude filter gain 2 | S | V97U2667C | none | OFC_RECON |
| CG_ARRAY | Array of vehicle cg's in the OV frame | A(9) V(3)S | V97U2511C to V97U2537C | inches | DAPLOAD_SELECT |
| MOMENTS_OF_INERTIA_ARRAY | Array of vehicle moments of inertia in the OV frame | A(9,3)S | V97U2541C to V97U2567C | slug-ft ² | DAPLOAD_SELECT |
| NOTCH_LOWER_UPPER_FREQS | Lower, upper frequency pairs for up to six filter notches for each of nine payload-extended configurations | A(9,6,2)S | V97U3101C to V97U3160C, V97U2598C to V97U2645C | Hz | PART1_FILTER |
| NUM_FILTERS | Absolute value is number of notch filters active for each of nine payload-extended configurations | A(9)I | V97U3161C to V97U3165C, V97U2646C to V97U2649C | none | DAPLOAD_SELECT |
| PRIMARY_ROT_MIN_IMPULSE | Largest value of change in vehicle angular rate in any axis due to minimum impulse RCS firing at nominal acceleration level using primary jets | S | V97U2797C | deg/s | JET_SELECT |
| PRODUCTS_OF_INERTIA_ARRAY | Array of vehicle products of inertia in the OV frame | A(9,3)S | V97U2571C to V97U2597C | slug-ft ² | DAPLOAD_SELECT |
| RATE_GAIN1_UNIQUE | Mission unique rate filter gain 1 | S | V97U2668C | none | OFC_RECON |
| RATE_GAIN2_UNIQUE | Mission unique rate filter gain 2 | S | V97U2669C | none | OFC_RECON |
| UNIQUE_FILTER_SELECTION_VALUE | Payload extended threshold for which unique gains are selected | I | V97U2670C | none | OFC_RECON |
| VERNIER_ROT_MIN_IMPULSE | Largest value of change in vehicle angular rate in any axis due to minimum impulse RCS firing using vernier jets | S | V97U2882C | deg/s | JET_SELECT |
| VEHICLE_MASS | Vehicle mass | S | V97U2910C | slug | TRANS_PULSE |
| DOCKING_FLT | Used to determine if the post-contact firing logic should be executed. DOCKING_FLT should be I-loaded to ON if a post-contact firing sequence will be required during the mission. | B | V99U5728C | none | OFC_RECON |
| MAX_NUM_CYCLES | Maximum number of cycles allowed prior to automatically stopping the post contact thrusting sequence. | I | V99U5729C | none | POST_CONTACT_THRUSTING |
| PHASE1_MAX_PULSES | Number of pulses for phase one jets in one cycle of the post contact thrusting sequence. | I | V99U5730C | none | POST_CONTACT_THRUSTING |

Table 4.1-7. On-Orbit DAP Mission-Dependent I-Loads

| Name | Description | Type | MSID | Unit | Module(s) Used by |
|---------------------|--|---------------|-------------------------|------|------------------------|
| PHASE1_PULSE_ON | The duration in number of 0.08 sec DAP cycles of each phase one jet pulse. | I | V99U5731C | none | POST_CONTACT_THRUSTING |
| PHASE1_DELAY | The time delay in number of 0.08 sec DAP cycles after each phase one pulse required prior to initiating the next phase one pulse. | I | V99U5732C | none | POST_CONTACT_THRUSTING |
| PHASE1_DELAY_PHASE2 | The time delay in number of 0.08 sec DAP cycles required after the final phase one pulse in a cycle prior to initiating the first phase two pulse. | I | V99U5733C | none | POST_CONTACT_THRUSTING |
| PHASE2_MAX_PULSES | Number of pulses for phase two jets in one cycle of the post contact thrusting sequence. | I | V99U5734C | none | POST_CONTACT_THRUSTING |
| PHASE2_PULSE_ON | The duration in number of 0.08 sec DAP cycles of each phase two jet pulse. | I | V99U5735C | none | POST_CONTACT_THRUSTING |
| PHASE2_DELAY | The time delay in number of 0.08 sec DAP cycles after each phase two pulse required prior to initiating the next phase two pulse. | I | V99U5736C | none | POST_CONTACT_THRUSTING |
| CYCLE_PAUSE | The time delay in number of 0.08 sec DAP cycles required after the final phase two pulse in a sequence cycle prior to initiating the next sequence cycle. | I | V99U5737C | none | POST_CONTACT_THRUSTING |
| PCT_DAP | The DAP to mode to if the contact sequence is deactivated by the SPARE PBI, LH_AUTOSB PBI, RH_AUTOSB PBI, LH_AUTMANBF PBI or the FREE PBI, or if the contact sequence exceeds the maximum number of cycles, the RHC is moved out of detent while the contact sequence is active, or the THC is moved out of detent while the contact sequence is active. | A(24)B | See Table 4.1-10. | none | POST_CONTACT_THRUSTING |
| PCT_DAP_LOAD | The numbers of the DAP A and B to be used if the contact sequence is inhibited by the SPARE PBI, LH_AUTOSB PBI, RH_AUTOSB PBI, LH_AUTMANBF PBI or the FREE PBI, or if the contact sequence is inhibited by exceeding the maximum number of cycles, by moving the RHC out of detent, or by moving the THC out of detent. | A(2)I | V99U5762C V99U5763C | none | POST_CONTACT_THRUSTING |
| RBST_GROUPS | Array of vectors of reboost jet groups for selection | A(4) V(6)I | V96U8201C- V96U8224C | none | JET_SELECT |
| RBST_ON_TIMES | Array of vectors of reboost firings times for jet group | A(4) V(6)S | V96U8225C- V96U8248C | sec | JET_SELECT |
| RBST_NUMJETS | Array of vectors of reboost number of jets within group | A(4) V(6)I | V96U8381C- V96U8404C | none | JET_SELECT |
| TRANS2ROT_DELAY | Reboost translation to rotation delay | S | V96U8521C | sec | JET_SELECT |
| ROT2TRANS_DELAY | Reboost rotation to translation delay | S | V96U8522C | sec | JET_SELECT |

Table 4.1-7. On-Orbit DAP Mission-Dependent I-Loads

| Name | Description | Type | MSID | Unit | Module(s) Used by |
|----------------------|---|---------------|--|------|----------------------------|
| RBST_INTERVAL_FACTOR | Reboost scaling factors for reboost firing intervals | A(10)S | V96U8523C- V96U8532C | none | JET_SELECT |
| ALT_DELAY_FACTOR | Alt Mode delay scaling factor | A(10)S | V96U8533C- V96U8542C | none | JET_SELECT |
| RBST_PP_SF | Scale factor for reboost acceleration compensation | S | V96U8543C | none | PHASE_PLANE |
| RBST_START | Array of vectors of reboost jet interval START times. | A(4) V(6)S | V96U8420C- V96U8443C | sec | JET_SELECT |
| PHASE1_GRP_CMD | The numbers of jets to be fired in jet groups G5, G6, G13 and G14 in phase one. [G-5,G-6,G-13,G-14] | A(4)I | V97U7460C V97U7461C V97U7462C V97U7463C | none | POST_CONTACT_ THRUSTING |
| PHASE2_GRP_CMD | The numbers of jets to be fired in jet groups G5, G6, G13 and G14 in phase two. [G-5,G-6,G-13,G-14] | A(4)I | V97U7464C V97U7465C V97U7466C V97U7467C | none | POST_CONTACT_ THRUSTING |

Table 4.1-8. On-Orbit DAP Design-Dependent I-Loads

| Name | Description | Type | MSID | Unit | Module(s) Used By |
|-----------------------------|--|-------|-------------------------------------|--------------------|-------------------------|
| ACCEL_GAIN_PRIMARY | State estimator filter 2 gain for acceleration term during RCS operations with primary jets | S | V97U2500C | none | OFC_RECON |
| ACCEL_GAIN_TVC | State estimator filter 2 gain for acceleration term during TVC operations | S | V97U9810C | none | OFC_RECON |
| ACCEL_GAIN_VERNIER | State estimator filter 2 gain for acceleration term during RCS operations with vernier jets | S | V97U2502C | none | OFC_RECON |
| AF_INH_COUNT | Duration of accel filter inhibit following jet firing (0.16 sec. increments) | I | V97U3166C | none | OFC_RECON |
| AF_OVR_ON_COUNT | Duration of accel filter inhibit override (0.16 sec. increments) | I | V97U3168C | none | OFC_RECON |
| ALT_MNVR_SCALE_FACTOR | Scale factor for Alternate DAP mode maneuvers with delays | S | V97U2671C | none | OFC_RECON |
| ATTITUDE_GAIN1_PRIMARY | State estimator filter 1 gain for attitude term during operations with primary jets | S | V97U2655C | none | OFC_RECON, PART1_FILTER |
| ATTITUDE_GAIN1_TVC | State estimator filter 1 gain for attitude term during TVC operations | S | V96U9811C | none | OFC_RECON |
| ATTITUDE_GAIN1_VERNIER | State estimator filter 1 gain for attitude term during RCS operations with vernier jets | S | V97U2657C | none | OFC_RECON |
| ATTITUDE_GAIN2_PRIMARY | State estimator filter 2 gain for attitude term during RCS operations with primary jets | S | V97U2658C | none | OFC_RECON |
| ATTITUDE_GAIN2_TVC | State estimator filter 2 gain for attitude term during TVC operations | S | V96U9812C | none | OFC_RECON |
| ATTITUDE_GAIN2_VERNIER | State estimator filter 2 gain for attitude term during RCS operations with vernier jets | S | V97U2660C | none | OFC_RECON |
| CANDIDATE_ALT_THRESHOLD | Threshold for allowing jets to become candidates in the minimum angle jet selection with ALT selected | S | V97U6303C | none | JET_SELECT |
| CANDIDATE_VERN_THRESHOLD | Threshold for allowing jets to become candidates in the minimum angle jet selection with VERN selected | S | V97U6307C | none | JET_SELECT |
| CG_NOM | Vector of nominal vehicle cg's in the OV frame | V(3)S | V97U2508C to V97U2510C | inches | DAPLOAD_SELECT |
| DELTA_V_MINIMP_SCALE_FACTOR | Scale factor for phase plane minimum impulse angular rate change values | S | V97U2664C | S | DAPLOAD_SELECT |
| JET_MAG_THRESHOLD | Threshold for jet magnitude to allow a combination of jets to fire | A(3)S | V97U6304C V97U6305C V97U6306C | none | JET_SELECT |
| JET_MIN_IMPULSE | Scaling factor to account for reduced impulse of initial firing of a PRCS jet | S | V97U6302C | none | JET_SELECT |
| KH | Maneuver/track hysteresis parameter | S | V97U9041C | none | AUTO_MNVR_TRACK |
| KTRK | Maneuver/track scale factor | S | V96U8095C | none | AUTO_MNVR_TRACK |
| KLEDGE | Phase plane deadband ledge for PRCS | S | V99U7609C | deg | PHASE_PLANE |
| MAG_CONTROL_ACCEL_REF_PRIM | Magnitude of average control acceleration--available for each axis with the STD PRCS mode | A(3)S | V98U9941C V98U9942C V98U9943C | deg/s ² | DAPLOAD_SELECT |
| MAG_CONTROL_FORCE | Magnitude of available RCS jet forces, by axis | A(3)S | V97U2957C V97U2958C V97U2959C | lbf | TRANS_PULSE |
| MAX_REPEAT | Number of passes for which the choice of vernier jets remains the same (disregarding any change in the fractional or off-axis preference part of ROT_JET_CMD) if the truncated value of ROT_JET_CMD remains the same | I | V97U2783C | none | JET_SELECT |

Table 4.1-8. On-Orbit DAP Design-Dependent I-Loads

| Name | Description | Type | MSID | Unit | Module(s) Used By |
|--------------------------------|--|-------|-------------------------------------|----------------------|----------------------------|
| MIN_ANGLE_JET_SEL_VALUE | Integer indicating condition to select the minimum angle jet selection algorithm (0 = minimum angle not selected, 1 = minimum angle always selected, 2 = minimum angle selected if ALT_ACTIVE or PAYLOAD_EXTENDED ≠ 0) | I | V97U6301C | none | OFC_RECON |
| MOMENTS_OF_INERTIA_NOM | Array of nominal vehicle moments of inertia in the OV frame | A(3)S | V97U2538C to V97U2540C | slug-ft ² | DAPLOAD_SELECT |
| PHASE_PLANE_ACCEL_SCALE_FACTOR | Scale factor for phase plane control acceleration values | S | V97U2795C | none | DAPLOAD_SELECT |
| PRINCIPAL_INERTIA_REF | Diagonals of nominal vehicle inertia matrix (body-axis moments of inertia) | A(3)S | V98U9938C V98U9939C V98U9940C | slug-ft ² | DAPLOAD_SELECT |
| PRODUCTS_OF_INERTIA_NOM | Array of nominal vehicle products of inertia in the OV frame | A(3)S | V97U2568C to V97U2570C | slug-ft ² | DAPLOAD_SELECT |
| RATE_GAIN1_PRIMARY | State estimator filter 1 gain for rate term during RCS operations with primary jets | S | V97U2952C | none | OFC_RECON, PART1_FILTER |
| RATE_GAIN1_TVC | State estimator filter 1 gain for rate term during TVC operations | S | V96U9813C | none | OFC_RECON |
| RATE_GAIN1_VERNIER | State estimator filter 1 gain for rate term during RCS operations with vernier jets | S | V97U2822C | none | OFC_RECON |
| RATE_GAIN2_PRIMARY | State estimator filter 2 gain for rate term during RCS operations with primary jets | S | V97U2823C | none | OFC_RECON |
| RATE_GAIN2_TVC | State estimator filter 2 gain for rate term during TVC operations | S | V96U9814C | none | OFC_RECON |
| RATE_GAIN2_VERNIER | State estimator filter 2 gain for rate term during RCS operations with vernier jets | S | V97U2825C | none | OFC_RECON |
| S5_SCALE | Multiplies RL to define lower drift channel line (S5) | S | V97U9086C | none | PHASE_PLANE |
| T1P | Threshold for use of second primary jet in ALT mode | S | V98U9169C | none | DAPLOAD_SELECT |
| T1V | Threshold for use of second vernier jet | S | V97U2879C | none | DAPLOAD_SELECT |
| T2P | Threshold for use of third primary jet in ALT mode | S | V98U9170C | none | DAPLOAD_SELECT |
| T2V | Threshold for use of third vernier jet | S | V97U2880C | none | DAPLOAD_SELECT |
| WFRATE | Scale factor for off-axis vernier preference | S | V97U2883C | none | PHASE_PLANE |

Table 4.1-9. On-Orbit DAP Carryover Values

| Name | Description | Type | Range | Unit | Principal Function Carried Over From | Module(s) Used By |
|--------------------------|--|----------------|-------------------|----------------------|--------------------------------------|-------------------------------------|
| ALT_ACTIVE | Alternate PRCS DAP mode indicator (1=active) | B | 0, 1 | none | ORBIT DAP (4.35) | OFC_RECON UNPACK_SW SET_LAMPS |
| ALT_ACTIVE_PBI | Flag indicating the last state of the ALT PBI on the Orbit DAP panel | B | 0, 1 | none | ORBIT DAP (4.35) | OFC_RECON UNPACK_SW SET_LAMPS |
| ANG_INCREMENTS | Angular rate change over 80 ms for each of the 14 primary jet groups and the six vernier jets. | A(20) V(3)S | | deg/s | ORBIT DAP (4.35) | JET_SELECT |
| AUTO_MANUAL | Auto/manual select (1=auto, 0=manual) | B | 0, 1 | none | UNPACK SW | UNPACK_SW |
| AVAILABLE_JET_AFT | List of available aft RCS jets (1=available) | A(28)B | 0,1 | none | RCS RM (4.91) | JET_SELECT |
| AVAILABLE_JET_FWD | List of available forward RCS jets (1=available) | A(16)B | 0,1 | none | RCS RM (4.91) | JET_SELECT |
| CG_ARRAY | Array of vehicle cg's in the OV frame | A(9) V(3)S | | inches | ORBIT DAP (4.35) | DAPLOAD_SELECT |
| CROSSFEED_OPEN_LEFT | Left crossfeed between aft RCS tanks is open (1=open) | B | 0, 1 | none | GNC SW PROC (4.180) | JET_SELECT |
| CROSSFEED_OPEN_RIGHT | Right crossfeed between aft RCS tanks is open (1=open) | B | 0, 1 | none | GNC SW PROC (4.180) | JET_SELECT |
| DAPLOAD | DAPLOAD A/B select 1 = DAPLOAD A; 2=DAPLOAD B | I | 1, 2 | none | ORBIT DAP (4.35) | UNPACK_SW |
| DAPLOAD_CHANGE | Flag signifying change in one or both dapload selection parameters (bit 1 ON = DAPLOAD has changed; bit 2 ON = PRIMARY_VERNIER_SW has changed) | B(2) | 0, 1 for each bit | none | ORBIT DAP (4.35) | UNPACK_SW |
| HL_LO_Z_TRANS_SW | Z-axis translational acceleration level select (1=high, 0=low) | B | 0, 1 | none | ORBIT DAP (4.35) | UNPACK_SW |
| FREE_DRIFT_MODE | Free Drift mode indicator (1=free drift) | B | 0, 1 | none | ORBIT DAP (4.35) | OFC_RECON UNPACK_SW SET_LAMPS |
| JET_MAP | Mapping of jet use preference within group | A(38)I | 1-28 | none | RCS RM (4.91) | JET_SELECT |
| LVLH_MODE | LVLH Mode Indicator (1=LVLH) | B | 0, 1 | none | ORBIT DAP (4.35) | OFC_RECON UNPACK_SW SET_LAMPS |
| MOMENTS_OF_INERTIA_ARRAY | Array of vehicle moments of inertia in the OV frame | A(9,3)S | | slug-ft ² | ORBIT DAP (4.35) | DAPLOAD_SELECT |
| NO_PLUS_Z_JETS | Flag to inhibit use of + Z jets (1=inhibit) | B | 0, 1 | none | ORBIT DAP (4.35) | UNPACK_SW DAPLOAD_SELECT |
| XJETS_ACTIVE | XJETS active indicator (1= active) | B | 0,1 | none | ORBIT DAP (4.35) | JET_SELECT DAPLOAD_SELECT |
| NOTCH_LOWER_UPPER_FREQS | Lower, upper frequency pairs for up to six filter notches for each of nine payload-extended configurations | A(9,6,2)S | 0 - 3.0 | Hz | ORBIT DAP (4.35) | PART1_FILTER |

Table 4.1-9. On-Orbit DAP Carryover Values

| Name | Description | Type | Range | Unit | Principal Function Carried Over From | Module(s) Used By |
|---------------------------|---|----------------|-------------|----------------------|--|---------------------|
| NUM_FILTERS | Absolute value is number of notch filters active for each of nine payload-extended configurations | A(9)I | -6 to 6 | none | ORBIT DAP (4.35) | DAPLOAD_SELECT |
| KP2 | Pitch filter gain for OMS TVC (two engines) | S | ≥ 0 | deg/(deg/sec) | ORBIT DAP (4.35), ORBIT DAP CONFIG (5.8) | TVC_LAW_PITCH_YAW |
| KR | Roll filter gain for OMS TVC (two engines) | S | ≥ 0 | deg/(deg/sec) | ORBIT DAP (4.35), ORBIT DAP CONFIG (5.8) | TVC_LAW_ROLL |
| KY2 | Yaw filter gain for OMS TVC (two engines) | S | ≥ 0 | deg/(deg/sec) | ORBIT DAP (4.35), ORBIT DAP CONFIG (5.8) | TVC_LAW_PITCH_YAW |
| OMS_PITCH_TRIM | OMS engine pitch trim angle with respect to center of gimbal travel | S | -6 to 6 | deg | TRANS DAP (4.201) | TVC_LAW_PITCH_YAW |
| OMS_YAW_TRIM | Left and right OMS engine yaw trim angles with respect to center of gimbal travel | A(2)S | -8 to 8 | deg | TRANS DAP (4.201) | TVC_LAW_PITCH_YAW |
| PRIMARY_VERNIER_SW | RCS primary/vernier jet select (1=primary; 0=vernier) | B | 0, 1 | none | ORBIT DAP (4.35) | UNPACK_SW |
| PRIMARY_VERNIER_PBI | Flag indicating the last state of the NORM and VERN PBI's on the Orbit DAP Panel | B | 0, 1 | none | ORBIT DAP (4.35) | UNPACK_SW OFC_RECON |
| PRODUCTS_OF_INERTIA_ARRAY | Array of vehicle products of inertia in the OV frame | A(9,3)S | | slug-ft ² | ORBIT DAP (4.35) | DAPLOAD_SELECT |
| THC_HOT_STICK | Flag indicating THC Hot Stick in progress (1=Hot Stick Upmode in Progress) | B | 0, 1 | none | ORBIT DAP(4.35) | OFC_RECON |
| ROT_OPTION | Manual rotation submode select (2 = pulse; 3 = discrete) | A(3)I | 2 to 3 | none | ORBIT DAP (4.35) | UNPACK_SW |
| RBST_INTERVAL_DISP | Reference interval between reboost firings | S | 0.08-999.99 | sec | 4.35 | JET_SELECT |
| RBST_CONF | Selected reboost configuration | I | 1-4 | none | 4.35 | JET_SELECT |
| RBST_OVRD | Reboost group overrides | A(20)B | 0, 1 | none | 4.35 | JET_SELECT |
| TRANS_OPTION | Manual translation submode select (1 = accel; 2 = pulse) | A(3)I | 1, 2 | none | ORBIT DAP (4.35) | UNPACK_SW |
| Q_B_M50_CMD_MNVR | Commanded vehicle attitude (quaternion) | Struc:S; V(3)S | -1 to 1 | none | ORBIT DAP (4.35) | AUTO_MNVR_TRACK |
| LVLH_ATTITUDE_REFERENCE | Reference att of free axis with respect to the local vertical frame | V(3)S | -1 to 1 | none | ORBIT DAP (4.35) | OFC_RECON |
| Q_B_LV_REFERENCE | Reference vehicle att (quaternion) with respect to the local vertical frame | Struc:S; V(3)S | -1 to 1 | none | ORBIT DAP (4.35) | OFC_RECON |
| TIME_OUT | Bad IMU data pass counter | I | | cycles | ORBIT DAP (4.35) | OFC_RECON |
| ATTITUDE_INCREMENT | Body attitude increment | V | | deg | A/E ATT PROC (4.226) | OFC_RECON |
| T_NOW | Time tag of Q_B_M50 | S | | S | ORB ATT PROC (4.97) | OFC_RECON |
| ATTITUDE_INCREMENT_6HZ | Attitude increment | V | | deg | ORB ATT PROC (4.97) | OFC_RECON |
| Q_B_M50 | Body wrt M50 quaternion S, V | Struc:S; V(3)S | ±1 | none | ORB ATT PROC (4.97) | OFC_RECON |

Table 4.1-9. On-Orbit DAP Carryover Values

| Name | Description | Type | Range | Unit | Principal Function Carried Over From | Module(s) Used By |
|---------------------------|--|-------------------|------------------------------------|--------------------|--------------------------------------|-----------------------|
| Q_M50_LVLH | M50 wrt LVLH quaternion S, V | Struc:S; V(3)S | ±1 | none | ORB ATT PROC (4.97) | OFC_RECON |
| ARRAY_COMP_THRESHOLD | Array of magnitudes of rotation compensation thresholds (0 = disable compensation) | A(2,2)S | ≥ 0 | deg/s | 4.35 | DAPLOAD_SELECT |
| ARRAY_DB | Array of magnitudes of phase plane attitude deadband requests | A(2,2)S | > 0 | deg | 4.35 | DAPLOAD_SELECT |
| ARRAY_MNVR_RATE | Array of magnitudes of discrete maneuver rates (about body axes for manual disc rate submode; about eigenaxis for auto mode) | A(2,2)S | > 0 | deg/s | 4.35 | DAPLOAD_SELECT |
| ARRAY_NOM_NOSE_TAIL_PITCH | Array of pitch acceleration options (1 = nominal, 2 = low nose, 3 = low tail) | A(2)I | 1,2,3 | none | 4.35 | DAPLOAD_SELECT |
| ARRAY_NOM_NOSE_TAIL_YAW | Array of yaw acceleration options (1 = nominal, 2 = low nose, 3 = low tail) | A(2)I | 1,2,3 | none | 4.35 | DAPLOAD_SELECT |
| ARRAY_PAYLOAD_EXTENDED | Array of payload extended flags (0 = payload not extended, 1 through 9 = selected payloads) | A(2)I | 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 | none | 4.35 | DAPLOAD_SELECT |
| ARRAY_RATE_LIMIT | Array of magnitudes of phase plane rate error limit requests | A(2,2)S | > 0 | deg/s | 4.35 | DAPLOAD_SELECT |
| ARRAY_ROT_PULSE | Array of magnitudes of rotation pulses | A(2,2)S | > 0 | deg/s | 4.35 | DAPLOAD_SELECT |
| ARRAY_TRANS_PULSE | Array of magnitudes of translation pulses | A(2)S | > 0 | ft/s | 4.35 | DAPLOAD_SELECT |
| ARRAY_ALT_RATE_LIMIT | Array of requested rate limit in ALT mode | A(2)S | 0.05 – 5 | deg/s | 4.35 | DAPLOAD_SELECT |
| ARRAY_ALT_JET_OPTION | Array of ALT mode jet options (1 = FWD & AFT, 3 = AFT only) | A(2)I | 1, 3 | none | 4.35 | DAPLOAD_SELECT |
| ARRAY_ALT_MAX_JETS | Array of max number of jets to be commanded ON in ALT mode | A(2)I | 1 – 3 | none | 4.35 | DAPLOAD_SELECT |
| ARRAY_ALT_ON_TIME | Array of requested max firing duration in ALT mode | A(2)S | 0.08 – 9.99 | S | 4.35 | DAPLOAD_SELECT |
| ARRAY_ALT_DELAY_TIME | Array of requested min time between firings in ALT mode | A(2)S | 0 – 99.9 | S | 4.35 | DAPLOAD_SELECT |
| Name | Description | Type | Range | Unit | Principal Function Carried Over To | Module(s) Supplied By |
| PHASE_PLANE_ACCEL | Magnitude of average control acceleration available for each axis, scaled for phase plane use | A(3)S | | deg/s ² | TRANS DAP (4.201) | Orbit DAP (4.35) |

| Table 4.1-10. Control Panel Switch Signal for Docking Capture, TIMEOUT, RHC Abort or THC Abort (PCT_DAP) MSID's | | | |
|---|-----------|-----------------|-----------|
| Panel Switch | MSID | Panel Switch | MSID |
| DAP A | V99U5738C | Disc rate roll | V99U5752C |
| DAP B | V99U5739C | Disc rate pitch | V99U5753C |
| Auto Mode | V99U5740C | Disc rate yaw | V99U5754C |
| Manual INRTL mode | V99U5741C | Pulse roll | V99U5755C |
| Primary RCS | V99U5742C | Pulse pitch | V99U5756C |
| Vernier RCS | V99U5743C | Pulse yaw | V99U5757C |
| ALT RCS | V99U5744C | Manual LVLH | V99U5758C |
| Norm X | V99U5745C | Manual FREE | V99U5759C |
| Norm Y | V99U5746C | Low Z | V99U5760C |
| High Z | V99U5747C | Spare | V99U5761C |
| Norm Z | V99U5748C | | |
| Pulse X | V99U5749C | | |
| Pulse Y | V99U5750C | | |
| Pulse Z | V99U5751C | | |

4.2 DETAILED FUNCTIONAL REQUIREMENTS

4.2.1 Reconfiguration Module (OFC_RECON)

4.2.1.1 Function

The primary function of OFC_RECON is to call the various modules comprising the OFC in their proper sequence. This sequence is determined by checking those parameters that define the current operating mode. It is also the function of OFC_RECON to specify configuration-dependent parameters such as rates and gains, set initialization flags when required, set up the signals to light panel lamps, keep a clock to time the processing of “slow” modules, and perform certain “housekeeping” operations.

The inputs to OFC_RECON are used to determine how the modules of the OFC should be strung together in order to perform the desired processing. Table 4.2.1.1-1 describes the positions of the switches of Figure 4.2.2-1 in terms of these inputs.

The “switches” in this diagram control data flow among the function modules, and their positions define which modules are needed, and, to an extent, their sequencing requirements. If, with a given switch configuration, module A’s outputs are not received anywhere, then module A is not needed. Generally, if B drives A and both are needed, B should precede A; however, exceptions to this can be found as “one-cycle delays” in Figure 4.2.2-1. These one-cycle delays occur when a “downstream” module must pass information back to an “upstream” module. The “upstream” module will not be able to process the new information until the following pass. Logical combinations of controlling inputs required for each switch position are given in the referenced table.

Certain sequences of execution may also be involved in the critical transport delay paths as defined by Level A Software Requirements (SS-P-002-170F, paragraph 6.4). Consequently, when changing certain on-orbit flight control modes, a variable delay in the establishment of that mode (first pass execution) may be experienced. This situation arises when the requested mode necessitates the activation of modules that must interface in a particular sequence with already active modules because of transport delay restrictions (Note: these may be modules external to on-orbit flight control). This delay presents no problem so long as the integrity of any functional outputs are maintained. A particular situation of note is entrance into TVC auto mode. The OMS_STEERING processor must interface with already active 1.04 Hz processors and satisfy a Level A transport delay requirement. Consequently, as much as 960 msec may pass before OMS_STEERING is evoked for the first time since an execution is not forced in order to maintain correct phasing with the other modules. This situation presents no problem so long as the resultant computation of the commanded body rate is not compromised. Under current requirements, any possible compromise is avoided by the protection of a K-load (MIN_DVB) and an initialization requirement for GUIDANCE_COMPENSATION.

| Table 4.2.1.1-1. Relationship Between OFC_RECON Outputs and Moding Inputs | | | |
|---|----------|--|---|
| OFC_RECON Output (See Figure 4.2.2-1) | | | Moding Input Combination (See Table 4.2.1.5-1) |
| Switch | Position | Axis | |
| S1 (Notes 1, 2, 3) | A | | RCS • PRIMARY_VERNIER_SW • TRANS_OPTION _{axis} = 1 • ALT_ACTIVE |
| | B | | RCS • PRIMARY_VERNIER_SW • TRANS_OPTION _{axis} = 2 • ALT_ACTIVE |
| | C | | TVC + PRIMARY_VERNIER_SW + ALT_ACTIVE |
| S2 (Notes 1, 2, 4) | A | | RCS • AUTO_MANUAL |
| | B | Roll | AUTO_MANUAL • (RCS • ROT_SUBMODE _{roll} = 3 + TVC • ONE_ENG) • ROT_SUBMODE _{roll} ≠ 4 |
| | | Pitch and Yaw | AUTO_MANUAL • RCS • ROT_SUBMODE _{P or Y} = 3 |
| | C | Roll | TVC • (AUTO_MANUAL + AUTO_MANUAL • TWO_ENG) • ROT_SUBMODE _{roll} ≠ 4 |
| | | Pitch and Yaw | TVC • (AUTO_MANUAL + AUTO_MANUAL • ROT_SUBMODE _{P or Y} ≠ 4) |
| D | | RCS • AUTO_MANUAL • ROT_SUBMODE _{axis} = 2 + ROT_SUBMODE _{axis} = 4 | |
| S3 (Notes 1, 2) | A | | LVLH_MODE |
| | B | | RCS • AUTO_MANUAL |
| | C | | A • B |
| S4 (Notes 1, 2) | A | | TVC • AUTO_MANUAL |
| | B | | TVC • AUTO_MANUAL |
| S5 (Notes 1, 2, 4) | A | | RCS • (AUTO_MANUAL + ROT_SUBMODE _{axis} = 3) + TVC • ROT_SUBMODE _{axis} ≠ 4 |
| | B | | ROT_SUBMODE _{axis} = 4 |
| | C | | RCS • AUTO_MANUAL • ROT_SUBMODE _{axis} = 2 |
| S6 (Note 1) | A | | IMU_FAIL |
| | B | | IMU_FAIL |
| S7 (Notes 1, 2) | A | | TVC • TWO_ENG |
| | B | | TVC • ONE_ENG + RCS • TRIM_OMS_GIMBALS |
| S8 (Notes 1, 2) | A | | (TVC + RCS • TRIM_OMS_GIMBALS) • IMU_FAIL |
| | B | | RCS • TRIM_OMS_GIMBALS + IMU_FAIL |
| S9 (Notes 1, 2, 5) | A | | AUTO_MANUAL = OFF → ON • PREBURN_LATCH • UP_LOCKOUT + MNVR_TRACK_OPTION = ON → OFF + GUIDED_DELTA_V_BURN = ON → OFF • UP_LOCKOUT • IMU_FAIL + MNVR_TRACK_ OPTION • [(OFC_RESTART • PREBURN_LATCH) + (AUTO_MANUAL = OFF → ON • UP_LOCKOUT)] |

| Table 4.2.1.1-1. Relationship Between OFC_RECON Outputs and Moding Inputs | | | |
|---|----------|--------------------------|--|
| OFC_RECON Output (See Figure 4.2.2-1) | | Moding Input Combination | |
| Switch | Position | Axis | (See Table 4.2.1.5-1) |
| | B | | $(\overline{\text{PREBURN_MNVR}} + [\overline{\text{GUIDED_DELTA_V_BURN}} \bullet \overline{\text{UP_LOCKOUT}}]) \bullet \overline{\text{IMU_FAIL}}$ |
| | C | | $\overline{\text{MNVR_TRACK_OPTION}} \bullet \overline{\text{UP_LOCKOUT}}$ |
| | D | | $\overline{\text{A}} \bullet \overline{\text{B}} \bullet \overline{\text{C}}$ |
| S10 (Notes 1, 2) | A | | $\overline{\text{RCS}} \bullet \overline{\text{AUTO_MANUAL}}$ |
| | B | | $\overline{\text{A}}$ |

NOTES:

1. Logical symbols used:

- + → OR
- ⊕ → exclusive OR
- → AND
- $\overline{\text{w}}$ → NOT w

2. The following mode abbreviations are used:

ENG1 = OMSL_ON_CMD
 ENG2 = OMSR_ON_CMD
 $\text{TVC} = (\text{ENG1} + \text{ENG2}) \bullet \overline{\text{IMU_FAIL}}$
 $\text{RCS} = \overline{\text{ENG1}} \bullet \overline{\text{ENG2}}$
 $\text{TWO_ENG} = \text{ENG1} \bullet \text{ENG2}$
 $\text{ONE_ENG} = \text{ENG1} \oplus \text{ENG2}$
 $\text{ACCEL}_{\text{axis}} = \text{SOFT STOP}_{\text{axis}} + [(\text{RCS} + \text{TVC} \bullet \text{ONE_ENG} \bullet \text{roll axis only}) \bullet (\text{RHC was beyond the soft stop by axis and has not yet been returned to detent in axis})]$

3. Translation options are defined as follows:

$$\overline{\text{TRANS_OPTION}}_{\text{axis}} = \begin{cases} 1 & \text{Acceleration} \\ 2 & \text{Pulse} \end{cases}$$

4. Manual rotation options are defined as follows:

$$\overline{\text{ROT_OPTION}}_{\text{axis}} = \begin{cases} 2 & \text{Pulse} \\ 3 & \text{Discrete rate/attitude hold} \end{cases}$$

ROT_SUBMODE values are set as follows upon entry into the specified conditions:

| <u>ROT_SUBMODE</u> _{axis} | <u>CONDITIONS</u> |
|------------------------------------|--|
| 2 | $\overline{\text{ROT_OPTION}}_{\text{axis}} = 2 \bullet \overline{\text{AUTO_MANUAL}} \bullet \overline{\text{RCS}} \bullet \overline{\text{ACCEL}}_{\text{axis}}$ |
| 3 axis = roll | $\left\{ \begin{array}{l} \overline{\text{ROT_OPTION}}_{\text{axis}} = 3 \bullet \overline{\text{RCS}} \bullet \overline{\text{AUTO_MANUAL}} \bullet \overline{\text{ACCEL}}_{\text{axis}} \\ + \text{TVC} \bullet \text{ONE_ENG} \bullet \overline{\text{ACCEL}}_{\text{axis}} \bullet \overline{\text{AUTO_MANUAL}} \\ \overline{\text{ROT_OPTION}}_{\text{axis}} = 3 \bullet \overline{\text{RCS}} \bullet \overline{\text{AUTO_MANUAL}} \bullet \overline{\text{ACCEL}}_{\text{axis}} \end{array} \right.$ |
| axis = pitch or yaw | |
| 4 | $\overline{\text{ACCEL}}_{\text{axis}}$ |

Table 4.2.1.1-1. Relationship Between OFC_RECON Outputs and Moding Inputs

5. Latch variables are set/reset as follows:

PREBURN_LATCH = OFF → ON when (PREBURN_MNVR = ON or GUIDED_DELTA_V_BURN = OFF → ON) and IMU_FAIL = OFF

= ON → OFF when AUTO_MANUAL = ON → OFF and GUIDED_DELTA_V_BURN = OFF and IMU_FAIL = OFF

= OFF when MM_202 = OFF and IMU_FAIL = OFF

= previous value when IMU_FAIL = ON

UP_LOCKOUT = OFF → ON when (PREBURN_MNVR = ON or TVC = OFF → ON) and IMU_FAIL = OFF

= OFF when MM_202 = OFF and IMU_FAIL = OFF

= previous value when IMU_FAIL = ON

NOTE: ROT_OPTION_{axis} = 1 (Acceleration) was deleted by CR 89921C
 AUTO_MANUAL is OFF whenever FREE_DRIFT_MODE or LVLH_MODE is ON

4.2.1.2 Definition of Modes

The OFC will normally be in one of two modes: TVC or RCS. The off-nominal mode is IMU fail, since it is not possible to run the normal flight control algorithm without good IMU data. These modes are broken down into a number of submodes, which are defined in Table 4.2.1.2-1. This table serves as an index to Figures 4.2.1.2-1(1) through 4.2.1.2-1(9), which give the module-by-module sequencing requirements for each of the listed modes. The first of these diagrams is a generalized flow chart defining the sequence requirements of the panel switch interfacing modules. Note that DAPLOAD_SELECT may be called twice on some passes to ensure that the primary jets are used during RCS translation and TVC operations.

The remaining diagrams are read vertically from top to bottom. Requirements for sequential execution are indicated with solid line arrows running down from “earlier” modules to “later” modules. For those cases in which two or more modules are at a given level, there is no execution sequencing requirement among these modules.

For example, in diagram I.A.1., GUIDANCE_COMPENSATION must be executed before TVC_LAW_ROLL in a given OFC minor cycle; similarly, STATE ESTIMATOR must be executed before TVC_LAW_ROLL. There is no requirement as to the execution sequence of OMS_STEERING with respect to STATE ESTIMATOR. (Later developments may indicate that transport delays might be alleviated by executing one or the other of these first, but this document does not deal with such considerations at present.)

In general, the sequential execution requirements are determined by the data flow requirements between OFC modules. There are some cases, however, where the outputs of one module may overwrite the outputs of another. The order in which these modules are processed is therefore important; this relationship is indicated by the use of a dashed line in the diagram.

4.2.1.2.1 TVC Attitude Control

The TVC mode is entered when an ON command is present for one or both OMS engines, and if the IMU_FAIL flag is off. (Note [for information only] that OMS burns are not supported in OPS 8.) Six submodes exist depending on the number of OMS engines burning, whether auto or manual has been selected, and on the position of the RHC. The processing requirements differ for each of these submodes as indicated in Figure 4.2.1.2-1, TVC modes.

It is assumed that for a two-engine burn, the ON commands for both engines will be turned ON together and also be turned OFF together.

OFC_RECON will configure for a two-engine burn if an ON command is present for both engines. If one of the ON commands is turned off during a two engine burn for any reason, OFC_RECON will automatically reconfigure the OFC to one engine status. This reconfiguration may not be reversed during the remainder of the burn. It is possible to make a nominal one-engine burn, whether or not the unused engine has failed.

The crew may choose to perform the OMS burn under automatic or manual control by means of the AUTO and INRTL PBI's. Changes from auto to manual or manual to auto are allowed at any time. Manual submodes may also be selected by moving the RHC out of detent. The OFC will then remain in manual until the RHC is returned to detent and the AUTO PBI is depressed. The manual LVLH and manual FREE drift PBI's are ignored in TVC mode.

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The auto submodes are determined on the basis of engine status (two engines or one engine). The RCS processor will run while the OMS processor is running during all auto submodes.

The manual submodes are determined on the basis of engine status and RHC position. The nominal manual mode will be proportional rate command processed by the MANUAL_TVC module of the steering processor. The RCS processor will be driven by MANUAL_TVC except in the following cases:

- A. If the soft stop for a given axis is exceeded, then that axis is downmoded to the ACCEL submode. The other axes are not affected. This submode passes RHC commands straight to JET_SELECT and bypasses the phase plane. Moding returns to proportional rate command when the RHC is no longer deflected beyond the soft stop.
- B. Discrete rate command/attitude hold will be provided during single engine burns for the roll axis only. If soft stop for the roll axis is exceeded, the roll axis is downmoded to the ACCEL submode. Moding returns to discrete rate command/attitude hold upon the return of the RHC to detent. This scheme allows for a free drift about the roll axis while the RHC is between detent and the soft stop.

The OMS engines will be trimmed before the burn begins (i.e., while still in RCS) upon the receipt of the TRIM_OMS_GIMBALS flag.

| Table 4.2.1.2-1. OFC Control Law Function Module Sequencing Requirements | | | | |
|--|-------------------------------|--|---|---|
| MODE, SUBMODE, AND CONDITION | | INPUT STATE ¹ | | |
| I. TVC | A. AUTO | 1. TWO ENGINES COMMANDED | $\overline{\text{ENG1}} \bullet \overline{\text{ENG2}} \bullet \overline{\text{AUTO_MANUAL}} \bullet \overline{\text{IMU_FAIL}}$ | |
| | | 2. ONE ENGINE COMMANDED | $\overline{\text{ONE_ENG}} \bullet \overline{\text{AUTO_MANUAL}} \bullet \overline{\text{IMU_FAIL}}$ | |
| | B. MANUAL | 1. TWO ENGINES COMMANDED | a. RHC IN DETENT OR NOT BEYOND SOFT STOP BY AXIS | $\overline{\text{ENG1}} \bullet \overline{\text{ENG2}} \bullet \overline{\text{AUTO_MANUAL}} \bullet \overline{\text{SOFT_STOP}}_{\text{AXIS}} \bullet \overline{\text{IMU_FAIL}}$ |
| | | | b. RHC BEYOND SOFT STOP BY AXIS | $\overline{\text{ENG1}} \bullet \overline{\text{ENG2}} \bullet \overline{\text{AUTO_MANUAL}} \bullet \overline{\text{SOFT_STOP}}_{\text{AXIS}} \bullet \overline{\text{IMU_FAIL}}$ |
| | 2. ONE ENGINE COMMANDED | a. RHC NOT DOWNMODED TO ACCEL BY AXIS. | $\overline{\text{ONE_ENG}} \bullet \overline{\text{AUTO_MANUAL}} \bullet \overline{\text{ACCEL}}_{\text{AXIS}} \bullet \overline{\text{IMU_FAIL}}$ | |
| | | b. RHC DOWNMODED TO ACCEL BY AXIS | $\overline{\text{ONE_ENG}} \bullet \overline{\text{AUTO_MANUAL}} \bullet \overline{\text{ACCEL}}_{\text{AXIS}} \bullet \overline{\text{IMU_FAIL}}$ | |
| II. RCS ² | A. AUTO ROTATION | | $\overline{\text{ENG1}} \bullet \overline{\text{ENG2}} \bullet \overline{\text{AUTO_MANUAL}} \bullet \overline{\text{IMU_FAIL}}$ | |
| | B. MANUAL INERTIAL ROTATION | 1. DISCRETE RATE | $\overline{\text{ENG1}} \bullet \overline{\text{ENG2}} \bullet \overline{\text{AUTO_MANUAL}} \bullet \overline{\text{LVLH_MODE}} \bullet \overline{\text{FREE_DRIFT_MODE}} \bullet \overline{\text{IMU_FAIL}} \bullet (\text{ROT_SUBMODE}_{\text{AXIS}} = 3)$ | |
| | | 2. PULSE | $\overline{\text{ENG1}} \bullet \overline{\text{ENG2}} \bullet \overline{\text{AUTO_MANUAL}} \bullet \overline{\text{LVLH_MODE}} \bullet \overline{\text{FREE_DRIFT_MODE}} \bullet \overline{\text{IMU_FAIL}} \bullet (\text{ROT_SUBMODE}_{\text{AXIS}} = 2)$ | |
| | | 3. ACCELERATION ³ | $\overline{\text{ENG1}} \bullet \overline{\text{ENG2}} \bullet \overline{\text{AUTO_MANUAL}} \bullet \overline{\text{LVLH_MODE}} \bullet \overline{\text{FREE_DRIFT_MODE}} \bullet \overline{\text{IMU_FAIL}} \bullet (\text{ROT_SUBMODE}_{\text{AXIS}} = 4)$ | |
| | C. MANUAL FREE DRIFT ROTATION | 1. PULSE | $\overline{\text{ENG1}} \bullet \overline{\text{ENG2}} \bullet \overline{\text{AUTO_MANUAL}} \bullet \overline{\text{FREE_DRIFT_MODE}} \bullet \overline{\text{IMU_FAIL}} \bullet (\text{ROT_SUBMODE}_{\text{AXIS}} = 2)$ | |
| | | 2. ACCELERATION ³ | $\overline{\text{ENG1}} \bullet \overline{\text{ENG2}} \bullet \overline{\text{AUTO_MANUAL}} \bullet \overline{\text{FREE_DRIFT_MODE}} \bullet \overline{\text{IMU_FAIL}} \bullet (\text{ROT_SUBMODE}_{\text{AXIS}} = 4)$ | |
| | D. MANUAL LVLH ROTATION | 1. DISCRETE RATE | $\overline{\text{ENG1}} \bullet \overline{\text{ENG2}} \bullet \overline{\text{AUTO_MANUAL}} \bullet \overline{\text{LVLH_MODE}} \bullet \overline{\text{IMU_FAIL}} \bullet (\text{ROT_SUBMODE}_{\text{AXIS}} = 3)$ | |
| | | 2. PULSE | $\overline{\text{ENG1}} \bullet \overline{\text{ENG2}} \bullet \overline{\text{AUTO_MANUAL}} \bullet \overline{\text{LVLH_MODE}} \bullet \overline{\text{IMU_FAIL}} \bullet (\text{ROT_SUBMODE}_{\text{AXIS}} = 2)$ | |
| | | 3. ACCELERATION ³ | $\overline{\text{ENG1}} \bullet \overline{\text{ENG2}} \bullet \overline{\text{AUTO_MANUAL}} \bullet \overline{\text{LVLH_MODE}} \bullet \overline{\text{IMU_FAIL}} \bullet (\text{ROT_SUBMODE}_{\text{AXIS}} = 4)$ | |
| | III. IMU FAIL | | | $\overline{\text{IMU_FAIL}}$ |
| NOTES: 1. SYMBOLS AND SOME OF THE TERMS USED IN THIS COLUMN ARE DEFINED IN THE NOTES TO TABLE 4.2.1.1-1 2. MANUAL RCS TRANSLATION SUBMODES (PULSE AND ACCELERATION) ARE COMPATIBLE WITH ANY OF THE LISTED RCS MODES AND ARE CHOSEN BY AXIS 3. CHOSEN BY RHC DOWNMODING AVAILABLE WHEN DISCRETE RATE OR PULSE CHOSEN VIA PBI AND RHC MOVED BEYOND SOFT STOP ($\text{ROT_SUBMODE} = 4$) | | | | |

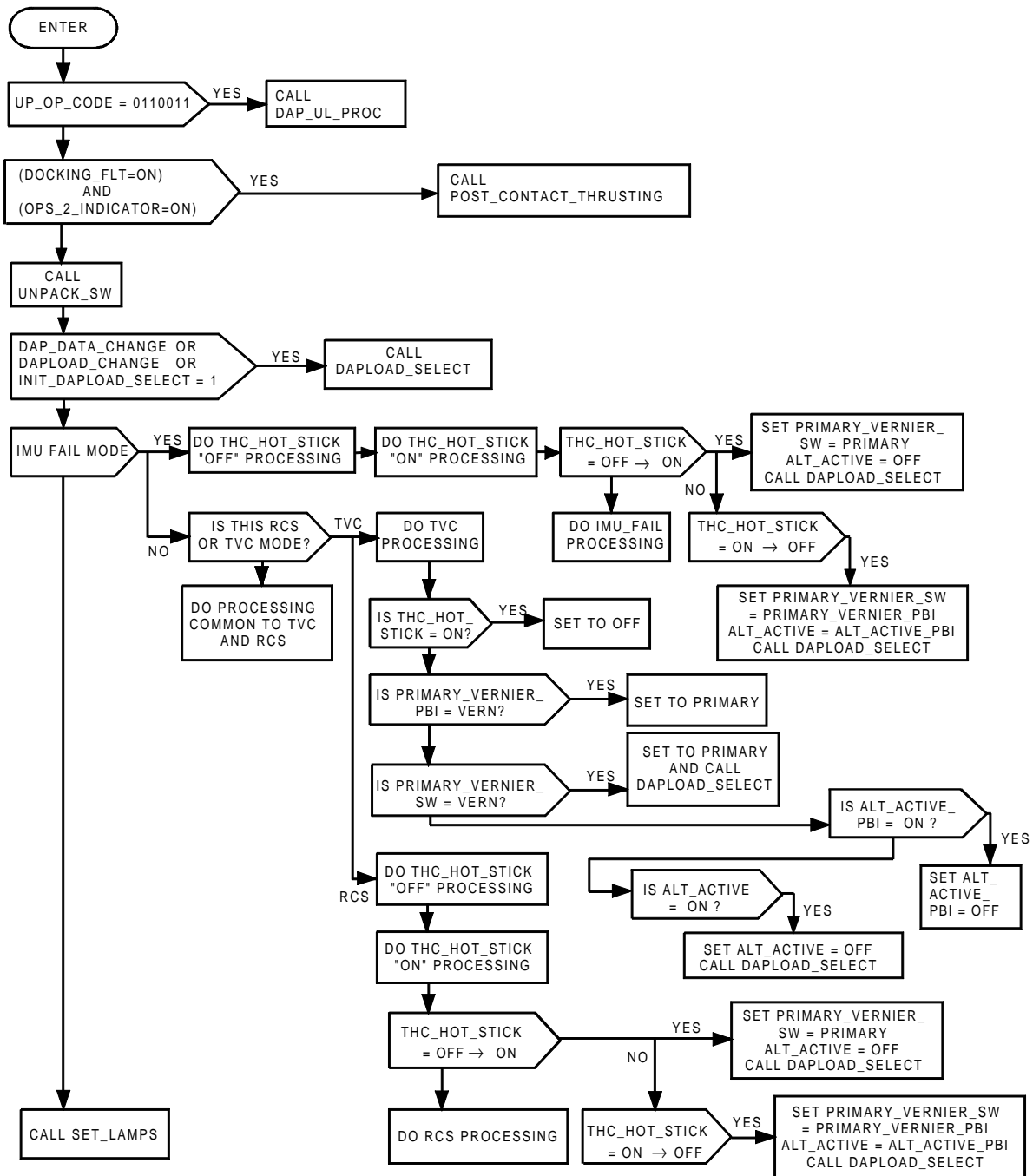


FIGURE 4.2.1.2-1.(1) OFC Control Law Function Module Sequencing Requirements (Sheet 1 of 9)

I.A.1 TVC AUTO: 2-ENGINES COMMANDED

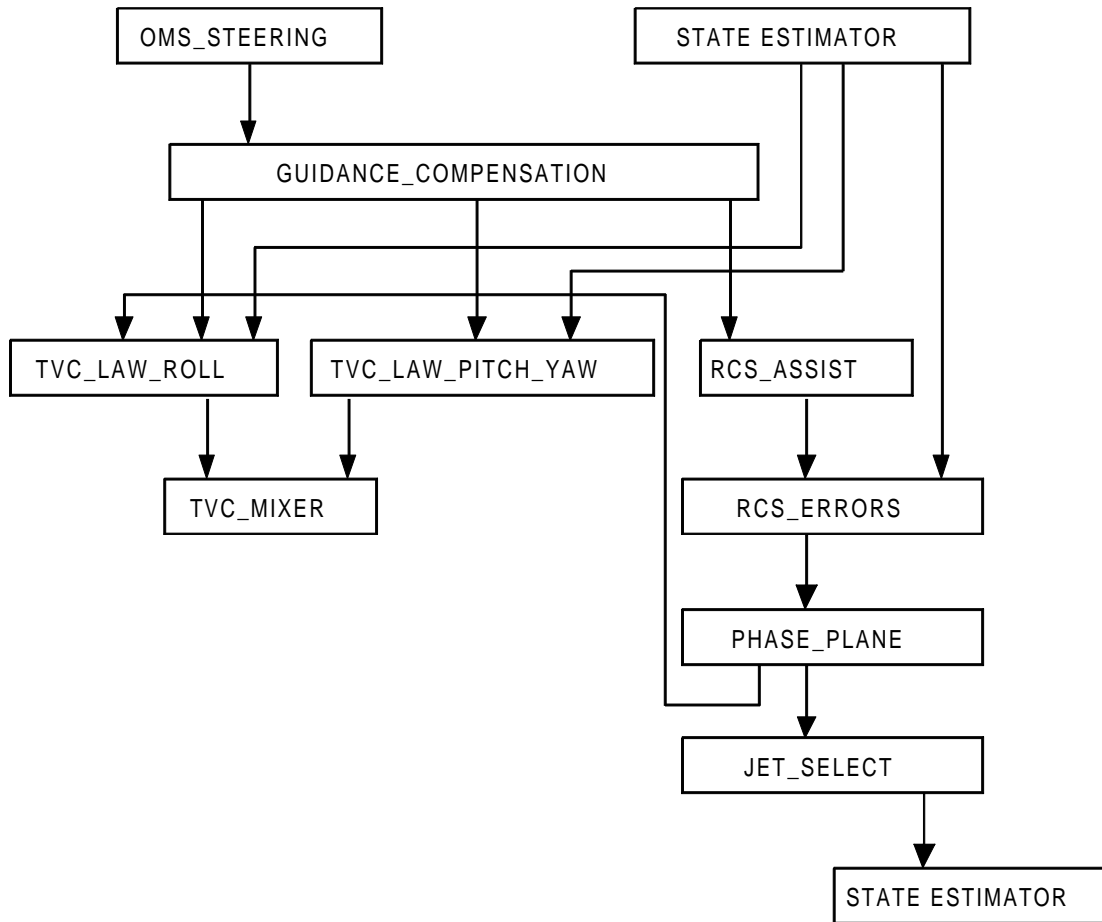


FIGURE 4.2.1.2-1.(2) OFC Control Law Function Module Sequencing Requirements (Sheet 2 of 9)

I.A.2 TVC AUTO: 1-ENGINE

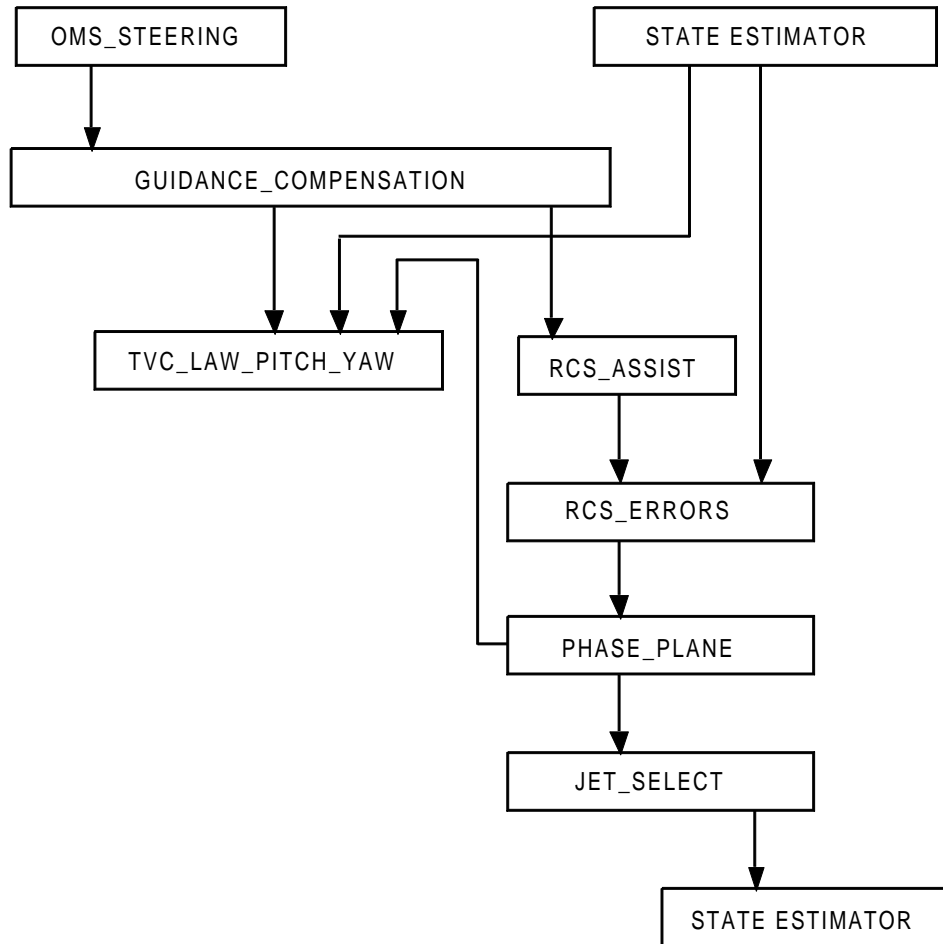
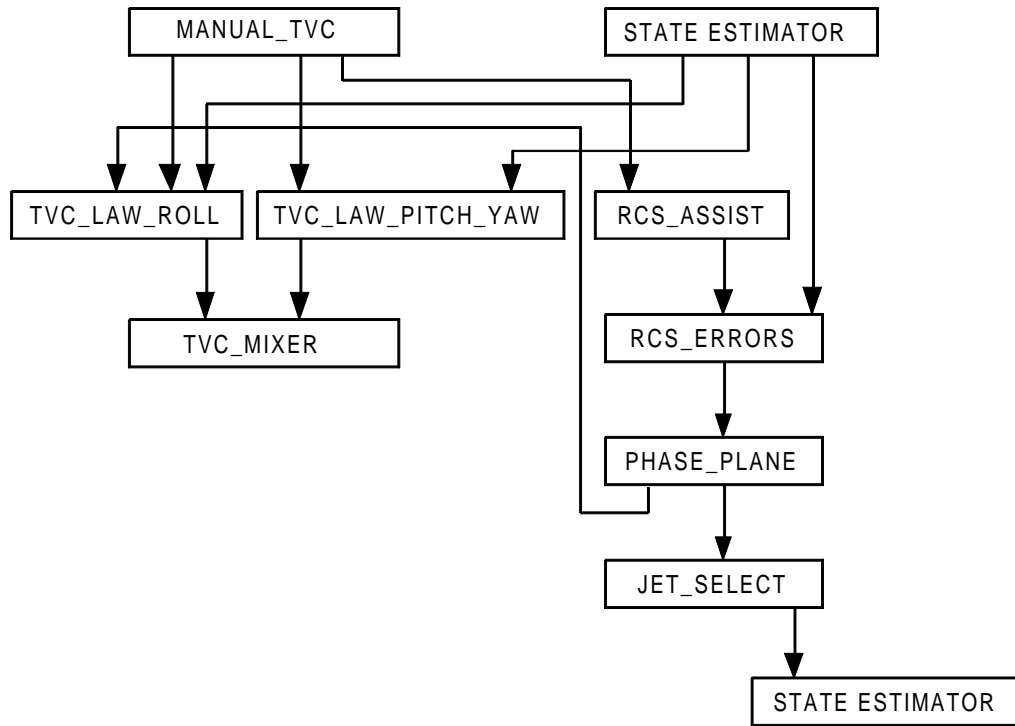
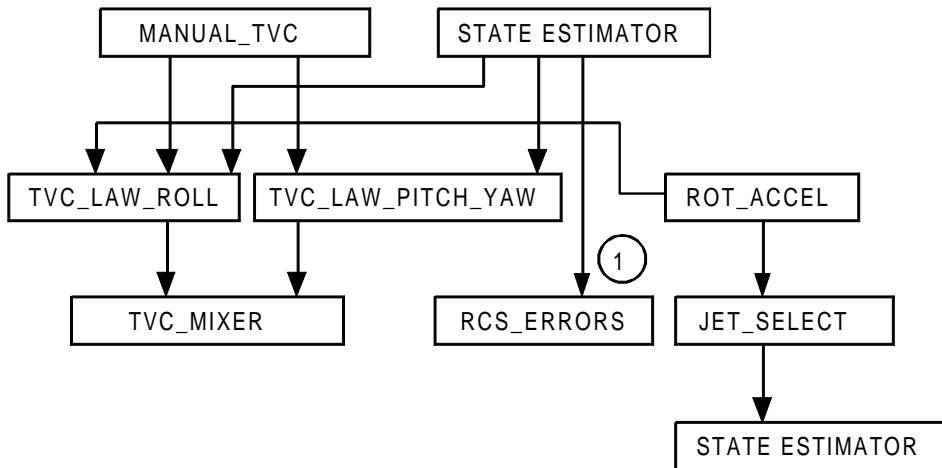


FIGURE 4.2.1.2-1.(3) OFC Control Law Function Module Sequencing Requirements (Sheet 3 of 9)

I.B.1.a TVC MANUAL: 2 ENGINES COMMANDED
AXES WITH RHC NOT BEYOND SOFT STOP



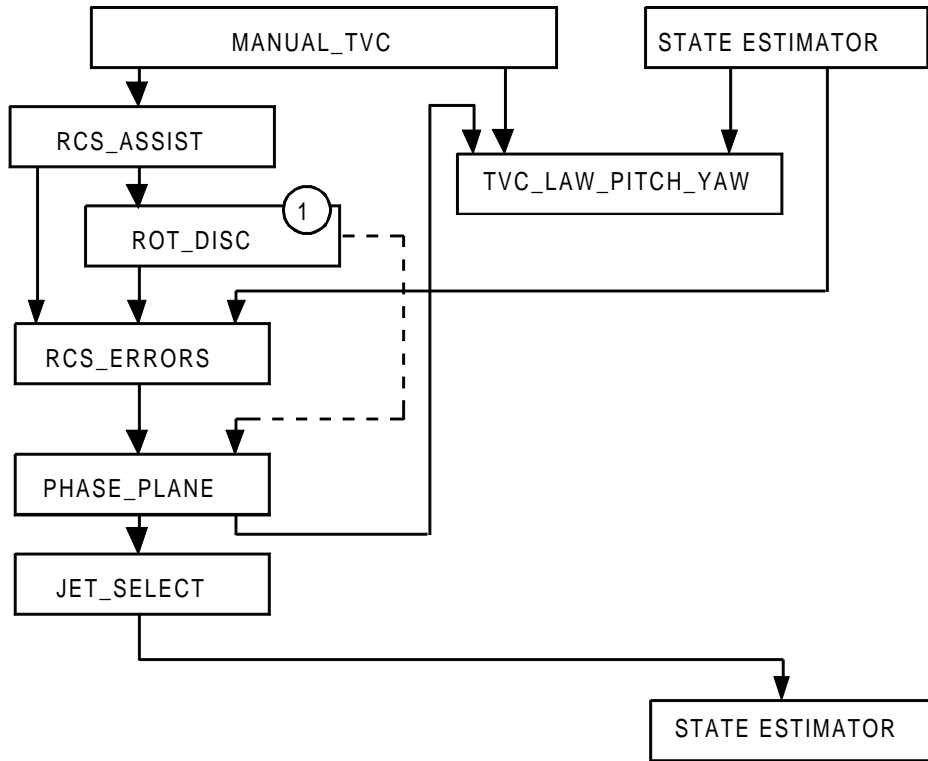
I.B.1.b AXES WITH RHC BEYOND SOFT STOP



① REQUIRED TO DRIVE DISPLAYS

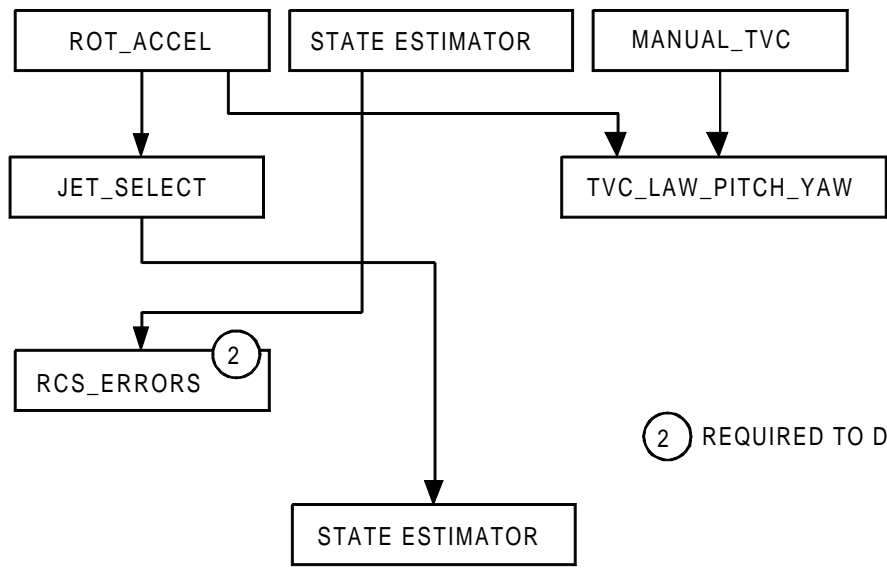
FIGURE 4.2.1.2-1.(4) OFC Control Law Function Module Sequencing Requirements (Sheet 4 of 9)

I.B.2.a TVC MANUAL: 1-ENGINE AXES WITH RHC NOT DOWNMODED TO ACCEL



(1) ROLL PROCESSING ONLY

I.B.2.b(1) RHC DOWNMODED TO ACCEL IN ROLL



(2) REQUIRED TO DRIVE DISPLAYS

FIGURE 4.2.1.2-1.(5) OFC Control Law Function Module Sequencing Requirements (Sheet 5 of 9)

I.B.2.b(2) RHC DOWNMODED TO ACCEL IN PITCH AND/OR YAW

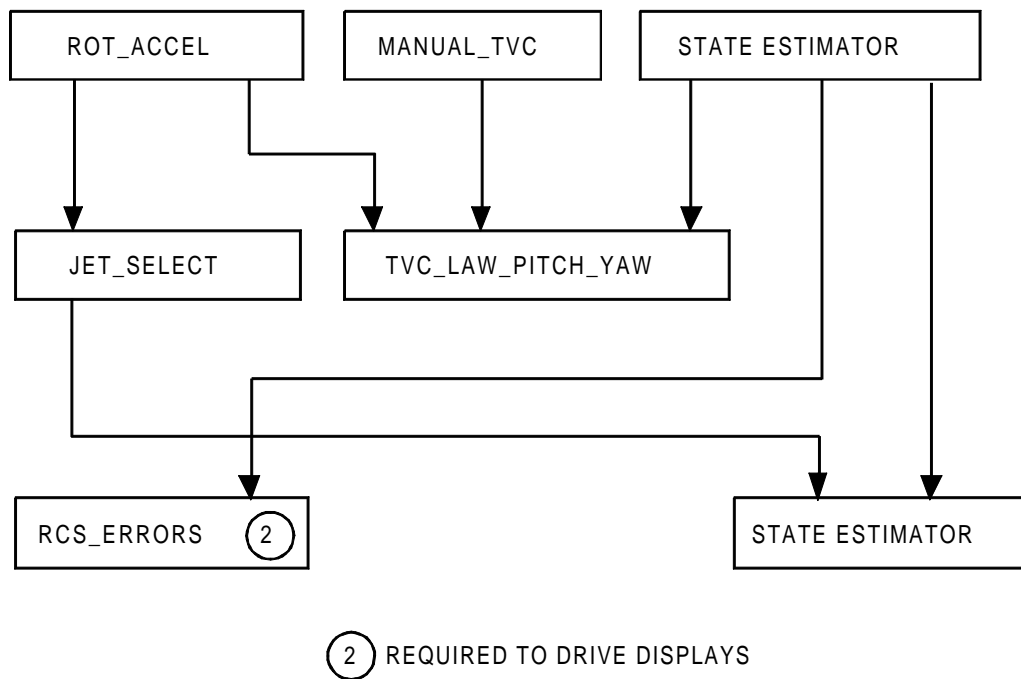
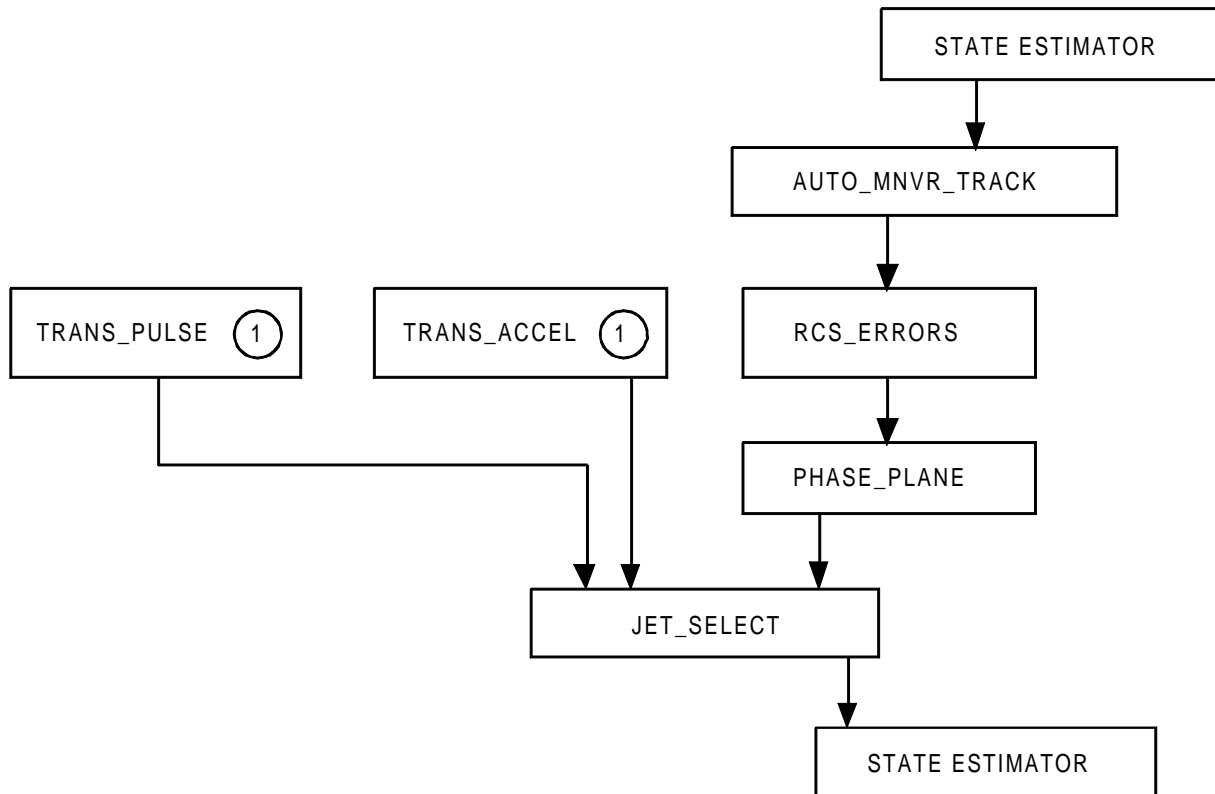


FIGURE 4.2.1.2-1.(6) OFC Control Law Function Module Sequencing Requirements (Sheet 6 of 9)

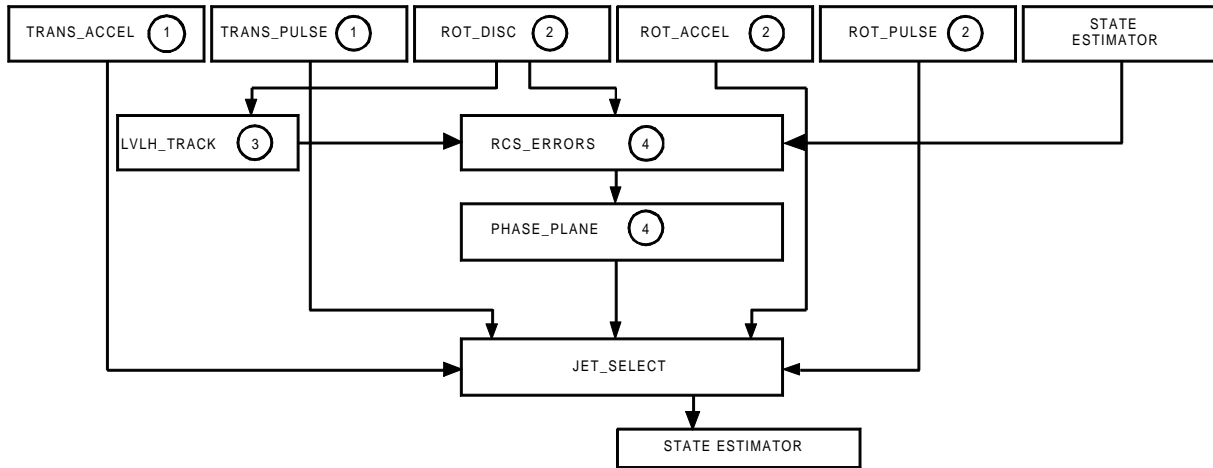
II.A RCS: AUTO ROTATION (MANEUVER-TRACK OR PREBURN MANEUVER OR ATTITUDE HOLD)



① EITHER OR BOTH OF THESE MODULES ARE EXECUTED ON A GIVEN PASS. THEY ARE SELECTED AXIS-BY-AXIS BASED ON FLIGHT CREW INPUTS.

FIGURE 4.2.1.2-1.(7) OFC Control Law Function Module Sequencing Requirements (Sheet 7 of 9)

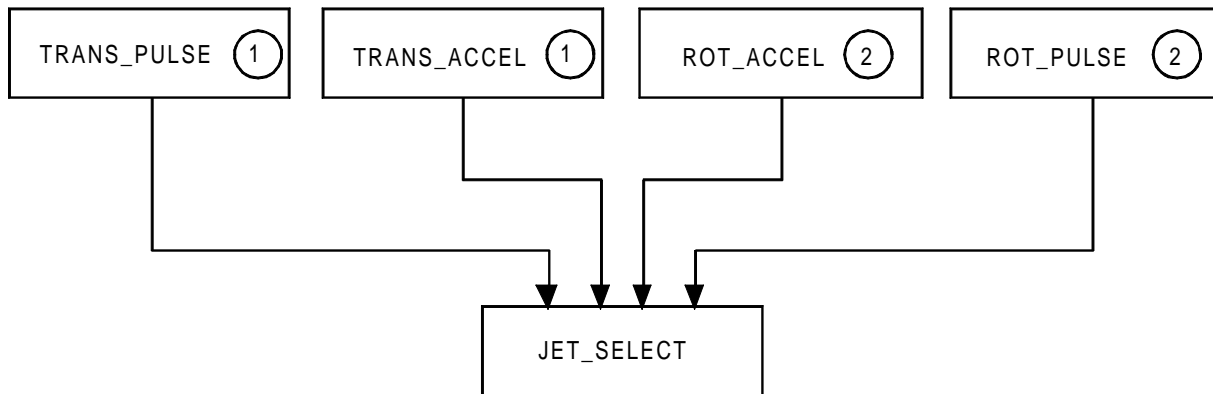
II.B RCS: MANUAL ROTATION



- ① EITHER OR BOTH OF THESE TRANSLATIONAL MODULES ARE EXECUTED ON A GIVEN PASS. THEY ARE SELECTED AXIS-BY-AXIS ON FLIGHT CREW INPUTS.
- ② ANY OR ALL OF THESE ROTATIONAL MODULES ARE EXECUTED ON A GIVEN PASS. THEY ARE SELECTED AXIS-BY-AXIS ON FLIGHT CREW INPUTS AND RHC SOFTSTOP DOWNMODING.
- ③ EXECUTED WHEN LVLH_MODE FLAG IS UP. LVLH_TRACK MAY NOT BE EXECUTED FOR UP TO 960 MSEC IN ORDER TO ALLOW FOR EFFICIENT BALANCING OF SOFTWARE LOADS.
- ④ PHASE_PLANE IS NOT EXECUTED UNLESS DISCRETE RATE COMMAND (ROT_DISC) IS CHOSEN FOR AT LEAST ONE OF THE ROTATIONAL AXES. RCS ERRORS MUST BE CALLED EVEN IF ROT_DISC AND PHASE_PLANE ARE NOT. THE BYPASS FLAG IS USED IN CONJUNCTION WITH THESE CALLS.

FIGURE 4.2.1.2-1.(8) OFC Control Law Function Module Sequencing Requirements (Sheet 8 of 9)

III. IMU FAIL



- ① EITHER OR BOTH OF THESE TRANSLATIONAL MODULES ARE EXECUTED ON A GIVEN PASS. THEY ARE SELECTED AXIS BY AXIS ON FLIGHT CREW INPUTS. SELECTION IS INITIALIZED TO TRANS_PULSE.
- ② EITHER OR BOTH OF THESE ROTATIONAL MODULES ARE SELECTED AXIS BY AXIS. SELECTION IS INITIALIZED TO ROT_PULSE AND REMAINS IN ROT_PULSE UNLESS THE RHC SOFTSTOP DOWNMODING (TO ROT_ACCEL) LOGIC IS INVOKED.

FIGURE 4.2.1.2-1.(9) OFC Control Law Function Module Sequencing Requirements (Sheet 9 of 9)

4.2.1.2.2 RCS

The RCS mode is entered if an ON command is not present for either OMS engine. The OFC may be configured in one of three automatic rotation submodes or one of three manual submodes while in RCS. In addition, either of two manual translation submodes is compatible at any time with both auto rotation and manual rotation. All manual modes are selected by axis.

Both rotation and translation are processed in a single pass as indicated in Figure 4.2.1.2-1 (Cases IIA and IIB). When processing modules that are called axis by axis, only a single call is made to those modules common to all axes. These include PART1_FILTER, PART2_FILTER, RCS_ERRORS, PHASE_PLANE, and JET_SELECT.

A. Automatic Rotation

There will be three auto rotation submodes processed within the DAP: maneuver-track operation, preburn maneuver, and attitude hold. OFC_RECON will default to an attitude hold when no other auto maneuver is taking place. Maneuver-track operation, preburn maneuver, and attitude hold are all processed by AUTO_MNVR_TRACK, and OFC_RECON calls exactly the same modules for each of these submodes. The auto rotation submodes are prioritized in the order preburn (highest), maneuver-track, attitude hold (lowest).

B. Manual Rotation

Three manual modes are available via the DAP panel PBI's. They are INRTL (inertial attitude hold), LVLH (LVLH attitude hold), and FREE (free drift mode). Furthermore, two manual rotation submodes exist which can be chosen by axis if either the INRTL or LVLH is the current manual mode. They are discrete rate command/attitude hold and pulse. Both can be chosen via the PBI's in the LVLH or INRTL modes. The Free-drift mode is not active in conjunction with the discrete rate submode. Discrete rate therefore cannot be selected via the PBI if free-drift mode is active. Whenever the LVLH or INRTL modes are selected, the rotation submode is initially set to discrete rate in all axes. If FREE is selected the rotation submode is set to PULSE in all AXES.

Soft stop acceleration is available for all manual modes and is automatically chosen if the RHC exceeds the soft stop in an axis. The rotational submode for all other axes is not affected. If the ALT mode is active, the delay time is set to zero, affecting all axes while soft stop acceleration is in effect. The originally chosen submode will be restored when the RHC is returned to detent. This scheme allows for an orbiter coast about the downmoded axis while the RHC is between detent and the soft stop.

The manual submode is automatically initialized to FREE (free-drift) if a vernier jet has failed and the vernier RCS is in use or if RCS RM has issued an RCS manifold close command and PAYLOAD_EXTENDED is non-zero. However, the crew can change the manual mode or select automatic rotation, and the appropriate lamps will be illuminated.

C. Manual Translation

The manual translation submodes, pulse and acceleration, are available only when the OFC is in the RCS mode with primary jets selected. They can not be used with the vernier jets. It is not necessary for OFC_RECON to call the modules TRANS_PULSE or TRANS_ACCEL if the THC is in detent and (TRANS_JET_CMD) is zero.

The DAP will automatically upmode to primary jets for the duration of the translational commands whenever the THC is deflected. If the DAP was in vernier mode or alternate primary mode when the THC was deflected, it will return to that respective mode when TRANS_PULSE and TRANS_ACCEL discontinue issuing [TRANS_JET_CMD]. In pulse mode the DAP will remain upmoded only for the duration of the pulse, whether the THC remains out of detent or not.

The PRIM, ALT and VERN PBI's will override this automatic upmode. If primary (PRIM) jets are selected (via the PBI) during an upmode, the DAP will remain in primary jets following completion of the translation and will not return to vernier or alt mode. If VERN or ALT are selected (via the PBI) during an upmode, the translational firing will be terminated and the DAP will mode to the PBI selected mode.

D. Automatic Reboost

The DAP provides a capability to perform an automatic translation while maintaining rotational attitude control. Four reboost configurations (jets by jet group, number of jets in group, jet start times, and duration of firings) are loaded pre-flight via I-loads. The reboost configuration selection and the interval between reboost firings is entered by the crew from the Orbit DAP Config Spec function. Activation and de-activation of the reboost is performed by the crew through the Universal Pointing Display. OFC_RECON will terminate a reboost in progress by resetting the reboost enable and setting the reboost cancel command if an OFC restart occurs, the FREE_DRIFT mode is activated, the FREE PBI is depressed, the THC is deflected, TVC mode is active or the RHC is deflected beyond the soft stop.

OFC Recon sets a flag when all axis errors are within 1.2 times the attitude deadband, (all AXIS_WITHIN_DEADBAND flags are set). This ERRORS_WITHIN_DEADBANDS flag is used in the reboost switching logic to insure that reboost translation firings only occur when the errors are within the hysteresis region of the DAP phase plane.

4.2.1.2.3 IMU Fail

The IMU fail mode will be selected when the IMU_FAIL flag is on. The IMU_FAIL flag will be on if IMU attitude data has not been updated (ATT_DG = OFF) for a prescribed number (12) of OFC_RECON cycles (see Table 4.2.1.3-2). An IMU_FAIL will cause OFC to terminate any reboost in progress. The OFC will reconfigure in an RCS manual free-drift mode with pulse command mode for both rotation and translation (with the low plus-Z translation option OFF) and will illuminate the corresponding lamps. Rotation will remain in the free-drift mode with pulse rotation (except for RHC softstop downmoding, as described in Subsection 4.2.1.2.2) for the duration of the IMU fail mode, i.e. the closed loop control modes (AUTO, INRTL, and LVLH) can not be selected; however, the crew can change the translation submode as required, and the appropriate lamps will be illuminated by SET_LAMPS. The state estimator will not be processed when the IMU fail mode is selected. Note: The OMS engines will be manually commanded OFF when IMU fail mode is selected.

If the IMU_FAIL flag is subsequently turned off, OFC RECON will return to "normal" processing on the next pass and allow crew selection of any desired modes.

4.2.1.3 Other OFC RECON Functions

A. RHC hot stick downmoding

The OFC will enter a manual rotation mode for all axes any time the RHC is out of detent in any axis and the DAP is in AUTO. Therefore, OFC_RECON will set AUTO_MANUAL to OFF (manual) whenever any component of RHC_STATE \neq 0. The events following depend on whether the OMS engines are on or off.

1. RCS operation: Any auto maneuver in progress will be terminated immediately. Manual INRTL mode will be entered and retained after the hand controller returns to detent unless a mode change command is received via the AUTO, LVLH, or FREE PBI.
2. OMS operation: Manual attitude control will be retained until the RHC is returned to detent and the AUTO PBI is depressed.

B. Setting module initialization flags

OFC_RECON will set the initialization flags used by the panel switch interfacing modules and the control law modules. The names of the flags and the conditions for setting them are given in Table 4.2.1.3-1. Each module turns off its own initialization flag.

C. Panel switch/uplink/Post Contact Thrusting interfacing

OFC_RECON is responsible for calling the modules POST_CONTACT_THRUSTING, UNPACK_SW, DAPLOAD_SELECT, DAP_UL_PROC and SET_LAMPS. First the DAP_UL_PROC will be called for a valid mass property/notch filter uplink OP code. UNPACK_SW and DAPLOAD_SELECT must run next to have the current settings of all the crew inputs, except when the DOCKING_FLT I-load is set ON and OPS2_INDICATOR is set ON. When DOCKING_FLT is set ON and OPS_2_INDICATOR is ON the POST_CONTACT_THRUSTING is executed first and when armed will process the NEW_PANEL_SW_WORD prior to its use in UNPACK_SW. DAPLOAD_SELECT must be called if the crew has changed the DAPLOAD A/B switch, the ALT_ACTIVE switch, NO_PLUS_Z_JETS, or the PRIMARY/VERNIER switch, or entered new DAPLOAD parameters since the last pass. The flags DAPLOAD_CHANGE from UNPACK_SW or the Orbit DAP Config Spec, and DAP_DATA_CHANGE from the external OFC interface provide this information. OFC_RECON resets these flags to zero after each pass. DAPLOAD_SELECT must also be called when OFC_RECON changes the PRIMARY_VERNIER_SW or ALT_ACTIVE discrettes. When a valid DAP mass properties/notch filter uplink is received, DAP_UL_PROC is called to process the uplinked data.

SET_LAMPS cannot be called until all parameters affecting the lamps have been set.

The lamps indicating the rotational and translational sub-options will be driven as follows. During RCS operations, the lamps will indicate the manual sub-options selected by the moding buttons. The lamps will not indicate that a particular axis has been downmoded to acceleration command when the RHC is moved past the soft stop. Rather, they will indicate the submode that will be back in effect when the downmoding ends. A failed vernier jet with vernier RCS in use or the issuance of an automatic RCS manifold isolation valve close command due to a failed-on jet when PAYLOAD_EXTENDED is non-zero initializes the free-drift mode and sets lamp illumination accordingly. When free-drift mode is active, OFC_RECON will not allow selection of the discrete rate rotation submode. During RCS operations, the DAP will accept manual mode changes if the RHC is out of detent. If manual INRTL or LVLH is selected (via the PBI) the DAP will mode to

the selected manual mode, but the rotation option DISC REQUEST will not be honored and the rotation submodes will not be modified. If manual FREE is selected the DAP will mode to manual FREE and the ROT option will be set to PULSE in all axes.

OFC_RECON will neither accept nor remember rotational sub-option change requests for any axis made via PBI when the RHC is out of detent in any axis. The same is true for translational sub-option change requests for any axis made via PBI when the THC is out of detent in any axis.

The NO_PLUS_Z_JETS translation option change request will be processed against a THC deflection prior to using it for setting of the INIT_TRANS_PULSE. Thus a re-initialiation of the TRANS PULSE module based on NO_PLUS_Z_JETS state changes should occur only if the NO_PLUS_Z_JETS state is actually allowed to change.

During TVC operations, the RCS sub-option lamps will remain illuminated. It is to be understood that these lamps indicate the option that will be in effect when the OFC returns to the RCS mode. The RCS sub-options may be changed during TVC and they will be acknowledged via the lights. However, they will not be implemented until the OMS burn is over.

During the IMU fail mode, the RCS sub-option lamps will indicate the pulse rotation submode and the selected translation submode, which is initialized to pulse without the low plus-Z option.

The lamps indicating the auto, manual INRTL, FREE-DRIFT mode, and the LVLH option will be driven as follows. During RCS operations, the four lamps are mutually exclusive: pressing any PBI illuminates it and extinguishes whichever of the other three PBI's was illuminated. Selection of INRTL, FREE, and LVLH all set the AUTO_MANUAL discrete to OFF (manual). Use of the RHC during the auto mode initializes the mode and lamp illumination to manual INRTL. A failed vernier jet with verniers in use or the issuance of an RCS manifold close command by RCS RM while PAYLOAD_EXTENDED is non-zero initializes the mode and lamp illumination to FREE and pulse in all three axis.

During TVC operation, the LVLH PBI and FREE PBI are nonfunctional and the lamps are extinguished. If the LVLH or FREE modes are in effect when TVC is entered, the mode is forced to manual TVC and the PBI illumination is forced to manual INRTL.

D. OMS Gimbal Trim

It is necessary for OFC_RECON to initialize and call the module TVC_LAW_PITCH_YAW in order to trim the OMS engines. OFC_RECON will cause a gimbal trim to occur when either of the following events takes place.

1. The TRIM_OMS_GIMBALS and RCS flags are ON. TVC_LAW_PITCH_YAW will be initialized and executed each pass while this flag is set. The trim values will be provided by the crew via the CRT display.
2. One OMS engine has been shut down during a two-engine burn. OFC_RECON will initialize TVC_LAW_PITCH_YAW one time at the time of engine shutdown. Execution of TVC_LAW_PITCH_YAW will continue without interruption. The trim values will be taken from a K-load.

OFC_RECON will also set the value of TVC_LAW_P_Y_GAIN_FLAG (Table 4.2.1.3-2) as a function of the number of OMS engines commanded ON.

E. Setting Gains, Deadbands, Flags, Etc.

Table 4.2.1.3–2 is a list of parameters used within the OFC whose values are modified by OFC_RECON. The need for most of the latter are found in the module descriptions of Section 4.2.2. Table 4.2.1.3–3 is a list of flags reset by OFC_RECON after use.

When the (BYPASS) flag is set to ON for all three axis, PHASE_PLANE is not called.

F. Clocking Slow Modules

OFC_RECON will keep clocks to time the calls to those modules processed at less than 12.5 Hz.

6.25 Hz

PART1_FILTER

1.04 Hz

AUTO_MNVR_TRACK

LVLH_TRACK

OMS_STEERING

G. Display Attitude Command Selection

OFC will transmit a commanded–attitude quaternion to the external interface for use in deriving an attitude error for display. The choice of which attitude quaternion to output is made by OFC_RECON. OFC_RECON also selects a maneuver commanded–attitude quaternion for use by AUTO_MNVR_TRACK. This is always identical to the display commanded–attitude quaternion.

Attitude quaternion selection is performed in MM 202 only if the IMU_FAIL flag is OFF. If a preburn maneuver is desired, the display attitude command, Q_B_M50_CMD_DISPLAY, is set equal to the preburn attitude command, Q_B_M50_CMD_PREBURN, on receipt of the preburn maneuver command.

Q_B_M50_CMD_DISPLAY is set equal to the command from ORB MNVR DIP for all OMS burns and for RCS burns for which a Preburn Maneuver has been requested. If an RCS burn is requested and no Preburn Maneuver is commanded, the burn is executed at the Universal Pointing attitude.

To facilitate an inertial attitude hold at the end of an OMS burn or an RCS burn performed in the +X attitude (Preburn Maneuver was performed). Q_B_M50_CMD_DISPLAY is set equal to Q_B_M50 once, at burn cutoff. For an RCS burn with no Preburn Maneuver, the Universal Pointing attitude will be maintained and no automatic inertial attitude hold is initiated at burn cutoff.

After return to MM 201, and until the next preburn maneuver command in MM 202, Q_B_M50_CMD_DISPLAY is set equal to the maneuver–track attitude command, Q_B_M50_CMD, whenever an active option is in effect.

H. Acceleration Filter Inhibition and Override

OFC_RECON will provide logic to inhibit the acceleration estimation filter located in PART1_FILTER of the state estimator during a jet firing and for an I-loaded number (AF_INH_COUNT) of 0.16 second processing cycles after the firing. An override function enables the acceleration filter regardless of the jet firing history if the filter has been disabled for an I-loaded

number (AF_OVR_DLY_COUNT) of consecutive cycles: once triggered, the override remains active for a sufficient number of cycles (the I-load AF_OVR_ON_COUNT) for the acceleration filter to converge. The flag FILTER_JETS_ON from JET_SELECT notifies OFC_RECON of a jet firing, and OFC_RECON sends the flag ENABLE_AF to PART1_FILTER to enable or inhibit the acceleration filter. A suggested implementation of the 6.25 Hz portion of the logic is shown in Figure 4.2.1.3-1. This implementation assumes that the 6.25 Hz portion will be executed at a time such that PART1_FILTER will subsequently be executed before JET_SELECT. The acceleration filter is only required to execute when PART1_FILTER is executed. Interfacing the 12.5 Hz flag FILTER_JETS_ON to the 6.25 Hz logic is accomplished via the flag AF_JETS_ON as specified in Table 4.2.1.3-2.

Table 4.2.1.3-1. Control Law Function Module Initialization Conditions

| Initialization Flag | Set Flag on Entry Into the Specified Mode or Submode or When Conditions Occur |
|----------------------------|--|
| INIT_AUTO_MNVR_TRACK | <p>A. $RCS \bullet (PREBURN_LATCH \bullet AUTO_MANUAL = OFF \rightarrow ON + PREBURN_LATCH = OFF \rightarrow ON \bullet AUTO_MANUAL \bullet UP_LOCKOUT)$</p> <p>B. $RCS \bullet \overline{UP_LOCKOUT} \bullet (AUTO_MANUAL = OFF \rightarrow ON \bullet MNVR_TRACK_OPTION + AUTO_MANUAL \bullet MNVR_TRACK_OPTION = OFF \rightarrow ON)$</p> <p>C. $RCS \bullet AUTO_MANUAL \bullet MNVR_TRACK_OPTION \bullet (UP_LOCKOUT = ON \rightarrow OFF) \bullet (AUTO_ATT_OPTION \neq 3)$</p> |
| INIT_DAPLOAD_SELECT | <p>A. OFC_RESTART = ON</p> <p>B. Transition from OPS 2 to 8, or OPS 8 to 2</p> <p>C. OPS 201 or 801 mode recall</p> <p>D. IMU_FAIL = ON \rightarrow OFF</p> |
| INIT_GUIDANCE_COMPENSATION | <p>A. TVC \bullet AUTO_MANUAL, two- to one-engine transition (Flag = 1)</p> <p>B. TVC \bullet AUTO_MANUAL (Flag = 2)</p> |
| INIT_JET_SELECT | <p>A. OFC_RESTART = OFF \rightarrow ON</p> <p>B. Transition from OPS 8 TO 2, OR 2 to 8, or 201 or 801 mode recall</p> <p>C. PRIMARY_VERNIER_SW = OFF \rightarrow ON or ON \rightarrow OFF</p> <p>D. ALT_ACTIVE = OFF \rightarrow ON or ON \rightarrow OFF</p> |
| INIT_LVLH_TRACK | LVLH_MODE = OFF \rightarrow ON |
| INIT_PART1_FILTER | <p>A. OFC_RESTART = ON (FLAG = 1)</p> <p>B. Transition from OPS 2 TO 8, OR OPS 8 TO 2 (FLAG = 1)</p> <p>C. (OPS 201 or 801 mode recall) and (IMU_FAIL = OFF at last pass prior to mode recall) and (IMU_FAIL = OFF at first pass after mode recall) (Flag = 1)</p> |

| Table 4.2.1.3-1. Control Law Function Module Initialization Conditions | |
|--|---|
| Initialization Flag | Set Flag on Entry Into the Specified Mode or Submode or When Conditions Occur |
| | <p>D. (OPS 201 OR 801 mode recall) and (IMU_FAIL = ON at last pass prior to mode recall) and (IMU_FAIL = OFF at first pass after mode recall) (Flag = 2)</p> <p>E. (IMU_FAIL = ON → OFF) and (no ops transition) (Flag = 2)</p> |
| [INIT_RCS_ERRORS] | <p>A. TVC</p> <p>B. Transition from OPS 8 to 2, or 2 to 8, or 201 or 801 mode recall</p> <p>C. RCS</p> <p>D. Set by axis in manual mode if BYPASS_{AXIS} = 1 → 0</p> <p>E. OFC_RESTART = ON</p> |
| INIT_ROT_PULSE | <p>A. EACH TIME ROT_PULSE IS CALLED IF IT WAS NOT CALLED ON THE PREVIOUS PASS FOR A GIVEN AXIS</p> <p>B. TRANSITION FROM OPS 8 to 2, or 2 to 8, or 201 or 801 MODE RECALL</p> <p>C. PRIMARY_VERNIER_SW = ON → OFF or OFF → ON</p> <p>D. ALT_ACTIVE = OFF → ON or ON → OFF</p> <p>E. DOCKING_ACTIVE = OFF → ON or ON → OFF</p> |
| INIT_TRANS_PULSE | <p>A. EACH TIME TRANS_PULSE IS CALLED IF IT WAS NOT CALLED ON THE PREVIOUS PASS FOR A GIVEN AXIS</p> <p>B. TRANSITION FROM OPS 8 TO 2, OR 2 TO 8, OR 201 OR 801 MODE RECALL</p> <p>C. DOCKING_ACTIVE = OFF → ON or ON → OFF</p> <p>D. NO_PLUS_Z_JETS not equal to previous value of NO_PLUS_Z_JETS (Z Axis only)</p> |
| INIT_TVC_LAW_PITCH_YAW | <p>A. RCS • TRIM_OMS_GIMBALS (Flag = 1)</p> <p>B. TVC TWO- TO ONE-ENGINE TRANSITION (Flag = 2)</p> <p>C. TVC (Flag = 3)</p> |
| INIT_TVC_LAW_ROLL | TVC 2-ENGINE |
| INIT_UNPACK_SW | <p>A. OFC_RESTART = ON (Flag = 1)</p> <p>B. TRANSITION FROM OPS 8 TO 2, OR 2 TO 8, OR 201 OR 801 MODE RECALL (Flag = 2)</p> |

| Table 4.2.1.3-1. Control Law Function Module Initialization Conditions | |
|--|--|
| Initialization Flag | Set Flag on Entry Into the Specified Mode or Submode or When Conditions Occur |
| INIT_ROT_DISC _{AXIS} | $\overline{\text{AUTO}} \text{ MANUAL} \bullet \text{ACCEL}_{\text{AXIS}} \bullet (\text{RCS} \bullet \text{ROT_SUBMODE}_{\text{AXIS}} = 3 + \text{TVC} \bullet \text{ONE_ENG} \bullet \text{AXIS} = \text{ROLL})$ |

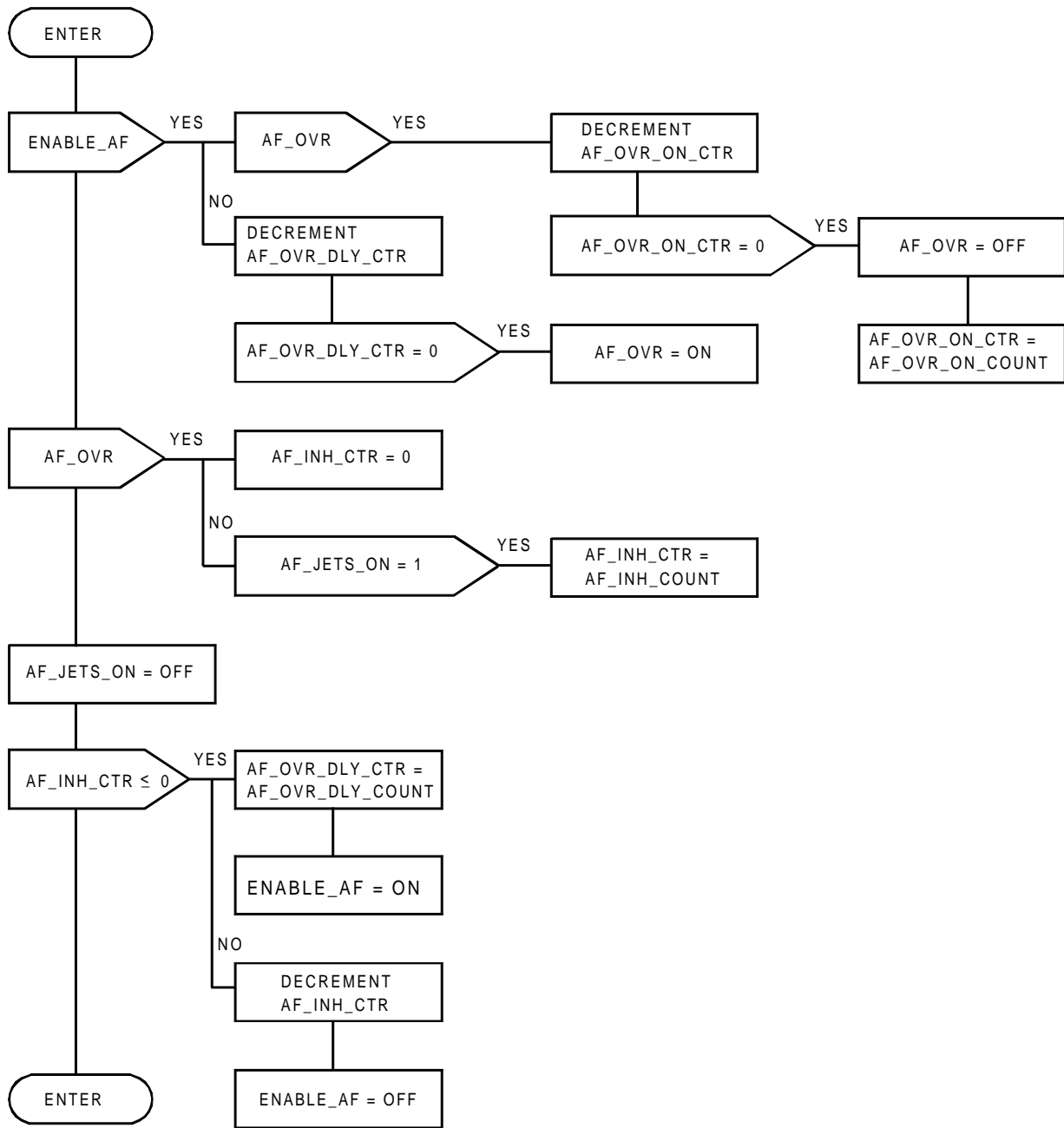


FIGURE 4.2.1.3-1. Acceleration Filter Inhibition and Override Logic, 6.25 Hz Portion

| Table 4.2.1.3-2. OFC Parameters Whose Values Are Modified by OFC_RECON | | |
|--|---|--|
| Variable Name | Value | Condition |
| ACCEL_GAIN | ACCEL_GAIN_PRIMARY ACCEL_GAIN_TVC ACCEL_GAIN_UNIQUE ACCEL_GAIN_VERNIER | RCS and PRIMARY_VERNIER_SW = ON and UNIQUE_GAINS_SELECTED TVC RCS and UNIQUE_GAINS_SELECTED RCS and PRIMARY_VERNIER_SW = OFF and UNIQUE_GAINS_SELECTED |
| AF_JETS_ON | ON | FILTER_JETS_ON = ON |
| ALT_ACTIVE | OFF | THC_HOT_STICK = OFF → ON or TVC |
| | ALT_ACTIVE_PBI | THC_HOT_STICK = ON → OFF |
| ALT_ACTIVE_PBI | OFF | TVC |
| ATTITUDE_GAIN1 | ATTITUDE_GAIN1_PRIMARY ATTITUDE_GAIN1_TVC ATTITUDE_GAIN1_UNIQUE ATTITUDE_GAIN2_VERNIER | RCS and PRIMARY_VERNIER_SW = ON and UNIQUE_GAINS_SELECTED TVC RCS and UNIQUE_GAINS_SELECTED RCS and PRIMARY_VERNIER_SW = OFF and UNIQUE_GAINS_SELECTED |
| ATTITUDE_GAIN2 | ATTITUDE_GAIN2_PRIMARY ATTITUDE_GAIN2_TVC ATTITUDE_GAIN2_UNIQUE ATTITUDE_GAIN2_VERNIER | RCS and PRIMARY_VERNIER_SW = ON and UNIQUE_GAINS_SELECTED TVC RCS and UNIQUE_GAINS_SELECTED RCS and PRIMARY_VERNIER_SW = OFF and UNIQUE_GAINS_SELECTED |
| AUTO_ATT_OPTION | 1 (preburn) | RCS auto and PREBURN_LATCH = ON and UP_LOCKOUT = ON |
| | 3 (Maneuver-track) | RCS auto and not UP_LOCKOUT and MNVR_TRACK_OPTION = ON |
| | 4 (Attitude hold) | RCS auto and not conditions for 1 or 3 |
| AUTO_MANUAL | OFF | a) RHC out of detent in any axis b) IMU_FAIL = ON c) VFAIL = ON and PRIMARY_VERNIER_SW = OFF d) AUTO_MANF_CLOSE = ON and PAYLOAD_EXTENDED ≠ 0 and TVC |
| AXIS | 1, 2, 3 set sequentially | Used when a loop variable for axis-by-axis processing of modules is required. |
| AXIS_WITHIN_DEADBAND _{axis} | ON | $ ATTITUDE_ERROR_{axis} < 1.2 * DEADBAND_{axis}$ |
| | OFF | OTHERWISE |
| BYPASS _{axis} | OFF | a) TVC auto b) TVC manual and ACCEL _{axis} = OFF c) RCS auto d) RCS manual and ROT_SUBMODE _{axis} = 3 (discrete) |
| | ON | a) TVC and ACCEL _{axis} b) RCS manual and ROT_SUBMODE _{axis} = 2 or 4 |

| Table 4.2.1.3-2. OFC Parameters Whose Values Are Modified by OFC_RECON | | |
|--|------------------------------------|--|
| Variable Name | Value | Condition |
| [DEADBAND] | [DB_REQUEST] [DB_TVC] | RCS TVC |
| ERRORS_WITHIN_DEADBANDS | ON | AXIS_WITHIN_DEADBAND = { ON, ON, ON } |
| | OFF | OTHERWISE |
| FREE_DRIFT_MODE | ON | a) IMU_FAIL = ON b) VFAIL = ON and PRIMARY_VERNIER_SW = OFF c) AUTO_MANF_CLOSE = ON and PAYLOAD_EXTENDED ≠ 0 and TVC |
| | OFF | TVC |
| [GUID_COMP_GAIN] | [GUID_COMP_GAIN_ONE_ENGINE] | TVC 1 - engine auto |
| | [GUID_COMP_GAIN_TWO_ENGINES] | TVC 2 - engine auto |
| HI_LO_Z_TRANS_SW | Previous value of HI_LO_Z_TRANS_SW | RCS and THC ≠ 0 |
| IMU_FAIL | OFF | ATT_DG |
| | ON | ATT_DG = OFF and (TIME_OUT ≥ 12) |
| JETS_ON | OFF | a. OFC_RESTART = ON b. Transition from OPS 2 to OPS 8, or 8 to 2, or 201 or 801 mode recall |
| LVLH_ATTITUDE_REFERENCE | LVLH_ATTITUDE_DESIRED | INIT_LVLH_TRACK = ON → OFF |
| LVLH_MODE | OFF | TVC |
| MAX_DELAY_COUNT | 0 | [SOFT_STOP] ≠ OFF and ALT_ACTIVE |
| | MAX_DELAY_COUNT_DAPLOAD | [SOFT_STOP] = OFF and ALT_ACTIVE |
| MINA_JS_SEL | ON | RCS and [(MIN_ANGLE_JET_SEL_VALUE = 1) or (MIN_ANGLE_JET_SEL_VALUE = 2 and (ALT_ACTIVE = ON or PAYLOAD_EXTENDED ≠ 0))] |
| | OFF | Otherwise |
| MNVR_SCALE_FACTOR | ALT_MNVR_SCALE_FACTOR | ALT_ACTIVE and MAX_DELAY_COUNT ≠ 0 |
| | 1 | ALT_ACTIVE = OFF or MAX_DELAY_COUNT = 0 |
| NO_PLUS_Z_JETS | Previous value of NO_PLUS_Z_JETS | RCS and [THC] ≠ 0 |
| PRIMARY_VERNIER_SW | ON | TVC or THC_HOT_STICK = OFF → ON |
| | PRIMARY_VERNIER_PBI | RCS and THC_HOT_STICK = ON → OFF |
| PRIMARY_VERNIER_PBI | ON | TVC |
| Q_B_LV_REFERENCE | Q_B_LV_DESIRED | INIT_LVLH_TRACK = ON → OFF |

| Table 4.2.1.3-2. OFC Parameters Whose Values Are Modified by OFC_RECON | | |
|--|---|--|
| Variable Name | Value | Condition |
| RATE_GAIN1 | RATE_GAIN1_PRIMARY RATE_GAIN1_TVC RATE_GAIN1_UNIQUE RATE_GAIN1_VERNIER | RCS and PRIMARY_VERNIER_SW = ON and UNIQUE_GAINS_SELECTED TVC RCS and UNIQUE_GAINS_SELECTED RCS and PRIMARY_VERNIER_SW = OFF and UNIQUE_GAINS_SELECTED |
| RATE_GAIN2 | RATE_GAIN2_PRIMARY RATE_GAIN2_TVC RATE_GAIN2_UNIQUE RATE_GAIN2_VERNIER | RCS and PRIMARY_VERNIER_SW = ON and UNIQUE_GAINS_SELECTED TVC RCS and UNIQUE_GAINS_SELECTED RCS and PRIMARY_VERNIER_SW = OFF and UNIQUE_GAINS_SELECTED |
| [RATE_LIMIT] | [RL_REQUEST] [RL_TVC] | RCS TVC |
| RBST_ENA RBST_CNCL | OFF ON | OFC_RESTART = ON FREE_REQUEST = ON [THC] ≠ 0 TVC = ON [SOFT_STOP] ≠ OFF Transition from OPS 2 to OPS 8 Transition from OPS 8 to OPS 2 FREE_DRIFT_MODE OFF to ON |
| [ROT_COMMAND] | [ROT_JET_CMD] 0 | FILTER_JETS_ON = ON FILTER_JETS_ON = OFF |
| [ROT_LAMP] | [ROT_OPTION] | Always |
| [ROT_OPTION] | 2 (PULSE) 3 (DISCRETE) Previous value of [ROT_OPTION] | a) IMU_FAIL = ON b) VFAIL = ON and PRIMARY_VERNIER_SW = OFF c) FREE_DRIFT_MODE = ON DISC_REQUEST = ON and [RHC_STATE] = 0 [RHC_STATE] ≠ 0 and (VFAIL = OFF or PRIMARY_VERNIER_SW = ON) and FREE_DRIFT_MODE = OFF |
| ROT_SUBMODE _{axis} | 3 (discrete) Previous values of ROT_SUBMODE _{axis} (before ACCEL _{axis} turned ON) | OFC_RESTART = OFF → ON RCS manual and ACCEL _{axis} = ON → OFF |
| [ROT_JET_CMD] | 0 | OFC_RESTART = ON |
| ROT_JET_CMD _{axis} | 0 | (PRIMARY_VERNIER_SW = OFF → ON or (ALT_ACTIVE = ON → OFF and BYPASS _{axis} = OFF and PRIMARY_VERNIER_SW = ON |
| THC_HOT_STICK | ON | RCS and [THC] = 0 → ≠ 0 and (PRIMARY_VERNIER_PBI = OFF or ALT_ACTIVE_PBI = ON) |

| Table 4.2.1.3-2. OFC Parameters Whose Values Are Modified by OFC_RECON | | |
|--|---|---|
| Variable Name | Value | Condition |
| | OFF | TVC or ([TRANS_JET_CMD] ≠ 0 or PRIMARY_VERNIER_SW = ON → OFF or (PRIMARY_VERNIER_PBI = ON and ALT_ACTIVE_PBI = OFF) or ALT_ACTIVE = OFF → ON) or OFC_RESTART = OFF → ON |
| TIME_OUT | 0 TIME_OUT = TIME_OUT + 1 | OFC_RESTART = ON or ATT_DG = ON ATT_DG = OFF and IMU_FAIL = OFF |
| [TRANS_JET_CMD] | 0 | TVC |
| [TRANS_LAMP] | [TRANS_OPTION] | Always |
| [TRANS_OPTION] | 2 (Pulse) Previous value of [TRANS_OPTION] | IMU_FAIL = OFF → ON [THC] ≠ 0 and (VFAIL = OFF or PRIMARY_VERNIER_SW = ON) |
| TVC_LAW_P_Y_GAIN_FLAG | 2 1 | TVC 1 - engine TVC 2 - engine |
| UNIQUE_GAINS_SELECTED | ON | PAYLOAD_EXTENDED ≥ UNIQUE_FILTER_SELECTION_VALUE |
| | OFF | PAYLOAD_EXTENDED < UNIQUE_FILTER_SELECTION_VALUE |
| NOTE: THC_HOT_STICK must be sequenced before OFC_RECON modification of flags ALT_ACTIVE and PRIMARY_VERNIER_SW, and after UNPACK_SW. | | |

| Table 4.2.1.3-3. Flags Reset by OFC_RECON After They Are Used | |
|--|--------|
| Flag | Set to |
| OFC_RESTART | OFF |
| PREBURN_MNVR* | OFF |
| DAPLOAD_CHANGE | OFF |
| DAP_DATA_CHANGE | OFF |
| DISC_REQUEST | OFF |
| AUTO_MANF_CLOSE | OFF |
| TRIM_OMS_GIMBALS | OFF |
| VFAIL ⁺ | OFF |
| * PREBURN_MNVR, once set, is latched on until AUTO_MANUAL = ON, MM_202 = ON, and RCS = ON + VFAIL, once set, remains set until PRIMARY_VERNIER_SW = OFF | |

4.2.1.4 Processing Rate

OFC_RECON is processed at 12.5 Hz.

4.2.1.5 Interface Requirements

The interface requirements of OFC_RECON are given in Table 4.2.1.5-1.

4.2.1.6 I-Loads/K-Loads

I-loads/K-Loads for OFC_RECON are given in Table 4.2.1.6-1.

4.2.1.7 Initialization Requirements

Initialization requirements for OFC_RECON are given in Table 4.2.1.7-1. Orbit Flight Control completely initializes itself (by means of the OFC restart logic) when any of the following events occur:

- (1) OPS 1 to OPS 2 transition
- (2) OPS 3 to OPS 2 transition
- (3) Flight computer memory overlay from the mass memory

If any of the listed events occur in the presence of invalid IMU data (indicated by the IMU data good flag in the OFF state) and then valid IMU data is made available before the DAP downmodes to the IMU fail mode, the OFC restart logic is re-executed.

A subset of the complete initialization, together with the carrying over of some variables, occurs for:

- (1) OPS 2 to OPS 2 transition (mode recall)
- (2) OPS 2 to OPS 8 transition
- (3) OPS 8 to OPS 2 transition
- (4) OPS 8 to OPS 8 transition (mode recall)

The following is presented for information only and should not be construed as a requirement. A set of flags informs OFC_RECON whenever any of the following has occurred:

- (1) OPS 1 cleanup or memory overlay from OPS 0
- (2) OPS 2 cleanup
- (3) OPS 3 cleanup
- (4) OPS 8 cleanup

This is the mechanism by which OFC_RECON learns that a transition has happened. Additional flags to tell OFC_RECON whether the current OPS is 2 or 8 are not necessary. (Although Table 4.2.1.7-1 specifies OPS 2 as the current OPS for transitions from OPS 0, 1, or 3, OPS 2 is in fact the only OPS to which such transitions can be made.)

Table 4.2.1.5-1. OFC_RECON Interface Requirements

| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
|------------------------|---|---|-------|------------------|------|------------------|
| INPUTS | | | | | | |
| ATT_DG | IMU data good (1 = data good) | IMU RM (4.72) | B | 0,1 | none | 12.5 |
| ATTITUDE_ERROR | Body angle error | RCS_ERRORS | V(3)S | | deg | 12.5 |
| ATTITUDE_INCREMENT_6HZ | Body angle increment over sampling interval | ORB ATT PROC (4.97) | V(3)S | | deg | 6.25 |
| AUTO_MANF_CLOSE | Flag indicating that an RCS manifold close command was issued due to a failed-on jet | RCS RM (4.91) | B | 0,1 | none | 12.5 |
| AUTO_MANUAL | Auto/manual select (1 = auto; 0 = manual) | UNPACK_SW, OFC_RECON | B | 0,1 | none | 12.5 |
| DAP_DATA_CHANGE | Flag signifying change in one or more DAPLOAD parameters (1 = change) | ORB DAP CONFIG SPEC (5.8), ORB DAP CONFIG (6.1) | B | 0,1 | none | 12.5 |
| DAPLOAD_CHANGE | Flag signifying change in one or both DAPLOAD selection parameters (bit 1 ON = DAPLOAD has changed; bit 2 ON = PRIMARY_VERNIER_SW, NO_PLUS_Z_JETS or ALT_ACTIVE have changed) | UNPACK_SW, ORB DAP CONFIG SPEC (5.8) | B(2) | 0,1 for each bit | none | 12.5 |
| DB_REQUEST | Magnitudes of phase plane attitude deadbands requested by crew | DAPLOAD_SELECT | A(3)S | ≥ 0 | deg | 12.5 |
| DOCKING_ACTIVE | Flag indicating post contact thrusting sequence in progress (1 = ON) | POST_CONTACT_THRUSTING | B | 0,1 | none | 12.5 |
| GUIDED_DELTA_V_BURN | Flag indicating RCS or OMS delta-V burn is in progress (1 = burn in progress; from ignition time to burn cutoff) | MSC | B | 0,1 | none | 12.5 |
| LVLH_ATTITUDE_DESIRED | Desired attitude of free axis with respect to the local vertical frame | LVLH_TRACK | V(3)S | -1 to 1 | none | 1.04 |
| LVLH_MODE | LVLH Mode Indicator (1 = LVLH) | UNPACK_SW OFC_RECON | B | 0,1 | none | 12.5 |
| MM_202 | Major Mode 202 (maneuver execute) flag (1 = major mode 202) | MSC | B | 0,1 | none | 12.5 |
| MNVR_HOLD | Flag indicating preburn MNVR in progress (1 = MNVR in progress) | AUTO_MNVR_TRACK | B | 0,1 | none | 12.5 |
| ALT_ACTIVE | ALT Mode active indicator (1 = active) | UNPACK_SW OFC_RECON | B | 0,1 | none | 12.5 |
| ALT_ACTIVE_PBI | Flag indicating last switch selected state of ALT_ACTIVE (1 = active) | UNPACK_SW OFC_RECON | B | 0,1 | none | 12.5 |
| DISC_REQUEST | Flag Initializing discrete rate in all axes (1 = DISC) | UNPACK_SW | B | 0,1 | none | 12.5 |
| FILTER_JETS_ON | Flag indicating one or more jets are currently firing (1 = firing) | JET_SELECT | B | 0, 1 | none | 12.5 |
| FREE_DRIFT_MODE | Free Drift Mode Indicator (1 = free drift) | UNPACK_SW OFC_RECON | B | 0,1 | none | 12.5 |
| FREE_REQUEST | FREE drift request from PBI | UNPACK_SW | B | 0, 1 | none | 12.5 |

Table 4.2.1.5-1. OFC_RECON Interface Requirements

| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
|-------------------------|---|-----------------------------------|------------------|---------------------|-------|------------------|
| MAX_DELAY_COUNT_DAPLOAD | Minimum time between firings, in minor cycles, in ALT mode | DAPLOAD_SELECT | I | 0 to 1250 | none | 12.5 |
| MNVR_TRACK_OPTION | Maneuver-track option select enable (1 = enable) | UNIV POINT PROC (4.213) | B | 0,1 | none | 12.5 |
| NO_PLUS_Z_JETS | Flag to inhibit use of +Z Jets (1 = inhibit) | UNPACK_SW | B | 0,1 | none | 12.5 |
| OPS_2_INDICATOR | OPERATIONAL SEQUENCE 2 FLAG | MSC | B | 0,1 | none | 12.5 |
| OMSL_ON_CMD | Left OMS engine turn-on command (1 = on) | OMS FIRE SEQ (4.182) | B | 0,1 | none | 12.5 |
| OMSR_ON_CMD | Right OMS engine turn-on command (1 = on) | OMS FIRE SEQ (4.182) | B | 0,1 | none | 12.5 |
| PAYLOAD_EXTENDED | Payload extended flag (0 = payload not extended, 1 through 9 = selected payloads) | DAPLOAD_SELECT | I | 0,1,2,3,4,5,6,7,8,9 | none | as req'd |
| PREBURN_MNVR | OMS pre thrust maneuver initiate command (1 = initiate maneuver) | MNVR EXEC (6.35) | B | 0,1 | none | 12.5 |
| PRIMARY_VERNIER_PBI | Flag indicating the last state of the NORM and VERN PBI's on the Orbit DAP Panel | UNPACK_SW | B | 0,1 | none | 12.5 |
| PRIMARY_VERNIER_SW | RCS primary/vernier jet select (1 = primary; 0 = vernier) | UNPACK_SW, OFC_RECON | B | 0,1 | none | 12.5 |
| Q_B_M50 | Vehicle attitude with respect to reference attitude given as M50-to-body quaternion | ORB ATT PROC (4.97) | Struct: S; V(3)S | 0 to 1 -1 to 1 | none | 1.04, 12.5 |
| Q_B_M50_CMD | Commanded vehicle attitude with respect to reference attitude during coast | UNIV POINT PROC (4.213) | Struct: S; V(3)S | 0 to 1 -1 to 1 | none | 1.04 |
| Q_B_M50_CMD_PREBURN | Commanded preburn vehicle attitude with respect to reference attitude | ORBIT MNVR DIP (4.158) | Struct: S; V(3)S | 0 to 1 -1 to 1 | none | 1.04 |
| Q_B_LV_DESIRED | Desired vehicle attitude (quaternion) with respect to the local vertical frame | LVLH_TRACK | Struct: S; V(3)S | 0 to 1 -1 to 1 | none | 1.04 |
| RHC_STATE | Rotational hand controller out-of-detent indication | ORB 3-AX RHC SOP (4.199) | A(3)I | -1,0,1 | none | 12.5 |
| RL_REQUEST | Magnitudes of phase plane rate error limits requested by crew | DAPLOAD_SELECT | A(3)S | 0 | deg/s | 12.5 |
| ROT_JET_CMD | RCS Rotation Command | PHASE_PLANE, ROT_ACCEL, ROT_PULSE | A(3)S | -1 to 1 | none | 12.5 |
| ROT_OPTION | Manual rotation submode select (2 = pulse; 3 = discrete) | UNPACK_SW | A(3)I | 2,3 | none | 12.5 |
| SOFT_STOP | Flag indicating rotational hand controller is deflected beyond soft stop (1 = beyond soft stop) | ORB 3-AX RHC SOP (4.199) | A(3)B | 0,1 | none | 12.5 |
| THC | Translation hand controller command | THC SOP (4.54) | A(3)I | -1,0,1 | none | 12.5 |
| TRANS_OPTION | Manual translation submode select (1 = accel; 2 = pulse) | UNPACK_SW | A(3)I | 1,2 | none | 12.5 |
| TRIM_OMS_GIMBALS | OMS prethrust trim command (1 = trim) | MSC | B | 0,1 | none | 12.5 |

Table 4.2.1.5-1. OFC_RECON Interface Requirements

| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
|-------------------------|---|--|-------|------------------|------|------------------|
| UP_OP_CODE | Uplinked operation code (0110011 – notch filter/mass properties update) | UPLINK | B(7) | | none | 12.5 |
| VFAIL | Flag indicating one or more vernier jets failed (1 = failed) | JET_SELECT | B | 0,1 | none | 12.5 |
| OUTPUTS | | | | | | |
| ACCEL_GAIN | Filter 2 gain for acceleration term | PART1_FILTER | S | ≥ 0 | none | 1/maneuver |
| DOCKING_ACTIVE | Status of Post Contact Thrusting Sequence ACTIVE (1=on; 0=off) | SET_LAMPS, JET_SELECT, POST_CONTACT_THRUSTING | B | 0,1 | none | On demand |
| ALT_ACTIVE | ALT Mode active indicator (1 = active) | OFC_RECON, DAPLOAD_SELECT, JET_SELECT, SET_LAMPS | B | 0,1 | none | 12.5 |
| ALT_ACTIVE_PBI | Flag indicating last switch selected state of ALT_ACTIVE (1 = active) | UNPACK_SW OFC_RECON | B | 0,1 | none | 12.5 |
| ATTITUDE_GAIN1 | Filter 1 gain for attitude term | PART1_FILTER | S | ≥ 0 | none | 1/maneuver |
| ATTITUDE_GAIN2 | Filter 2 gain for attitude term | PART1_FILTER | S | ≥ 0 | none | 1/maneuver |
| AUTO_ATT_OPTION | Auto attitude option indicator (1 = pre-burn attitude; 3 = maneuver track; 4 = attitude hold) | AUTO_MNVR_TRACK | I | 1,3,4 | none | 1/maneuver |
| AUTO_MANF_CLOSE | Flag indicating that an RCS manifold close command was issued due to a failed-on jet | RCS RM (4.91) | B | 0,1 | none | 12.5 |
| AUTO_MANUAL | Auto/manual select (1 = auto; 0 = manual) | SET_LAMPS, OFC_RECON | B | 0,1 | none | 12.5 |
| AXIS | Body axis for this execution | ROT_ACCEL, ROT_DISC, ROT_PULSE, TRANS_ACCEL, TRANS_PULSE | I | 1,2,3 | none | 12.5/axis |
| BYPASS | Open loop control command, by axis (1 = open loop) | RCS_ERRORS, PHASE_PLANE, JET_SELECT | B(3) | 0,1 for each bit | none | 12.5 |
| DEADBAND | Magnitudes of attitude deadbands | AUTO_MNVR_TRACK, PHASE_PLANE | A(3)S | ≥ 0 | deg | 12.5 |
| ENABLE_AF | Flag to enable/disable acceleration filter (1 = enable) | PART1_FILTER | B | 0,1 | none | On demand |
| ERRORS_WITHIN_DEADBANDS | Flag to indicate that all attitude errors are within deadbands | JET_SELECT | B | 0,1 | none | 12.5 |
| GUID_COMP_GAIN | TVC compensation gains | GUIDANCE_COMPENSATION | A(3)S | | none | 12.5 |
| HI_LO_Z_TRANS_SW | Z-axis translation acceleration level select (1 = high, 0 = low) | SET_LAMPS, JET_SELECT | B | 0,1 | none | 12.5 |
| INIT_AUTO_MNVR_TRACK | Module initialization flag (1 = init) | AUTO_MNVR_TRACK | B | 0,1 | none | 12.5 |

Table 4.2.1.5-1. OFC_RECON Interface Requirements

| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
|-----------------------------|---|--|-------|-----------|------|------------------|
| INIT_DAPLOAD_SELECT | Module initialization flag (1 = init) | DAPLOAD_SELECT | B | 0,1 | none | On demand |
| INIT_GUIDANCE_COMPENSATION | Module initialization flag (0 = no init; 1 = two-engine to one-engine transition init; 2 = normal init) | GUIDANCE_COMPENSATION | I | 0,1,2 | none | 12.5 |
| INIT_JET_SELECT | Module initialization flag (1 = init) | JET_SELECT | B | 0,1 | none | 12.5 |
| INIT_LVLH_TRACK | Module initialization flag (1 = init) | LVLH_TRACK | B | 0,1 | none | 12.5 |
| INIT_PART1_FILTER | Module initialization flag (0 = no init; 1 = OPS transition or major mode recall with good IMU data before and after; 2 = recovery of IMU data within an OPS or during a major mode recall) | PART1_FILTER PART2_FILTER | I | 0,1,2 | none | 12.5 |
| INIT_POST_CONTACT_THRUSTING | Module initialization flag (1 = init) | POST_CONTACT_THRUSTING | B | 0,1 | none | 12.5 |
| INIT_RCS_ERRORS | Module initialization flag (1 = init) | RCS_ERRORS | A(3)B | 0,1 | none | 12.5 |
| INIT_ROT_DISC | Module initialization flag (1 = init) | ROT_DISC | A(3)B | 0,1 | none | 12.5 |
| INIT_ROT_PULSE | Module initialization flag (1 = init) | ROT_PULSE | B | 0,1 | none | 12.5 |
| INIT_TRANS_PULSE | Module initialization flag (1 = init) | TRANS_PULSE | B | 0,1 | none | 12.5 |
| INIT_TVC_LAW_PITCH_YAW | Module initialization flag (0 = no init; 1 = pre thrust trim; 2 = transition from two engines to one engine; 3 = first dynamic pass after pre thrust trim) | TVC_LAW_PITCH_YAW | I | 0,1,2,3 | none | 12.5 |
| INIT_TVC_LAW_ROLL | Module initialization flag (1 = init) | TVC_LAW_ROLL | B | 0,1 | none | 12.5 |
| FREE_DRIFT_MODE | Free Drift Mode Indicator (1 = free drift) | OFC_RECON, SET_LAMPS | B | 0,1 | none | 12.5 |
| INIT_UNPACK_SW | Module initialization flag (1 = OFC_RESTART init, 2 = OPS transition init) | UNPACK_SW | I | 0,1,2 | none | 12.5 |
| LVLH_ATTITUDE_REFERENCE | Reference attitude of free axis with respect to the local vertical frame | LVLH_TRACK | V(3)S | -1 to 1 | none | 12.5 |
| LVLH_MODE | LVLH mode indicator (1 = LVLH) | OFC_RECON, ROT_DISC, SET_LAMPS, ORB ATT PROC (4.97), UNIV POINT PROC (4.213) | B | 0,1 | none | 12.5 |
| MAX_DELAY_COUNT | Minimum time between firings, in minor cycles, in ALT mode | JET_SELECT | I | 0 to 1250 | none | 12.5 |
| MINA_JS_SEL | Flag indicating that the minimum angle jet selection logic has been selected | JET_SELECT | B | 0,1 | none | 12.5 |
| MNVR_SCALE_FACTOR | Scale factor for Alternate DAP mode maneuvers with delays (1 = otherwise) | AUTO_MNVR_TRACK | S | > 0 to 1 | none | 1.04 |

Table 4.2.1.5-1. OFC_RECON Interface Requirements

| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
|--------------------------|---|---|------------------|-------------------|-------|------------------|
| NO_PLUS_Z_JETS | Flag to inhibit use of +Z jets (1 = inhibit) | SET_LAMPS, JET_SELECT, DAPLOAD_SELECT | B | 0,1 | none | 12.5 |
| OLD_ATT_INCR | Carryover value of ATTITUDE_INCREMENT_6HZ | PART1_FILTER | V(3)S | | deg | 6.25 |
| PREBURN_MNVR_IN_PROGRESS | Flag indicating auto preburn maneuver is in progress (1 = maneuver in progress) | MNVR EXEC (6.35), UNIV POINT PROC (4.213), ORB MNVR DIP (4.158) | B | 0,1 | none | 12.5 |
| PRIMARY_VERNIER_SW | RCS primary/vernier jet select (1 = primary; 0 = vernier) | SET_LAMPS, JET_SELECT, PHASE_PLANE, OFC_RECON, DAPLOAD_SELECT | B | 0,1 | none | 12.5 |
| Q_B_LV_REFERENCE | Reference vehicle attitude (quaternion) with respect to the local vertical frame | LVLH_TRACK | Struct: S; V(3)S | 0 to 1 -1 to 1 | none | 12.5 |
| Q_B_M50_CMD_DISPLAY | Commanded vehicle attitude (quaternion) | ORB ATT PROC (4.97) | Struct: S; V(3)S | 0 to 1 -1 to 1 | none | 12.5 |
| Q_B_M50_CMD_MNVR | Commanded vehicle attitude (quaternion) | AUTO_MNVR_TRACK | Struct: S; V(3)S | 0 to 1 -1 to 1 | none | 12.5 |
| RATE_GAIN1 | Filter 1 gain for rate term | PART1_FILTER | S | 0 | none | 1/maneuver |
| RATE_GAIN2 | Filter 2 gain for rate term | PART1_FILTER | S | 0 | none | 1/maneuver |
| RATE_LIMIT | Magnitudes of rate error limits | PHASE_PLANE | A(3)S | ≥ 0 | deg/s | 12.5 |
| RCS | RCS mode indicator (1 = RCS mode) | UNPACK_SW, PHASE_PLANE | B | 0,1 | none | 12.5 |
| RBST_ENA | Reboost enable flag | UNIV POINT PROC (4.213), ORB DAP CONFIG DISP (6.1), JET_SELECT, TLM | B | 0, 1 | none | 12.5 |
| RBST_CNCL | Reboost cancel | UNIV POINT PROC(4.213), JET SELECT | B | 0,1 | none | 12.5 |
| RBST_OVRD | Group failure override flags | JET_SELECT | A(20) B | 0, 1 | none | 12.5 |
| ROT_COMMAND | RCS rotation command for output to activity lights | RCS ACT LT (4.230) | A(3)S | -1 to 1 | none | 12.5 |
| ROT_JET_CMD | RCS rotation command | JET_SELECT | A(3)S | -1 to 1 | deg/s | 12.5 |
| ROT_LAMP | Rotational submode indicator drive signal (2 = pulse; 3 = discrete) | SET_LAMPS | A(3)I | 2,3 | none | 12.5 |
| ROT_SUBMODE | RCS rotation submode (2 = pulse; 3 = discrete, 4 = accel, selected by RHC soft stop downmoding) | LVLH_TRACK | A(3)I | 2,3,4 | none | 12.5 |
| TRANS_JET_CMD | Translation command | JET_SELECT | A(3)I | -1,0,1 | none | 12.5 |
| TRANS_LAMP | Translational submode indicator drive signal (1 = accel; 2 = pulse) | SET_LAMPS | A(3)I | 1,2 | none | 12.5 |

| Table 4.2.1.5-1. OFC_RECON Interface Requirements | | | | | | |
|---|---|--|------|-------|------|------------------|
| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
| TVC_LAW_P_Y_G AIN_FLAG | Flag indicating number of OMS engines to burn (1 = two engines; 2 = one engine) | TVC_LAW_PITCH_YAW | I | 1,2 | none | 12.5 |
| VFALL | Flag indicating one or more vernier jets failed (1 = failed) | JET_SELECT | B | 0,1 | none | 12.5 |
| XJETS_ACTIVE | XJETS active indicator (1 = active) | JET_SELECT DAPLOAD_SELECT ORB DAP CONFIG (6.1) | B | 0,1 | none | On demand |

| Table 4.2.1.6-1. OFC_RECON I-Loads/K-Loads | | | | | |
|--|---|-------|------|-------------------------------------|--|
| Name | Description | Type | Unit | MSID | |
| ACCEL_GAIN_PRIMARY | State estimator filter 2 gain for acceleration term during RCS operations with primary jets | S | none | V97U2500C | |
| ACCEL_GAIN_UNIQUE | Mission unique acceleration gain | S | none | V97U2665C | |
| ACCEL_GAIN_VERNIER | State estimator filter 2 gain for acceleration term during RCS operations with vernier jets | S | none | V97U2502C | |
| ACCEL_GAIN_TVC | State estimator filter 2 gain for acceleration term during TVC operations | S | none | V96U9810C | |
| ALT_MNVR_SCALE_FACTOR | Scale factor for Alternate DAP mode maneuvers with delays | S | none | V97U2671C | |
| ATTITUDE_GAIN1_PRIMARY | State estimator filter 1 gain for attitude term during RCS operations with primary jets | S | none | V97U2655C | |
| ATTITUDE_GAIN1_UNIQUE | Mission unique attitude filter gain 1 | S | none | V97U2666C | |
| ATTITUDE_GAIN1_VERNIER | State estimator filter 1 gain for attitude term during RCS operations with vernier jets | S | none | V97U2657C | |
| ATTITUDE_GAIN1_TVC | State estimator filter 1 gain for attitude term during TVC operations | S | none | V96U9811C | |
| ATTITUDE_GAIN2_PRIMARY | State estimator filter 2 gain for attitude term during RCS operations with primary jets | S | none | V97U2658C | |
| ATTITUDE_GAIN2_UNIQUE | Mission unique attitude filter gain 2 | S | none | V97U2667C | |
| ATTITUDE_GAIN2_VERNIER | State estimator filter 2 gain for attitude term during RCS operations with vernier jets | S | none | V97U2660C | |
| ATTITUDE_GAIN2_TVC | State estimator filter 2 gain for attitude term during TVC operations | S | none | V96U9812C | |
| DB_TVC * | Attitude deadbands for use during TVC | A(3)S | deg | V97U2338C V97U2404C V97U2405C | |
| GUID_COMP_GAIN_ONE_ENGINE * | Filter gain for GUIDANCE_COMPENSATION during one engine TVC burns | A(3)S | none | V97U2344C V97U2345C V97U2346C | |
| GUID_COMP_GAIN_TWO_ENGINES * | Filter gain for GUIDANCE_COMPENSATION during two engine TVC burns | A(3)S | none | V97U2347C V97U2348C V97U2349C | |

Table 4.2.1.6-1. OFC_RECON I-Loads/K-Loads

| Name | Description | Type | Unit | MSID |
|-------------------------------|--|-------|-------|-------------------------------------|
| MIN_ANGLE_JET_SEL_VALUE | Integer indicating condition to select the minimum angle jet selection algorithm (0 = minimum angle not selected, 1 = minimum angle always selected, 2 = minimum angle selected if ALT_ACTIVE or PAYLOAD_EXTENDED ≠ 0) | I | none | V97U6301C |
| RATE_GAIN1_PRIMARY | State estimator filter 1 gain for rate term during RCS operations with primary jets | S | none | V97U2952C |
| RATE_GAIN1_UNIQUE | Mission unique rate filter gain 1 | S | none | V97U2668C |
| RATE_GAIN1_VERNIER | State estimator filter 1 gain for rate term during RCS operations with vernier jets | S | none | V97U2822C |
| RATE_GAIN1_TVC | State estimator filter 1 gain for rate term during TVC operations | S | none | V96U9813C |
| RATE_GAIN2_PRIMARY | State estimator filter 2 gain for rate term during RCS operations with primary jets | S | none | V97U2823C |
| RATE_GAIN2_UNIQUE | Mission unique rate filter gain 2 | S | none | V97U2669C |
| RATE_GAIN2_VERNIER | State estimator filter 2 gain for rate term during RCS operations with vernier jets | S | none | V97U2825C |
| RATE_GAIN2_TVC | State estimator filter 2 gain for rate term during TVC operations | S | none | V96U9814C |
| RL_TVC * | Rate error limits for use during TVC | A(3)S | deg/s | V97U2386C V97U2387C V97U2388C |
| DOCKING_FLT | Used to determine if the post-contact firing logic should be executed. DOCKING-FLT should be I-loaded to ON if a post-contact firing sequence will be required during the mission. | B | none | V99U5728C |
| UNIQUE_FILTER_SELECTION_VALUE | Payload extended threshold for which unique gains are selected | I | none | V97U2670C |
| * K-Loads | | | | |

| Table 4.2.1.7-1. OFC_RECON Initialization Requirements | | | |
|--|------------------|-----------------------------|------------------|
| Initialize on Transition | | Variable | Initial Value |
| From | To | | |
| OPS 1, 3 | OPS 2 and ATT_DG | OFC_RESTART | ON |
| OFC_RESTART = OFF | OFC_RESTART = ON | INIT_JET_SELECT | ON |
| | | INIT_PART1_FILTER | 1 |
| | | INIT_RCS_ERRORS | ON |
| | | INIT_UNPACK_SW | 1 |
| | | ROT_JET_CMD | 0 |
| | | JET_STATUS_CHANGE | ON |
| | | AF_INH_CTR | 0 |
| | | AF_JETS_ON | OFF |
| | | AF_OVR | OFF |
| | | AF_OVR_DLY_CTR | AF_OVR_DLY_COUNT |
| | | AF_OVR_ON_CTR | AF_OVR_ON_COUNT |
| | | ENABLE_AF | ON |
| | | FILTER_JETS_ON | OFF |
| | | INIT_DAPLOAD_SELECT | ON |
| | | INIT_POST_CONTACT_THRUSTING | ON |
| | | XJETS_ACTIVE | OFF |
| | | DOCKING_ACTIVE | OFF |
| | | RBST_OVRD | OFF |
| OPS 0* | OPS2 and ATT_DG | OFC_RESTART | ON |
| OPS 2, 8 ② _____ or _____ | OPS 2 | INIT_UNPACK_SW | 2 |
| | | INIT_POST_CONTACT_THRUSTING | ON |
| | | DOCKING_ACTIVE | OFF |
| OPS 2,8 ② | OPS 8 | ROT_JET_CMD | 0 |
| | | INIT_JET_SELECT | ON |
| | | DAPLOAD_CHANGE | (ON, ON) |

| Table 4.2.1.7-1. OFC_RECON Initialization Requirements | | | |
|--|---|---|--|
| Initialize on Transition | | Variable | Initial Value |
| From | To | | |
| | | Q_B_M50_CMD_MNVR Q_B_M50_CMD_DISPLAY LVLH_ATTITUDE_REFERENCE Q_B_LV_REFERENCE | Q_B_M50_CMD_MNVR ① Q_B_M50_CMD_MNVR ① LVLH_ATTITUDE_REFERENCE ① Q_B_LV_REFERENCE ① |
| OPS 2, 8 ② ————— or ——— OPS 2,8 ② | OPS 2 ————— OPS 8 | AF_INH_CTR AF_JETS_ON AF_OVR AF_OVR_DLY_CTR AF_OVR_ON_CTR ENABLE_AF FILTER_JETS_ON INIT_DAPLOAD_SELECT INIT_RCS_ERRORS INIT_ROT_PULSE INIT_TRANS_PULSE INIT_PART1_FILTER | 0 OFF OFF AF_OVR_DLY_COUNT AF_OVR_ON_COUNT ON OFF ON ON ON ON ON 1 |
| OPS 1, 3 † | OPS 2 and $\overline{\text{ATT_DG}}$ | OLD_ATT_INCR OFC_RESTART_REPEAT | 2.0 ATTITUDE_INCREMENT (from 4.226) ON |
| OPS 8, 2 † ————— or ——— OPS 2, 8 † | OPS 2 and $\overline{\text{ATT_DG}}$ ————— OPS 8 and $\overline{\text{ATT_DG}}$ | TNOW OLD_ATT_INCR Q_B_M50 Q_B_LVLH TIME_OUT | TNOW ① ATTITUDE_INCREMENT_6HZ ① Q_B_M50 ① Q_B_LVLH ① TIME_OUT ① |

| Table 4.2.1.7-1. OFC_RECON Initialization Requirements | | | |
|--|---------------------------------------|---|---|
| Initialize on Transition | | Variable | Initial Value |
| From | To | | |
| OPS 0* † | OPS 2 and $\overline{\text{ATT_DG}}$ | OFC_RESTART_REPEAT | ON |
| $\overline{\text{IMU_FAIL}}$ | IMU_FAIL | OFC_RESTART_REPEAT | OFF |
| IMU_FAIL | $\overline{\text{IMU_FAIL}}$ | AF_INH_CTR AF_JETS_ON AF_OVR AF_OVR_DLY_CTR AF_OVR_ON_CTR DAPLOAD_CHANGE ENABLE_AF FILTER_JETS_ON INIT_DAPLOAD_SELECT | 0 OFF OFF AF_OVR_DLY_COUNT AF_OVR_ON_COUNT (ON, ON) ON OFF ON |
| OFC_RESTART_REPEAT and $\overline{\text{ATT_DG}}$ | OFC_RESTART_REPEAT and ATT_DG | OFC_RESTART_REPEAT OFC_RESTART | OFF ON |
| * Only if a mass memory read is employed to overlay the flight computer memory ① Carryover values † These requirements are in addition to the nominal OPS transition requirements. ② Only if flight computer is not overlaid. | | | |

4.2.2 Control Law Module

Figure 4.2.2–1 is the major block diagram of the on–orbit flight control law module. This module contains 19 function modules that execute the control laws. On any given pass, the configuration of the control law module (i.e., the effective interconnection and behavior of the function modules) is determined by inputs from the supervisory module OFC_RECON.

Configuration control is implemented in five ways:

1. By executing the particular function modules necessary to perform a given task in the sequence required. This function is performed by OFC_RECON and indicated in Figure 4.2.2–1 by switches S1 through S11, whose logic is described in Subsection 4.2.1.1.
2. By passing initialization flags to the function modules which, in turn, initialize pass–to–pass storage elements such as filters, counters, and integrators, and/or recompute vehicle mass property dependent parameters. All initialization flags are generated by OFC_RECON and turned off by the receiving module.
3. By passing parameters defining quantitative behavior of certain function modules. These parameters include gains, desired rates, thresholds, limits and deadbands, and are supplied by OFC_RECON and by external sources via DAPLOAD_SELECT.
4. By passing flags defining qualitative behavior of certain function modules. These flags perform low–level reconfigurations within the modules.
5. By directly “forcing” certain variables. OFC_RECON does this when making major mode changes.

The control law function modules are grouped into four categories: steering, RCS processor, OMS processor, and state estimator. The general sequence of processing is as follows:

1. State estimator, Part 1 (every other pass)
2. Steering module(s)
3. Processor(s)
4. State estimator, Part 2

To avoid loss of precision, the attitude variables (ATTITUDE, MEASURED_ATTITUDE, DESIRED_ATTITUDE, ATTITUDE_EST1, and ATTITUDE_EST2) should be double precision.

A. State Estimator. The state estimator combines attitude measurement data with extrapolations based on effector states to form a filtered estimate of the vehicle state. To reduce transport lag and to interface the 6.25 Hz attitude measurement update rate with the 12.5 Hz effector command update rate, the process is divided into two parts. Part 1, operating at 6.25 Hz and processed before the rest of the control law modules, incorporates the attitude measurement data and develops the vehicle angular rate and undesired angular acceleration estimates. Part 2, operating at 12.5 Hz and processed after the rest of the control law modules, generates extrapolation data based on effector states to be used on the following cycle. The state estimator timing and data flow are described in greater detail in Subsection 4.2.2.3.

B. Steering Processor. The steering processor converts a variety of input commands and data to forms acceptable by the OMS and RCS processors. It also generates an attitude command used to derive attitude errors for display to aid manual steering during OMS TVC and guided manual RCS delta-V burns. In Figure 4.2.2-1, these modules are of the following types:

1. Two manual RCS translation (TRANS_ACCEL, TRANS_PULSE)
2. One automatic RCS rotation (AUTO_MNVR_TRACK)
3. Three manual RCS rotation (ROT_DISC, ROT_ACCEL, ROT_PULSE)
4. One assisted-manual RCS rotation (LVLH_TRACK)
5. One RCS rotation error determination (RCS_ERRORS)
6. One OMS to RCS-rotation linkage (RCS_ASSIST)
7. Two automatic OMS TVC (OMS_STEERING, GUIDANCE_COMPENSATION)
8. One manual OMS TVC (MANUAL_TVC)

The manual RCS translation modules generate commands for the jet selection module in the RCS processor. They process a single vehicle axis at a time.

Of the RCS rotation modules, three (AUTO_MNVR_TRACK, LVLH_TRACK, and ROT_DISC) generate commands for the RCS error determination module, and the remaining two (ROT_ACCEL and ROT_PULSE) drive the jet selection module directly. AUTO_MNVR_TRACK and LVLH_TRACK operate on three vehicle axes. The manual RCS rotation modules can be selected individually by axis.

The automatic RCS rotation submodes available are as follows:

1. Auto maneuver-track: drive the vehicle to the attitude and angular rate commanded by the universal pointing processor.
2. Preburn maneuver: drive the vehicle to the attitude commanded by the orbit maneuver display processor in the maneuver execute major mode.
3. Attitude hold: maintain the present attitude.

These submodes are implemented by AUTO_MNVR_TRACK with attitude command selection performed by OFC_RECON.

ROT_DISC supplies the RCS processor with FORCE_FIRE flags, which act as rate damping commands. The function of these commands is to accelerate and decelerate the vehicle to quickly achieve a limit cycle about the desired coasting or holding attitude, by forcing the phase plane switching logic to operate in a "rate damping" mode (i.e., to command continuous RCS jet firings to bring the rate error to zero). When the rate error is zeroed, the phase plane switching logic resumes normal limit cycle operation.

The module RCS_ERRORS accepts attitude and rate commands from the various steering command generators, and attitude and rate data from the state estimator. From these it derives attitude error for the RCS processor and for display, and rate error for the RCS processor. For any body axis not using this processing path, the BYPASS flag is set on, and RCS_ERRORS zeroes the attitude error output. As a

result, the DAP attitude error display will show nonzero values only when RCS control is actually a function of that error.

ROT_DISC must initialize RCS_ERRORS in any axis in the discrete rate/ attitude hold rotation submode whenever the RHC goes into or out of detent. The initialization causes RCS_ERRORS to set the desired attitude equal to the present attitude in the initialized axis. OFC_RECON also performs three-axis initializations of RCS_ERRORS for certain mode transitions.

If the LVLH option has been selected, ROT_DISC initializes the three-axis routine LVLH_TRACK cyclically while the RHC is out of detent in an axis in the discrete rate/attitude hold submode. Each initialization causes LVLH_TRACK to accept the present attitude as the reference attitude for LVLH attitude hold. When the RHC is returned to detent, the vehicle attitude at the time of the next execution of LVLH_TRACK will be the reference. (The LVLH option is discussed further in paragraph E.)

Any time the RCS processor is being driven by body rate commands from MANUAL_TVC or OMS_STEERING, the module RCS_ASSIST is used to transfer the rate commands and generate attitude commands.

The OMS steering modules generate body rate commands for the RCS processor (via RCS_ERRORS) and for the OMS processor. The automatic steering module OMS_STEERING commands a rate proportional to the cross product of the desired and actual vehicle velocity vectors. The output of this module is filtered by GUIDANCE_COMPENSATION. The manual steering module MANUAL_TVC simply commands a rate proportional to the RHC deflection. The module TVC_TRANS_ATT_CMD_PROC updates an attitude command quaternion according to the filtered rate command from GUIDANCE_COMPENSATION.

C. RCS Processor. The RCS processor consists of jet selection logic for rotation and translation preceded by a phase plane switching logic for rotation only, which processes attitude and angular rate errors to drive the vehicle into a limit cycle about the desired attitude and angular rate. The phase plane logic also provides crossfeed signals to the OMS processor indicating the desired angular rate error and the RCS rotation commands. The translation commands come directly from the steering modules to the jet selection logic; two rotation modules also feed commands directly to the jet selection logic. In addition to producing the primary RCS processor output— commands to the RCS jets—the jet selection logic also provides rotational velocity change predictions for use by Part 2 of the state estimator.

D. OMS Processor. The OMS processor contains all the functions required for trimming and thrust vector control of the OMS engines. Because pitch and yaw may be controlled differently from roll, the TVC law function is split into two modules to prevent execution of unnecessary code, with a mixer module to perform the required roll-pitch command summations.

E. RCS Manual Rotation Control Configuration. Any time the discrete rate/attitude hold rotation submode or the pulse rotation submode is available (i.e., during certain manual RCS-only operations, and in the roll axis only, during a manual one-engine OMS burn), downmoding to an acceleration/coast hysteresis submode is enabled as a function of RHC use. If the RHC is deflected beyond soft stop in a given axis, acceleration is commanded continuously in that axis. To prevent fuel waste, orbiter coast is commanded when the RHC is returned to within soft stop but not to detent. When the RHC is returned to detent, the mode is discrete rate/attitude hold or pulse again.

At other times (i.e., during a two-engine OMS burn and, in the pitch and yaw axes, during a one-engine OMS burn), an acceleration mode is available in any axis in which the RHC is beyond soft stop. There is

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no coast zone, however; RCS control returns to its previous mode as soon as the RHC is returned to within soft stop. RCS control during OMS TVC is discussed further in paragraph F.

The pulse, discrete, and soft stop acceleration submodes are discussed in the individual steering module descriptions.

The LVLH option of the manual RCS mode uses the module LVLH_TRACK to calculate attitude errors for implementation of an attitude hold in the rotating LVLH coordinate frame. The “normal” manual rotation submode for attitude maintenance is discrete rate/attitude hold; if two or more axes are in this submode, and the RHC is in detent in these axes, the attitude errors in these axes will indicate any rotation about these axes relative to LVLH. If only one axis is in the discrete rate/attitude hold submode, LVLH_TRACK accepts the current attitude. ROT_DISC commands body-axis components of the orbital rate (LVLH frame rotation rate), plus or minus the discrete maneuver rate if the RHC is out of detent. If any axis changes submode to or from discrete rate/ attitude hold, and while the RHC is out of detent in any axis, LVLH_TRACK accepts the current attitude as the new reference for attitude hold.

F. TVC Control Configuration. In TVC operation, the OMS and RCS processors are driven by three-axis commands from the steering processor. For those axes in which the OMS processor has control capability (roll, pitch, and yaw in a two-engine burn; pitch and yaw in a one-engine burn), it has the primary control responsibility; and the RCS processor operates as a “wraparound” controller, exercising RCS control only if the TVC control authority is inadequate, as evidenced by excessive attitude or angular rate errors, or if the RHC is moved beyond soft stop, forcing accel downmoding. In a one-engine burn, roll is controlled exclusively by the RCS processor, operating with the same attitude and angular rate error tolerances as in the two-engine case.

The steering processor provides the drive signals to the OMS and RCS processors. For the OMS processor, these drive signals are body rate commands. For the RCS processor, they are either attitude error and angular rate error signals derived from body rate commands or RCS jet commands.

In automatic TVC mode, OMS_STEERING, GUIDANCE_COMPENSATION, and PHASE_PLANE provide the body rate commands to the OMS processor, and RCS_ERRORS generates error signals based on these commands for the RCS processor.

In manual TVC mode, MANUAL_TVC and PHASE_PLANE provide the body rate commands to the OMS processor, and the RCS processor is driven by signals that are a function of the number of OMS engines active, the RHC deflection (within or beyond soft stop), and (in the one-engine case) the particular body axis. In a two-engine burn, with the RHC within soft stop, RCS_ERRORS supplies error signals to the RCS processor based on the rate commands from MANUAL_TVC; if the RHC is deflected beyond soft stop in any axis, that axis is driven by RCS jet commands from ROT_ACCEL. In a one-engine burn, pitch and yaw control operates identically to the two-engine case for both RHC conditions. Roll control in the one-engine case is by ROT_DISC via RCS_ERRORS when the RHC is within soft stop and by RCS jet command from ROT_ACCEL when the RHC is beyond soft stop. The acceleration/drift/discrete hysteresis described in paragraph E applies to roll control in the one-engine case.

Table 4.2.2-1 summarizes the TVC control configurations. Control inputs to the OMS and RCS processors are indicated for all relevant combinations of mode, number of engines, RHC deflection, and axis.

G. Flag Reset. Certain flags are turned off by the recipient after use but are not listed as outputs of those modules (since no other modules use the flag). These are listed below:

| Flag | Module |
|---------------------|-------------|
| All initializations | Recipient |
| FORCE_FIRE | PHASE_PLANE |
| JET_STATUS_CHANGE | JET_SELECT |

H. Function Module Descriptions. The control law function modules are described in Subsections 4.2.2.1 through 4.2.2.4. Within these subsections, the modules are ordered alphanumerically by name. The groups are as follows:

| Section | Subject |
|---------|--|
| 4.2.2.1 | Steering Processor |
| 4.2.2.2 | RCS Processor |
| 4.2.2.3 | State Estimator |
| 4.2.2.4 | OMS TVC Processor |
| 4.2.2.5 | Service Modules (Referred to in Subsections 4.2.2.1 through 4.2.2.4) |

| Table 4.2.2-1. TVC Control Configuration | | | | | | | | | |
|---|-------------------|-------------------|-------------------|-------------------|---|-----------------------------------|-------------------|---------------------------------|------------------|
| TVC Mode | Automatic | | | | Manual | | | | |
| No. of Engines | Two | One | | Two | | One | | | |
| RHC Deflection | (In Detent) | (In Detent) | | Within ss | Beyond ss | Within ss | | Beyond ss | |
| Axis | All | Roll | Pitch, yaw | Any | Any | Roll | Pitch, yaw | Roll | Pitch, yaw |
| OMS Proc. Control Inputs | Rate Cnds from 1 | Not used | Rate Cnds from 1 | Rate Cnds from 2 | Rate Cnds from 2 | Not used | Rate Cnds from 2 | Not used | Rate Cnds from 2 |
| RCS Proc. Control Inputs | Errors from 1 + 4 | Errors from 1 + 4 | Errors from 1 + 4 | Errors from 2 + 4 | Jet Cnds from 5 | Errors from 3 + 4 (A) See note | Errors from 2 + 4 | Jet Cnds from 5 (B) See note | Jet Cnds from 5 |
| 1. OMS_STEERING and GUIDANCE_COMPENSATION 2. MANUAL_TVC 3. ROT_DISC 4. RCS_ASSIST and RCS_ERRORS 5. ROT_ACCEL | | | | | Note: Accel/drift/discrete hysteresis logic applies to transitions between states (A) and (B) | | | | |

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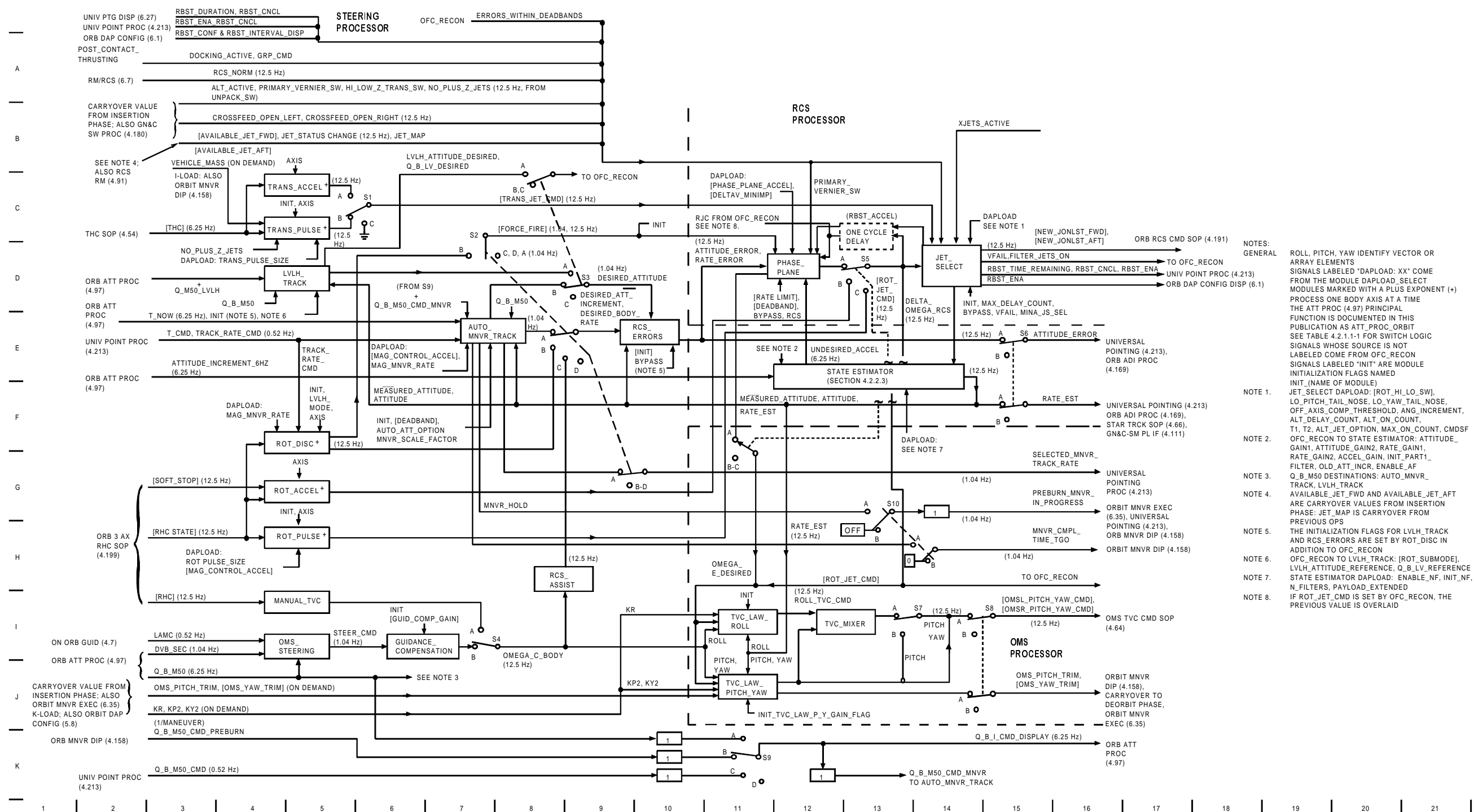


FIGURE 4.2.2-1. OFC Control Law Module Functions

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4.2.2.1 Steering Processor

4.2.2.1.1 AUTO_MNVR_TRACK

A. Function. This module generates control signals to achieve a commanded vehicle attitude and angular rate at a given time, or to achieve and hold a commanded vehicle attitude. Selection among these options is controlled by the AUTO_ATT_OPTION flag. A maneuver completion time to go (MNVR_CMPL_TIME_TGO) is calculated while a preburn maneuver is in progress (MNVR_HOLD = ON).

If the AUTO_ATT_OPTION flag is 1 or 4, the module will cause whatever maneuver is required to attain the attitude defined by Q_B_M50_CMD_MNVR, followed by an attitude held at that attitude.

If the AUTO_ATT_OPTION flag is 3, the module will cause a maneuver that converges on a specified angular track whose determining parameters (the attitude defined by Q_B_M50_CMD_MNVR and the angular rate defined by TRACK_RATE_CMD) are specified for the time T_CMD. To reconcile the difference between T_CMD and the present time, the commanded attitude is updated by the commanded angular rate multiplied by the time difference.

For both the above cases, if the commanded attitude is not close to the actual attitude, the vehicle converges upon the commanded attitude at a rate that is provided by DAPLOAD_SELECT. When the vehicle reaches the attitude at which the available control acceleration would decelerate it to the commanded attitude, deceleration is commanded and the control signals become a function of the actual attitude error and commanded angular rate.

B. Block Diagram. The block diagram for AUTO_MNVR_TRACK is shown in Figure 4.2.2.1.1-1.

C. Processing Rate. The module AUTO_MNVR_TRACK is processed at 1.04 Hz.

D. Interface Requirements. The interface requirements for the module AUTO_MNVR_TRACK are shown in Table 4.2.2.1.1-1. The variables ATTITUDE, MEASURED_ATTITUDE and DESIRED_ATTITUDE are double precision.

E. I-Loads/Constants. The I-loads/constants for the module AUTO_MNVR_TRACK are shown in Table 4.2.2.1.1-2.

F. Initialization Requirements. The initialization requirements for the module AUTO_MNVR_TRACK are shown in Figure 4.2.2.1.1-1.

| Table 4.2.2.1.1-1. AUTO_MNVR_TRACK Interface Requirements | | | | | | |
|---|--|------------------------------|---------------------|--------------------|---------|------------------|
| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
| INPUTS | | | | | | |
| ATTITUDE | Body angles: summation of body attitude increments | PART1_FILTER PART2_FILTER | V(3)S | | deg | 1.04 |
| AUTO_ATT_OPTION | Auto attitude option indicator (1=preburn attitude; 3=maneuver-track; 4=attitude hold) | OFC_RECON | I | 1, 3, 4 | none | 1.04 |
| DEADBAND | Magnitudes of attitude deadband | OFC_RECON | A(3)S | ≥ 0 | deg | 1.04 |
| INIT_AUTO_MNVR_TRACK | Module initialization flag | OFC_RECON | B | 0, 1 | none | 1.04 |
| MAG_CONTROL_ACCEL | Magnitude of average control acceleration available for each axis | DAPLOAD_SELECT | A(3)S | ≥ 0 | deg/s/s | 1.04 |
| MAG_MNVR_RATE | Magnitude of discrete maneuver rate about eigenaxis | DAPLOAD_SELECT | S | ≥ 0 | deg/s | 1.04 |
| MEASURED_ATTITUDE | Body angles: Summation of body attitude increments (unfiltered) | PART1_FILTER | V(3)S | -360 to 360 | deg | 1.04 |
| MNVR_SCALE_FACTOR | Scale factor for Alternate DAP mode maneuvers with delays. Is set to 1 otherwise. | OFC_RECON | S | > 0 to 1 | none | 1.04 |
| Q_B_M50 | Vehicle attitude with respect to reference attitude, given as the M50-to-body quaternion | ORB ATT PROC (4.97) | Struct: S; V(3)S | 0 to 1; -1 to 1 | none | 1.04 |
| Q_B_M50_CMD_MNVR | Commanded vehicle attitude with respect to reference attitude, given as the M50-to-body quaternion | OFC_RECON | Struct: S; V(3)S | 0 to 1; -1 to 1 | none | 1.04 |
| RATE_EST | Body angular rate estimate | PART1_FILTER PART2_FILTER | V(3)S | | deg/s | 1.04 |
| T_CMD | Time at which commanded attitude and angular rate are desired, expressed as mission elapsed time | UNIV POINT PROC (4.213) | S | | s | 1.04 |
| T_NOW | IMU attitude data time tag, expressed as mission elapsed time | ORB ATT PROC (4.97) | S | | s | 1.04 |
| TIME_BIAS | Average time delay for computing bias angle | DAPLOAD_SELECT | S | 0 to 99.99 | s | 1.04 |
| TRACK_RATE_CMD | Body axis components of commanded body angular rate in tracking mode | UNIV POINT PROC (4.213) | V(3)S | | deg/s | 1.04 |
| OUTPUTS | | | | | | |
| DESIRED_ATT_INCREMENT | Desired body attitude increments | RCS_ERRORS | V(3)S | | deg | 1.04 |
| DESIRED_ATTITUDE | Desired body angles | RCS_ERRORS | V(3)S | | deg | 1.04 |
| DESIRED_BODY_RATE | Desired body angular rate | RCS_ERRORS | V(3)S | | deg/s | 1.04 |
| MNVR_CMPL_TIME_TGO | Preburn maneuver time to go | ORB MNVR DIP (4.158) | S | | s | 1.04 |
| MNVR_HOLD | Flag indicating preburn maneuver is in progress (1=maneuver in progress) | OFC_RECON | B | 0, 1 | none | 1.04 |

| Table 4.2.2.1.1-1. AUTO_MNVR_TRACK Interface Requirements | | | | | | |
|---|--|-------------------------|------|----------|-------|------------------|
| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
| SELECTED_MNVR_TRACK_RATE | Desired angular rate during maneuver or track mode | UNIV POINT PROC (4.213) | S | ≥ 0 | deg/s | 1.04 |

| Table 4.2.2.1.1-2. AUTO_MNVR_TRACK I-Loads/Constants | | | | |
|--|--------------------------------------|------|------------|---------|
| Name | Description | Type | MSID/Value | Unit |
| KTRK | Maneuver/track hysteresis parameter | S | V96U8095C | none |
| DEG_TO_RAD | Degrees-to-radians conversion factor | S | pi/180 | rad/deg |
| KH | Maneuver/track hysteresis parameters | S | V97U9041C | none |
| RAD_TO_DEG | Radians-to-degrees conversion factor | S | 180/pi | deg/rad |
| TDAP | Period of the FC minor cycle | S | 0.08 | s |

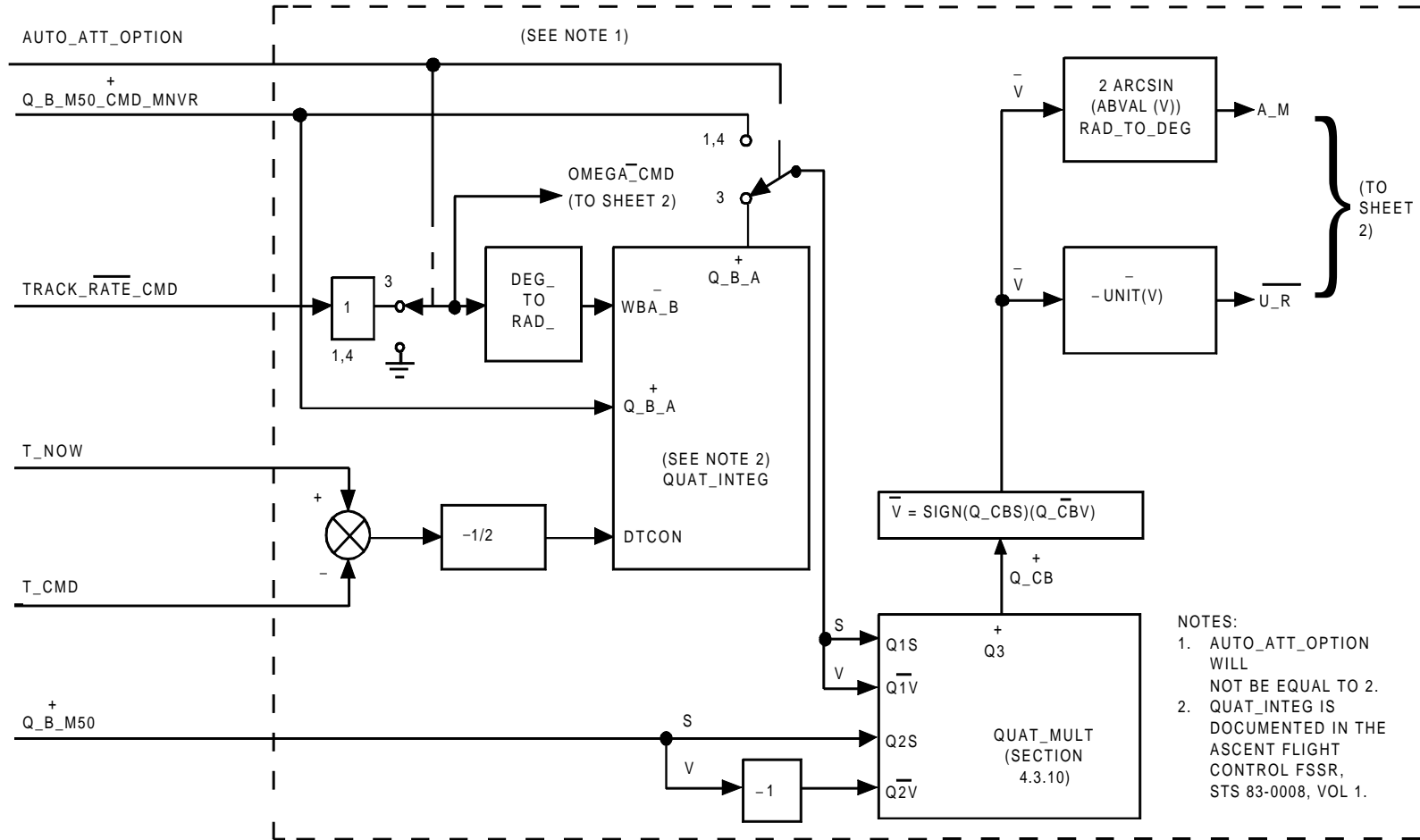


FIGURE 4.2.2.1.1-1(1) AUTO_MNVR_TRACK Block Diagram (Sheet 1 of 2)

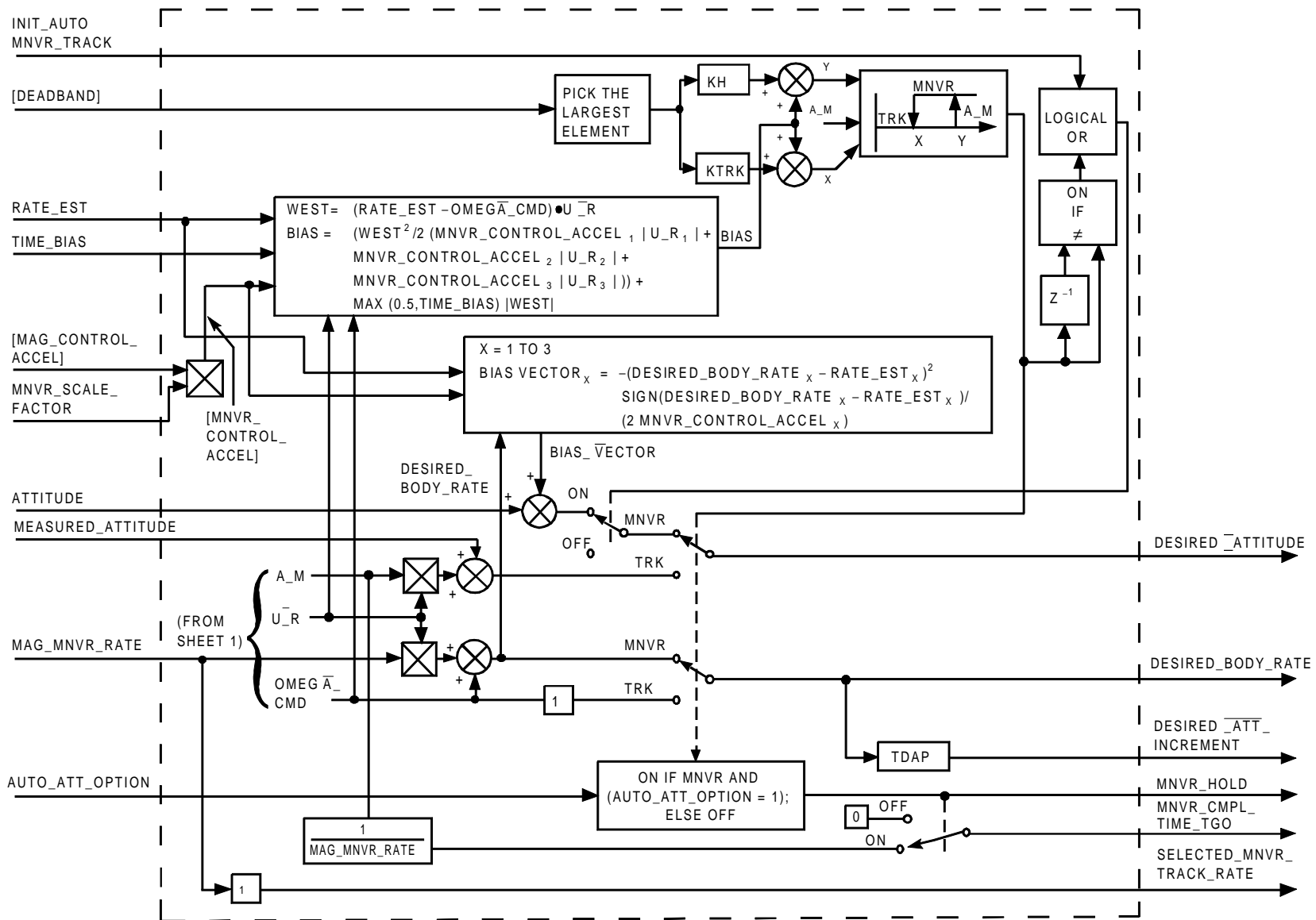


FIGURE 4.2.2.1.1-1.(2) AUTO_MNVR_TRACK Block Diagram (Sheet 2 of 2)

4.2.2.1.2 GUIDANCE_COMPENSATION

A. Function. This module provides gain, compensation filtering, and rate limiting for the guidance loop in pitch and yaw. The roll rate command is set to zero.

B. Block Diagram. The block diagram for GUIDANCE_COMPENSATION is shown in Figure 4.2.2.1.2-1.

C. Processing Rate. The module GUIDANCE_COMPENSATION is processed at 12.5 Hz.

D. Interface Requirements. The interface requirements for the module GUIDANCE_COMPENSATION are shown in Table 4.2.2.1.2-1.

E. K-Loads. The K-loads for the module GUIDANCE_COMPENSATION are shown in Table 4.2.2.1.2-2.

F. Initialization Requirements. The initialization requirements for the module GUIDANCE_COMPENSATION are shown in Table 4.2.2.1.2-3.

G. S-Plane Formulation. The S-plane formulation for the pitch and yaw rate command processing in GUIDANCE_COMPENSATION is

$$G(s) = \frac{(GCG_1 - GCG_2)}{(1 - GCG_3)} \left[\frac{1 + S\left(\frac{TDAP}{2}\right)\left(\frac{GCG_1 + GCG_2}{GCG_1 - GCG_2}\right)}{1 + S\left(\frac{TDAP}{2}\right)\left(\frac{1 + GCG_3}{1 - GCG_3}\right)} \right]$$

where

$$GCG_1 = \text{GUID_COMP_GAIN\$1}$$

$$GCG_2 = \text{GUID_COMP_GAIN\$2}$$

$$GCG_3 = \text{GUID_COMP_GAIN\$3}$$

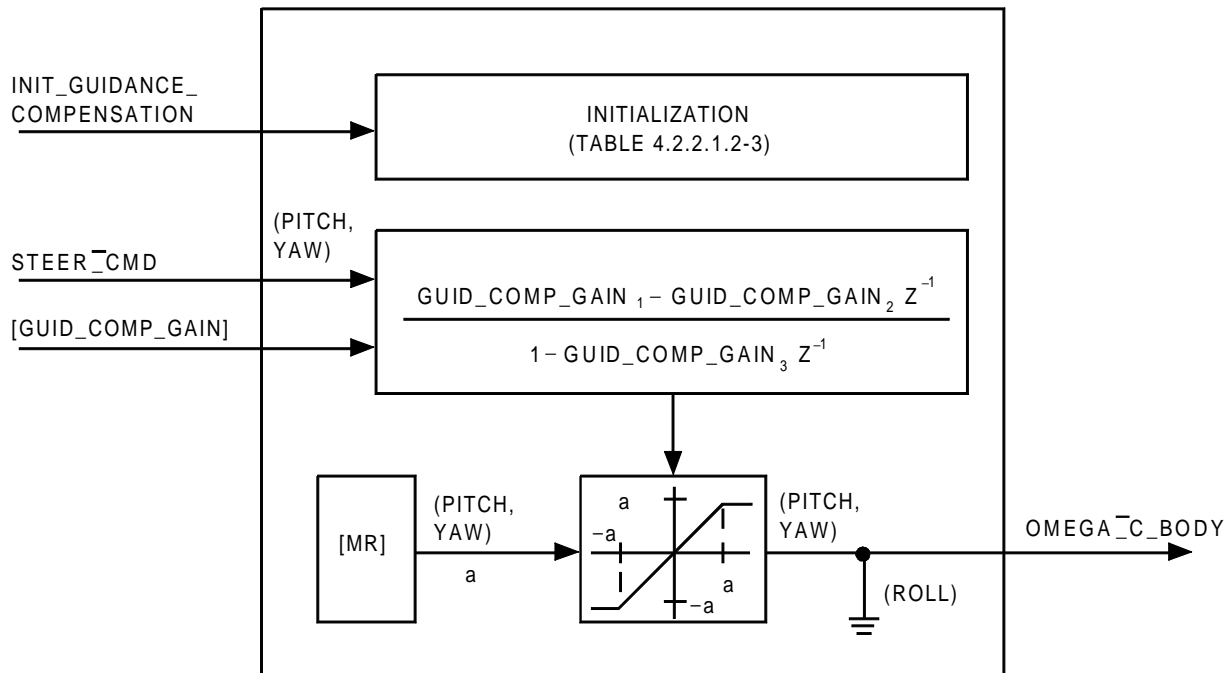


FIGURE 4.2.2.1.2-1. GUIDANCE_COMPENSATION

| Table 4.2.2.1.2-1. GUIDANCE_COMPENSATION Interface Requirements | | | | | | |
|---|---|---|-------|---------|------|------------------|
| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
| INPUTS | | | | | | |
| GUID_COMP_GAIN | TVC compensation gains | OFC_RECON | A(3)S | 0 to 5 | none | 12.5 |
| INIT_GUIDANCE_COMPENSATION | Module initialization flag (0=no init; 1=two-engine to one-engine transition init; 2=normal init) | OFC_RECON | I | 0, 1, 2 | none | 12.5 |
| STEER_CMD | Commanded body steering angle | OMS_STEERING | V(3)S | ±180 | deg | 12.5 |
| OUTPUTS | | | | | | |
| OMEGA_C_BODY | Commanded body angular rate | RCS_ASSIST Roll component: TVC_LAW_ROLL Pitch and yaw components: TVC_LAW_PITCH_YAW | V(3)S | -5 to 5 | deg | 12.5 |

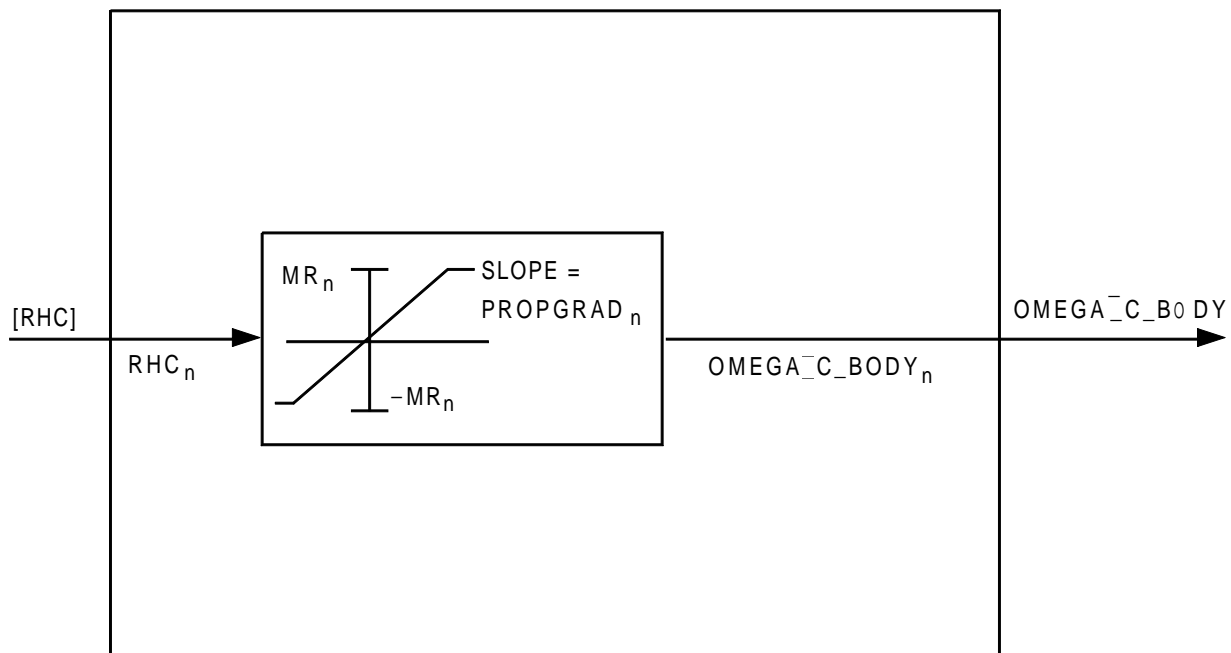
| Table 4.2.2.1.2-2. GUIDANCE_COMPENSATION K-Loads | | | | | |
|--|---|-------|-------------------------------------|-------------------|-------|
| Name | Description | Type | MSID | Value | Units |
| MR | Maximum angular rate command during OMS TVC | A(3)S | V97U2357C V97U2358C V97U2359C | 2.0 2.0 2.0 | deg/s |

| Table 4.2.2.1.2-3. GUIDANCE_COMPENSATION Initialization Requirements | | | |
|--|--------------------------------|---|---|
| Initialize on Transition From | Initialize on Transition To | Variable | Initial Value |
| INIT_GUIDANCE_COMPENSATION ≠ 1 | INIT_GUIDANCE_COMPENSATION = 1 | FILTER NODE | OMEGA_C_BODY \$ (2 to 3) GUID_COMP_GAIN\$3 -STEER_CMD \$ (2 to 3) GUID_COMP_GAIN\$2 |
| INIT_GUIDANCE_COMPENSATION ≠ 2 | INIT_GUIDANCE_COMPENSATION = 2 | STEER_CMD OMEGA_C_BODY, FILTER NODE | 0 OMEGA_C_BODY \$ (2 to 3) GUID_COMP_GAIN\$3 -STEER_CMD \$ (2 to 3) GUID_COMP_GAIN\$2 |

NOTE 1. Do not perform filter and limiter processing on the initialization pass.

4.2.2.1.3 MANUAL_TVC

- A. Function. This module provides commands to generate a three-axis vehicle angular rate during a TVC burn. The generated rate corresponds in sense and magnitude to the RHC deflection and is constrained to a limiting value.
- B. Block Diagram. The block diagram for MANUAL_TVC is shown in Figure 4.2.2.1.3-1.
- C. Processing Rate. The module MANUAL_TVC is processed at 12.5 Hz.
- D. Interface Requirements. The interface requirements for the module MANUAL_TVC are shown in Table 4.2.2.1.3-1.
- E. K-Loads. The K-loads for the module MANUAL_TVC are shown in Table 4.2.2.1.3-2.
- F. Initialization Requirements. None.



NOTE: ARRAY OR VECTOR SUBSCRIPT $_n$ SHOULD BE TAKEN AS INDICATING THAT THE PROCESSING SHOWN IS FOR ONE ELEMENT, AND ALL THREE ELEMENTS ARE PROCESSED.

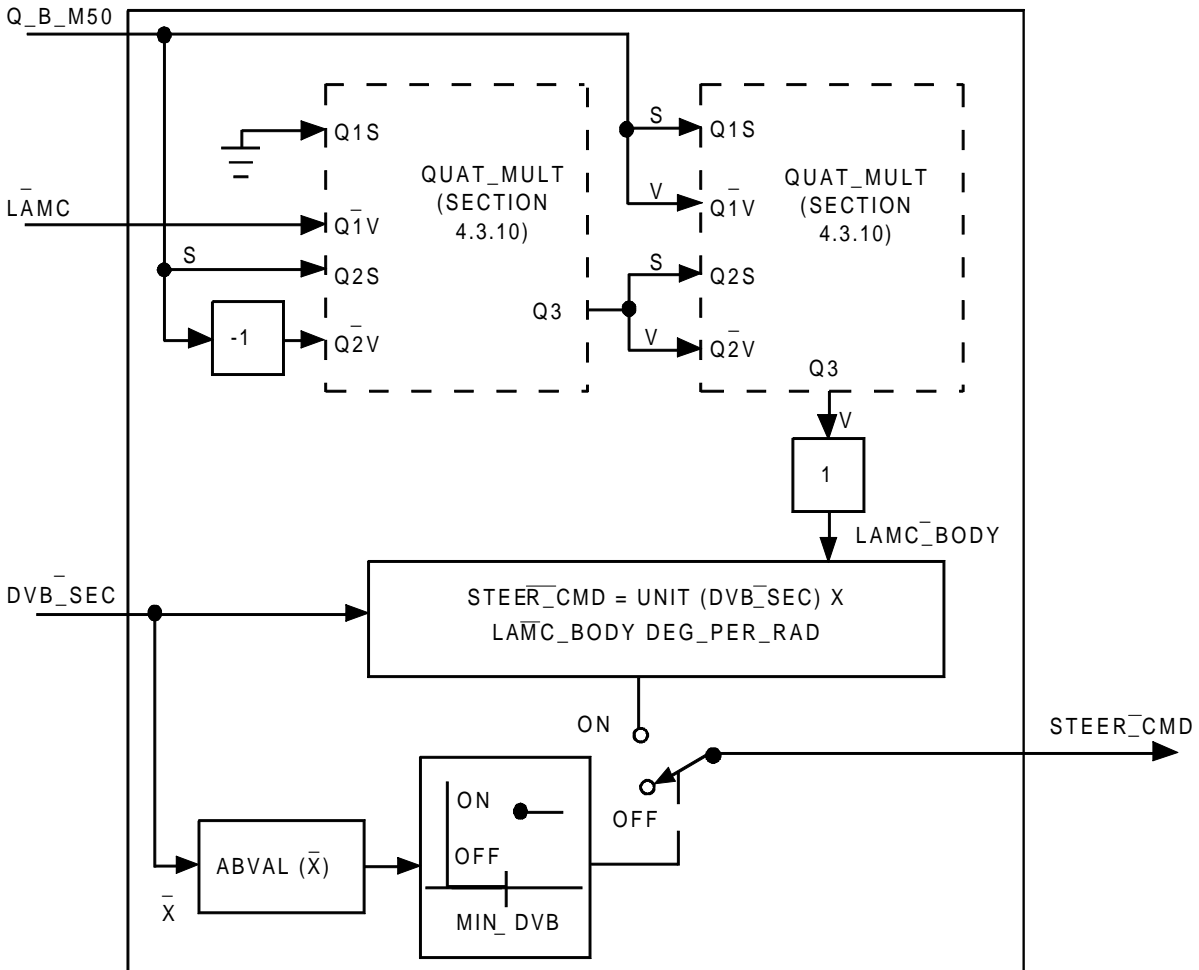
FIGURE 4.2.2.1.3-1. MANUAL_TVC

| Table 4.2.2.1.3-1. MANUAL_TVC Interface Requirements | | | | | | |
|--|---|---|-------|---|-------|------------------|
| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
| INPUTS | | | | | | |
| RHC | Rotational hand controller deflection | ORB 3-AX RHC SOP (4.199) | A(3)S | -20 to 20 (roll, pitch), -10 to 10 (yaw) | deg | 12.5 |
| OUTPUTS | | | | | | |
| OMEGA_C_BODY | Commanded vehicle angular rate in body axis | RCS_ASSIST: Roll component: TVC_LAW_ROLL; Pitch and yaw components: TVC_LAW_PITCH_YAW | V(3)S | -5 to 5 | deg/s | 12.5 |

| Table 4.2.2.1.3-2. MANUAL_TVC K-Loads | | | | | |
|---------------------------------------|---|-------|-------------------------------------|----------------------|-------------|
| Name | Description | Type | MSID | Value | Unit |
| PROPGRAD | Gain; commanded body rate divided by RHC deflection | A(3)S | V97U2374C V97U2375C V97U2376C | 0.1 0.1 0.1875 | (deg/s)/deg |
| MR | Maximum rate command during OMS TVC | A(3)S | V97U2357C V97U2358C V97U2359C | 2.0 2.0 2.0 | deg/s |

4.2.2.1.4 OMS_STEERING

- A. Function. This module commands a vehicle angular rate proportional to the vector cross product of the commanded thrust direction and the sensed vehicle velocity change. If the sensed velocity change falls below a threshold value, the module holds its output at the previous value.
- B. Block Diagram. The block diagram for OMS_STEERING is shown in Figure 4.2.2.1.4-1.
- C. Processing Rate. The module OMS_STEERING is processed at 1.04 Hz.
- D. Interface Requirements. The interface requirements for the module OMS_STEERING are shown in Table 4.2.2.1.4-1.
- E. K-Loads/Constants. The K-loads/constants for the module OMS_STEERING are shown in Table 4.2.2.1.4-2.
- F. Initialization Requirements. None.



NOTES:

1. X SYMBOLIZES VECTOR CROSS PRODUCT.
2. S AND V REPRESENT THE SCALAR AND VECTOR PARTS, RESPECTIVELY, OF THE INDICATED QUATERNION.

FIGURE 4.2.2.1.4-1. OMS_STEERING

| Table 4.2.2.1.4-1. OMS_STEERING Interface Requirements | | | | | | |
|--|---|---------------------------|---------------------|--------------------|------|------------------|
| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
| INPUTS | | | | | | |
| DVB_SEC | Vehicle velocity increment over the past 0.96 second | ORB ATT PROC (4.97) | V(3)S | -100 to 100 | ft/s | 1.04 |
| LAMC | Commanded vehicle thrust direction unit vector in reference (M50) coordinates | ON-ORB GUID (4.7) | V(3)S | -1 to 1 | none | 1.04 |
| Q_B_M50 | Vehicle attitude with respect to reference attitude given as the M50-to-body quaternion | ORB ATT PROC (4.97) | Struct: S; V(3)S | 0 to 1; -1 to 1 | none | 1.04 |
| OUTPUTS | | | | | | |
| STEER_CMD | Commanded vehicle steering angle in body axes | GUIDANCE_ COMPENSATION | V(3)S | | deg | 1.04 |

| Table 4.2.2.1.4-2. OMS_STEERING K-Loads/Constants | | | | |
|---|--|------|---------------|---------|
| Name | Description | Type | MSID/Value | Unit |
| MIN_DVB | Minimum magnitude of sensed delta-V for cross-product steering | S | V97U2784C/0.6 | ft/s |
| DEG_PER_RAD | Radians to degrees conversion factor | S | 180/PI | deg/rad |

4.2.2.1.5 LVLH_TRACK

A. Function. This module generates an attitude reference with respect to local vertical coordinates for use in the manual LVLH mode. The rotational PBI's are scanned when the module is processed to establish one of the three following submodes.

1. "All axes constrained" (all three axes in discrete rate)
2. "One free axis" (only one axis not in discrete rate)
3. "Multi-free axes" (more than one axis not in discrete rate)

When the LVLH mode is engaged with all axes constrained, the module uses the initial attitude with respect to local vertical coordinates as the reference and generates control signals to maintain that attitude in the local vertical system. If the hand controller is deflected, the module is continuously re-initialized until the hand controller is returned to detent. The vehicle attitude that exists on the next pass through the module then becomes the new attitude reference.

If only one axis is not in discrete rate ("one free axis"), the module establishes a plane fixed in the local vertical frame and initially normal to the free axis. It then generates the control signals required to maintain the constrained axes (those in discrete rate) in that plane. Hand controller inputs in the free axis can establish an arbitrary angular rate about that axis with the remaining axes constrained to remain in the plane originally fixed in the local vertical reference frame.

If two or more axes are not in discrete rate, the current attitude is established as the desired attitude.

If an LVLH tracking option is in effect when an OPS 2 → 8 or OPS 8 → 2 transition is executed, the last attitude reference established in the old OPS is maintained in the new OPS.

B. Block Diagram. The block diagram for LVLH_TRACK is shown in Figure 4.2.2.1.5-1.

C. Processing Rate. The module LVLH_TRACK is processed at 1.04 Hz.

D. Interface Requirements. The interface requirements for the module LVLH_TRACK are shown in Table 4.2.2.1.5-1. The variables ATTITUDE, MEASURED_ATTITUDE and DESIRED_ATTITUDE are double precision.

E. Constants. None.

F. Initialization Requirements. The initialization requirements for the module LVLH_TRACK are shown in Figure 4.2.2.1.5-1.

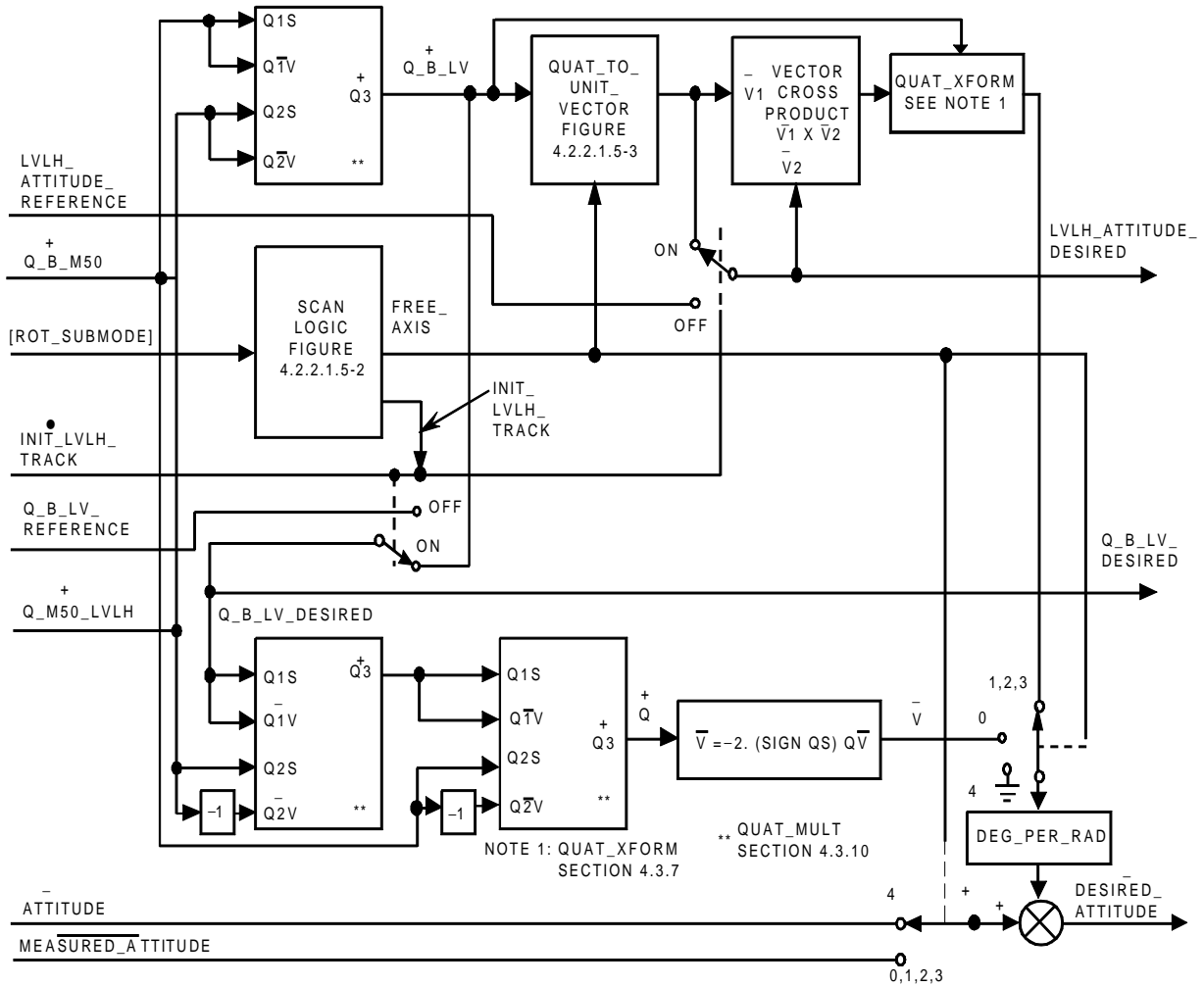


FIGURE 4.2.2.1.5-1. LVLH_TRACK Block Diagram

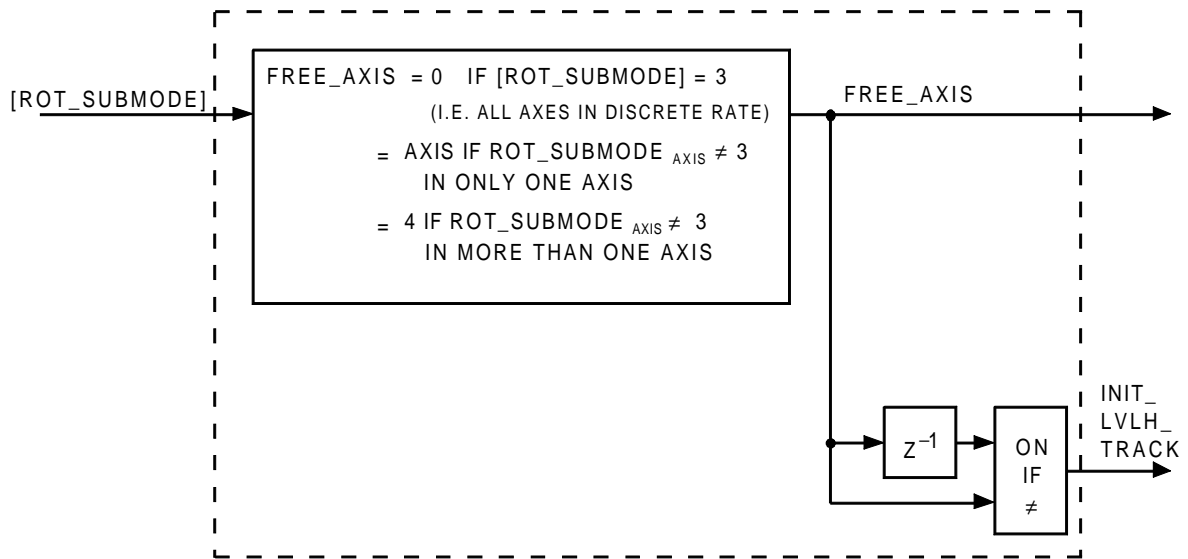


FIGURE 4.2.2.1.5-2. Scan Logic

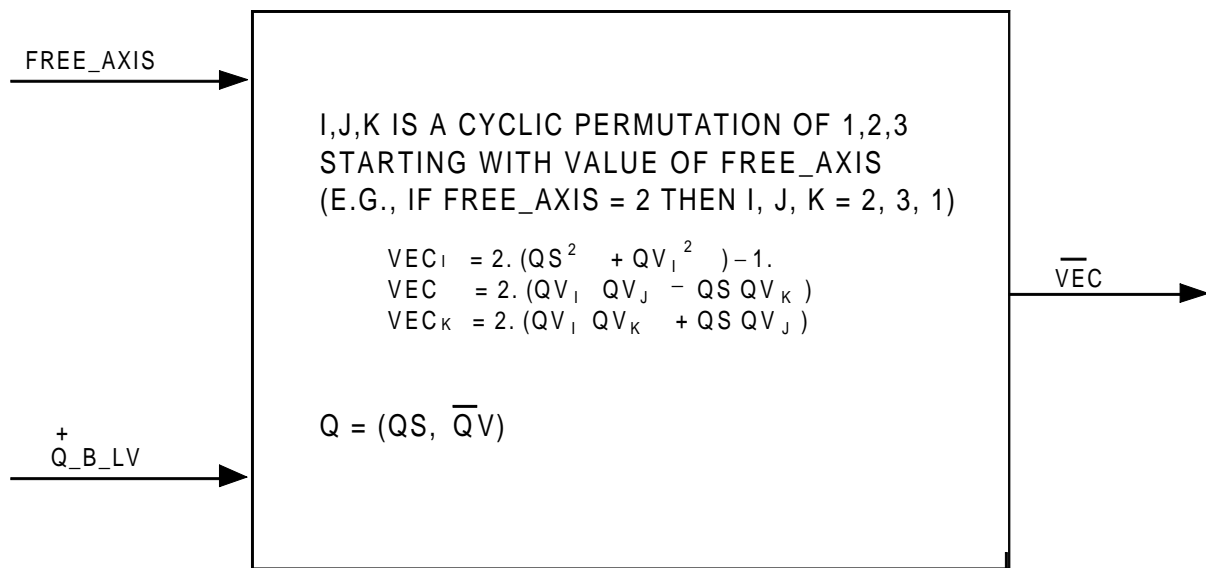


FIGURE 4.2.2.1.5-3. QUAT_TO_UNIT_VECTOR

Table 4.2.2.1.5-1. LVLH_TRACK Interface Requirements

| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
|-------------------------|--|----------------------------|------------------|--------------------|------|------------------|
| INPUTS | | | | | | |
| ATTITUDE | Body angles: summation of body attitude increments | PART1_FILTER, PART2_FILTER | A(3)S | | deg | 1.04 |
| INIT_LVLH_TRACK | Module initialization flag (1 = init) | OFC_RECON, ROT_DISC | B | 0,1 | none | 1.04 |
| LVLH_ATTITUDE_REFERENCE | Reference attitude of free axis with respect to the local vertical frame | OFC_RECON | V(3)S | | deg | 1.04 |
| MEASURED_ATTITUDE | Body angles: summation of body attitude increments (unfiltered) | PART1_FILTER | V(3)S | -360 to 360 | deg | 1.04 |
| Q_B_LV_REFERENCE | Reference vehicle attitude (quaternion) with respect to the local vertical frame | OFC_RECON | Struct: S; V(3)S | 0 to 1 -1 to 1 | none | 1.04 |
| Q_B_M50 | Vehicle attitude with respect to reference attitude, given as the M50-to-body quaternion | ORB ATT PROC (4.97) | Struct: S; V(3)S | 0 to 1; -1 to 1 | none | 1.04 |
| Q_M50_LVLH | LVLH_to_M50 quaternion | ORB ATT PROC (4.97) | Struct: S; V(3)S | 0 to 1; -1 to 1 | none | 1.04 |
| ROT_SUBMODE | RCS rotation submode (2 = pulse; 3 = discrete; 4 = accel, selected by RHC softstop downmoding) | OFC_RECON | A(3)I | 2,3,4 | none | 1.04 |
| OUTPUTS | | | | | | |
| DESIRED_ATTITUDE | Desired body angles | RCS_ERRORS | V(3)S | | deg | 1.04 |
| LVLH_ATTITUDE_DESIRED | Desired attitude of free axis with respect to the local vehicle frame | OFC_RECON | V(3)S | | deg | 1.04 |
| Q_B_LV_DESIRED | Desired vehicle attitude (quaternion) with respect to the local vehicle frame | OFC_RECON | Struct: S; V(3)S | 0 to 1 -1 to 1 | none | 1.04 |

4.2.2.1.6 RCS_ASSIST

- A. Function. This module transfers the vehicle angular rate command and derives the vehicle attitude increment command required for RCS assistance of OMS TVC.
- B. Block Diagram. The block diagram for RCS_ASSIST is shown in Figure 4.2.2.1.6-1.
- C. Processing Rates. The module RCS_ASSIST is processed at 12.5 Hz manual TVC; 25 Hz auto TVC.
- D. Interface Requirements. The interface requirements for the module RCS_ASSIST are shown in Table 4.2.2.1.6-1.
- E. Constants. The constants for the module RCS_ASSIST are shown in Table 4.2.2.1.6-2.
- F. Initialization Requirements. None.

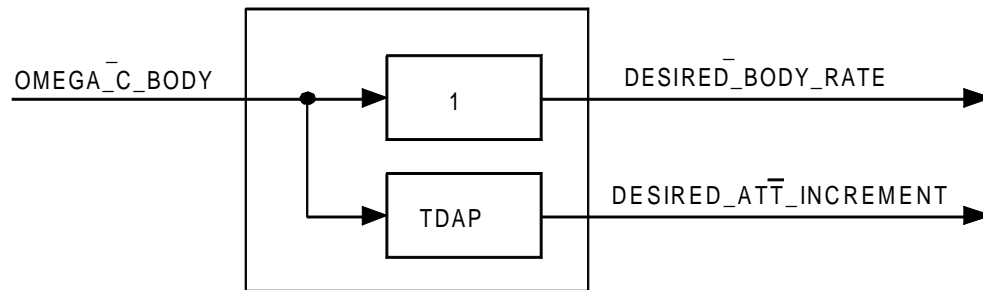


FIGURE 4.2.2.1.6-1. RCS_ASSIST

| Table 4.2.2.1.6-1. RCS_ASSIST Interface Requirements | | | | | | |
|--|---------------------------------|--------------------------------------|-------|---------|-------|------------------|
| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
| INPUTS | | | | | | |
| OMEGA_C_BODY | Commanded body angular rate | GUIDANCE_COMPENSATION, MANUAL_TVC | A(3)S | -5 to 5 | deg/s | 12.5 |
| OUTPUTS | | | | | | |
| DESIRED_ATT_INCREMENT | Desired body attitude increment | RCS_ERRORS | V(3)S | | deg | 12.5 |
| DESIRED_BODY_RATE | Desired body angular rate | RCS_ERRORS | V(3)S | -5 to 5 | deg/s | 12.5 |

| Table 4.2.2.1.6-2. RCS_ASSIST Constants | | | | |
|---|--------------------|------|-------|------|
| Name | Description | Type | Value | Unit |
| TDAP | Period of FC cycle | S | 0.08 | s |

4.2.2.1.7 RCS_ERRORS

A. Function. This module obtains the vehicle attitude and angular rate errors, based upon commands from various steering modules and measurement data from the state estimator. It also performs the incrementation required to interface commands from slower steering modules to the RCS processor rate of 12.5 Hz. Two input discretes enable RCS_ERRORS to change its operation to suit various requirements. The initialization flag sets the desired attitude equal to the present attitude, and the BYPASS flag zeros the attitude error output.

B. Block Diagram. The block diagram for RCS_ERRORS is shown in Figure 4.2.2.1.7-1.

C. Processing Rate. The module RCS_ERRORS is processed at 12.5 Hz.

D. Interface Requirements. The interface requirements for the module RCS_ERRORS are shown in Table 4.2.2.1.7-1. The variables ATTITUDE and DESIRED_ATTITUDE are double precision.

E. Constants. None.

F. Initialization Requirements. The initialization requirements for the module RCS_ERRORS are shown in Figure 4.2.2.1.7-1.

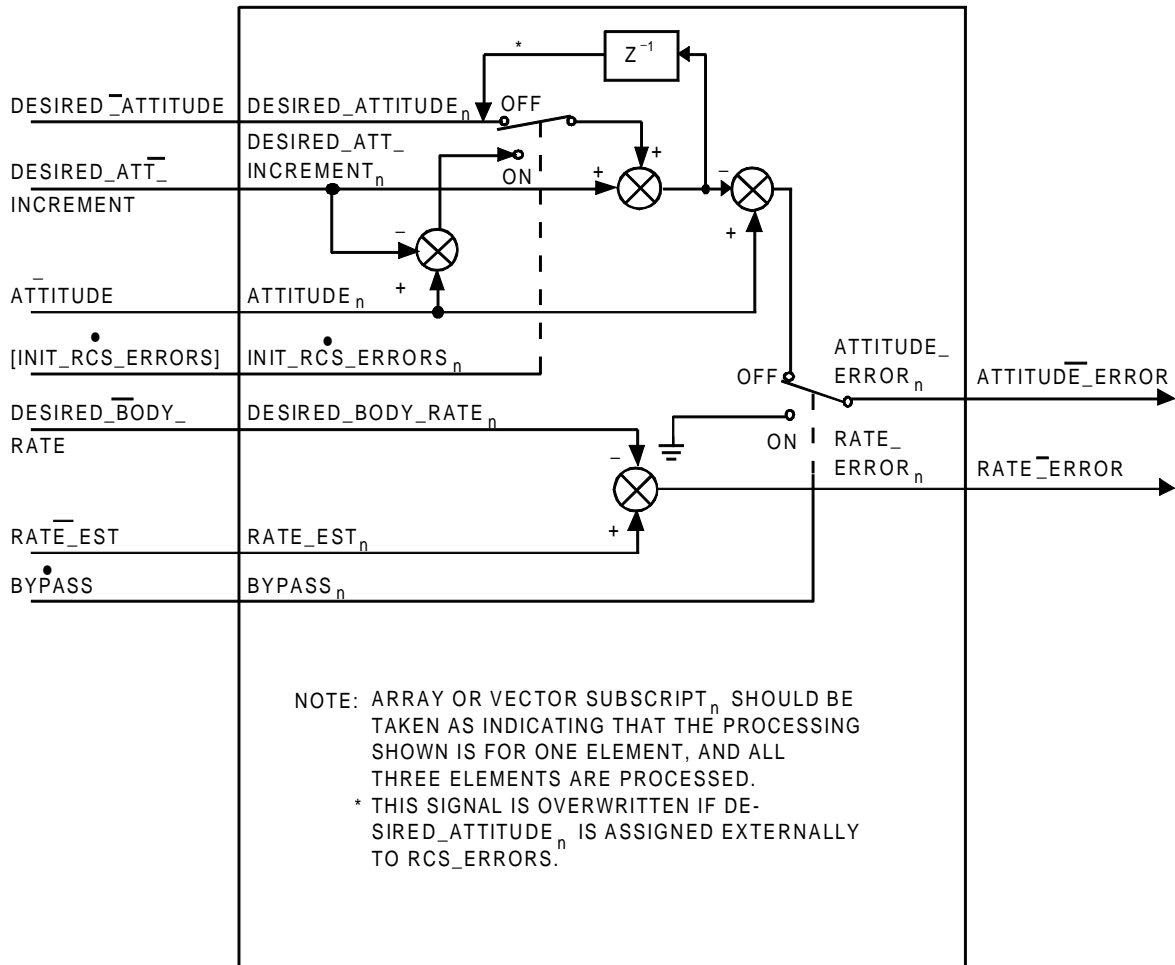


FIGURE 4.2.2.1.7-1. RCS_ERRORS

| Table 4.2.2.1.7-1. RCS_ERRORS Interface Requirements | | | | | | |
|--|---|--|-------|------------------|-------|------------------|
| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
| INPUTS | | | | | | |
| ATTITUDE | Body angle: Summation of body attitude increments | PART1_FILTER, PART2_FILTER | V(3)S | | deg | 12.5 |
| BYPASS | Non-execution command by axis (1 = do not execute; 0 = execute) | OFC_RECON | B(3) | 0,1 for each bit | none | 12.5 |
| DESIRED_ATT_INCREMENT | Desired body attitude increment | AUTO_MNVR_TRACK, RCS_ASSIST, ROT_DISC | V(3)S | | deg | 12.5 |
| DESIRED_ATTITUDE | Desired body angles | AUTO_MNVR_TRACK, LVLH_TRACK | V(3)S | | deg | 12.5 |
| DESIRED_BODY_RATE | Desired body angular rate | AUTO_MNVR_TRACK, RCS_ASSIST, ROT_DISC | V(3)S | -5 to 5 | deg/s | 12.5 |
| INIT_RCS_ERRORS | Module initialization flag | OFC_RECON, ROT_DISC | A(3)B | 0,1 | none | 12.5 |
| RATE_EST | Body angular rate estimate | PART1_FILTER, PART2_FILTER | V(3)S | | deg/s | 12.5 |
| OUTPUTS | | | | | | |
| ATTITUDE_ERROR | Body angle error | PHASE_PLANE, UNIV POINT PROC (4.213), ORB ADI PROC (4.169), TLM, OFC_RECON | V(3)S | | deg | 12.5 |
| RATE_ERROR | Body angular rate error | PHASE_PLANE, TLM | V(3)S | | deg/s | 12.5 |

4.2.2.1.8 ROT_ACCEL

A. Function. This module provides a command to generate a vehicle angular acceleration about an axis while the RHC exceeds the soft stop in that axis. When the RHC is within soft stop, orbiter coast is commanded. (OFC_RECON remodes to the previously existing rotational submode when the RHC returns to detent)

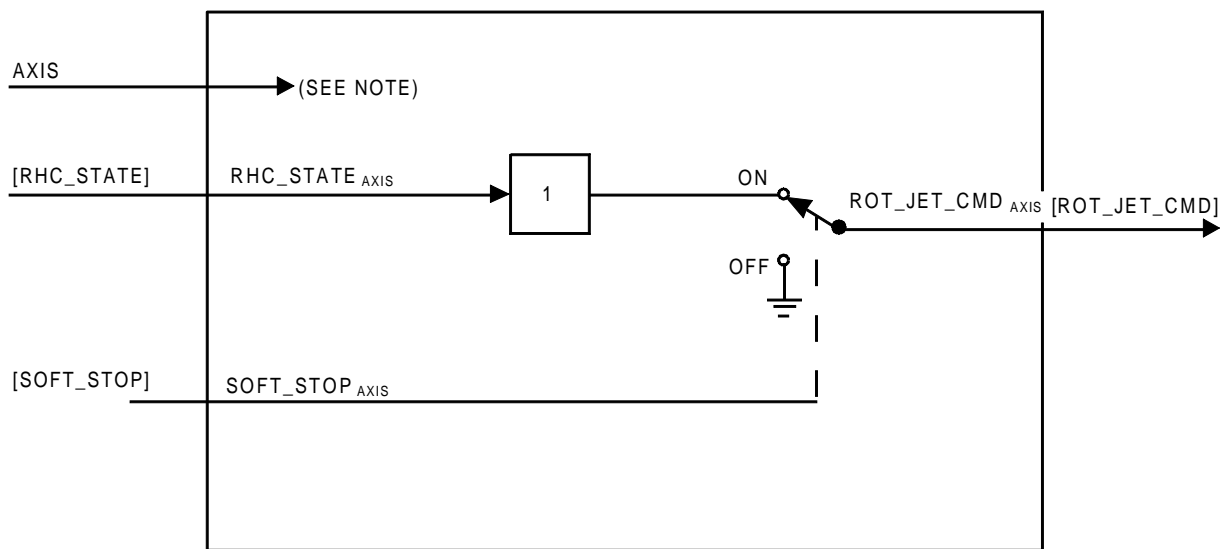
B. Block Diagram. The block diagram for ROT_ACCEL is shown in Figure 4.2.2.1.8-1.

C. Processing Rate. The module ROT_ACCEL is processed at 12.5 Hz/axis.

D. Interface Requirements. The interface requirements for the module ROT_ACCEL are shown in Table 4.2.2.1.8-1.

E. Constants. None.

F. Initialization Requirements. None.



NOTE:

1. ARRAY OR VECTOR SUBSCRIPT AXIS SHOULD BE TAKEN AS INDICATING THAT THE PROCESSING SHOWN IS FOR THAT ELEMENT SPECIFIED BY THE PRESENT VALUE OF AXIS.

FIGURE 4.2.2.1.8-1. ROT_ACCEL

| Table 4.2.2.1.8-1. ROT_ACCEL Interface Requirements | | | | | | |
|---|---|---|-------|----------|------|------------------|
| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
| INPUTS | | | | | | |
| AXIS | Body axis for this execution | OFC_RECON | I | 1,2,3 | none | 12.5/axis |
| RHC_STATE | Rotational hand controller command with sense of deflection | ORB 3-AX RHC SOP (4.199) | A(3)I | -1,0,1 | none | 12.5/axis |
| SOFT_STOP | Flag indicating rotational hand controller is deflected beyond soft stop (1=beyond soft stop) | ORB 3-AX RHC SOP (4.199) | A(3)B | 0,1 | none | 12.5/axis |
| OUTPUTS | | | | | | |
| ROT_JET_CMD | Rotation command | JET_SELECT, TVC_LAW_PITCH_YAW, TVC_LAW_ROLL, OFC_RECON | A(3)S | -1 to +1 | none | 12.5/axis |

4.2.2.1.9 ROT_DISC

- A. Function. For each vehicle axis that is in the manual discrete rate rotation submode, this module provides commands to generate a predetermined vehicle angular rate about that axis while the RHC is out of detent in that axis. The sense of the angular rate corresponds to the sense of the RHC deflection. When the RHC is in detent, an attitude hold is performed in the affected axis. Rate damping is commanded via the FORCE_FIRE flag to achieve vehicle angular acceleration and deceleration.
- B. Block Diagram. The block diagram for ROT_DISC is shown in Figure 4.2.2.1.9-1.
- C. Processing Rate. The module ROT_DISC is processed at 12.5 Hz/axis.
- D. Interface Requirements. The interface requirements for the module ROT_DISC are shown in Table 4.2.2.1.9-1.
- E. Constants. The constants for the module ROT_DISC are shown in Table 4.2.2.1.9-2.
- F. Initialization Requirements. The initialization requirements for the module ROT_DISC are shown in Figure 4.2.2.1.9-1.

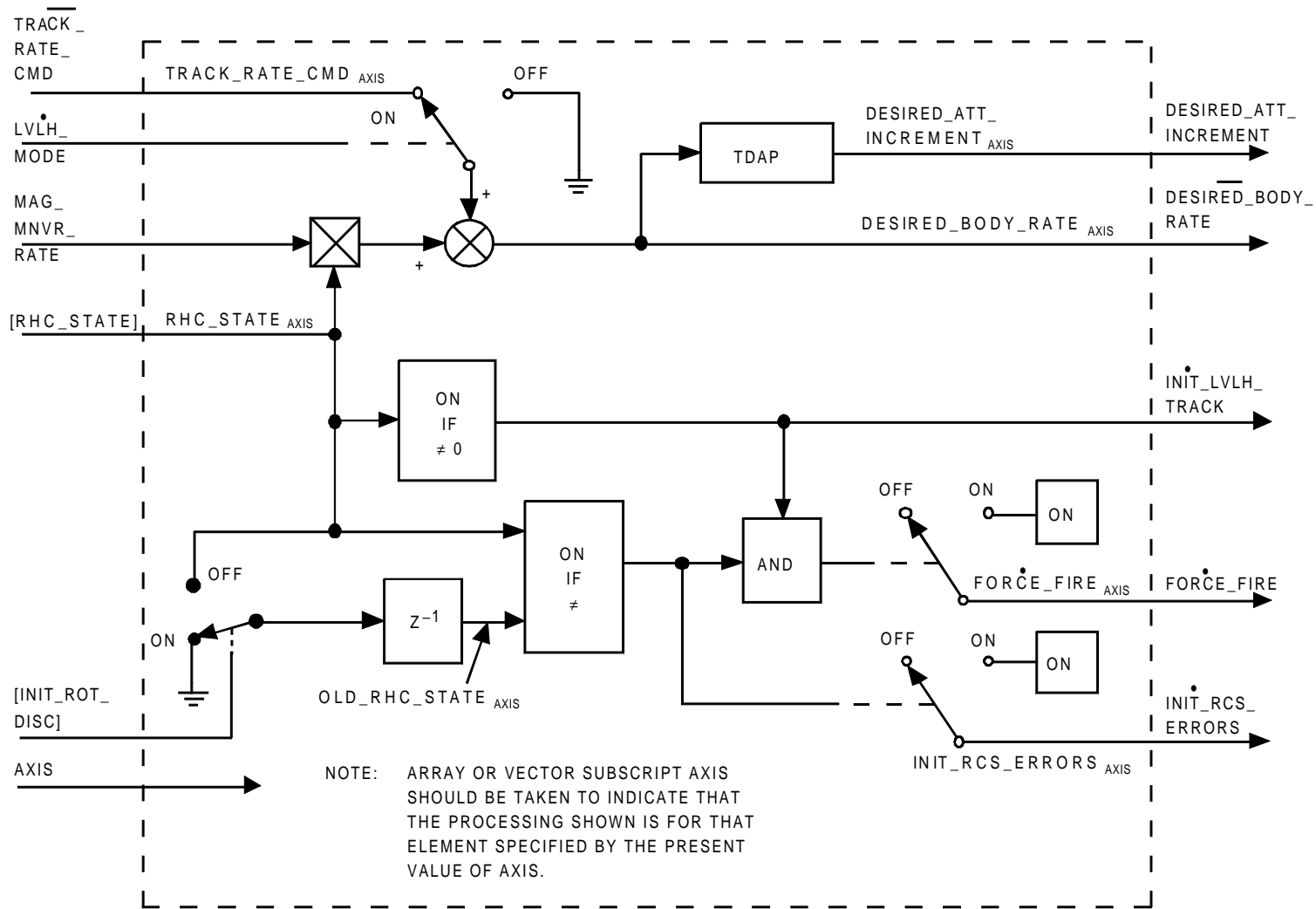


FIGURE 4.2.2.1.9-1. ROT_DISC

| Table 4.2.2.1.9-1. ROT_DISC Interface Requirements | | | | | | |
|--|---|--------------------------|-------|------------------|-------|------------------|
| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
| INPUTS | | | | | | |
| AXIS | Body axis for this execution | OFC_RECON | I | 1 to 3 | none | 12.5/axis |
| LVLH_MODE | LVLH mode indicator (1=LVLH) | OFC_RECON | B | 0,1 | none | 12.5/axis |
| MAG_MNVR_RATE | Magnitude of discrete maneuver rate about body axes | DAPLOAD_SELECT | S | ≥ 0 | deg/s | 12.5/axis |
| RHC_STATE | Rotational hand controller command with sense of deflection | ORB 3-AX RHC SOP (4.199) | A(3)I | -1,0,1 | none | 12.5/axis |
| TRACK_RATE_CMD | Orbital rate in body axes | UNIV POINT PROC (4.213) | V(3)S | -9.9 to 9.9 | deg/s | 12.5/axis |
| INIT_ROT_DISC | Initialization flag (1=init) | OFC_RECON | A(3)B | 0,1 | none | 12.5/axis |
| OUTPUTS | | | | | | |
| DESIRED_ATT_INCREMENT | Desired body attitude increment | RCS_ERRORS | V(3)S | | deg | 12.5/axis |
| DESIRED_BODY_RATE | Desired body angular rate | RCS_ERRORS | V(3)S | | deg/s | 12.5/axis |
| FORCE_FIRE | Rate damping flag | PHASE_PLANE | B(3) | 0,1 for each bit | none | 12.5/axis |
| INIT_LVLH_TRACK | Module initialization flag (1=init) | LVLH_TRACK | B | 0,1 | none | 12.5/axis |
| INIT_RCS_ERRORS | Module initialization flag (1=init) | RCS_ERRORS | A(3)B | 0,1 | none | 12.5/axis |

| Table 4.2.2.1.9-2. ROT_DISC Constants | | | | |
|---------------------------------------|-------------------------|------|-------|-------|
| Name | Description | Type | Value | Units |
| TDAP | Period of RCS DAP cycle | S | 0.08 | s |

4.2.2.1.10 ROT_PULSE

- A. Function. For each vehicle axis that is in the manual pulse rotation submode, this module provides a command to generate a predetermined vehicle angular rate increment about that axis for each time the RHC is moved out of detent in that axis. The sense of the angular rate increment corresponds to the sense of the RHC deflection. When the sum of all commanded rate increments about a given axis has been attained, vehicle rotation about that axis is free, regardless of whether the RHC is in detent or out of detent in that axis. The module operates open-loop by determining how many passes the RCS jets must fire to implement each commanded rate increment and maintaining a jet command of the correct sign for the total number of passes needed.
- B. Block Diagram. The block diagram for ROT_PULSE is shown in Figure 4.2.2.1.10-1.
- C. Processing Rate. The module ROT_PULSE is processed at 12.5 Hz/axis.
- D. Interface Requirements. The interface requirements for the module ROT_PULSE are shown in Table 4.2.2.1.10-1.
- E. Constants. The constants for the module ROT_PULSE are shown in Table 4.2.2.1.10-2.
- F. Initialization Requirements. The initialization requirements for the module ROT_PULSE are shown in Table 4.2.2.1.10-3.

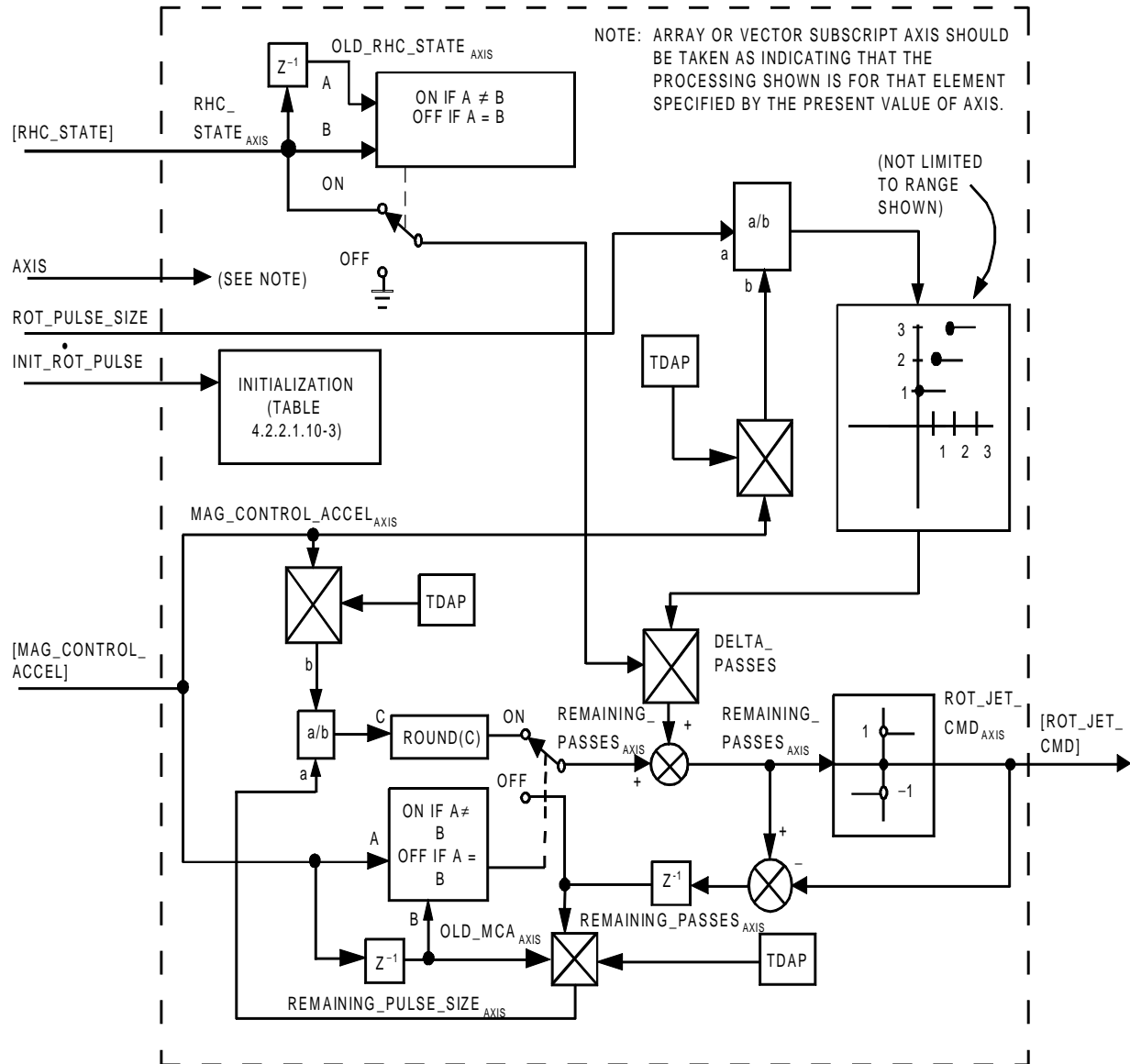


FIGURE 4.2.2.1.10-1. ROT_PULSE

| Table 4.2.2.1.10-1. ROT_PULSE Interface Requirements | | | | | | |
|--|---|--------------------------|-------|----------|--------------------|------------------|
| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
| INPUTS | | | | | | |
| AXIS | Body axis for this execution | OFC_RECON | I | 1,2,3 | none | 12.5/axis |
| INIT_ROT_PULSE | Module initialization flag | OFC_RECON | B | 0, 1 | none | 12.5/axis |
| MAG_CONTROL_ACCEL | Magnitude of average control acceleration available for each axis | DAPLOAD_SELECT | A(3)S | > 0 | deg/s ² | 12.5/axis |
| RHC_STATE | Rotational hand controller command with sense of deflection | ORB 3-AX RHC SOP (4.199) | A(3)I | -1,0,1 | none | 12.5/axis |
| ROT_PULSE_SIZE | Magnitude of desired body angular rate changed per deflection of rotational hand controller | DAPLOAD_SELECT | S | ≥ 0 | deg/s | 12.5/axis |
| OUTPUTS | | | | | | |
| ROT_JET_CMD | RCS rotation command | JET_SELECT, OFC_RECON | A(3)S | -1 to +1 | none | 12.5/axis |

| Table 4.2.2.1.10-2. ROT_PULSE Constants | | | | |
|---|--------------------|------|-------|-------|
| Name | Description | Type | Value | Units |
| TDAP | Period of FC cycle | S | 0.08 | s |

| Table 4.2.2.1.10-3. ROT_PULSE Initialization Requirements | | | |
|---|-----------------------------|---|-------------------------------------|
| Initialization on Transition From | Initialize on Transition To | Variable | Initial Value |
| INIT_ROT_PULSE = OFF | INIT_ROT_PULSE = ON | OLD_RHC_STATES\$(AXIS) REMAINING_PASSES\$(AXIS) OLD_MCA\$(AXIS) | 0 0 MAG_CONTROL_ACCEL\$(AXIS) |

4.2.2.1.11 TRANS_ACCEL

A. Function. For each vehicle axis that is in the manual acceleration translation mode, this module provides a command to generate a vehicle translational acceleration along that axis while the THC is out of detent in that axis. The sense of the translational acceleration corresponds to the sense of the THC deflection. When the THC is in detent, the command for the affected axis is zeroed.

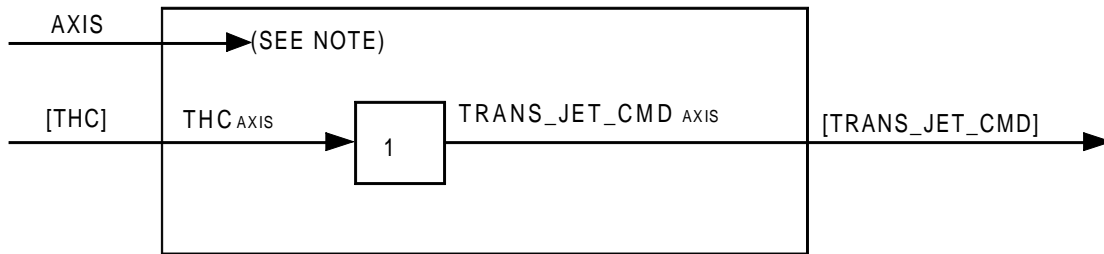
B. Block Diagram. The block diagram for TRANS_ACCEL is shown in Figure 4.2.2.1.11-1.

C. Processing Rate. The module TRANS_ACCEL is processed at 12.5 Hz/axis.

D. Interface Requirements. The interface requirements for the module TRANS_ACCEL are shown in Table 4.2.2.1.11-1.

E. Constants. None.

F. Initialization Requirements. None.



NOTE: ARRAY OF VECTOR SUBSCRIPT AXIS SHOULD BE TAKEN TO INDICATE THAT THE PROCESSING SHOWN IS FOR THAT ELEMENT SPECIFIED BY THE PRESENT VALUE OF AXIS.

FIGURE 4.2.2.1.11-1. TRANS_ACCEL

| Table 4.2.2.1.11-1. TRANS_ACCEL Interface Requirements | | | | | | |
|--|-------------------------------------|-----------------------|-------|--------|------|------------------|
| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
| INPUTS | | | | | | |
| AXIS | Body axis for this execution | OFC_RECON | I | 1,2,3 | none | 12.5/axis |
| THC | Translation hand controller command | THC SOP (4.54) | A(3)I | -1,0,1 | none | 12.5/axis |
| OUTPUTS | | | | | | |
| TRANS_JET_CMD | Translation command | JET_SELECT | A(3)I | -1,0,1 | none | 12.5/axis |

4.2.2.1.12 TRANS_PULSE

- A. Function. For each vehicle axis that is in the manual pulse translational mode, this module provides a command to generate a predetermined vehicle translational velocity increment along that axis for each time the THC is moved out of detent in that axis. The sense of the translational velocity increment corresponds to the sense of the THC deflection. When the sum of all commanded velocity increments along a given axis has been attained, the command for that axis is zeroed, regardless of whether the THC is in detent or out of detent in that axis. The module operates open-loop by determining how many passes the RCS jets must fire to implement each commanded velocity increment and by maintaining a jet command of the correct sign for the total number of passes needed. Each time the module is initialized in a given axis, the number of passes required to implement a unit velocity increment is recomputed, based on the available control force in that axis (a constant) and the updated vehicle mass.
- B. Block Diagram. The block diagram for TRANS_PULSE is shown in Figure 4.2.2.1.12-1.
- C. Processing Rate. The module TRANS_PULSE is processed at 12.5 Hz/axis.
- D. Interface Requirements. The interface requirements for the module TRANS_PULSE are shown in Table 4.2.2.1.12-1.
- E. I-Loads/Constants. The I-loads/constants for the module TRANS_PULSE are shown in Table 4.2.2.1.12-2.
- F. Initialization Requirements. The initialization requirements for the module TRANS_PULSE are shown in Table 4.2.2.1.12-3.

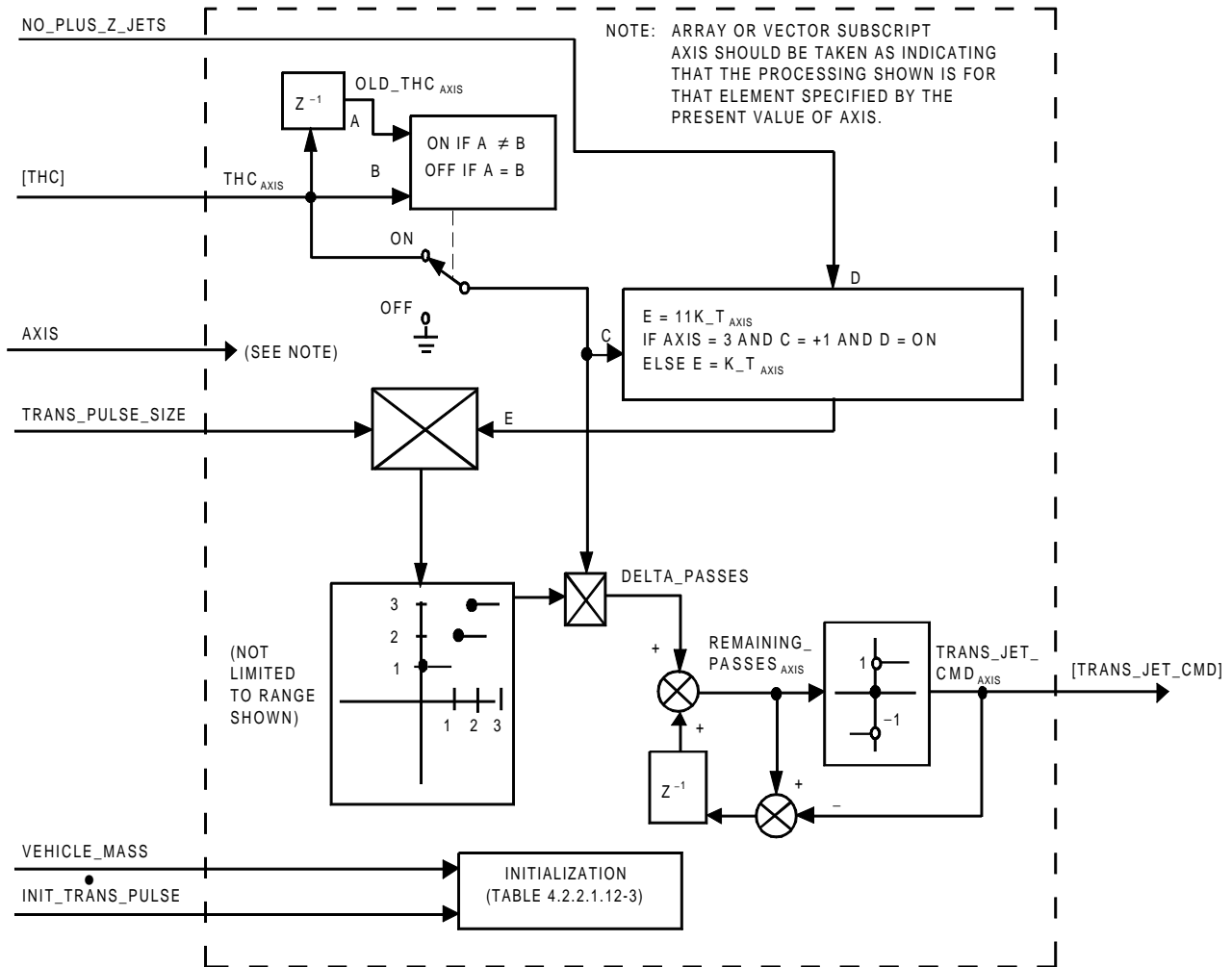


FIGURE 4.2.2.1.12-1. TRANS_PULSE

| Table 4.2.2.1.12-1. TRANS_PULSE Interface Requirements | | | | | | |
|--|--|------------------------------|-------|--------|------|------------------|
| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
| INPUTS | | | | | | |
| AXIS | Body axis for this execution | OFC_RECON | I | 1,2,3 | none | 12.5/axis |
| INIT_TRANS_PULSE | Module initialization flag | OFC_RECON | B | 0, 1 | none | 12.5/axis |
| NO_PLUS_Z_JETS | Flag to inhibit use of plus Z jets (1 = INHIBIT) | UNPACK_SW | B | 0, 1 | none | 12.5/axis |
| THC | Translational hand controller command | THC SOP (4.54) | A(3)I | -1,0,1 | none | 12.5/axis |
| TRANS_PULSE_SIZE | Magnitude of desired velocity change per deflection of translational hand controller | DAPLOAD_SELECT | S | ≥ 0.01 | ft/s | 12.5/axis |
| VEHICLE_MASS | Vehicle mass | I-load; ORB MNVR DIP (4.158) | S | > 0 | slug | 12.5/axis |
| OUTPUTS | | | | | | |
| TRANS_JET_CMD | Translational command | JET_SELECT | A(3)I | -1,0,1 | none | 12.5/axis |

| Table 4.2.2.1.12-2. TRANS_PULSE I-Loads/Constants | | | | |
|---|--|-------|-------------------------------------|-------|
| Name | Description | Type | MSID/Value | Units |
| MAG_CONTROL_FORCE | Magnitude of available RCS jet forces, by axis | A(3)S | V97U2957C V97U2958C V97U2959C | lb |
| TDAP | Period of FC cycle | S | 0.08 | s |

| Table 4.2.2.1.12-3. TRANS_PULSE Initialization Requirements | | | |
|---|-----------------------------|--------------------------|--|
| Initialization on Transition From | Initialize on Transition To | Variable | Initial Value |
| INIT_TRANS_PULSE = OFF | INIT_TRANS_PULSE = ON | OLD_THC\$(AXIS) | 0 |
| | | REMAINING_PASSES\$(AXIS) | 0 |
| | | K_T\$(AXIS) | VEHICLE_MASS/ [MAG_CONTROL_FORCE\$(AXIS)TDAP] |

4.2.2.2 RCS Processor

4.2.2.2.1 JET_SELECT

A. Function. This module generates jet firing commands required to implement commanded translations and rotations and to apply post contact thrusting when DOCKING_ACTIVE is ON. It also predicts the resulting angular rate increments and sets the JETS_ON flag for use by the Navigation function indicating the jets have been commanded ON by the DAP. This flag will be reset by the Navigation function when used. JET_SELECT contains logic enabling external selection of either the primary or vernier jets and defaulting to a free drift mode (all jets off) in case of any vernier jet failure while vernier jets are selected. The primary jet logic enables external selection of high or nominal acceleration levels in +Z translation and nominal or low acceleration for pitch and yaw rotation independently. The primary jet logic takes jet failures into account and allows external selection of forward or aft jets to effect low-level rotation acceleration in pitch and yaw independently. This last option is to permit forward/aft RCS fuel use balancing. Logic is provided to allow variation of primary jet preferences via mission-dependent I-loads and/or crew action to equalize jet utilization. Logic is also provided to accommodate a low +Z option (+Z translation using +/-X jets) to prevent payload contamination by jet plumes. Primary jet selection is according to a table lookup scheme, described in this subsection under paragraph G, "Primary RCS Table Lookup." The vernier/alt jet logic is used to select from among either the vernier jets (vernier mode selected) or a subset of the primary jets (alternate mode selected) for rotation control only. It selects 1, 2, or 3 jets whose angular rate change either maximizes the dot product with rotational jet command or minimizes the angular error between the jets angular rate change and the rotational jet command. The selection criteria is chosen by OFC_RECON based on an I-load, MIN_ANGLE_JET_SEL_VALUE. The alternate primary jet mode allows the primary jets to be used for payload extended operations. When this mode is active, the jet selection is performed among either 11 jets (nominal), 8 jets (low +Z option), or 6 jets (tail only). When alternate primary jet mode is active, +/- Xjets may be included to supplement the 11 rotational jet groups. In this case, jet selection is performed among either 14 jets (nominal and +/- Xjets), 11 jets (low + Z option and +/- Xjets), or 8 jets (tail only and + Xjets). Logic is provided to restrict the maximum on-time of the primary jet firing and to enforce a fixed time delay between firings. Logic is also provided to limit the maximum number of simultaneous jet firings to 1, 2, or 3 jets. Jets are selected to perform automatic translation when a reboost is enabled and no rotation is being commanded.

B. Block Diagram. The block diagrams for JET_SELECT are shown in Figures 4.2.2.2.1-1 through 4.2.2.2.1-20 and in Tables 4.2.2.2.1-1 through 4.2.2.2.1-4 (refer to paragraph G).

C. Processing Rate. The module JET_SELECT is processed at 12.5 Hz.

D. Interface Requirements. The interface requirements for the module JET_SELECT are shown in Table 4.2.2.2.1-5.

E. I-Loads/Constants. The I-loads/constants for the module JET_SELECT are shown in Table 4.2.2.2.1-6.

F. Initialization Requirements. None.

G. General Description.

JET_SELECT (Figure 4.2.2.2.1-1)

JET_SELECT is divided into six subroutines:

1. PRIMARY_JETS (Figure 4.2.2.2.1–3) selects jets from the 38 large RCS thrusters.
2. VERNIER_ALT_JETS (Figure 4.2.2.2.1–16) selects jets from the six small RCS thrusters, or from 6, 8, 11 or 14 large RCS thrusters.
3. Failure reconfiguration (Figure 4.2.2.2.1–20) sets a series of Booleans whose values determine the failure status of various jet clusters.
4. Rotation compensation (Figure 4.2.2.2.1–13) provides open loop compensation in the three rotation axes for either primary jets or vernier jets to help overcome undesired cross-axis acceleration, using a single threshold level for all three axes. Compensation is inhibited for any axis that is under closed-loop (phase plane) attitude control (Figure 4.2.2.2.1–14).
5. POST_CONTACT_THRUSTING_JET_SELECT (Figure 4.2.2.2-1A) selects jets corresponding to the group commands from the Post Contact Thrusting module when activated for docking.
6. REBOOST (Figure 4.2.2.2.1-12) provides the capability to perform a closed-loop reboost per a defined pattern of firings..

PRIMARY_JETS (Figure 4.2.2.2.1–3)

PRIMARY_JETS consists of table lookup and default logic. The table lookup and default logic first determines how to reconfigure JET_SELECT inputs to provide adequate vehicle response and then selects appropriate jets.

Binary Command Generator (Figure 4.2.2.2.1–5)

The binary command generator converts externally generated rotation and translation commands to a form usable by JET_SELECT. Outputs are 12 binary bits, two for each translation and rotation axis. Each odd bit represents the sign of the command (ON = negative, OFF = positive), while the even bit represents the presence of a command (ON = response required, OFF = no response required). The order of the array is X, Y, Z, roll, pitch, yaw.

Single Axis Translation Logic (Figure 4.2.2.2.1–6)

The single axis translation logic prevents X jets from being commanded if X and high +Z translations are commanded simultaneously. The purpose is to prevent exceeding the aft tank constraint limit of four jets. If both the X and high +Z translation commands are generated, high +Z axis has priority over X axis.

Pitch Rate Default Logic (Figure 4.2.2.2.1–7)

Pitch defaults are intended to adjust the externally commanded acceleration rates and nose–tail options of pitch to guarantee direction and magnitude of desired pitch.

1. Rate Default

If a nominal pitch rate is specified, it is ignored if a + pitch command is present and two forward manifolds for the primary jets have failed on the same side of the vehicle (left or right). If low–level pitch is commanded and NO_PLUS_Z_JETS=ON, then the nominal pitch rate is set in default.

2. Low-Level Nose Option Default

The nose pitch option will be retained only if no Z translation and no roll rotation are desired due to lack of command or default, and two manifolds for the primary jets have not been failed on the same side of the vehicle (left or right).

3. Low-Level Tail Option Default

The tail pitch option will be used whenever low pitch is specified and nose pitch is bypassed.

Z Translation Rate Default Logic (Figure 4.2.2.2.1-8)

Z translation default is intended to guarantee attitude control and/or Z translation. If yaw is required along with -Z translation in the event that two forward -Z translation jets are failed on the same side (left or right), then Z translation is bypassed to ensure adequate yaw control from aft jets. Also, if +Z translation is commanded and the low +Z option is selected via PBI (NO_PLUS_Z_JETS=ON) then Z translation is transferred to +/-X jets.

Yaw Rate Default Logic (Figure 4.2.2.2.1-9)

Yaw defaults are intended to adjust the externally commanded acceleration rates and nose/tail options of yaw to guarantee direction and magnitude of desired yaw.

1. Rate Default

If a low yaw rate is specified, it is ignored if forward -Z jets are being used when two forward -Z jets on one side (left or right) are failed.

2. Low-Level Nose Option Default

The nose option is ignored if forward yaw control is lost due to failures of jets.

3. Low-Level Tail Option Default

The tail option is used when specified or when the nose option is bypassed.

Y Translation Default Logic (Figure 4.2.2.2.1-10)

Y translation defaults are intended to ignore a Y translation command if translation will interfere with yaw control. This can happen with loss of two forward Y jets on one side and/or two forward -Z jets on one side (left or right).

X Translation Default Logic (Figure 4.2.2.2.1-11)

A -X translation rate reduction default is included to meet tank constraints. The -X translation acceleration rate is reduced if more than three forward jets are already required for other commands. This is required to meet the constraint of a maximum of five jets firing simultaneously in the RCS forward cluster.

REBOOST (Figure 4.2.2.2.1-12)

When a reboost is enabled, this module performs an automatic reboost by commanding an I-load defined pattern of jet firings when the DAP is not otherwise commanding rotation. If a rotation is commanded, the

reboost translation firings will be suspended until the rotational requirement is satisfied upon which the reboost will automatically resume. Up to four different reboost firing pattern configurations can be defined pre-flight through I-loads. Each configuration specifies which jet groups to fire, the number of jets to fire within the group, the interval start times, and duration of each jet group firing. The reboost logic also enforces delays between firing intervals and transitions from rotation-to-translation and translation-to-rotation. The configuration and the nominal interval between firings are selected via the DAP CONFIG display. Up to ten varying intervals between firings can be specified as a function of the nominal interval. REBOOST also controls the termination of a reboost by resetting the reboost enable flag after transitioning to rotation control when a cancel request is made. A cancel request can originate externally from the Univ Ptg display or internally on completion of the reboost or if an abort condition is encountered where there are not enough jets available to support the required reboost.

Reboost is broken up into three subfunctions. The Reboost Rotation/Translation Switching Logic sets the appropriate flags for selection of rotation or translation jets. The Reboost Accel Calc estimates the disturbance acceleration imposed by the reboost jet firings. Finally, Reboost Translation makes the required translational jet selections and calculates the associated delta omegas. Reboost takes care of calling the subfunctions and keeps track of the time remaining in the reboost.

REBOOST ROTATION/TRANSLATION SWITCHING LOGIC (Figure 4.2.2.2.1-12a)

The reboost rotation/translation switching logic sets flags to enable rotation or translation based on the status of the Rotation Jet Commands and transition delays, and controls termination of a reboost. If rotation is commanded, the translation firing in progress is allowed to complete, then the reboost translation firings are inhibited by resetting the reboost translation enable flag and rotation is enabled after enforcing a translation-to-rotation delay. When rotation is no longer required, rotation is disabled by resetting the reboost rotation enable flag and reboost translation is resumed after a rotation-to-translation delay. If both the reboost jets and the rotation jets are vernier, the transition delays, rotation-to-translation and translation-to-rotation, are not enforced. If a cancellation request is present the rotation/translation switching logic will initiate a transition to rotation and when accomplished will terminate the reboost by resetting the reboost enable.

A flag to indicate the first pass of the translation enable is set for use by the REBOOST TRANSLATION function.

REBOOST ACCEL CALC (Figure 4.2.2.2.1-12b)

An estimation of the average reboost disturbance acceleration is calculated upon initiation of a reboost event. The reboost acceleration is dependent on the jet groups selected, the number of jets within the groups, and the firing times in relation to the firing intervals.

REBOOST TRANSLATION (Figure 4.2.2.2.1-12c)

The reboost translation function calculates and enforces the intervals between reboost firings and sets the reboost jet firing times, REBOOST FIRETIMES, and makes the required jet selections, REBOOST JET SELECTION.

REBOOST FIRETIMES (Figure 4.2.2.2.1-12d)

The reboost firetimes are set to the reboost on-time I-loads each time a reboost firing is required. Firetimes are decremented by REBOOST JET SELECTION as the interval start times are encountered and the jets

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are fired. The interval between reboost firings is calculated by multiplying the reference reboost interval time from the DAP Config Spec by one of ten I-loaded scale factors. This allows for variable non-uniform firing intervals for loads reduction. Upon each initialization of reboost translation, the scale factor index is re-started at 1. Each subsequent expiration of the index will increment the scale factor for the following interval until the last/tenth scale factor is used or a 0.0 scale factor is encountered upon which the index will be restarted at 1.

A flag to force the firing complete indicator to always be true will be set if the firetimes for any jet group exceeds the interval time. This insures that rotation can be enabled if the firetimes exceed the interval time.

REBOOST JET SELECTION (Figure 4.2.2.2.1-12e)

The reboost jet selection function makes jet selections of up to the number of jets required from the selected reboost groups for the defined firetimes, `RBST_FIRETIME`'s. An estimate of the rotation increment for a minor cycle (including accounting for the degraded initial primary impulse) is calculated and returned along with the jet on discretetes.

If for primary selections there are not enough available jets to satisfy the desired requirement or if a required vernier jet is not available, the reboost is aborted and an override flag for the jet group is set. An abort resets all the jet on discretetes and zeroes the rotation increments. A subsequent manual re-initialization of the reboost will allow a continuation of the reboost without the full complement of jets. If the jet or jets should again become available, the override will be reset.

A flag will be set to indicate completion of the a reboost interval firing. This flag allows the switching logic to delay a transition to rotation until a translation firing pulse is completed.

VERNIER_ALT_JETS (Figure 4.2.2.2.1-16)

`VERNIER_ALT_JETS` selects up to three jets to be fired that will best achieve the desired rotation in Vernier and ALT modes (translation is not supported).

Compensation Command Generator (Figure 4.2.2.2.1-16a)

Compensation Command Generator converts the binary rotation commands from Rotation Compensation to a vector of the same form as the rotation jet command, i.e., for each element (roll, pitch, and yaw) +1 = positive rotation, -1 = negative rotation, 0 = no rotation.

ALT Mode Jet Select Inhibit Logic (Figure 4.2.2.2.1-16b)

ALT Mode Jet Select Inhibit Logic determines whether jet firings should be enabled or inhibited for ALT mode, based on the crew selected or I-loaded on time and delay time. Jet firings are always enabled in Vernier mode.

Variable delay timing is mechanized by applying one of ten I-loaded delay scale factors, array `ALT_DELAY_FACTOR`, to the reference delay time. The delay scale factor is incremented through the array unless a zero value is encountered or the end of the array is reached, at which time it is reset back to the first scale factor. The scale factor increment is also reset to the first value in the array if no jets have been commanded for a period equal to ten times the reference delay.

Vernier Command Generator (Figure 4.2.2.2.1-17)

Vernier Command Generator combines the compensated command from Compensation Command Generator, with the rotation jet command from the control laws and Phase Plane into one command for Vernier and ALT mode jet selection.

Vernier/ALT Jet Logic (Figure 4.2.2.2.1–18)

Vernier/ALT Jet Logic determines whether jet selection will be performed for Vernier or ALT mode. Jet selection is only performed if at least one element of the command from the Vernier Command Generator is ± 1 . This logic also determines whether jet selection parameters need to be reinitialized as a result of changes in crew selected mode parameters.

Jet Selection Parameter Initialization (Figure 4.2.2.2.1–18a)

Jet Selection Parameter Initialization sets parameters that control which primary jet groups may be selected from for ALT mode, based on crew selected jet option and Low Z mode. Also considered are which elements of ANG_INCREMENTS are to be used for jet selection for Vernier or ALT mode.

Vernier/ALT Jet Selection (Figure 4.2.2.2.1–19)

Vernier/ALT Jet Selection determines which jets should be fired to achieve the desired rotation for Vernier or ALT mode. Jets (for Vernier mode) or jet groups (for ALT mode) are chosen based on the dot product of their angular rate increment vectors with the desired rotation command.

ANG_INCREMENT Mapping (Figure 4.2.2.2.1–19a)

ANG_INCREMENT Mapping selects from the ANG_INCREMENT array the specific angular rate increment vectors for the six vernier jets or for the six (Tail only mode), eight (Low Z mode), or eleven (Nominal mode) primary jet groups to be used for the ALT mode chosen by the crew.

ALT Jet Selection (Figure 4.2.2.2.1–19b)

ALT Jet Selection chooses a specific jet to be fired from each jet group selected in Vernier/ALT Jet Selection for ALT mode, based on jet availability and the jet priorities in the JET_MAP array.

Minimum Angle Jet Selection (Figure 4.2.2.2.1–19c)

The Minimum Angle Jet Selection algorithm is divided into two parts:

1. Jet Candidate Selection, where the set of jets to be considered by the algorithm is calculated.
2. Minimum Angle testing, where the optimal set of jets to minimize angular error between commanded and actual acceleration is calculated.

Jet Candidate Selection (Figure 4.2.2.2.1–19d)

Jet Candidate Selection eliminates jets from consideration by the minimum angle jet selection algorithm if their acceleration falls outside of an I-loaded tolerance when compared with the “best jet”.

Failure Reconfiguration (Figure 4.2.2.2.1–20)

The failure reconfiguration, which is run only when the failed jet list changes, sets a group of flags that provide information on the failure status of various jet groupings.

1. VFAIL when set signifies one or more failures of the vernier jets.
2. DYFAIL is a two-bit array, each bit of which when set signifies that both jets have failed in one of the two forward Y firing clusters.
3. DZFAIL_2 when set signifies two failed forward -Z jets on one side of the vehicle (left or right).
4. HFAIL_JSL is an array that indicates the availability for firing selection of prioritized primary RCS jets (refer to Table 4.2.2.2.1-4).
5. AVAIL_VJET signifies the availability of the vernier RCS jets.

ALT Mode Failure Reconfiguration (Figure 4.2.2.2.1-20a)

ALT mode failure reconfiguration determines, for each primary jet group, whether or not any jets in the group are available.

1. AVAIL_GRP_S signifies the availability of the 14 primary RCS jet groups (AVAIL_GRP_{*i*} = OFF implies that all jets in the *i*th group have failed.)

Angular Rate Increment Prediction by PRIMARY_JETS (Figure 4.2.2.2.1-3) VERNIER_JETS (Figure 4.2.2.2.1-19), and ALTERNATE_JETS (Figure 4.2.2.2.1-19b).

Prediction of vehicle angular rate increments due to RCS jet usage requires reference to a table of constants indicating the vehicular angular rate change associated with each jet. This table is the array ANG_INCREMENT_S which contains one three-element vector for each of the 14 different primary jet groups and one three-element vector for each of the six vernier jets. These predictions of the angular rate change are calculated in DAPLOAD_SELECT based on I-loaded/uplinked sets of vehicle mass properties. The calculations of predicted angular rate change for the primary jets are scaled to account for the minimum impulse characteristics (e.g., thrust build up) of the thrusters.

To facilitate reference in ANG_INCREMENT_S to the primary-jet angular rate increments, the constant list JET_TABLE relates each primary jet to its group. JET_TABLE values are in Table 4.2.2.2.1-4.

Primary RCS Table Lookup (Tables 4.2.2.2.1-1, -2, and -3)

The primary RCS jet selection tables are in three sections (Tables 4.2.2.2.1-1, -2, and -3). The first section provides the logic for the 19 jets that fire into the Z axis. These jets divide into seven directional jet clusters; namely groups 4, 5, 6, 11, 12, 13, and 14. The second section provides logic for the 12 jets that fire into the Y axis. These jets divide into four directional jet clusters; namely groups 2, 3, 9, and 10. The third section provides logic for the seven jets that fire into the X axis. These jets divide into three directional jet clusters; namely groups 1, 7, and 8. (See Figure 4.2.2.2.1-23 for RCS jet locations and plume directions.)

Each page of the table lookup logic has three main divisions. The leftmost division provides the command to be responded to. The middle division lists all failure combinations, through two failures, that need to be considered. The right-most division specifies how many jets must be commanded to fire in each directional group under the conditions specified. In the middle division, the first row of each command configuration is always the no-failure case. The rows that follow list a group number for each jet failed in that group (e.g., "9 9" which means two jet failures in group 9).

The table lookup logic determines (for nominal and failure conditions) the total number by group of primary RCS jets to be fired. This information, in conjunction with the availability of jets (HFAIL_JSL), is used to determine which (prioritized) jets within a particular RCS jet group should be fired (NEW_JONLST_JSL). This selection is performed by choosing the required number of jets for each group from among the unfailed jets within that group and with the highest priority within that group. (Refer to Table 4.2.2.2.1–4 for the jet group and jet priority associated with each element of NEW_JONLST_JSL and HFAIL_JSL. Note that no particular RCS jet is associated with each element of either parameter.)

As a limited example, suppose the second and third priority jets of group 9 were not available for firing (HFAIL_JSL_{19 to 22} = (0,1,1,0)) and that the table lookup logic required that two jets in group 9 be fired, then NEW_JONLST_JSL_{19 to 22} would be set equal to (1,0,0,1).

The principle behind the table lookup scheme is that all jets that fire in the Z axis can give Z translation and/or roll rotation and/or pitch rotation control. These other 19 jets are considered independent of other axes, however. All jets fired in the Y axis are considered to give Y translation and/or yaw rotation control only. All jets fired in the X axis are considered to give X translation control only. Any interactions between these axes are handled by rate-level defaults defined in the block diagrams and/or open-loop compensation also shown in the block diagrams and/or phase-plane feedback and/or closed-loop feedback external to JET_SELECT.

Specific information for each table is given with each table.

PRIMARY_JETS Variable Priority Logic (Figures 4.2.2.2.1–3 and 4.2.2.2.1–20)

The priority of a particular primary RCS jet within its group is a mission-dependent and/or a crew dependent function. Thus a mechanism is needed to identify which particular jet is associated with a particular in-group priority. This mechanism is the parameter JET_MAP. In order for JET_MAP to work properly, the input and output interfaces (AVAILABLE_JET_FWD, AVAILABLE_JET_AFT, NEW_JONLST_AFT) must be aligned identically, i.e., each respective element must refer to the same RCS jet. JET_MAP is an array of input/output interface array element numbers arranged by descending group number and in order of descending priority (see Table 4.2.2.2.1–4 for arrangement). JET_MAP is used in the following equations:

$$I = 1 \text{ to } 14$$

$$HFAIL_JSL_I = \overline{AVAILABLE_JET_FWD}_{JET_MAP_I} \quad (\text{Figure 4.2.2.2.1–20})$$

$$I = 15 \text{ to } 38$$

$$HFAIL_JSL_I = \overline{AVAILABLE_JET_AFT}_{JET_MAP_I} \quad (\text{Figure 4.2.2.2.1–20})$$

$$I = 1 \text{ to } 14$$

$$NEW_JONLST_FWD_{JET_MAP_I} = NEW_JONLST_JSL_I \quad (\text{Figure 4.2.2.2.1–3})$$

$$I = 15 \text{ to } 38$$

$$NEW_JONLST_AFT_{JET_MAP_I} = NEW_JONLST_JSL_I \quad (\text{Figure 4.2.2.2.1–3})$$

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As a limited example, note that group 1 jets F1F, F2F, and F3F availability and commands are represented by elements 1, 5, and 13, respectively, on the input/output interface for the forward jets. Suppose that the preferred firing order within group 1 is F2F, F3F, and F1F, then

$$\begin{aligned} \text{JET_MAP}_{(1 \text{ to } 3)} &= (5, 13, 1), \text{ and} \\ \text{HFAIL_JSL}_1 &= \overline{\text{AVAILABLE_JET_FWD}_5} \\ \text{HFAIL_JSL}_2 &= \overline{\text{AVAILABLE_JET_FWD}_{13}} \\ \text{HFAIL_JSL}_3 &= \overline{\text{AVAILABLE_JET_FWD}_1} \\ \text{NEW_JONLST_FWD}_5 &= \text{NEW_JONLST_JSL}_1 \\ \text{NEW_JONLST_FWD}_{13} &= \text{NEW_JONLST_JSL}_2 \\ \text{NEW_JONLST_FWD}_1 &= \text{NEW_JONLST_JSL}_3 \end{aligned}$$

VERNIER_JETS I/O Mapping (Figures 4.2.2.2.1–21 and 4.2.2.2.1–22)

The functions MAP_V_IN and MAP_V_OUT perform the mapping needed to transfer the vernier jet availability data and commands between the DAP I/O interface and the internal variables (AVAIL_VJET and NEW_JONLST_JSL) used in VERNIER_JETS. The following shows the correspondence between the DAP I/O elements and the VRCS jets in the order used in Figures 4.2.2.2.1–21 and –22:

| Element of DAP I/O Interface (AVAILABLE_JET_XXX and NEW_JONLST_XXX) | VRCS jet |
|---|----------|
| FWD ₁₂ | F5R |
| FWD ₁₁ | F5L |
| AFT ₁₅ | R5R |
| AFT ₈ | L5L |
| AFT ₁₆ | R5D |
| AFT ₇ | L5D |

ALT and Vernier Mapping of ANG_INCREMENTS to AUX_ANG_INCS.

ROT_GRPS and ROT_GRPS_XJETS (if XJETS_ACTIVE is on) are a list of pointers used in two applications: first, to index into the 11 or 14 PRCS jet groups represented in ANG_INCREMENTS_{1 TO 14}, and second, to index into HFAIL_JSL via JET_MAP_PNTR. As shown in Figure 4.2.2.2.1–24 and Table 4.2.2.2.1-4c, ROT_GRPS and ROT_GRPS_XJETS values are arranged so that data pertaining to the set of jets needed for any ALT jet option (Aft only or Fwd+Aft) or NO +Zjets can be indexed from a continuous segment (or all) of ROT_GRPS or ROT_GRPS_XJETS, thus simplifying the coding and documentation.

In the first application, ANG_INCREMENT_MAPPING (Figure 4.2.2.2.1–19a) uses ROT_GRPS or ROT_GRPS_XJETS to extract the nominal PRCS ANG_INCREMENTS for the selected rotation option

and deposit them in AUX_ANG_INCS. Neither ROT_GRPS nor ROT_GRPS_XJETS are used if ALT_ACTIVE is OFF since ANG_INCREMENT_MAPPING then merely needs to move the set of six VRCS ANG_INCREMENTS into AUX_ANG_INCS without either transposition or subset selection.

In the second application, after the Vernier /ALT jet selection (Figure 4.2.2.2.1–19) algorithm has identified the jet group(s) from which it wants a jet or jets fired, ALT jet selection (Figure 4.2.2.2.1–19b) searches through the PRCS failure status array HFAIL_JSL to find the highest priority unfailed jet in each requested group. The indexing must go from the group ordering used in AUX_ANG_INCS to that used in HFAIL_JSL. The intermediate array JET_MAP_PNTR (Table 4.2.2.2.1–4a) is first indexed into via ROT_GRPS or ROT_GRPS_XJETS. The first 14 members of JET_MAP_PNTR are indices for the first jet of each of the 14 PRCS groups in HFAIL_JSL. The 15th member is the first index of a hypothetical 15th group. The values extracted from JET_MAP_PNTR yield the beginning and end indices for each requested group in HFAIL_JSL.

VERNIER/ALT JET Selection

The Vernier/Alternate Jet Selection selects jets based on one of two criteria. The criteria to be used is based on the state of the flag MINA_JS_SEL. If this flag is true the jets are selected so as to minimize the angular error between the angular rate of the jets selected and the rotational jet command. If the flag is false the jets are selected to maximize the dot product between the angular rates of the jets and the rotational jet command. The conditions for which the minimum angle jet selection is active is defined by an I-loaded integer, MIN_ANGLE_JET_SEL_VALUE.

The minimum angle jet select logic (Figure 4.2.2.2.1–19c) is used to select the jets that minimize the angular error between the jets resultant acceleration and the desired rotational jet command. The Jet Candidate Selection logic (Figure 4.2.2.2.1–19d) determines candidate jets by comparing the dot product of each available jet to the maximum dot product of all available jets. A jet becomes a candidate if its dot product is within a threshold of the maximum dot product. To reduce calculations, the maximum number of candidate jets is limited to eight, utilizing the eight jets with the largest dot products. A separate candidate threshold can be I-loaded for the Alternate PRCS and for VRCS. The Jet Candidate Selection logic also determines the maximum magnitude thresholds for use by the Minimum Angle Test. A different magnitude threshold is calculated for 1, 2 and 3 jet combinations based on the I-loads JET_MAG_THRESHOLD. The Minimum Angle Test (Figure 4.2.2.2.1–19e) is used to select the 1, 2 or 3 jets that minimize the angular error between jet acceleration and rotational jet command. For all combinations of 1, 2 or 3 candidate jets whose magnitudes satisfy all of the magnitude thresholds (i.e., the magnitude of each jet in the combination satisfies the single jet magnitude threshold, the magnitude of all pairings of two jets in the combination satisfy the dual jet threshold and the magnitude of all three jets combined satisfies the three jet threshold), the combination with the least angular error between the resulting jet acceleration and the rotational jet command is selected. To reduce calculations, the maximum of the dot product of the unit vectors of the resultant acceleration and rotational jet command are compared, which is the equivalent to minimizing the angle between the two vectors. The index of the jets in the AUX_ANG_INCS array is returned for use in selection of the appropriate jets.

The dot product jet selection (Figure 4.2.2.2.1–19) sequentially selects 1, 2 or 3 jets that maximize the dot product between the angular rate of the jets and the rotational jet command. A second or third jet are only selected if their dot products are at least a specified percentage of the the first jet.

Both jet selections may be restricted to fire only 1 or 2 jets in the Alternate mode based on crew input.

Use of Table 4.2.2.2.1–1:

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This table is in five parts. Parts A and B are to be accessed only if there is a high-level +Z translation command present. Part A is for the case with `CROSSFEED_INTERCONNECT_FLAG = OFF` or no +X translation. Part B is for the case with `CROSSFEED_INTERCONNECT_FLAG = ON` and +X translation. Part C is for nominal Z translations, possibly combined with roll rotation and/or pitch rotation commands. Part D is for cases with no Z translation, but with roll rotation and/or pitch rotation, and `NO_PLUS_Z_JETS = OFF`. Part E is for cases with no Z translation, but with roll rotation and/or pitch rotation and `NO_PLUS_Z_JETS = ON`.

The following inputs mean the following commands:

NOSE_CHK_Z: ON = LO ROT NOSE
 OFF = LOOK AT TAIL_CHK_Z

TAIL_CHK_Z: ON = LO ROT TAIL
 OFF = IF NOT LO ROT NOSE THEN HI ROT

HI_PITCH: ON = HI ROT
 OFF = LO ROT

HI_Z: ON = HIGH LEVEL +Z TRANSLATION COMMAND
 PRESENT
 OFF = NO HIGH LEVEL +Z TRANSLATION
 COMMAND PRESENT

NO_PLUS_Z_JETS: ON = INHIBIT USE OF +Z JETS
 OFF = ALLOW USE OF +Z JETS

CROSSFEED_INTERCONNECT_FLAG: ON = CROSSFEED BETWEEN AFT RCS TANKS OR
 INTERCONNECT BETWEEN OMS AND RCS
 OPEN
 OFF = CROSSFEED BETWEEN AFT RCS TANKS AND
 INTERCONNECT BETWEEN OMS AND RCS
 CLOSED

ACOM: ACOM_{1 to 4}: IGNORE

 ACOM₆: ON = Z TRANSLATION REQUIRED
 OFF = NO Z TRANSLATION REQUIRED

 ACOM₅: ON = MINUS SIGN FOR Z TRANSLATION
 OFF = PLUS SIGN FOR Z TRANSLATION

 ACOM₈: ON = ROLL ROTATION REQUIRED
 OFF = NO ROLL ROTATION REQUIRED

 ACOM₇: ON = MINUS SIGN FOR ROLL ROTATION
 OFF = PLUS SIGN FOR ROLL ROTATION

 ACOM₁₀: ON = PITCH ROTATION REQUIRED
 OFF = NO PITCH ROTATION REQUIRED

 ACOM₉: ON = MINUS SIGN FOR PITCH ROTATION
 OFF = PLUS SIGN FOR PITCH ROTATION

 ACOM_{11 to 12}: IGNORE

Figure 4.2.2.2.1–23 shows RCS jet locations, plume directions, and ID's.

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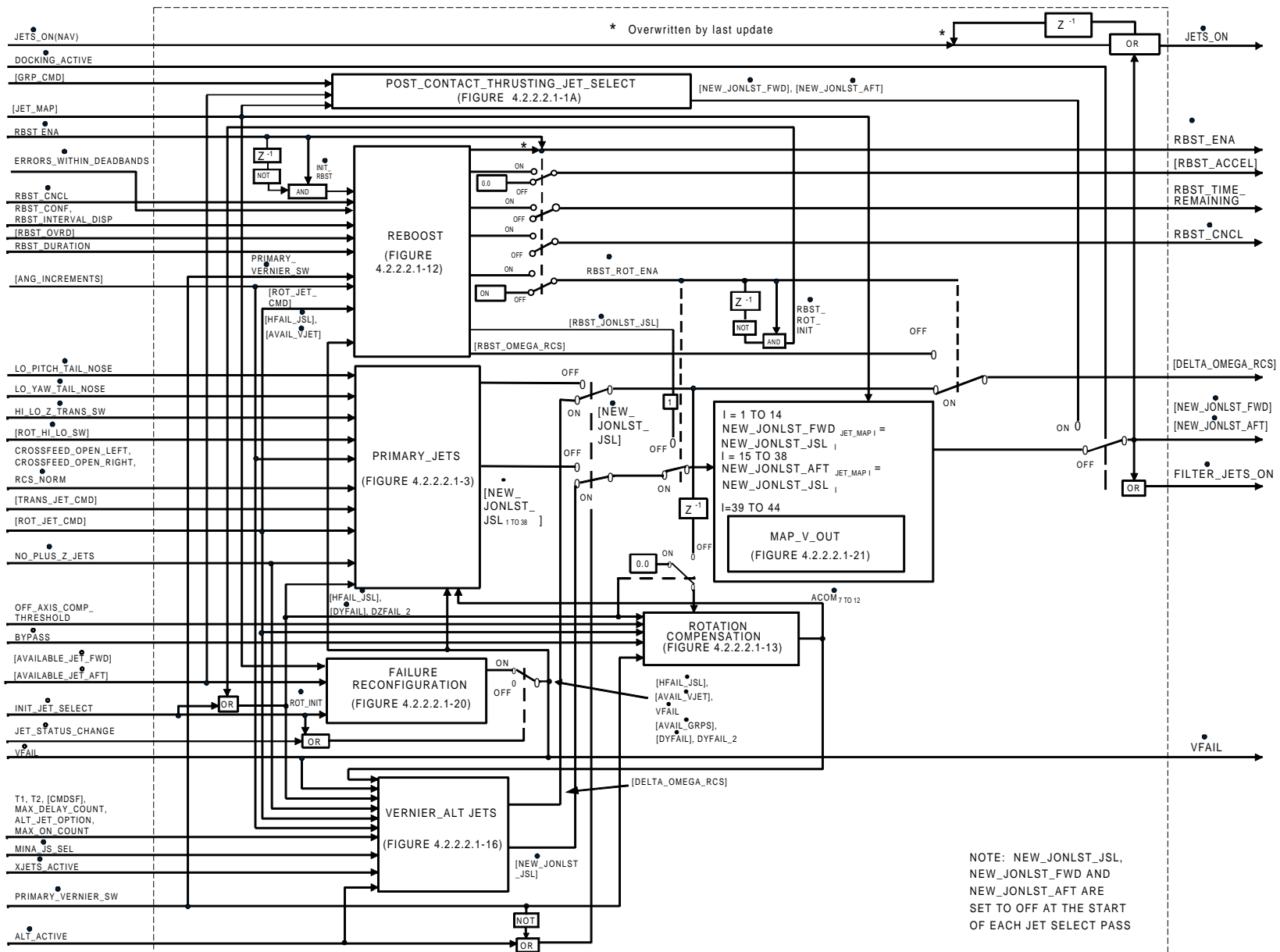


FIGURE 4.2.2.2.1-1. JET_SELECT

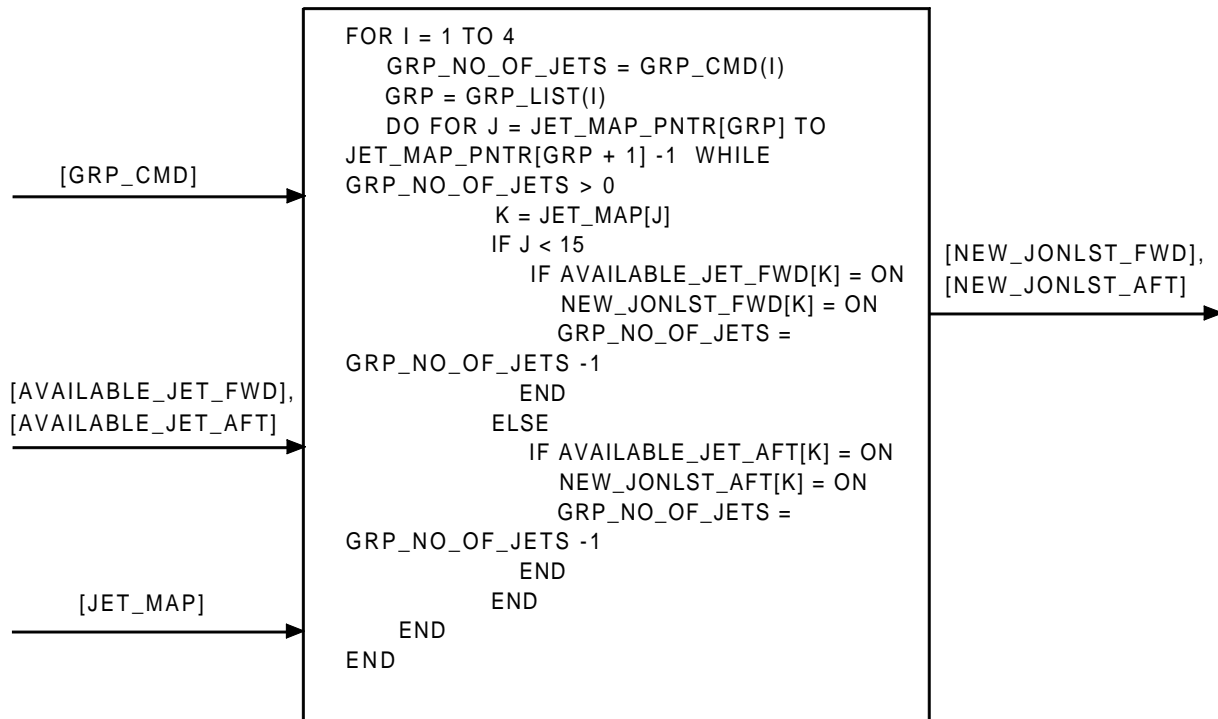
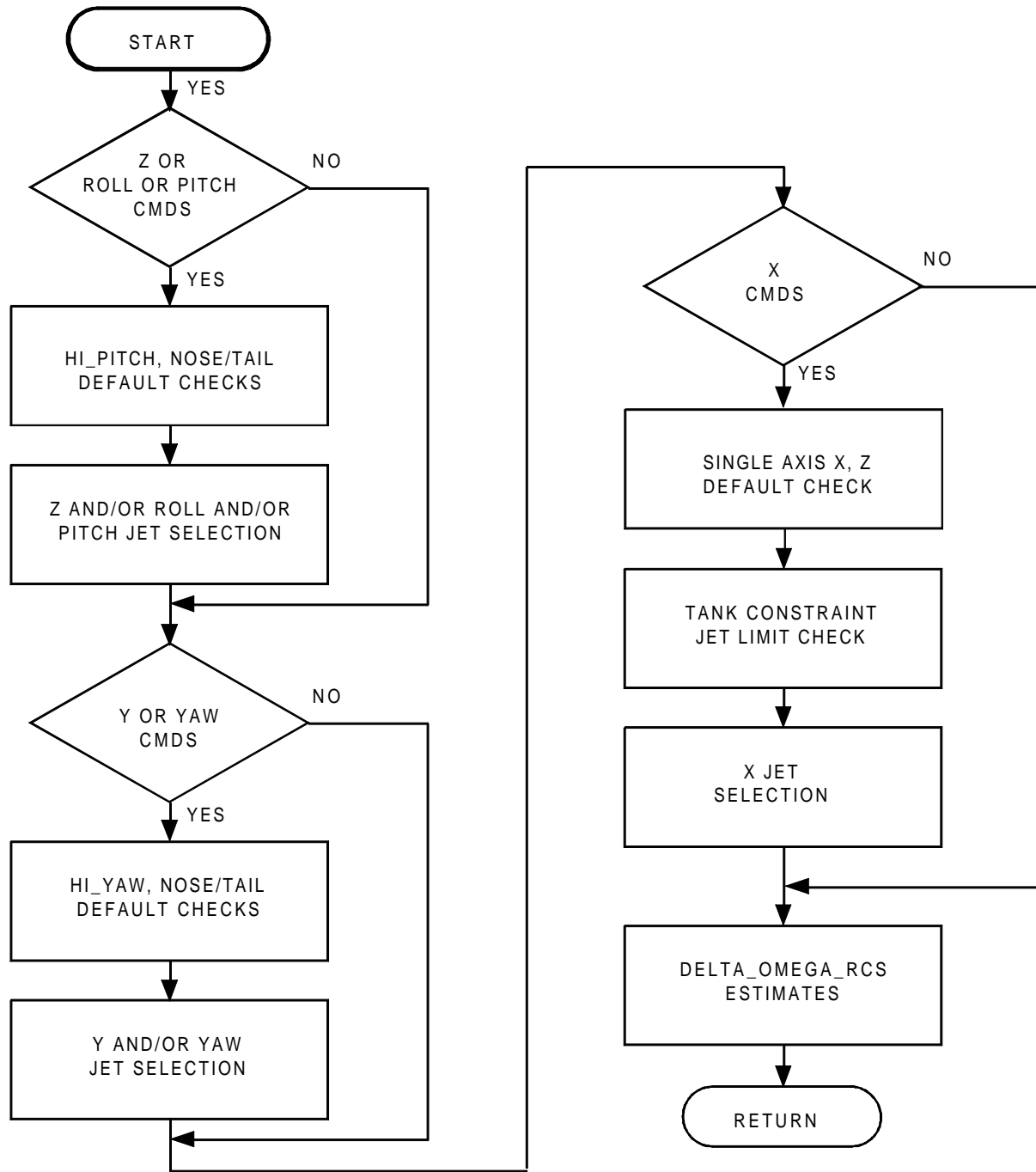


FIGURE 4.2.2.2.1-1a. POST_CONTACT_THRUSTING_JET_SELECT



NOTE: THE FUNCTION OF THE DEFAULT CHECKS IS TO CAUSE ONE OR MORE ELEMENTS OF ROT_HI_LO_SW, HI_LO_Z_TRANS_SW, TRANS_JET_CMD, LO_PITCH_TAIL_NOSE OR LO_YAW_TAIL_NOSE, TO BE IGNORED IF CROSS-COUPLING IS THEREBY IMPROVED.

FIGURE 4.2.2.2.1-2. PRIMARY_JETS Simplified Flow Chart

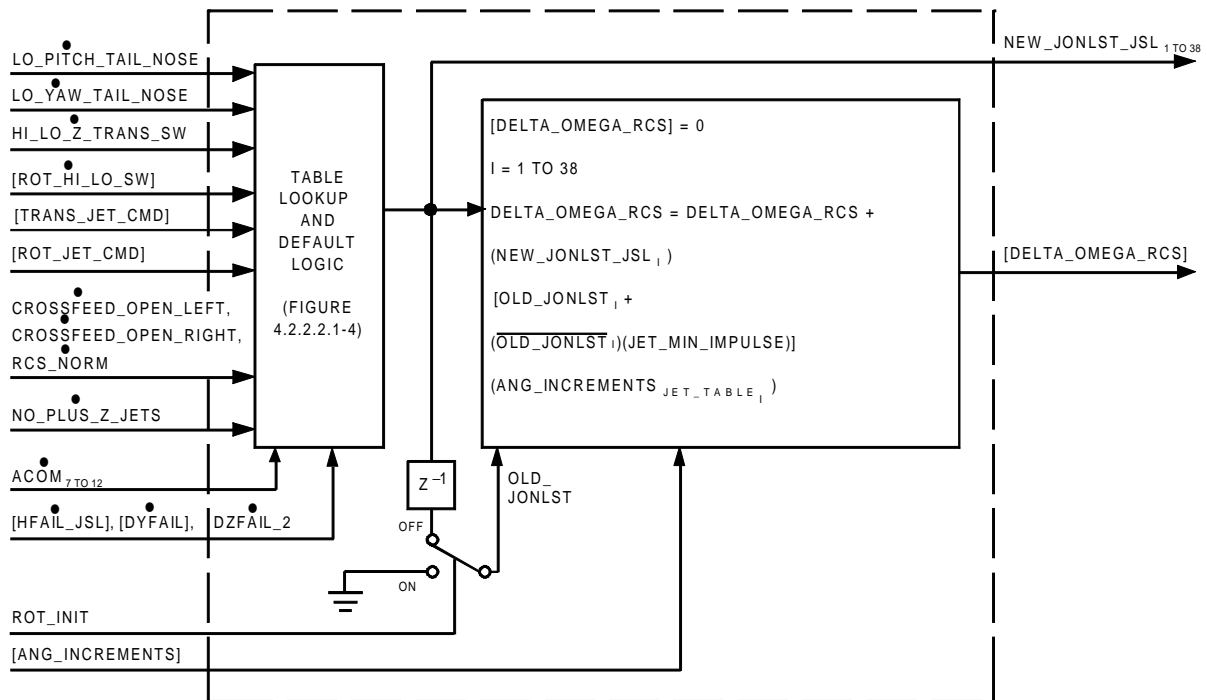


FIGURE 4.2.2.2.1-3. PRIMARY_JETS

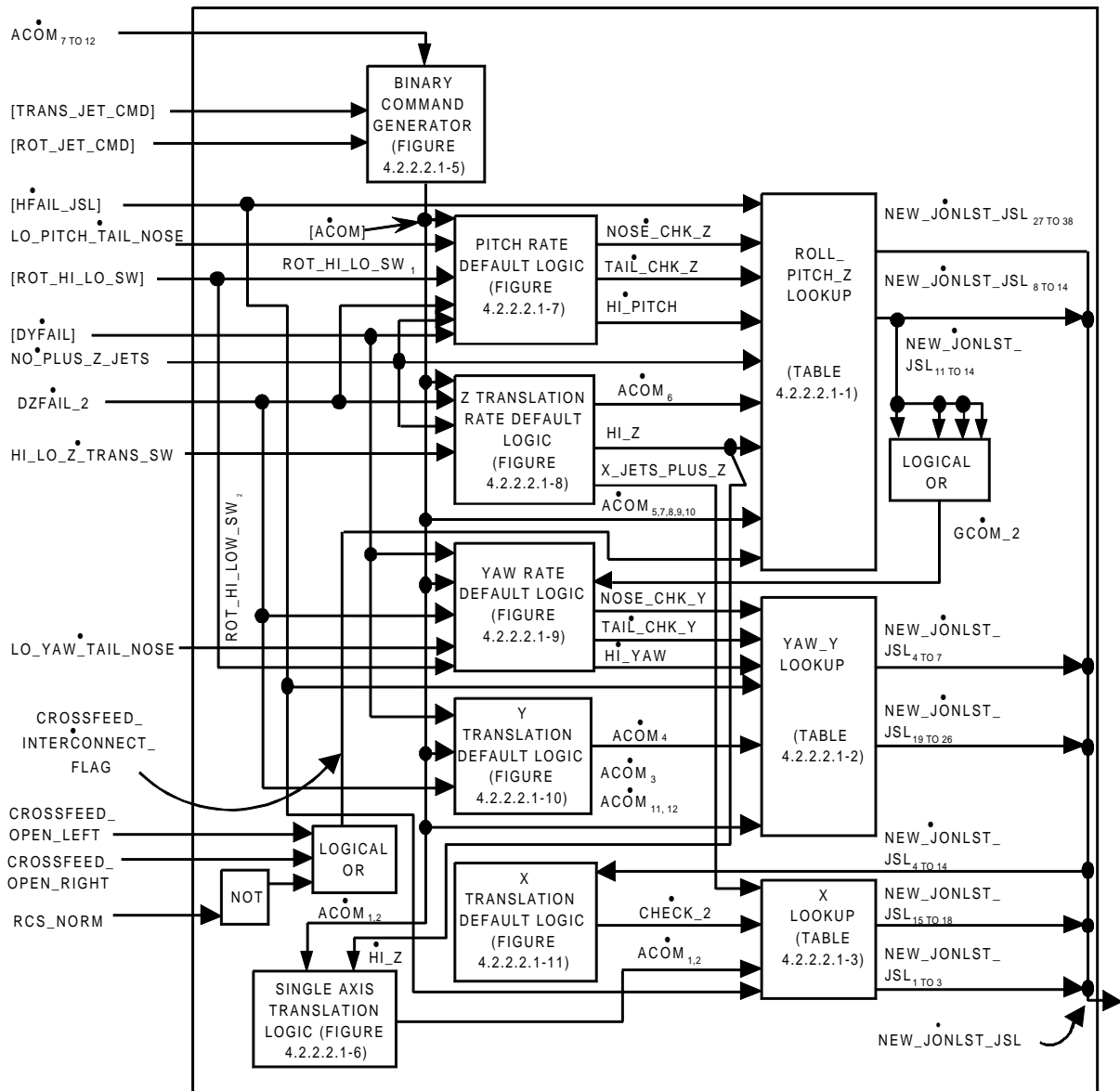


FIGURE 4.2.2.2.1-4. Table Lookup and Default Logic

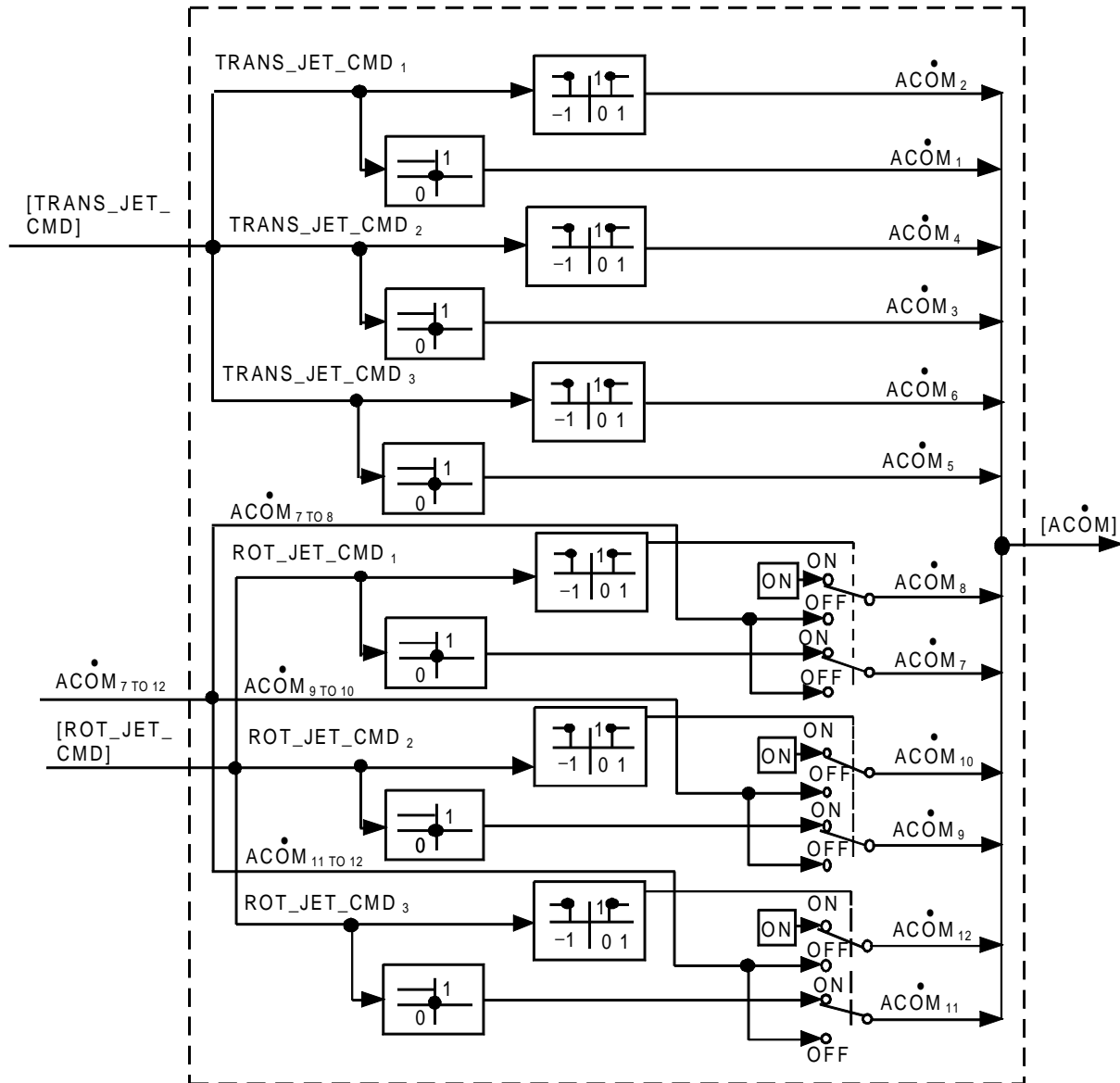


FIGURE 4.2.2.1-5. Binary Command Generator

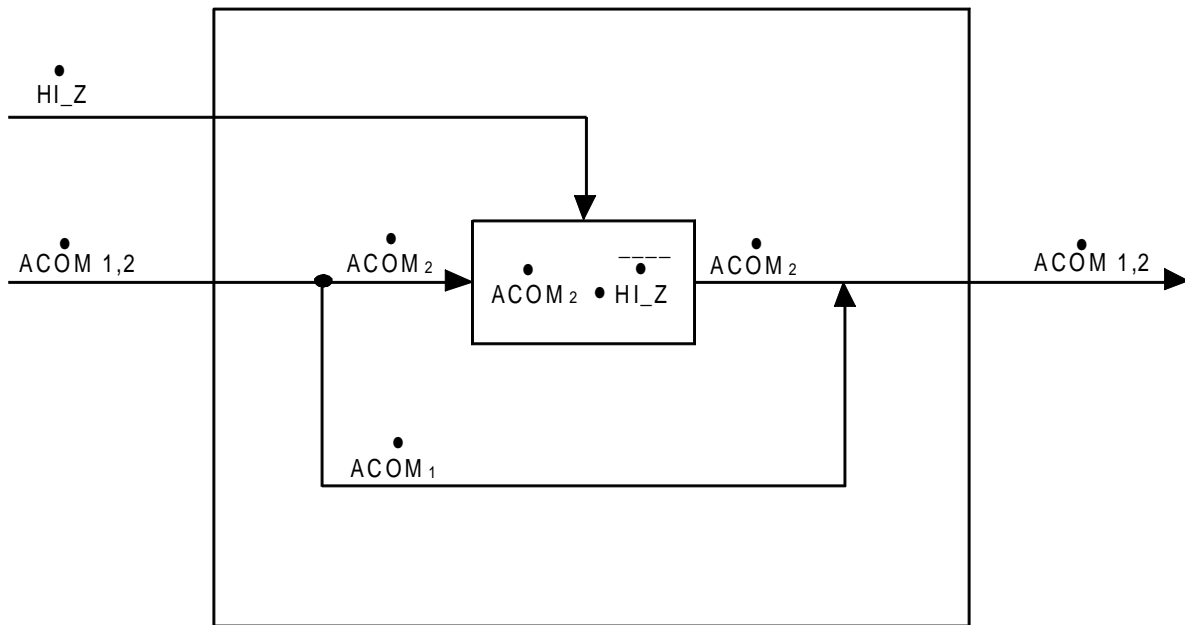


FIGURE 4.2.2.2.1-6. Single Axis Translation Logic

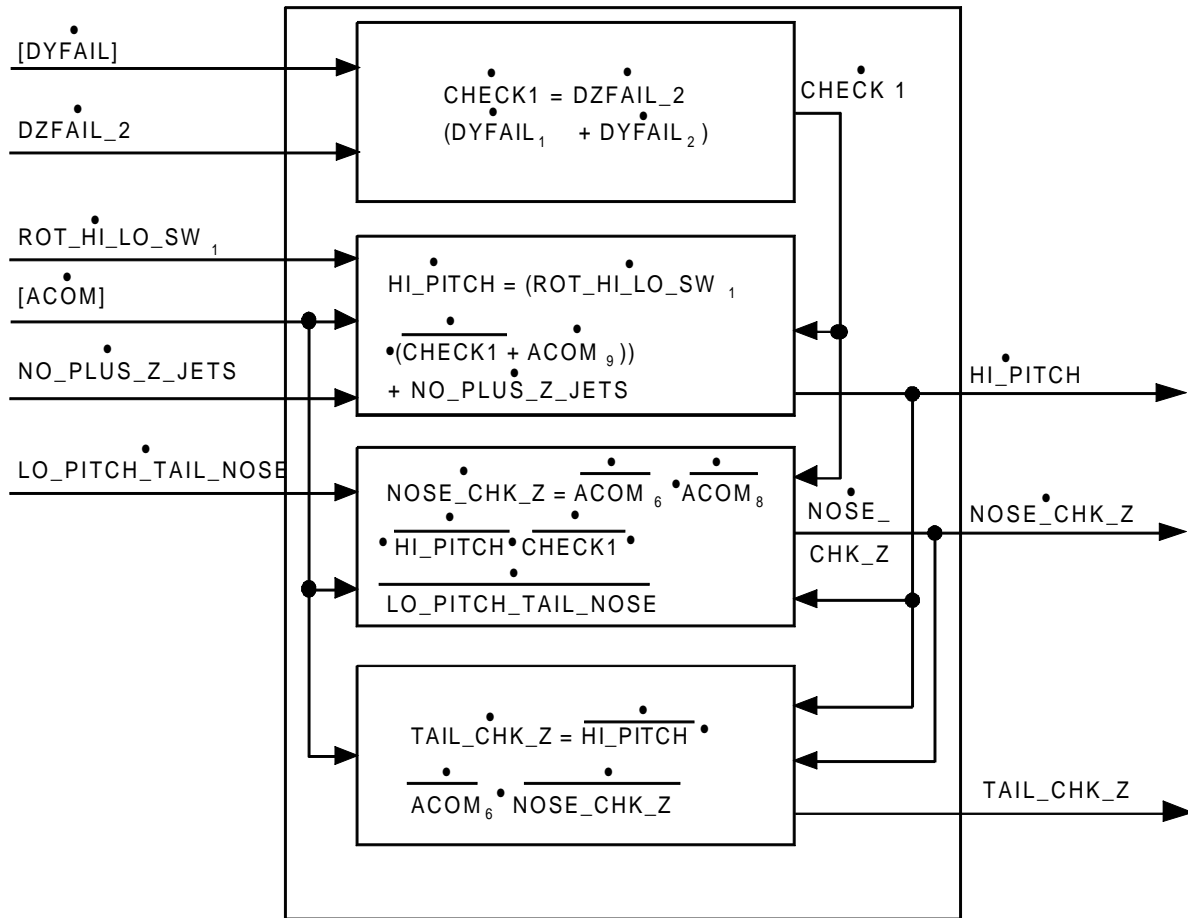


FIGURE 4.2.2.2.1-7. Pitch Rate Default Logic

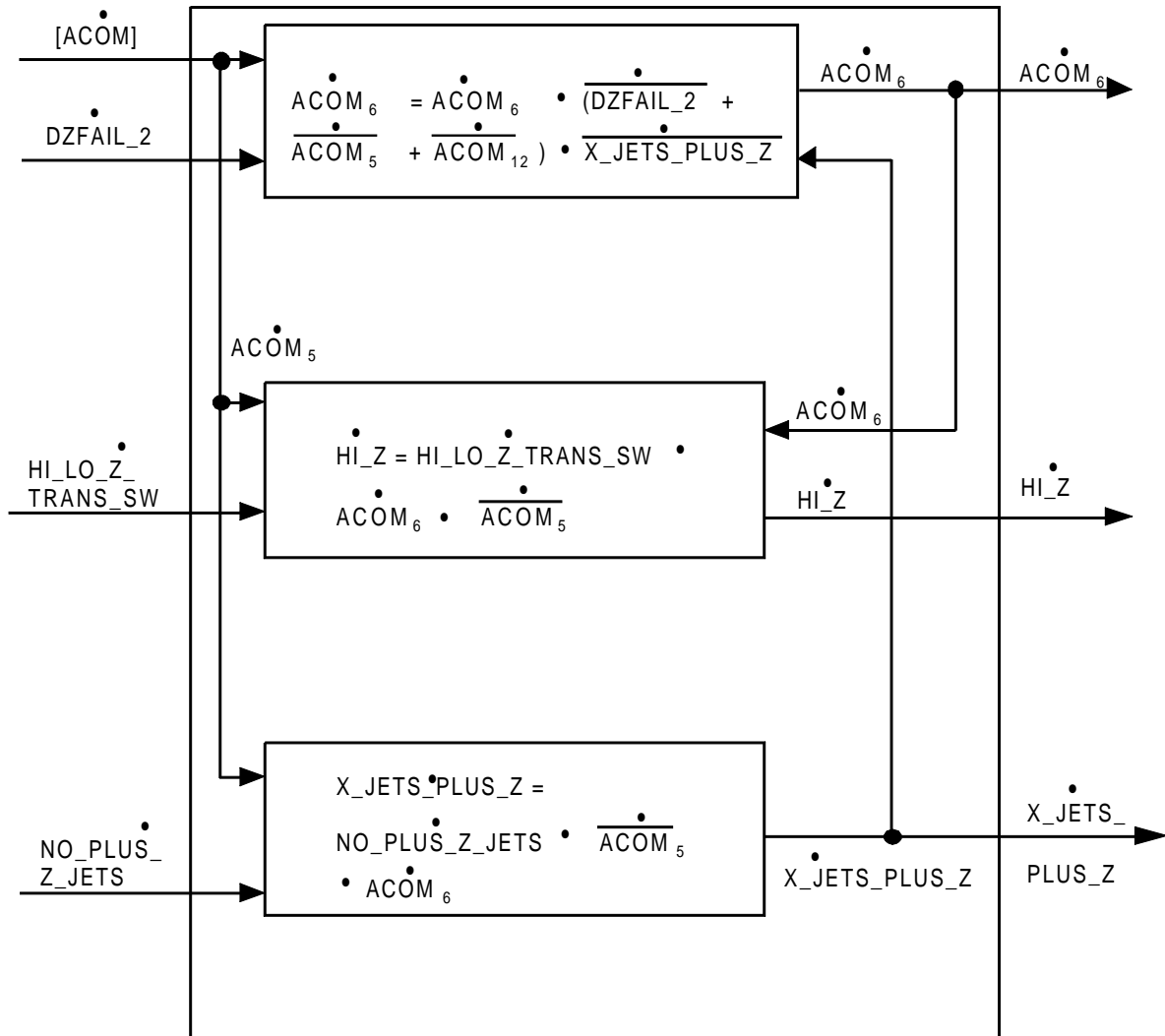


FIGURE 4.2.2.2.1-8. Z Translation Rate Default Logic

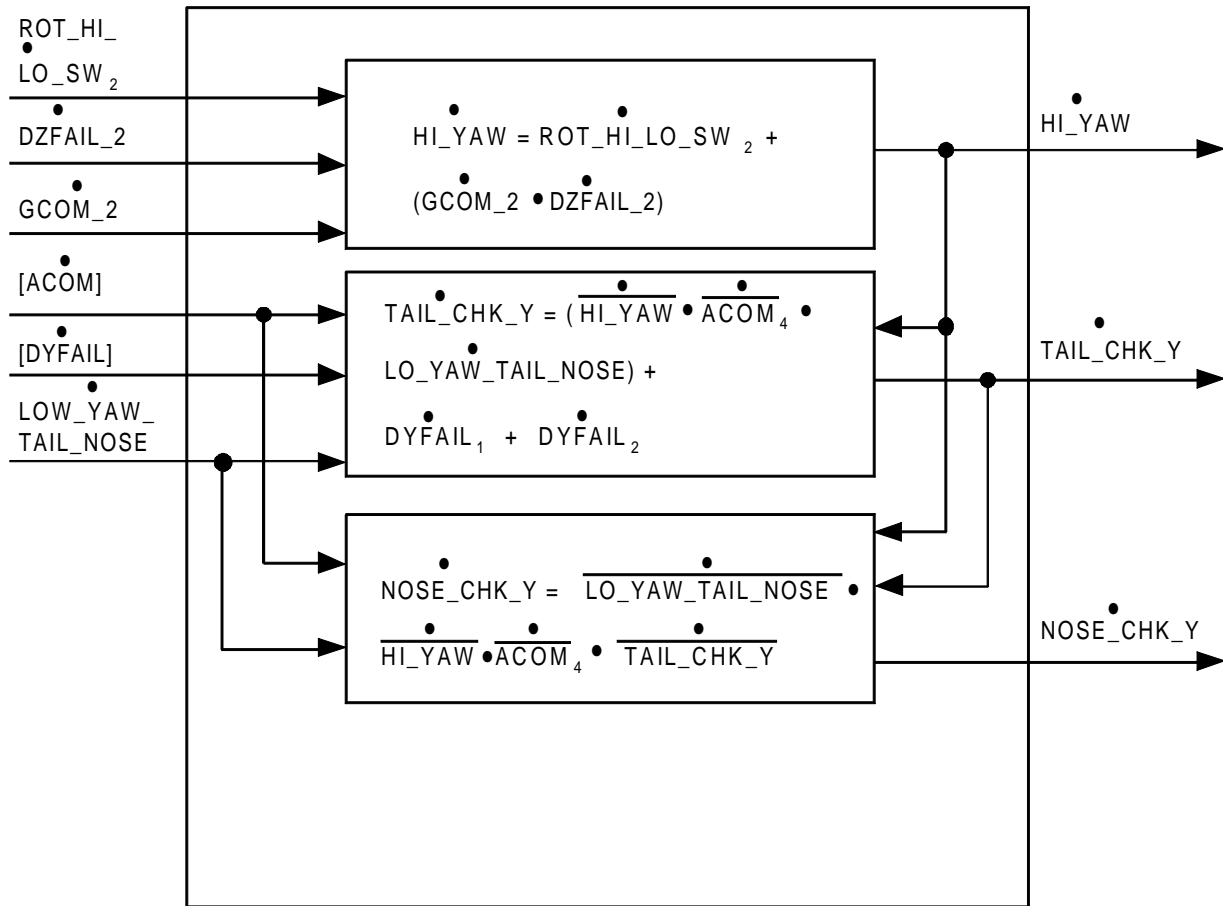


FIGURE 4.2.2.2.1-9. Yaw Rate Default Logic

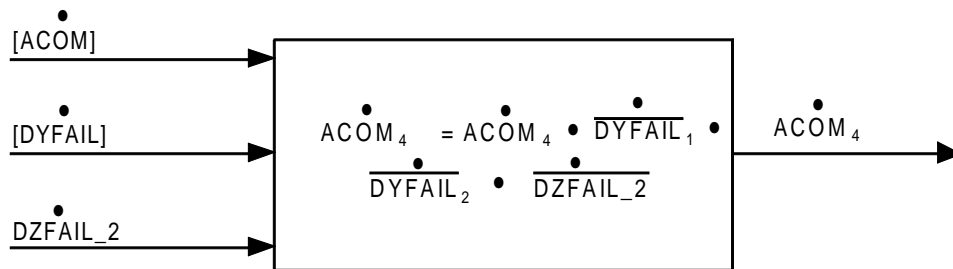


FIGURE 4.2.2.2.1-10. Y Translation Default Logic

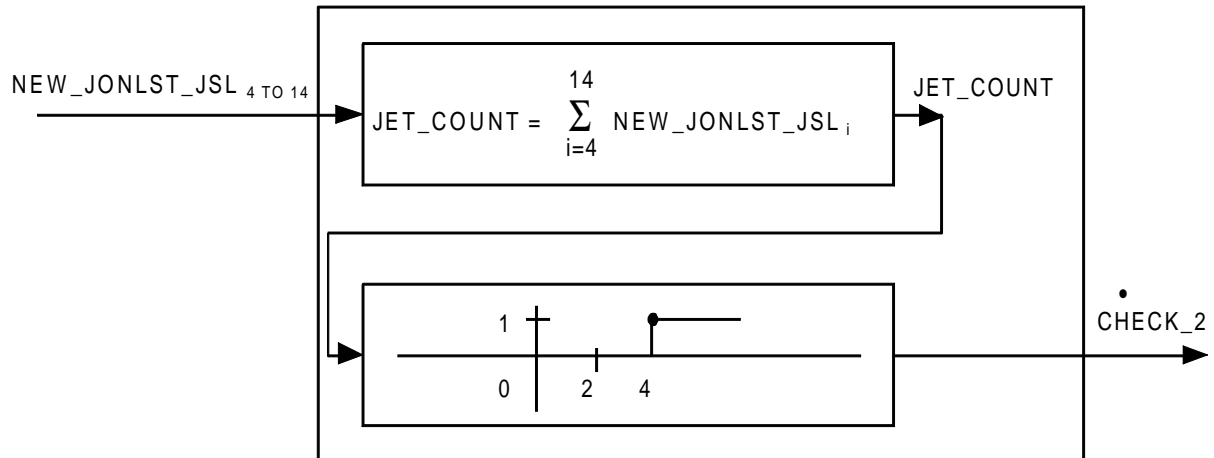
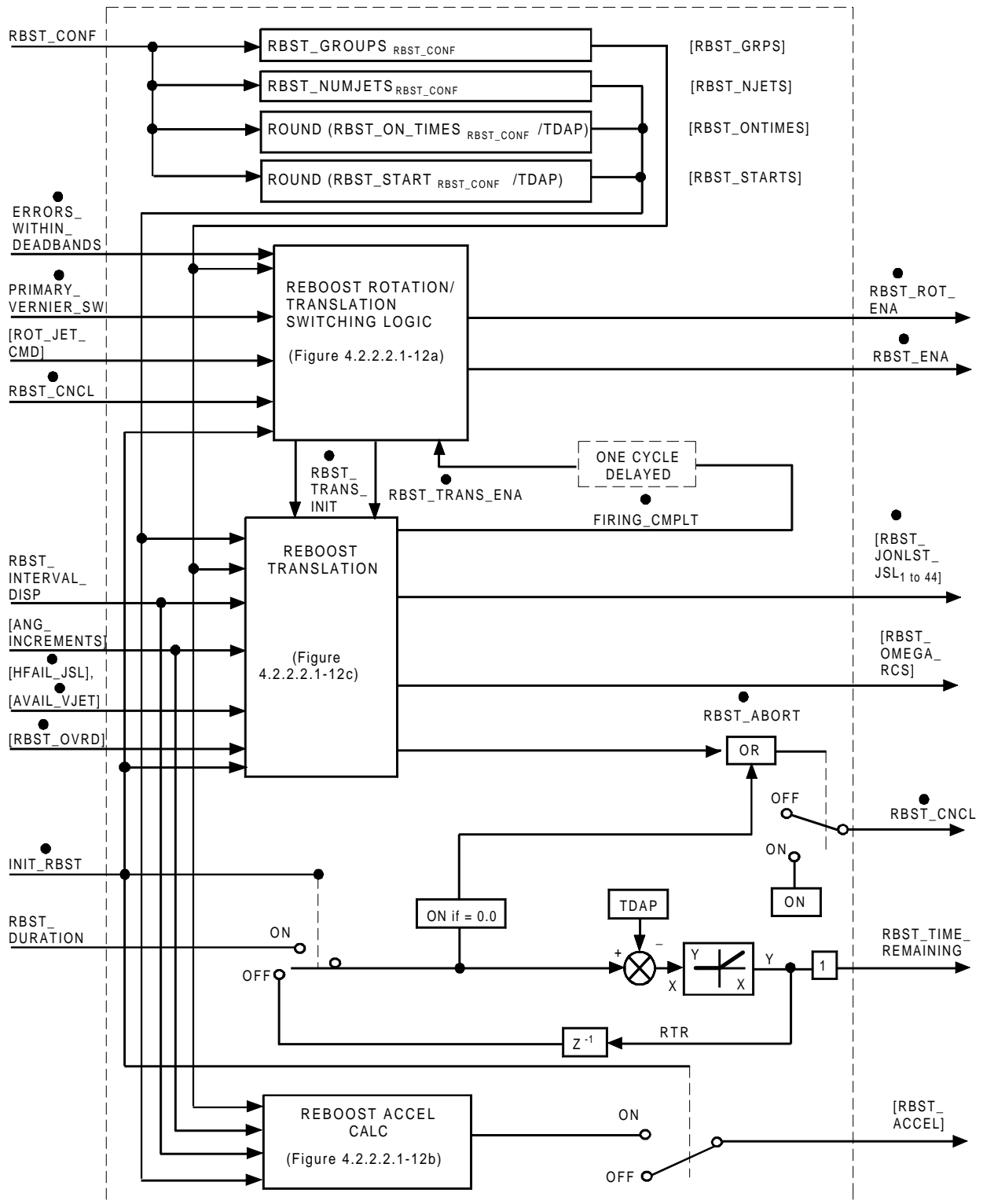


FIGURE 4.2.2.2.1-11. X Translation Default Logic



NOTE: Internal Reboost time remaining variable RTR should be declared as double precision to provide required accuracy. The variable RBST_TIME_REMAINING is passed externally as single precision for display purposes.

FIGURE 4.2.2.2.1-12. Reboost

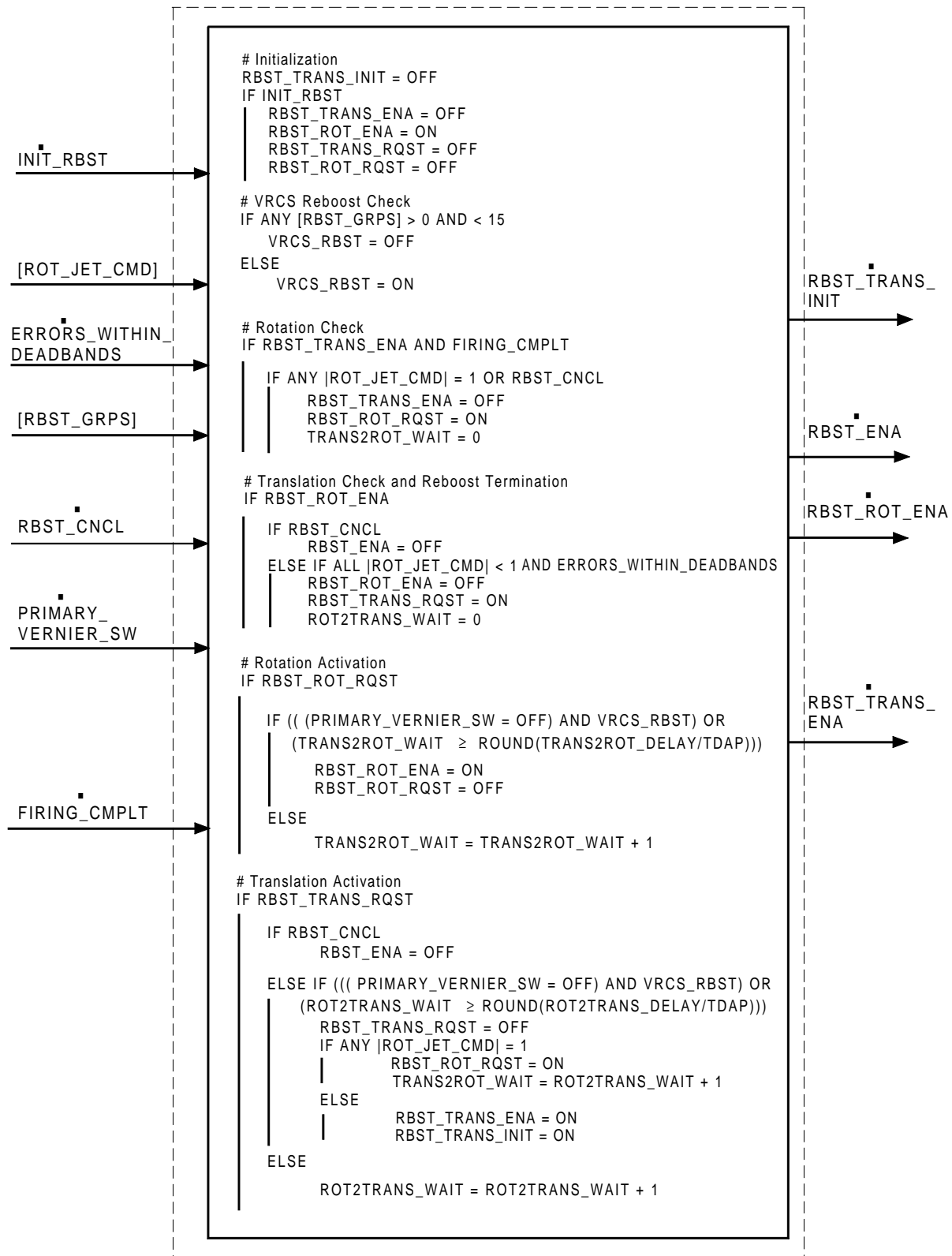
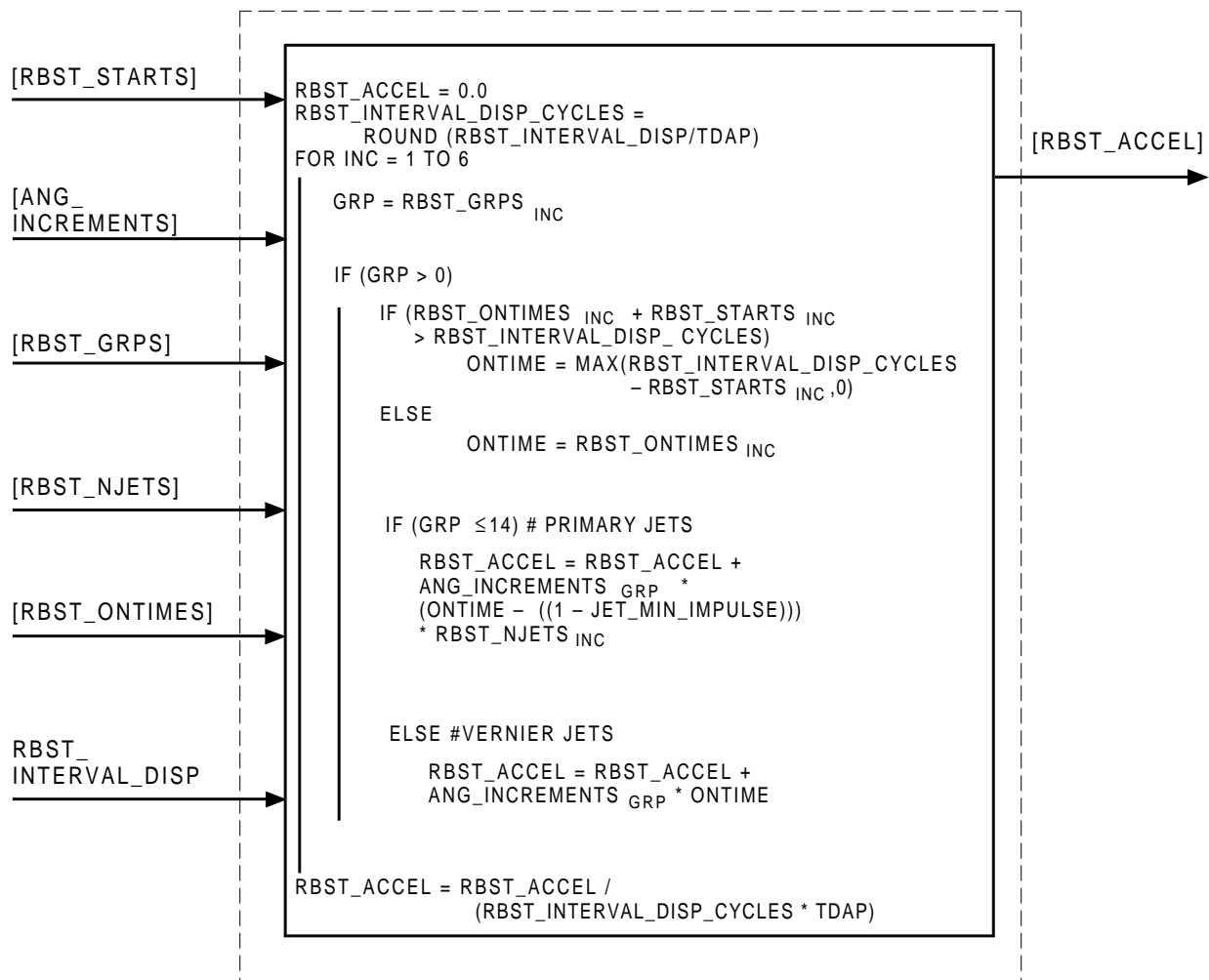


FIGURE 4.2.2.2.1-12a. Reboost Rotation/Translation Switching Logic



Notes:

- (1) The lower limit of RBST_INTERVAL_DISP is 80ms, as set by display entry constraints.
- (2) The RBST_INTERVAL_DISP is an input from the DAP Spec function and can take on values which are not integral multiples of TDAP. Since the intervals are acted upon on DAP cycles, any RBST_INTERVAL_DISP which is not an integral multiple of TDAP shall be rounded to the nearest TDAP multiple in order to make the acceleration calculation accurately estimate the operation.

FIGURE 4.2.2.2.1-12b. Reboost ACCEL CALC

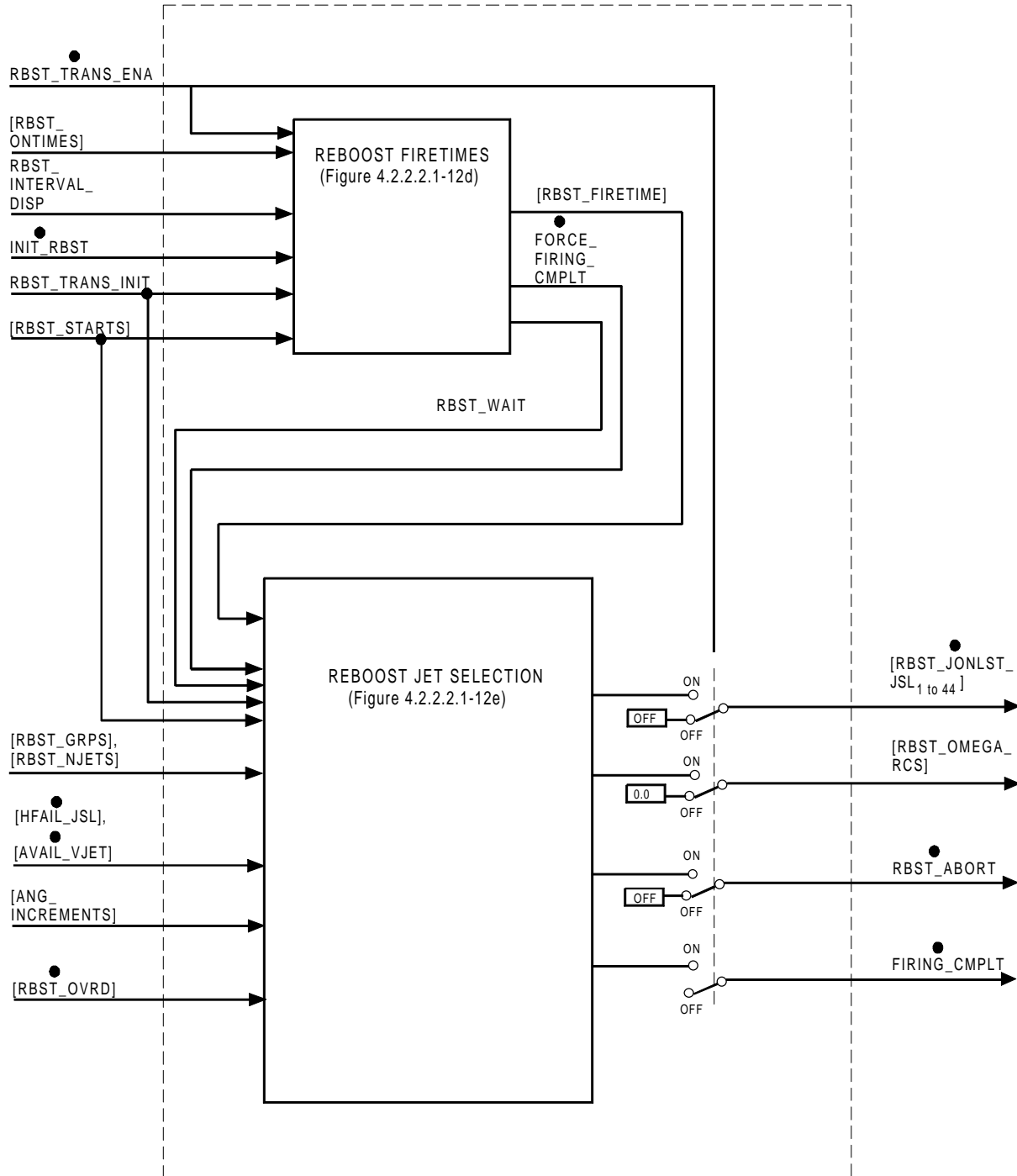
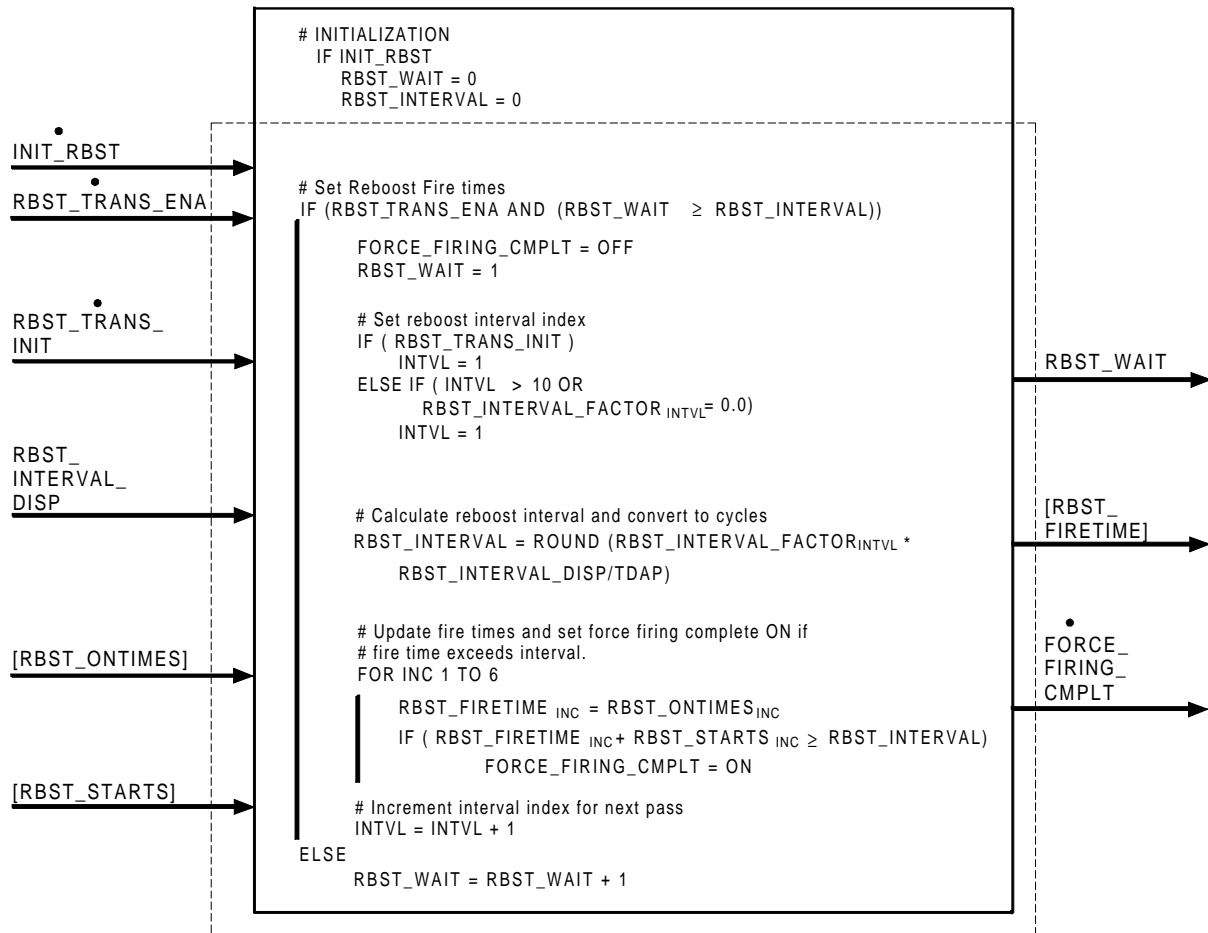


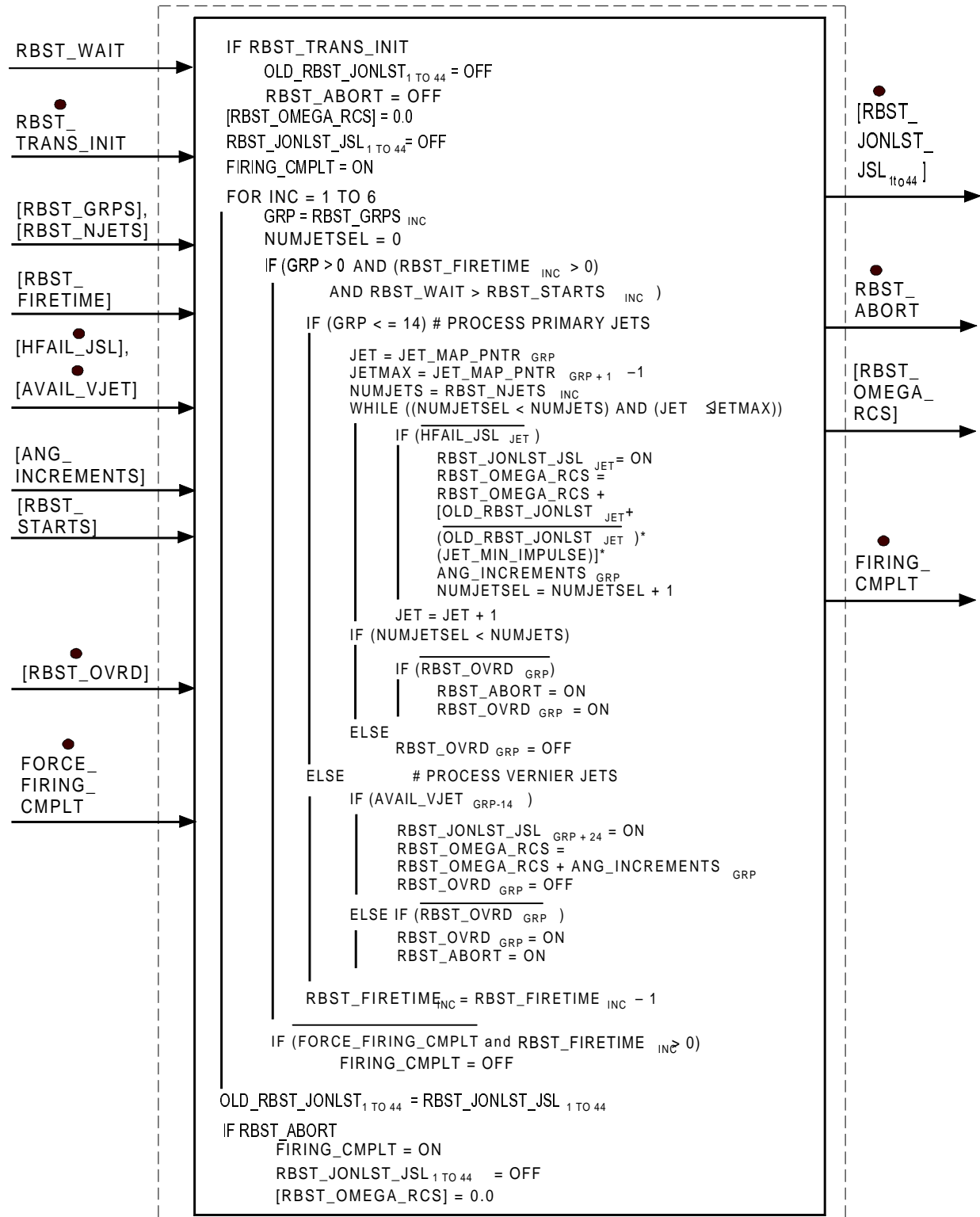
FIGURE 4.2.2.2.1-12c. Reboost Translation



Notes:

- (1) RBST_WAIT will accumulate whether reboost translation active or not.

FIGURE 4.2.2.2.1-12d. Reboost Firetimes



Notes:
(1) RBST_OVRD is initialized to OFF by RECON and then should remain static unless changed internally by this function.
(2) RBST_FIRETIME is set by Reboost Firetimes and then is decremented locally.

FIGURE 4.2.2.2.1-12e. Reboost Jet Selection

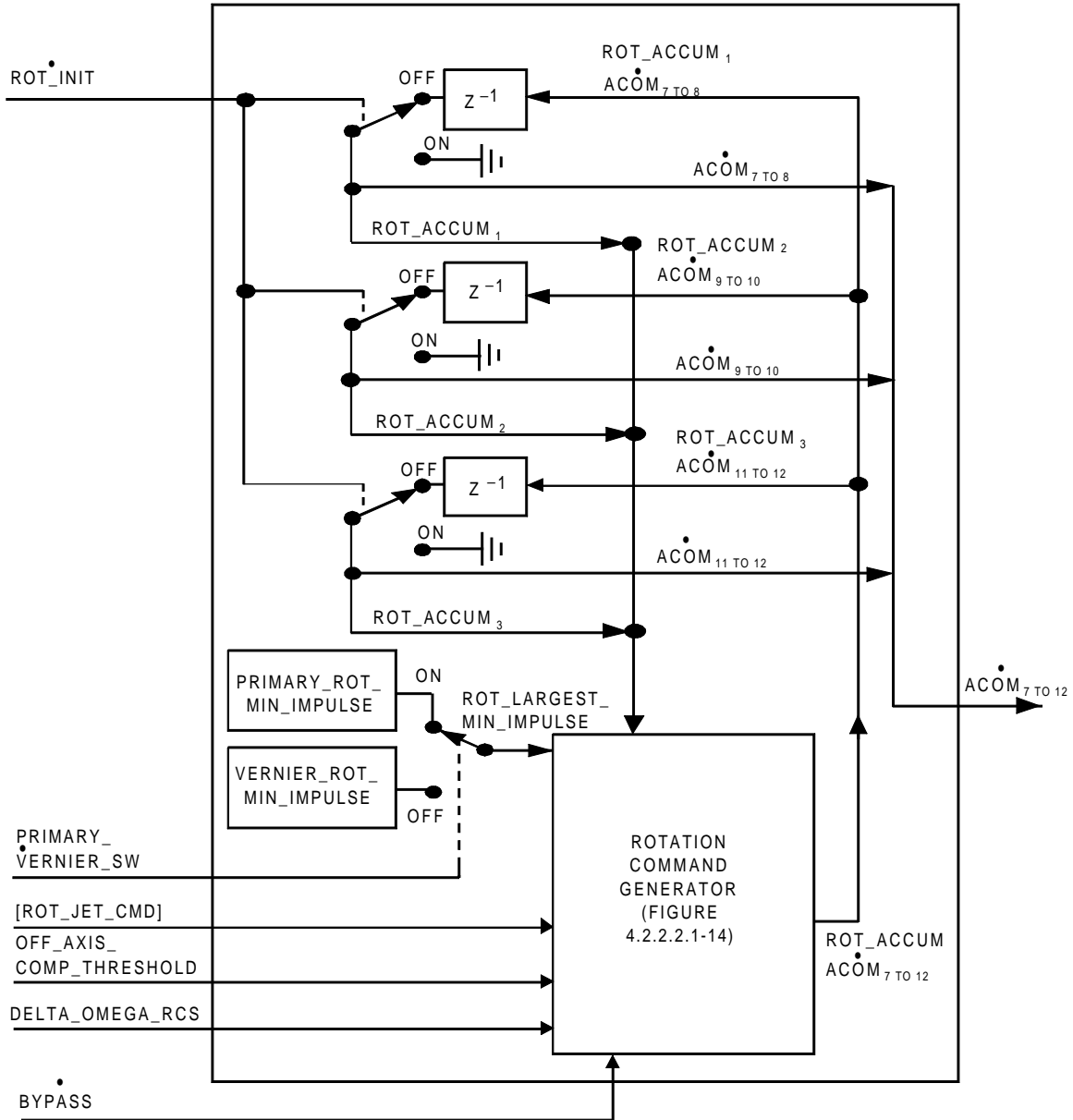


FIGURE 4.2.2.2.1-13. Rotation Compensation

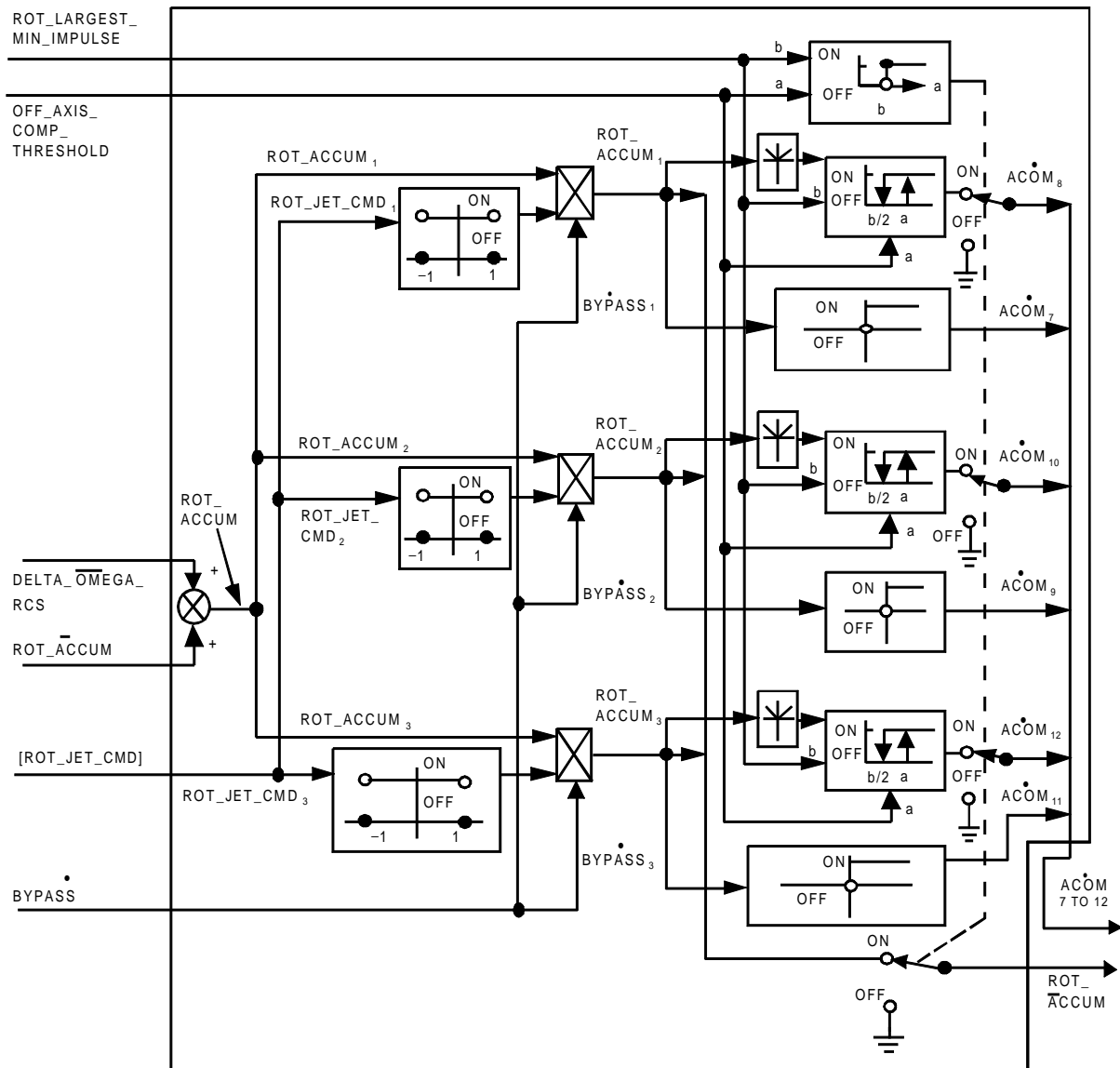
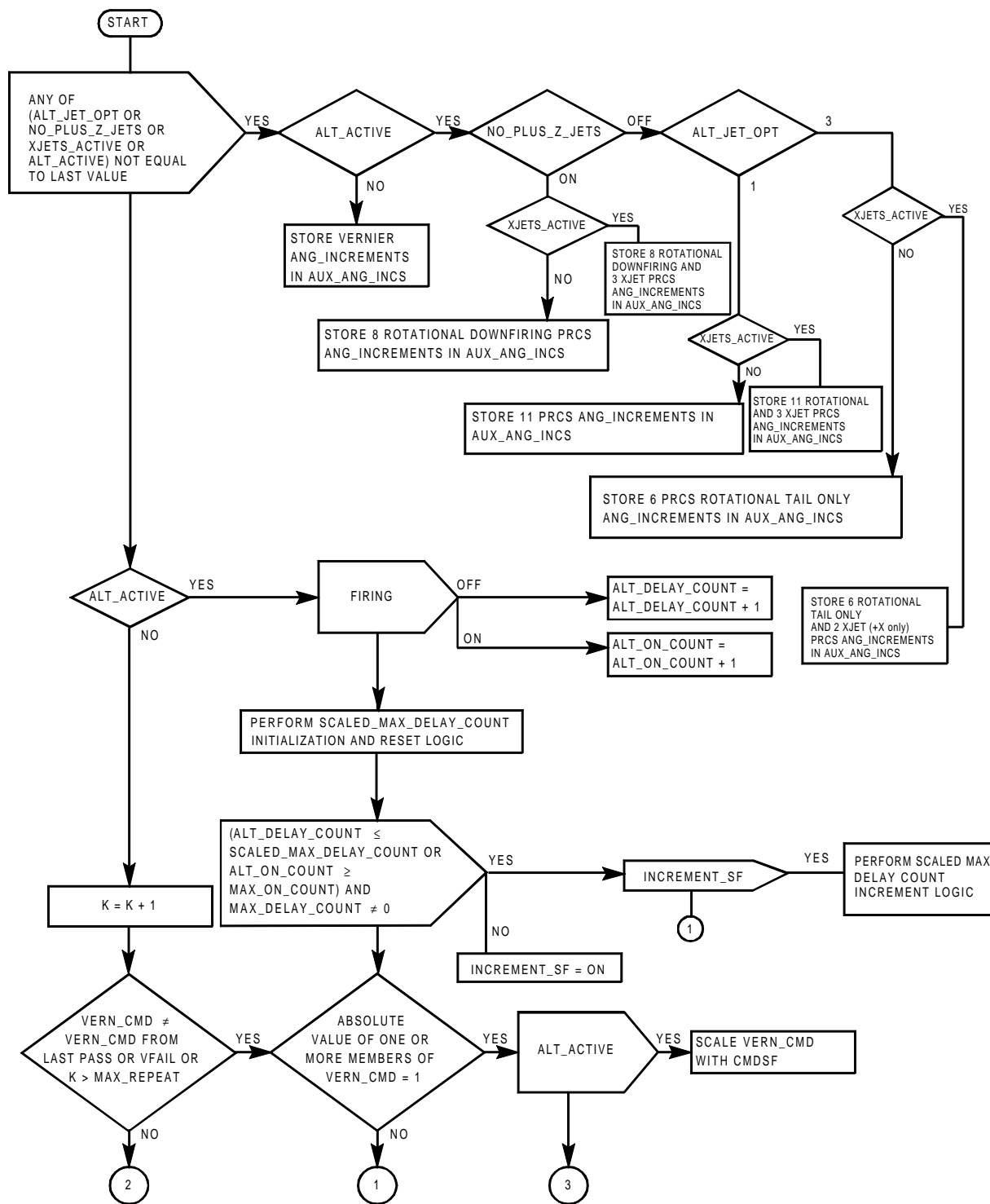
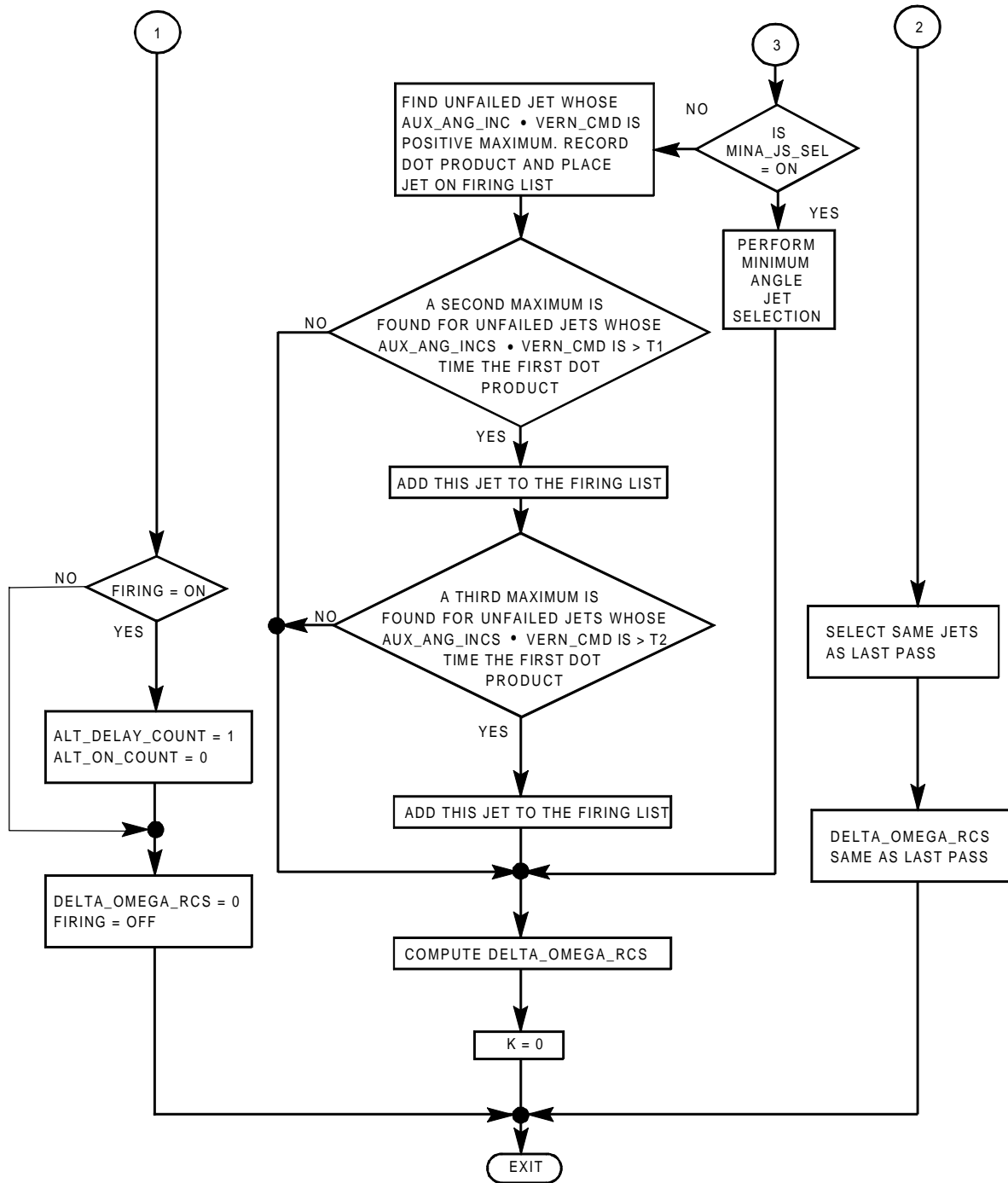


FIGURE 4.2.2.1-14. Rotation Command Generator



FOR INFORMATION ONLY

FIGURE 4.2.2.2.1-15.(1) VERNIER_ALT_JETS Simplified Flow Chart (Sheet 1 of 2)



FOR INFORMATION ONLY

FIGURE 4.2.2.2.1-15.(2) VERNIER_ALT_JETS Simplified Flow Chart (Sheet 2 of 2)

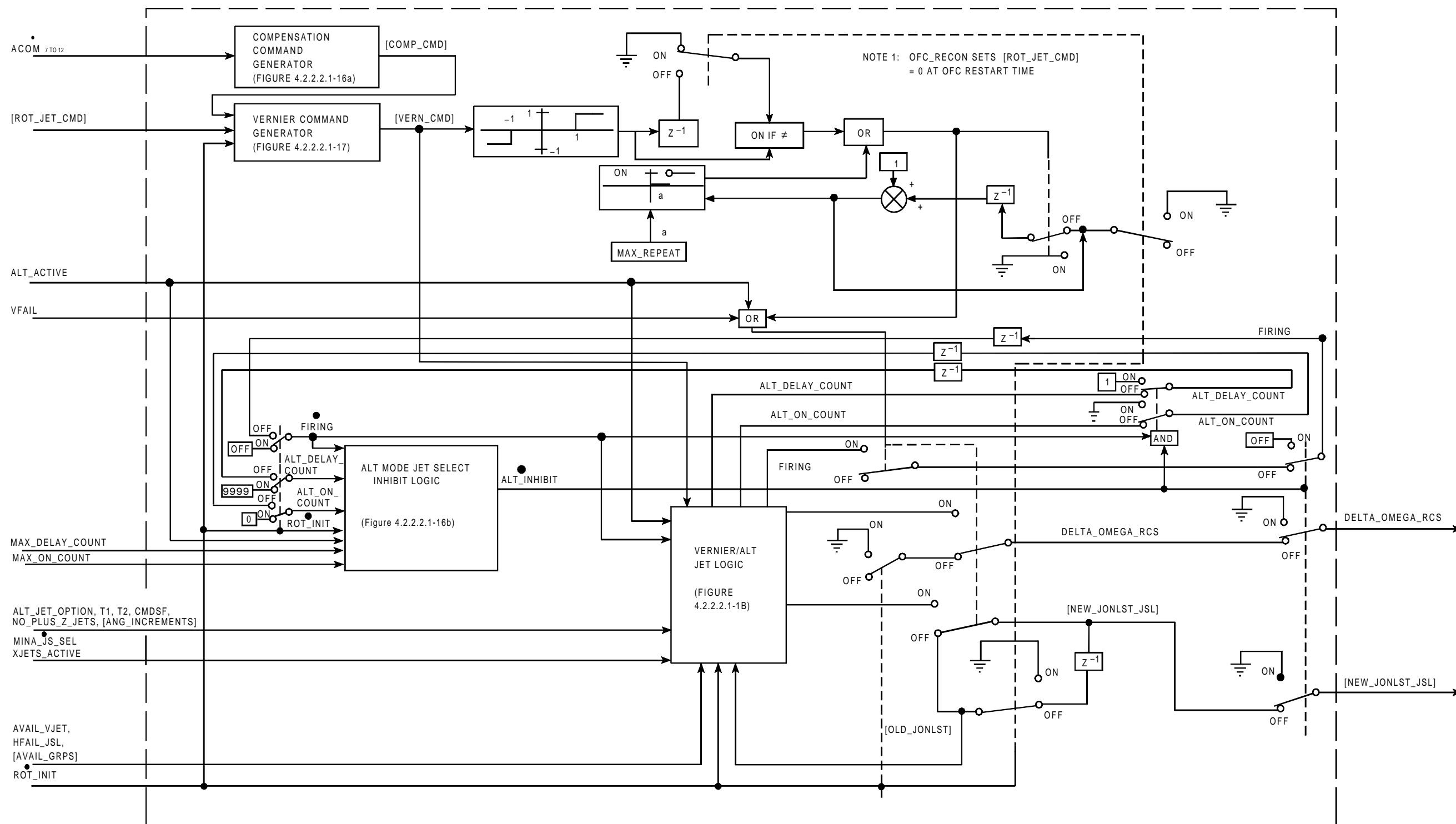


FIGURE 4.2.2.2.1-16. VERNIER_ALT_JETS

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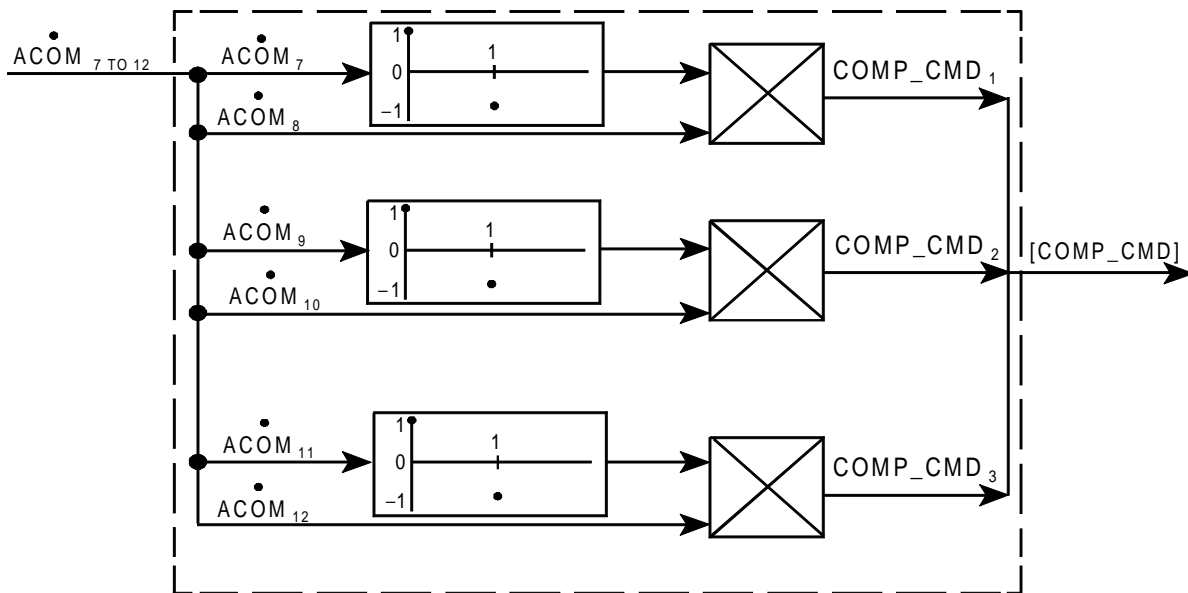


FIGURE 4.2.2.2.1-16a. Compensation Command Generator

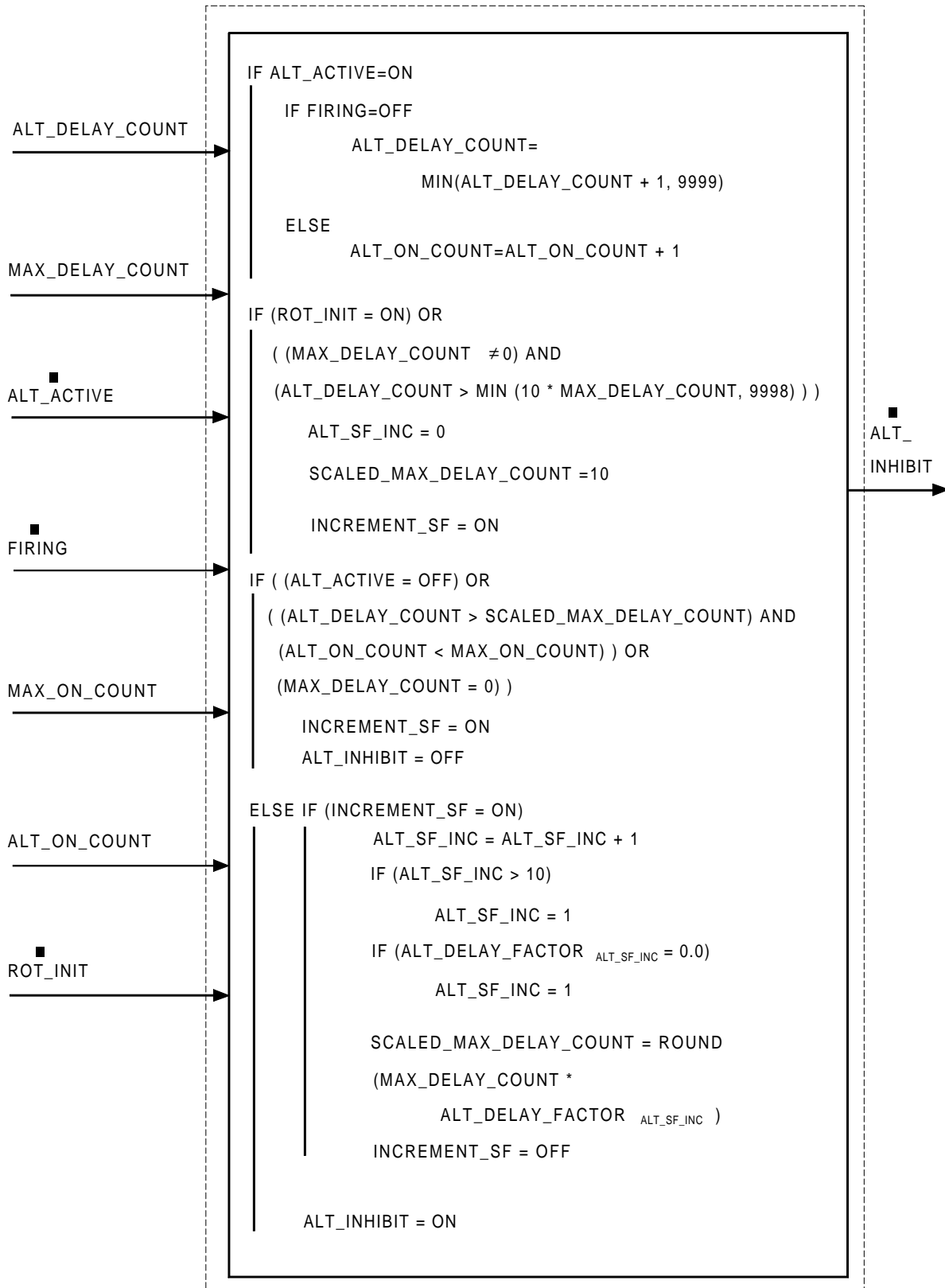


FIGURE 4.2.2.2.1-16b. ALT Mode Jet Select Inhibit Logic

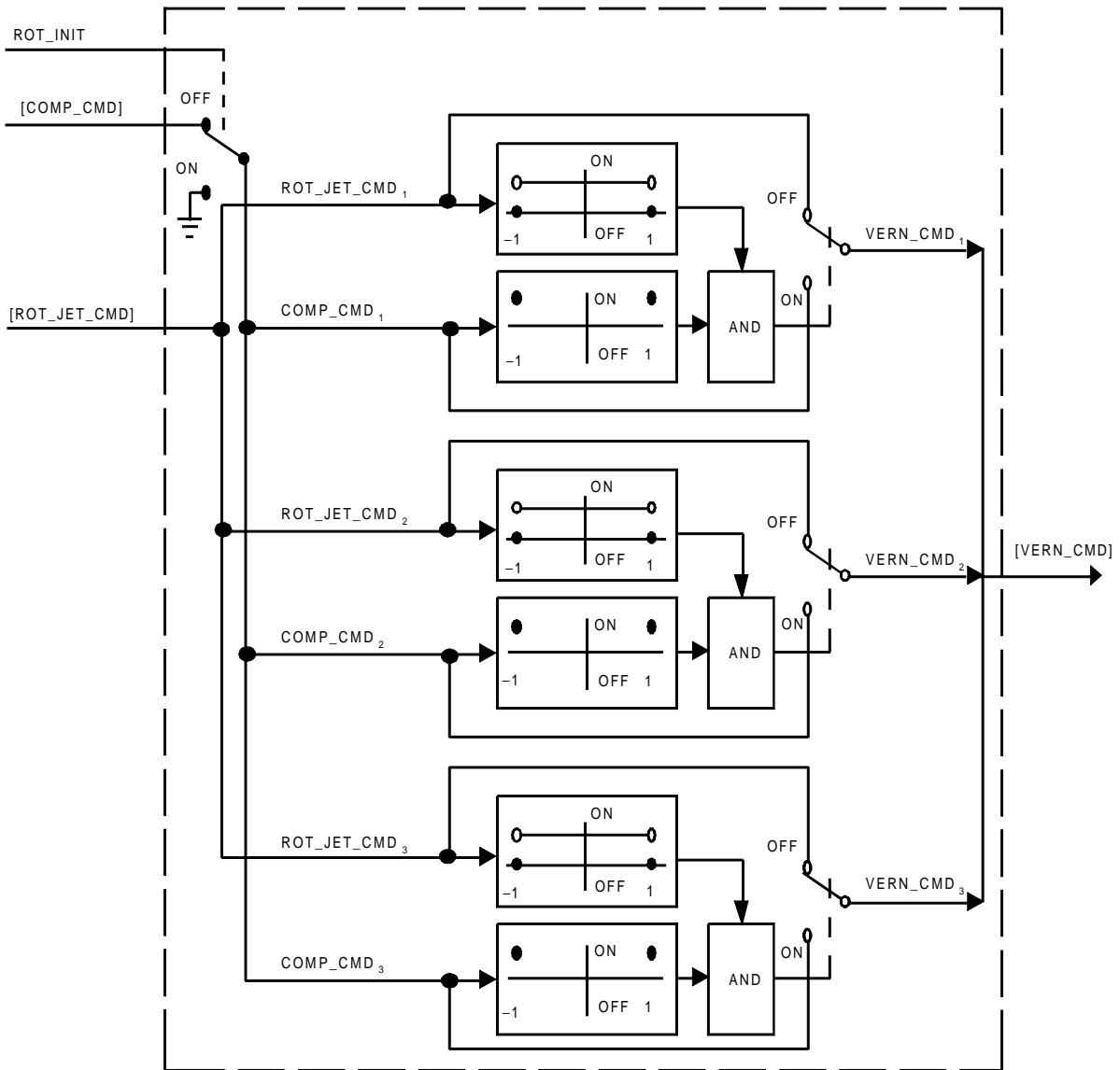


FIGURE 4.2.2.2.1-17. Vernier Command Generator

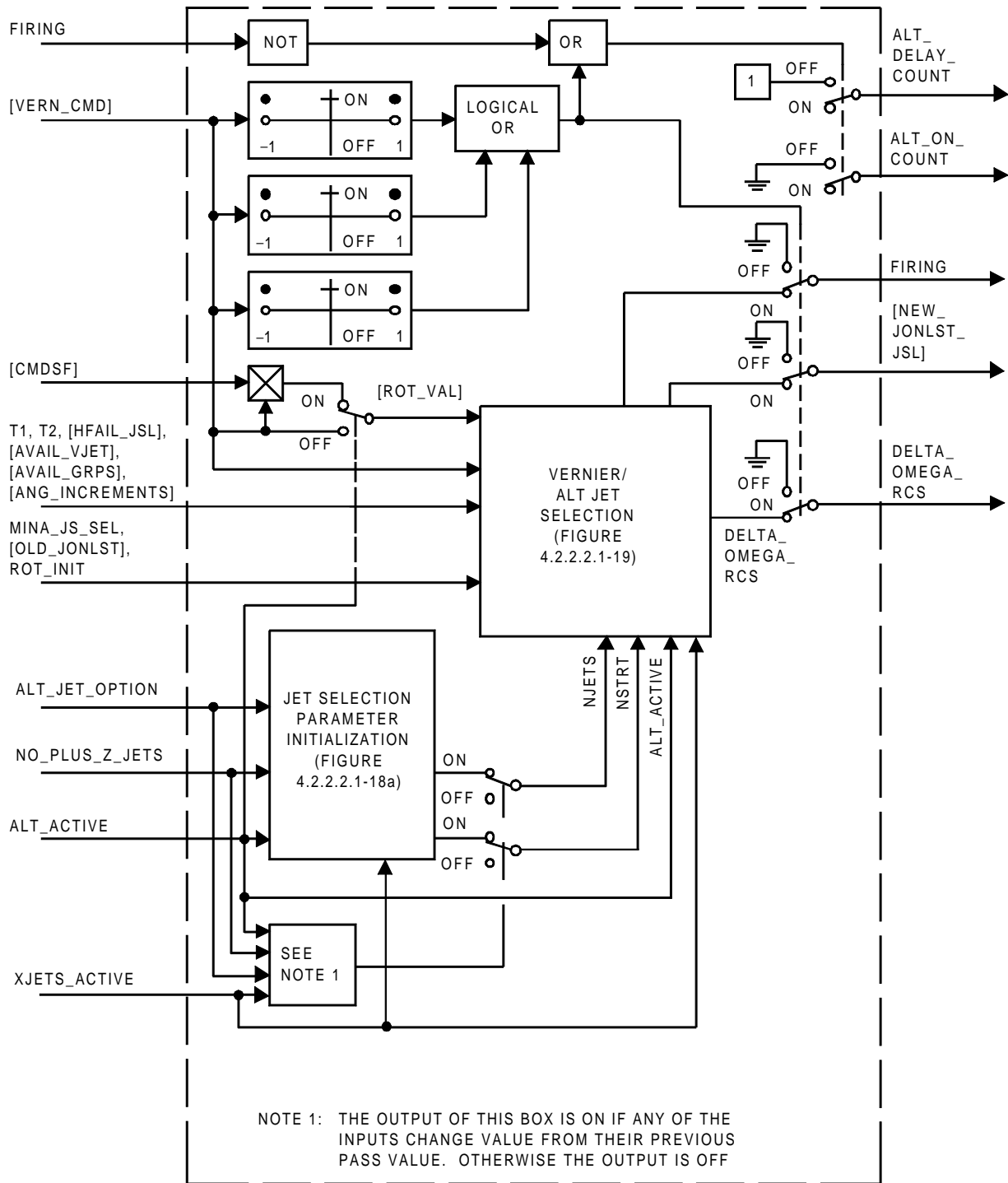


FIGURE 4.2.2.2.1-18. Vernier/ALT Jet Logic

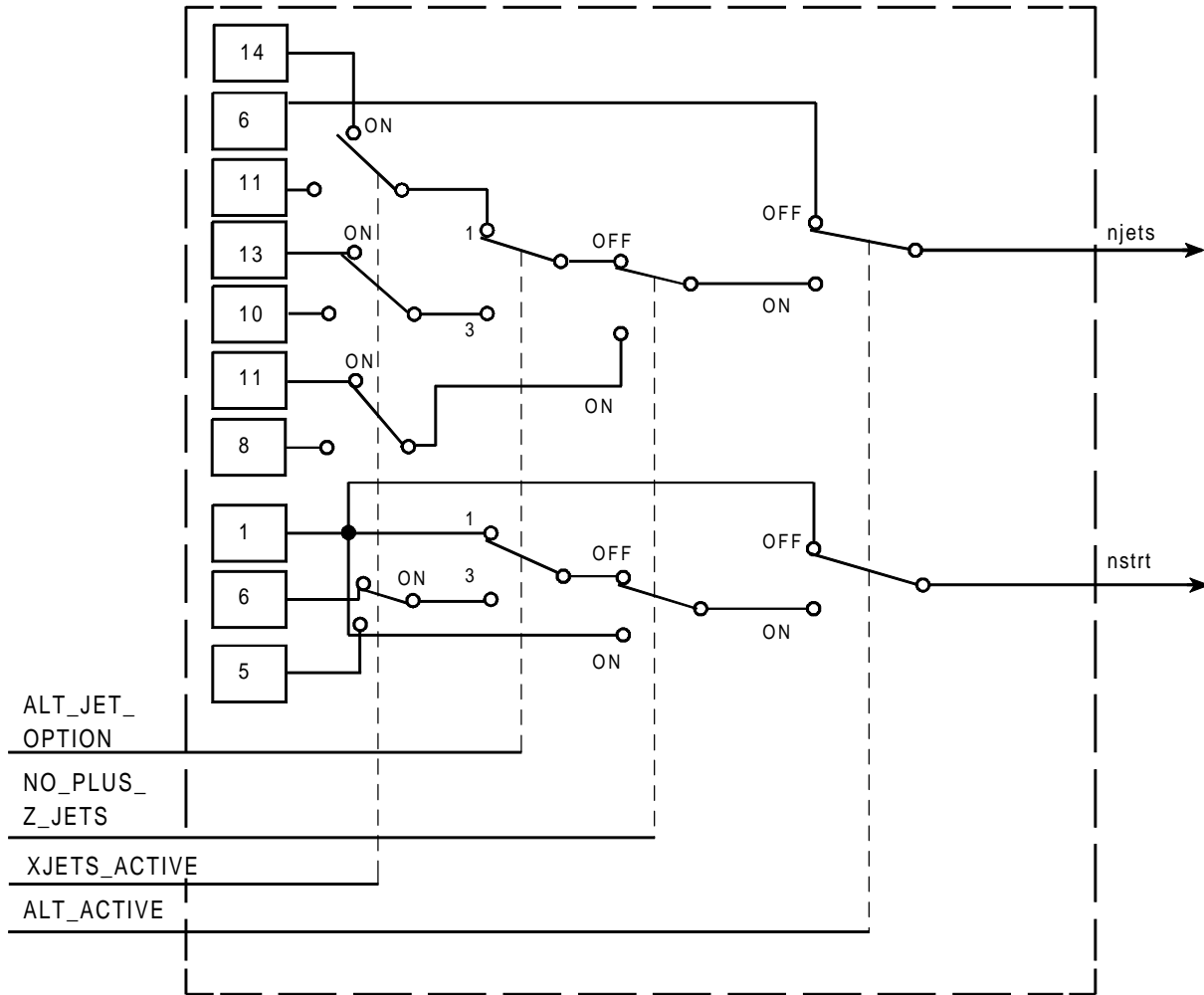
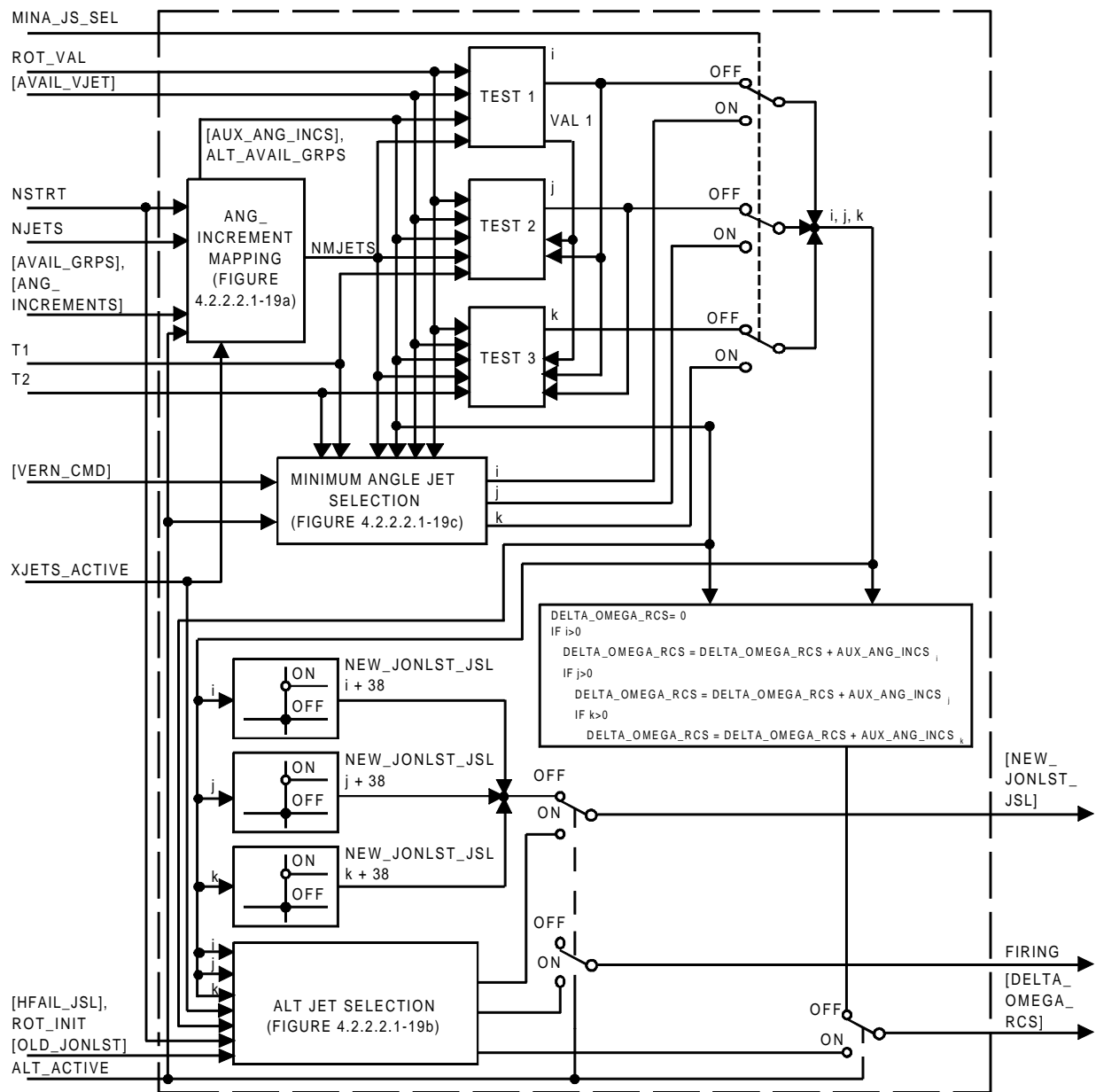


FIGURE 4.2.2.2.1-18a. Jet Selection Parameter Initialization



NOTES:

- TEST 1: SEEK POSITIVE MAXIMUM OF [INTEGER [(AVAIL_VJET_i AND ALT_ACTIVE) OR (ALT_AVAIL_GRPs_i AND ALT_ACTIVE)] VECTOR (ROT_VAL) • AUX_ANG_INCS_i] WHERE i = 1 TO NMJETS. IF FOUND, OUTPUT IT AS VAL1 AND OUTPUT THE ASSOCIATED i. IF NOT FOUND, THEN OUTPUT VAL1 = 0, i = 0.
- TEST 2: DO ONLY IF i ≠ 0. SEEK POSITIVE MAXIMUM OF [INTEGER [(AVAIL_VJET_j AND ALT_ACTIVE) OR (ALT_AVAIL_GRPs_j AND ALT_ACTIVE)] VECTOR (ROT_VAL) • AUX_ANG_INCS_j] THAT IS GREATER THAN [(T₁) (VAL1)] WHEN i ≠ j WHERE j = 1 TO NMJETS. IF FOUND, OUTPUT THE ASSOCIATED j. IF NOT FOUND, THEN OUTPUT j = 0.
- TEST 3: DO ONLY IF j ≠ 0. SEEK POSITIVE MAXIMUM OF [INTEGER [(AVAIL_VJET_k AND ALT_ACTIVE) OR (ALT_AVAIL_GRPs_k AND ALT_ACTIVE)] VECTOR (ROT_VAL) • AUX_ANG_INCS_k] THAT IS GREATER THAN [(T₂) (VAL1)] WHEN i ≠ k, j ≠ k, WHERE k = 1 TO NMJETS. IF FOUND, OUTPUT THE ASSOCIATED k. IF NOT FOUND, THEN OUTPUT k = 0. IF j = 0, THEN OUTPUT k = 0.

FIGURE 4.2.2.2.1-19. Vernier/ALT Jet Selection

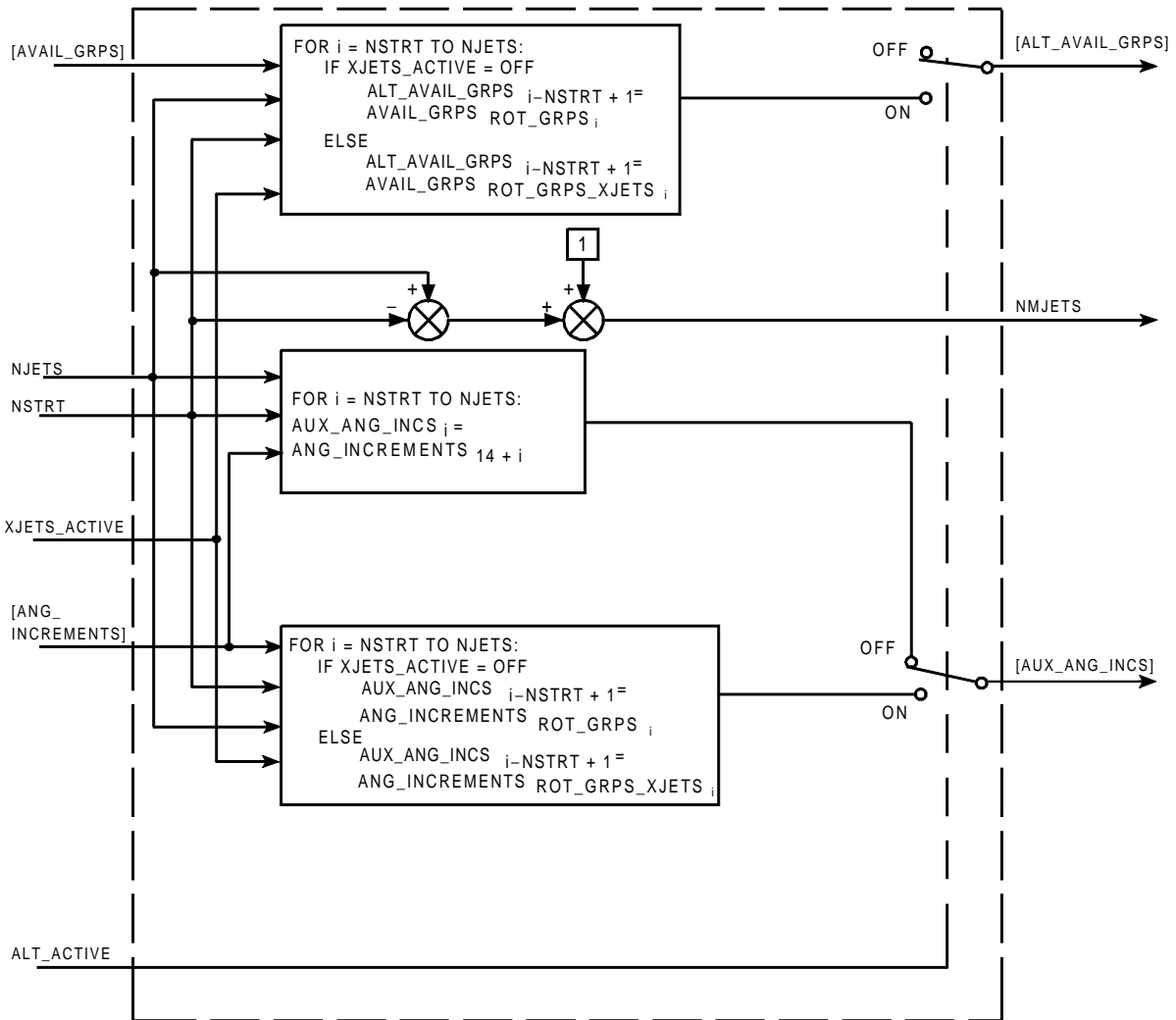
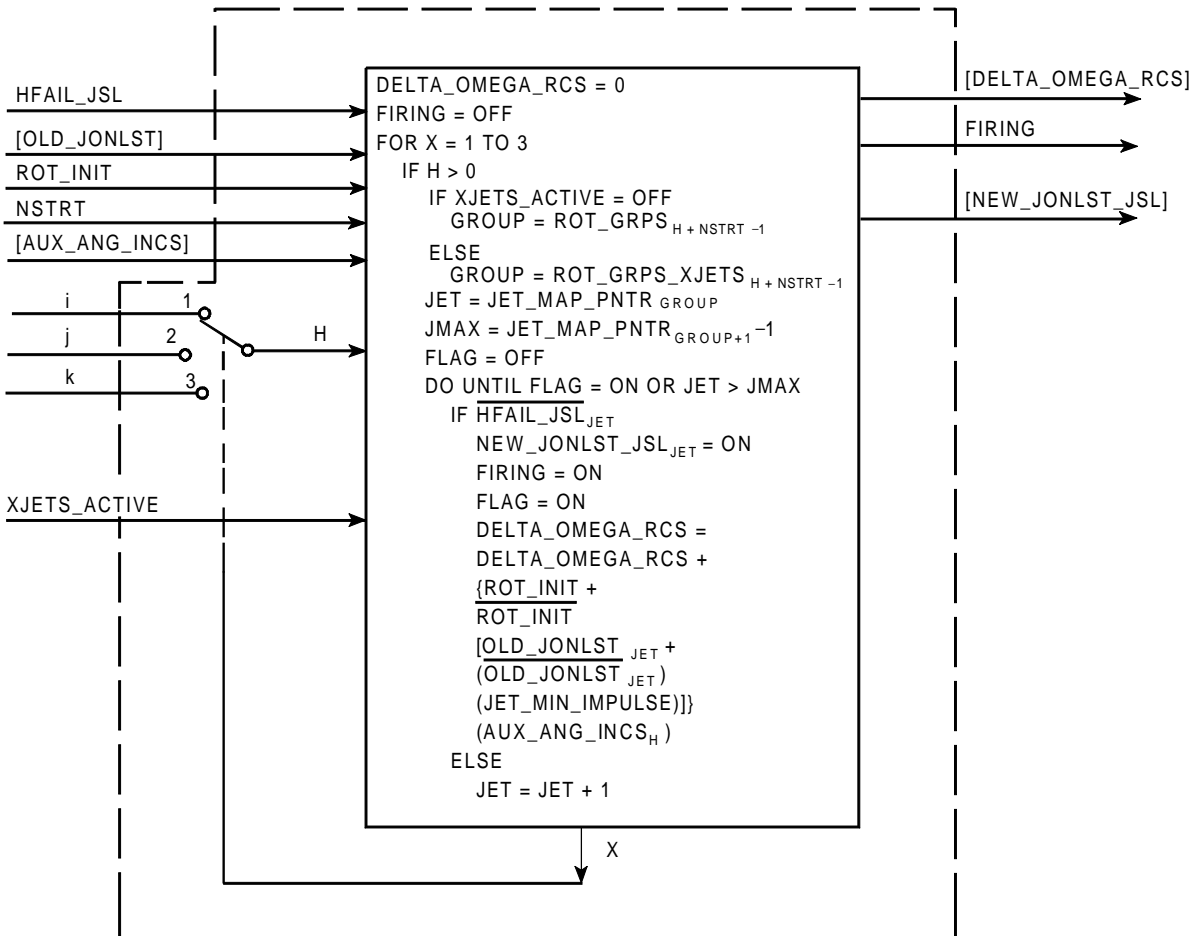


FIGURE 4.2.2.2.1-19a. ANG_INCREMENT Mapping



NOTE: THE FLAGS ROT_INIT AND [OLD_JONLST] AND XJETS_ACTIVE ARE ASSUMED ON = 1 AND OFF = 0.

FIGURE 4.2.2.2.1-19b. ALT Jet Selection

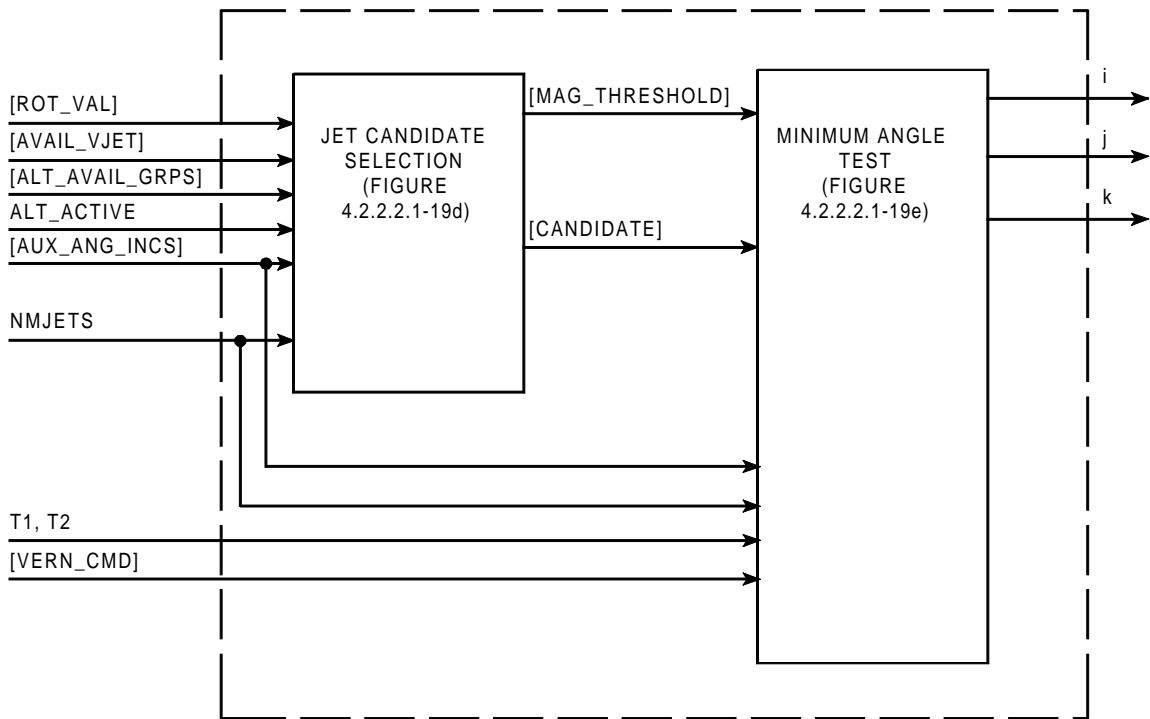


FIGURE 4.2.2.2.1-19c. Minimum Angle Jet Selection

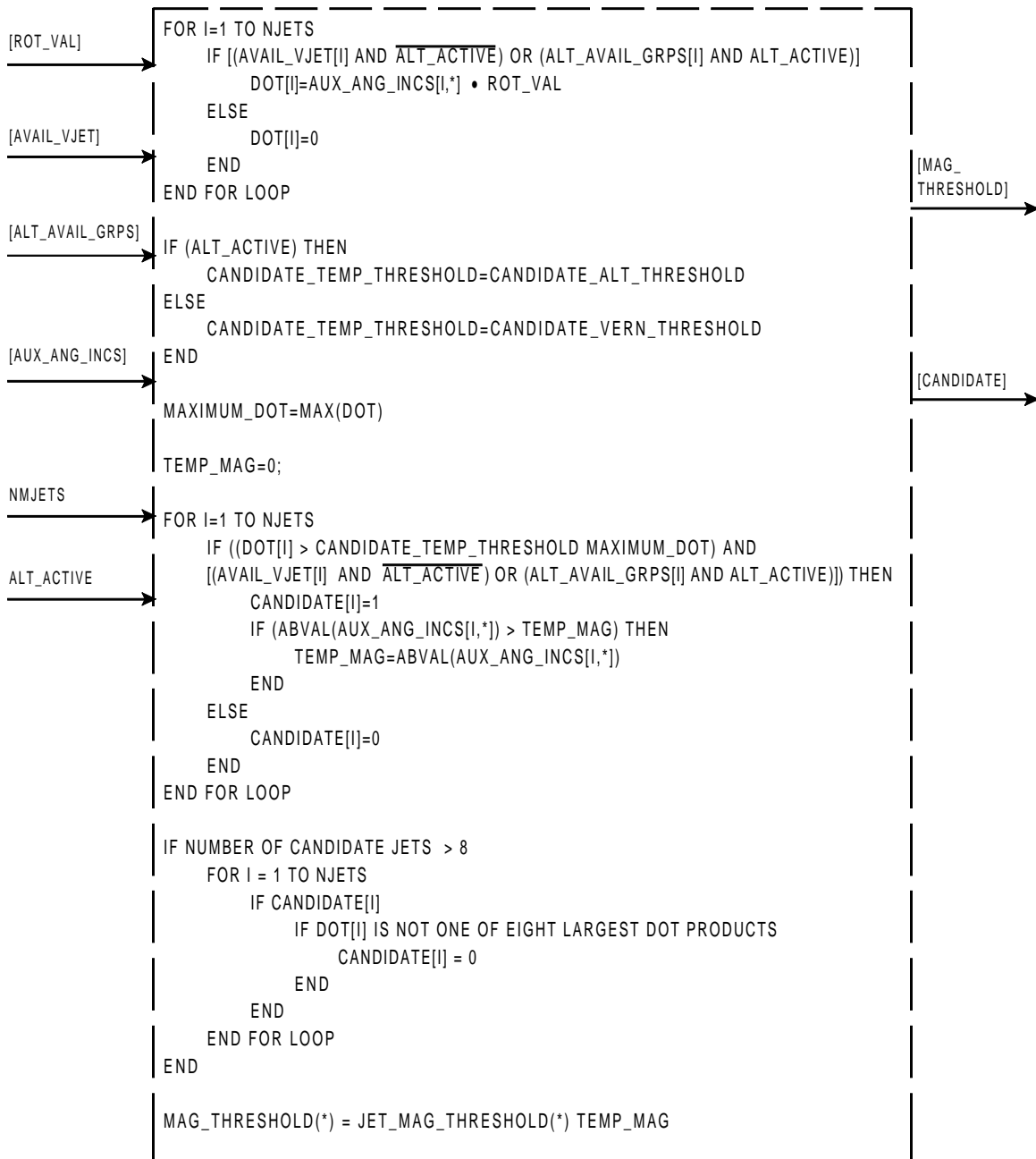


FIGURE 4.2.2.2.1-19d. Jet Candidate Selection

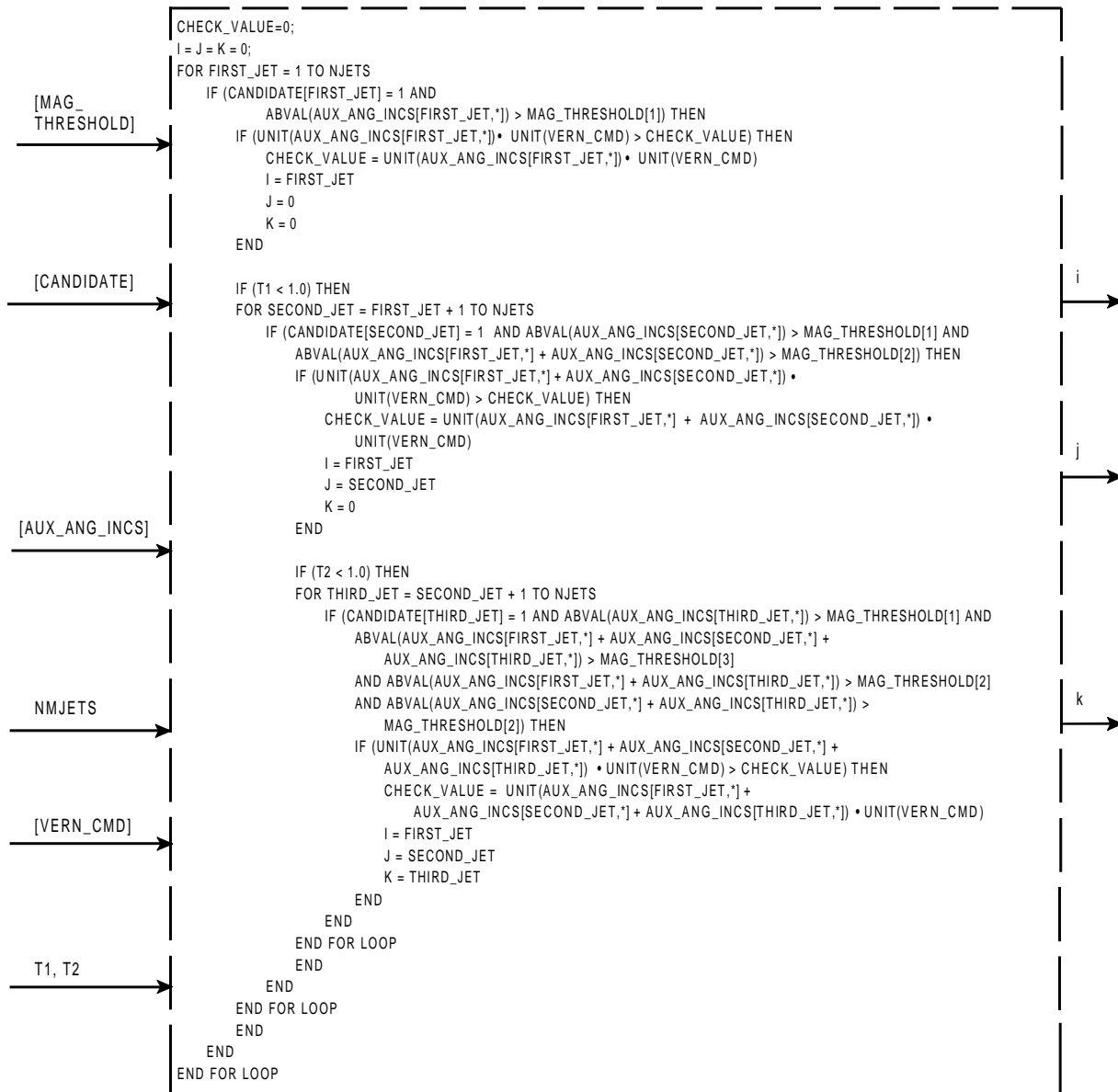


FIGURE 4.2.2.2.1-19e. Minimum Angle Test

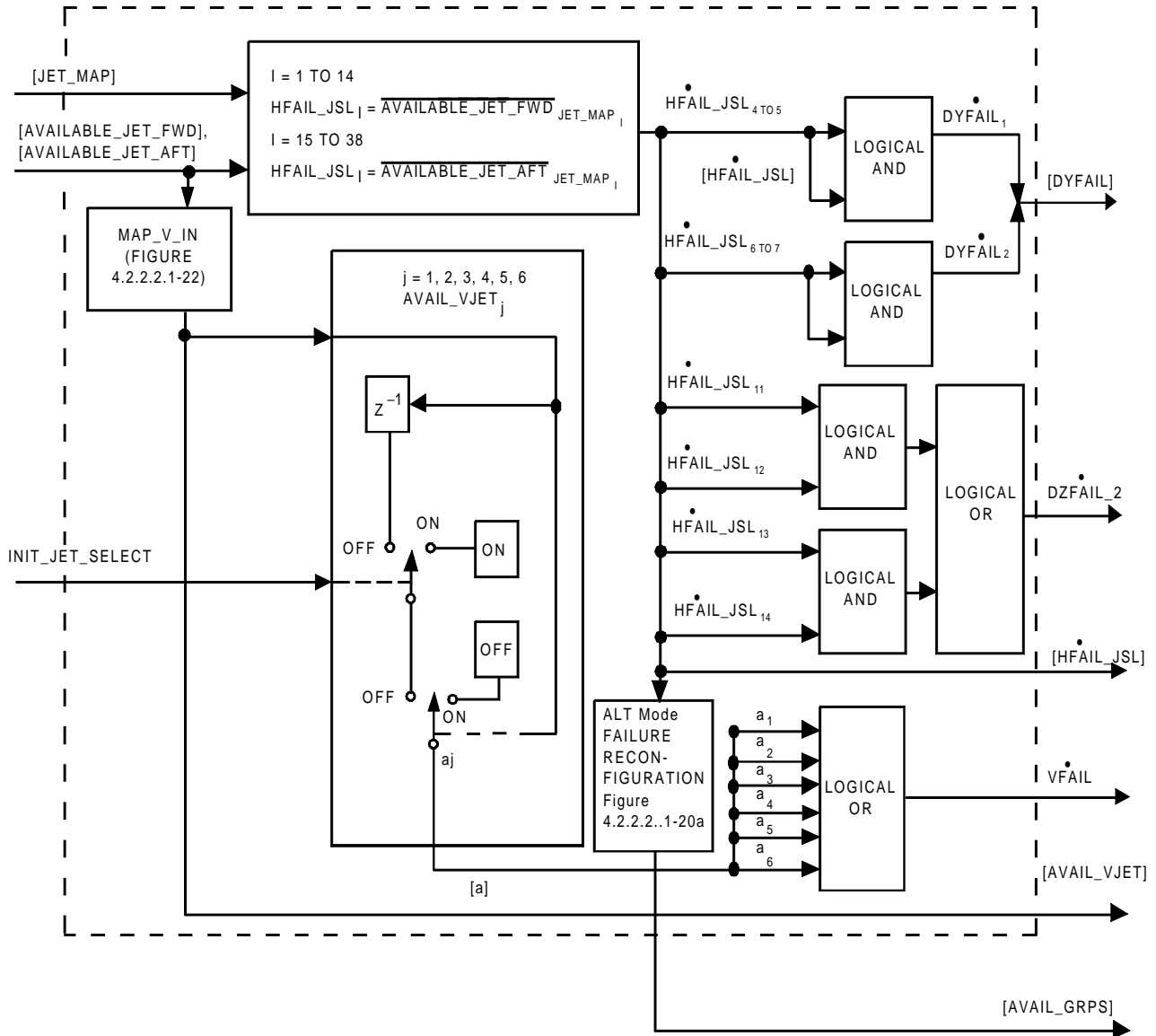


FIGURE 4.2.2.2.1-20. Failure Reconfiguration

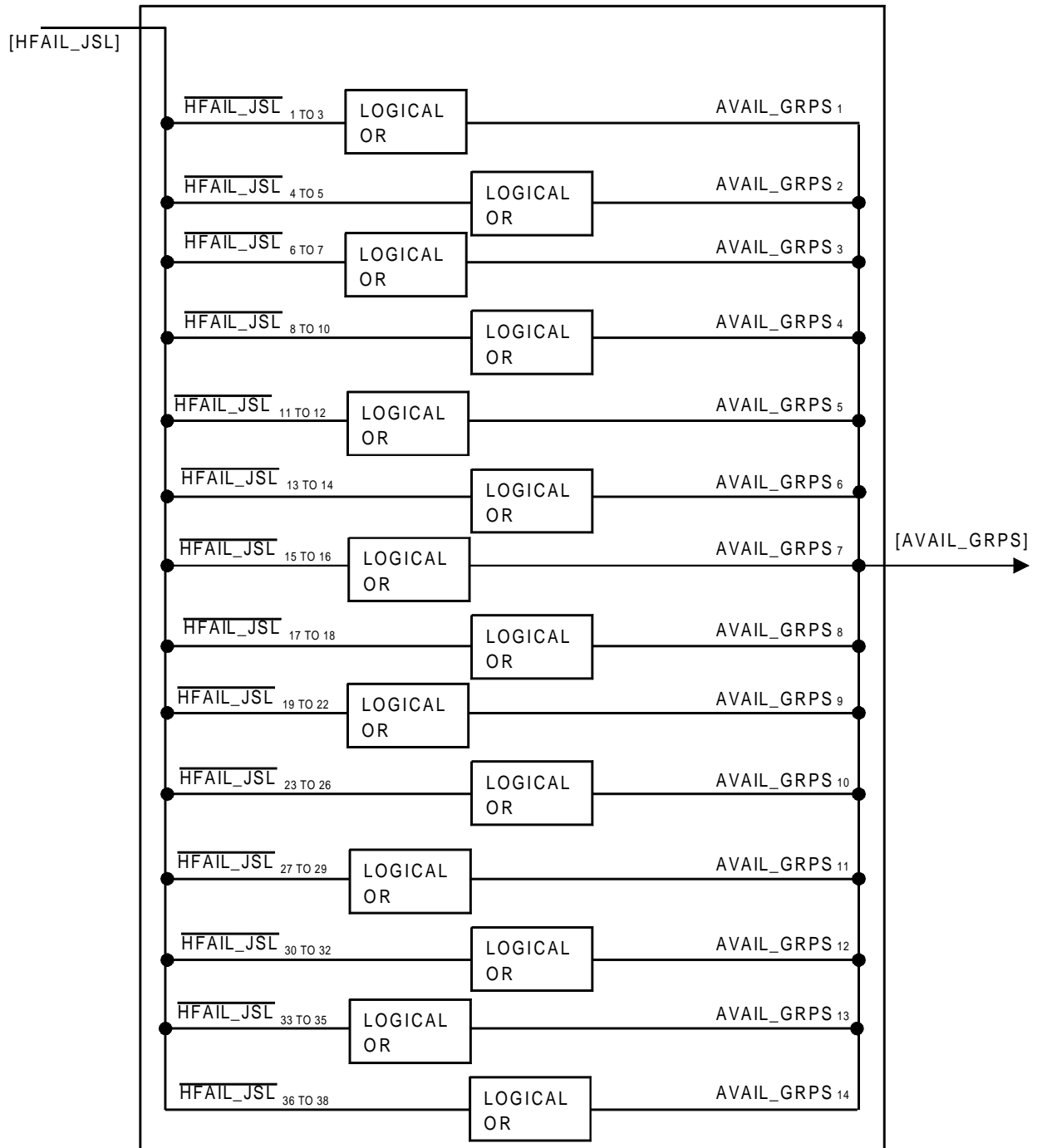


FIGURE 4.2.2.1-20a. ALT Mode Failure Reconfiguration

NEW_JONLST_FWD₁₂ = NEW_JONLST_JSL₃₉
NEW_JONLST_FWD₁₁ = NEW_JONLST_JSL₄₀
NEW_JONLST_AFT₁₅ = NEW_JONLST_JSL₄₁
NEW_JONLST_AFT₈ = NEW_JONLST_JSL₄₂
NEW_JONLST_AFT₁₆ = NEW_JONLST_JSL₄₃
NEW_JONLST_AFT₇ = NEW_JONLST_JSL₄₄

FIGURE 4.2.2.2.1-21. MAP_V_OUT

AVAIL_VJET₁ = AVAILABLE_JET_FWD₁₂
AVAIL_VJET₂ = AVAILABLE_JET_FWD₁₁
AVAIL_VJET₃ = AVAILABLE_JET_AFT₁₅
AVAIL_VJET₄ = AVAILABLE_JET_AFT₈
AVAIL_VJET₅ = AVAILABLE_JET_AFT₁₆
AVAIL_VJET₆ = AVAILABLE_JET_AFT₇

FIGURE 4.2.2.2.1-22. MAP_V_IN

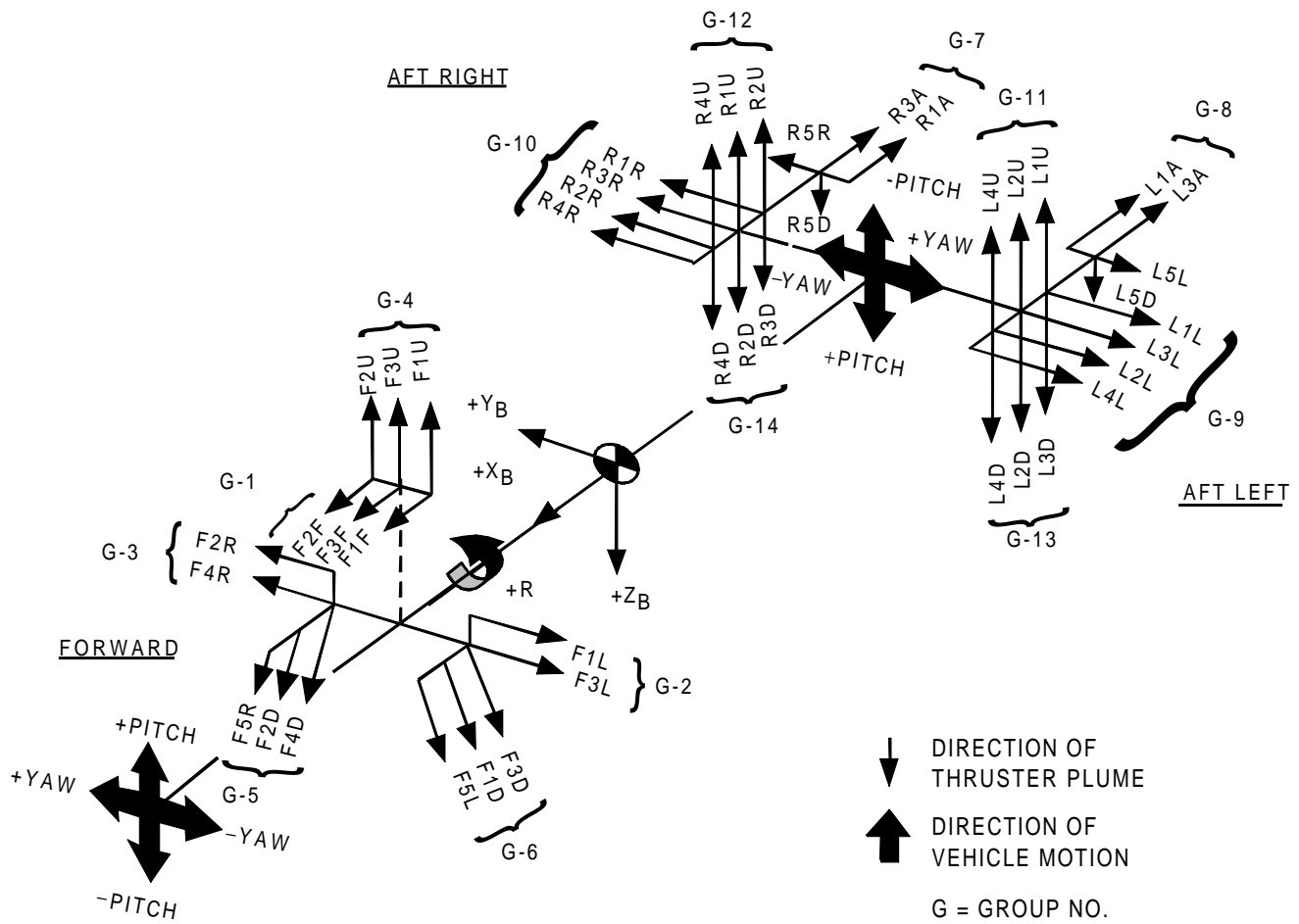
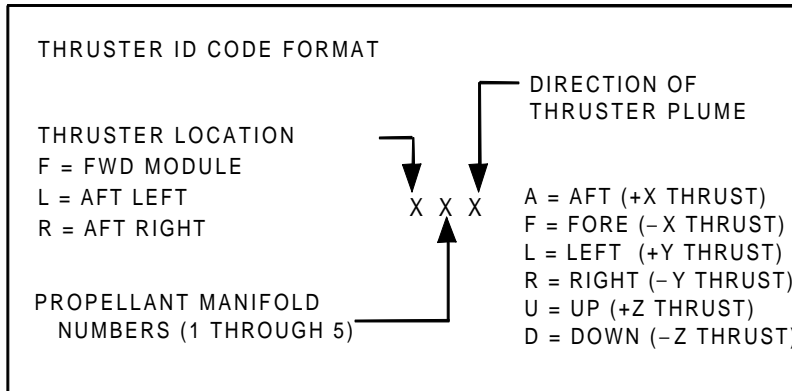


FIGURE 4.2.2.2.1-23. RCS Jet Locations and Plume Directions

| Table 4.2.2.2.1-1A. Z Translation and/or Roll Rotation and/or Pitch Rotation Jet Groups (High +Z Translation With Both Closed Crossfeed and Interconnect or No +X Translation) | | | | | | | | | |
|--|-------------------------------|----|------------------------------|-----|-----|------|------|------|------|
| Commands | Failure Locations by Group | | Number of Jets Used by Group | | | | | | |
| | | | G-4 | G-5 | G-6 | G-11 | G-12 | G-13 | G-14 |
| +Z +ROLL +PITCH | None | | 1 | 0 | 0 | 1 | 3 | 0 | 0 |
| | 4 | | 1 | 0 | 0 | 1 | 3 | 0 | 0 |
| | 11 | | 1 | 0 | 0 | 1 | 3 | 0 | 0 |
| | 12 | | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| | 4 | 4 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 4 | 11 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 4 | 12 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 11 | 11 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 11 | 12 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 12 | 12 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| +Z +ROLL | None | | 3 | 0 | 0 | 1 | 3 | 0 | 0 |
| | 4 | | 2 | 0 | 0 | 1 | 3 | 0 | 0 |
| | 11 | | 3 | 0 | 0 | 1 | 3 | 0 | 0 |
| | 12 | | 2 | 0 | 0 | 0 | 2 | 0 | 0 |
| | 4 | 4 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 4 | 11 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 4 | 12 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 11 | 11 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 11 | 12 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 12 | 12 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| +Z +ROLL -PITCH | None | | 3 | 0 | 0 | 0 | 2 | 0 | 0 |
| | 4 | | 2 | 0 | 0 | 0 | 2 | 0 | 0 |
| | 11 | | 3 | 0 | 0 | 0 | 2 | 0 | 0 |
| | 12 | | 3 | 0 | 0 | 0 | 2 | 0 | 0 |
| | 4 | 4 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 4 | 11 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 4 | 12 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 11 | 11 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 11 | 12 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 12 | 12 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| +Z +PITCH | None | | 2 | 0 | 0 | 3 | 3 | 0 | 0 |
| | 4 | | 2 | 0 | 0 | 3 | 3 | 0 | 0 |
| | 11 | | 1 | 0 | 0 | 2 | 2 | 0 | 0 |
| | 12 | | 1 | 0 | 0 | 2 | 2 | 0 | 0 |
| | 4 | 4 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 4 | 11 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 4 | 12 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 11 | 11 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 11 | 12 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 12 | 12 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |

| Table 4.2.2.2.1-1A. Z Translation and/or Roll Rotation and/or Pitch Rotation Jet Groups (High +Z Translation With Both Closed Crossfeed and Interconnect or No +X Translation) | | | | | | | | |
|--|-------------------------------|------------------------------|-----|-----|------|------|------|------|
| Commands | Failure Locations by Group | Number of Jets Used by Group | | | | | | |
| | | G-4 | G-5 | G-6 | G-11 | G-12 | G-13 | G-14 |
| +Z | None | 3 | 0 | 0 | 3 | 3 | 0 | 0 |
| | 4 | 2 | 0 | 0 | 2 | 2 | 0 | 0 |
| | 11 | 3 | 0 | 0 | 2 | 2 | 0 | 0 |
| | 12 | 3 | 0 | 0 | 2 | 2 | 0 | 0 |
| | 4 4 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 4 11 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 4 12 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 11 11 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 11 12 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 12 12 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| +Z -PITCH | None | 3 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 4 | 2 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 11 | 3 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 12 | 3 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 4 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 11 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 12 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 11 11 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 11 12 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 12 12 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| +Z -ROLL +PITCH | None | 1 | 0 | 0 | 3 | 1 | 0 | 0 |
| | 4 | 1 | 0 | 0 | 3 | 1 | 0 | 0 |
| | 11 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| | 12 | 1 | 0 | 0 | 3 | 1 | 0 | 0 |
| | 4 4 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 4 11 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 4 12 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 11 11 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 11 12 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 12 12 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| +Z -ROLL | None | 3 | 0 | 0 | 3 | 1 | 0 | 0 |
| | 4 | 2 | 0 | 0 | 3 | 1 | 0 | 0 |
| | 11 | 2 | 0 | 0 | 2 | 0 | 0 | 0 |
| | 12 | 3 | 0 | 0 | 3 | 1 | 0 | 0 |
| | 4 4 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 4 11 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 4 12 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 11 11 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 11 12 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 12 12 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |

| Table 4.2.2.2.1-1A. Z Translation and/or Roll Rotation and/or Pitch Rotation Jet Groups (High +Z Translation With Both Closed Crossfeed and Interconnect or No +X Translation) | | | | | | | | | |
|--|-------------------------------|----|------------------------------|-----|-----|------|------|------|------|
| Commands | Failure Locations by Group | | Number of Jets Used by Group | | | | | | |
| | | | G-4 | G-5 | G-6 | G-11 | G-12 | G-13 | G-14 |
| +Z | None | | 3 | 0 | 0 | 2 | 0 | 0 | 0 |
| -ROLL | 4 | | 2 | 0 | 0 | 2 | 0 | 0 | 0 |
| -PITCH | 11 | | 3 | 0 | 0 | 2 | 0 | 0 | 0 |
| | 12 | | 3 | 0 | 0 | 2 | 0 | 0 | 0 |
| | 4 | 4 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 4 | 11 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 4 | 12 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 11 | 11 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 11 | 12 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 12 | 12 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |

| Table 4.2.2.2.1-1B. Z Translation and/or Roll Rotation and/or Pitch Rotation Jet Groups (High +Z Translation With Either Open Crossfeed or Interconnect and +X Translation) | | | | | | | | | |
|---|-------------------------------|----|------------------------------|-----|-----|------|------|------|------|
| Commands | Failure Locations by Group | | Number of Jets Used by Group | | | | | | |
| | | | G-4 | G-5 | G-6 | G-11 | G-12 | G-13 | G-14 |
| +Z +ROLL +PITCH +X | None | | 1 | 0 | 0 | 1 | 3 | 0 | 0 |
| | 4 | | 1 | 0 | 0 | 1 | 3 | 0 | 0 |
| | 11 | | 1 | 0 | 0 | 1 | 3 | 0 | 0 |
| | 12 | | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| | 4 | 4 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 4 | 11 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 4 | 12 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 11 | 11 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| +Z +ROLL +X | None | | 3 | 0 | 0 | 1 | 3 | 0 | 0 |
| | 4 | | 2 | 0 | 0 | 1 | 3 | 0 | 0 |
| | 11 | | 3 | 0 | 0 | 1 | 3 | 0 | 0 |
| | 12 | | 2 | 0 | 0 | 0 | 2 | 0 | 0 |
| | 4 | 4 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 4 | 11 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 4 | 12 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 11 | 11 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| +Z +ROLL -PITCH +X | None | | 3 | 0 | 0 | 0 | 2 | 0 | 0 |
| | 4 | | 2 | 0 | 0 | 0 | 2 | 0 | 0 |
| | 11 | | 3 | 0 | 0 | 0 | 2 | 0 | 0 |
| | 12 | | 3 | 0 | 0 | 0 | 2 | 0 | 0 |
| | 4 | 4 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 4 | 11 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 4 | 12 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 11 | 11 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| +Z +PITCH +X | None | | 1 | 0 | 0 | 2 | 2 | 0 | 0 |
| | 4 | | 1 | 0 | 0 | 2 | 2 | 0 | 0 |
| | 11 | | 1 | 0 | 0 | 2 | 2 | 0 | 0 |
| | 12 | | 1 | 0 | 0 | 2 | 2 | 0 | 0 |
| | 4 | 4 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 4 | 11 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 4 | 12 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 11 | 11 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 11 | 12 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | |
| 12 | 12 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | |

| Table 4.2.2.2.1-1B. Z Translation and/or Roll Rotation and/or Pitch Rotation Jet Groups (High +Z Translation With Either Open Crossfeed or Interconnect and +X Translation) | | | | | | | | | |
|---|-------------------------------|----|------------------------------|-----|-----|------|------|------|------|
| Commands | Failure Locations by Group | | Number of Jets Used by Group | | | | | | |
| | | | G-4 | G-5 | G-6 | G-11 | G-12 | G-13 | G-14 |
| +Z +X | None | | 3 | 0 | 0 | 2 | 2 | 0 | 0 |
| | 4 | | 2 | 0 | 0 | 2 | 2 | 0 | 0 |
| | 11 | | 3 | 0 | 0 | 2 | 2 | 0 | 0 |
| | 12 | | 3 | 0 | 0 | 2 | 2 | 0 | 0 |
| | 4 | 4 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 4 | 11 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 4 | 12 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 11 | 11 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| +Z -PITCH +X | None | | 3 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 4 | | 2 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 11 | | 3 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 12 | | 3 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 4 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 | 11 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 | 12 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 11 | 11 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| +Z -ROLL +PITCH +X | None | | 1 | 0 | 0 | 3 | 1 | 0 | 0 |
| | 4 | | 1 | 0 | 0 | 3 | 1 | 0 | 0 |
| | 11 | | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| | 12 | | 1 | 0 | 0 | 3 | 1 | 0 | 0 |
| | 4 | 4 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 4 | 11 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 4 | 12 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 11 | 11 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| +Z -ROLL +X | None | | 3 | 0 | 0 | 3 | 1 | 0 | 0 |
| | 4 | | 2 | 0 | 0 | 3 | 1 | 0 | 0 |
| | 11 | | 2 | 0 | 0 | 2 | 0 | 0 | 0 |
| | 12 | | 3 | 0 | 0 | 3 | 1 | 0 | 0 |
| | 4 | 4 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 4 | 11 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 4 | 12 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 11 | 11 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |

| Table 4.2.2.2.1-1B. Z Translation and/or Roll Rotation and/or Pitch Rotation Jet Groups (High +Z Translation With Either Open Crossfeed or Interconnect and +X Translation) | | | | | | | | | |
|---|-------------------------------|----|------------------------------|-----|-----|------|------|------|------|
| Commands | Failure Locations by Group | | Number of Jets Used by Group | | | | | | |
| | | | G-4 | G-5 | G-6 | G-11 | G-12 | G-13 | G-14 |
| +Z | None | | 3 | 0 | 0 | 2 | 0 | 0 | 0 |
| -ROLL | 4 | | 2 | 0 | 0 | 2 | 0 | 0 | 0 |
| -PITCH | 11 | | 3 | 0 | 0 | 2 | 0 | 0 | 0 |
| +X | 12 | | 3 | 0 | 0 | 2 | 0 | 0 | 0 |
| | 4 | 4 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 4 | 11 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 4 | 12 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 11 | 11 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 11 | 12 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 12 | 12 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |

| Table 4.2.2.2.1-1C. Z Translation and/or Roll Rotation and/or Pitch Rotation Jet Groups (Nominal Z Translation) | | | | | | | | | |
|--|-------------------------------|----|------------------------------|-----|-----|------|------|------|------|
| Commands | Failure Locations by Group | | Number of Jets Used by Group | | | | | | |
| | | | G-4 | G-5 | G-6 | G-11 | G-12 | G-13 | G-14 |
| +Z +ROLL +PITCH | None | | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 4 | | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 11 | | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 12 | | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 4 | 4 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 4 | 11 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 4 | 12 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 11 | 11 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 11 | 12 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 12 | 12 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| +Z +ROLL | None | | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 4 | | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 11 | | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 12 | | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 4 | 4 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 4 | 11 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 4 | 12 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 11 | 11 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 11 | 12 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 12 | 12 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| +Z +ROLL -PITCH | None | | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 4 | | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 11 | | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 12 | | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 4 | 4 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 4 | 11 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 4 | 12 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 11 | 11 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 11 | 12 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 12 | 12 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| +Z +PITCH | None | | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 4 | | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 11 | | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 12 | | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 4 | 4 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 4 | 11 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 4 | 12 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 11 | 11 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 11 | 12 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 12 | 12 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |

| Table 4.2.2.2.1-1C. Z Translation and/or Roll Rotation and/or Pitch Rotation Jet Groups (Nominal Z Translation) | | | | | | | | | |
|--|-------------------------------|----|------------------------------|-----|-----|------|------|------|------|
| Commands | Failure Locations by Group | | Number of Jets Used by Group | | | | | | |
| | | | G-4 | G-5 | G-6 | G-11 | G-12 | G-13 | G-14 |
| +Z | None | | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 4 | | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 11 | | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 12 | | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 4 | 4 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 4 | 11 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 4 | 12 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 11 | 11 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 11 | 12 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 12 | 12 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| +Z -PITCH | None | | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 | | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 11 | | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 12 | | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 | 11 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 | 12 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 11 | 11 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 11 | 12 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 12 | 12 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| +Z -ROLL +PITCH | None | | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 4 | | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 11 | | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 12 | | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 4 | 4 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 4 | 11 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 4 | 12 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 11 | 11 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 11 | 12 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 12 | 12 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| +Z -ROLL | None | | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 4 | | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 11 | | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 12 | | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 4 | 4 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 4 | 11 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 4 | 12 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 11 | 11 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 11 | 12 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 12 | 12 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |

| Table 4.2.2.2.1-1C. Z Translation and/or Roll Rotation and/or Pitch Rotation Jet Groups (Nominal Z Translation) | | | | | | | | | |
|--|-------------------------------|----|------------------------------|-----|-----|------|------|------|------|
| Commands | Failure Locations by Group | | Number of Jets Used by Group | | | | | | |
| | | | G-4 | G-5 | G-6 | G-11 | G-12 | G-13 | G-14 |
| +Z -ROLL -PITCH | None | | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 4 | | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 11 | | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 12 | | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 4 | 4 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 4 | 11 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 4 | 12 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 11 | 11 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 11 | 12 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 12 | 12 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| -Z +ROLL +PITCH | None | | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 5 | | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 6 | | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 13 | | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 14 | | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 5 | 5 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| | 5 | 6 | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 5 | 13 | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 5 | 14 | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 6 | 6 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| | 6 | 13 | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 6 | 14 | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 13 | 13 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| | 13 | 14 | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| 13 | 14 | 0 | 1 | 1 | 0 | 0 | 2 | 0 | |
| -Z +ROLL | None | | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 5 | | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 6 | | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 13 | | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 14 | | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 5 | 5 | 0 | 0 | 1 | 0 | 0 | 2 | 0 |
| | 5 | 6 | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 5 | 13 | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 5 | 14 | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 6 | 6 | 0 | 1 | 0 | 0 | 0 | 2 | 0 |
| | 6 | 13 | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 6 | 14 | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 13 | 13 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| | 13 | 14 | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| 14 | 14 | 0 | 1 | 1 | 0 | 0 | 2 | 0 | |

| Table 4.2.2.2.1-1C. Z Translation and/or Roll Rotation and/or Pitch Rotation Jet Groups (Nominal Z Translation) | | | | | | | | | |
|--|-------------------------------|----|------------------------------|-----|-----|------|------|------|------|
| Commands | Failure Locations by Group | | Number of Jets Used by Group | | | | | | |
| | | | G-4 | G-5 | G-6 | G-11 | G-12 | G-13 | G-14 |
| -Z +ROLL -PITCH | None | | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 5 | | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 6 | | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 13 | | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 14 | | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 5 | 6 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 5 | 13 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 5 | 14 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 6 | 6 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 6 | 13 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 6 | 14 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 13 | 13 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | 13 | 14 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| 14 | 14 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | |
| -Z +PITCH | None | | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 5 | | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 6 | | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 13 | | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 14 | | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 5 | 5 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| | 5 | 6 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 5 | 13 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 5 | 14 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 6 | 6 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 6 | 13 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 6 | 14 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 13 | 13 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 13 | 14 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 14 | 14 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | |
| -Z | None | | 0 | 1 | 1 | 0 | 0 | 2 | 2 |
| | 5 | | 0 | 1 | 1 | 0 | 0 | 2 | 2 |
| | 6 | | 0 | 1 | 1 | 0 | 0 | 2 | 2 |
| | 13 | | 0 | 1 | 1 | 0 | 0 | 2 | 2 |
| | 14 | | 0 | 1 | 1 | 0 | 0 | 2 | 2 |
| | 5 | 5 | 0 | 0 | 1 | 0 | 0 | 2 | 2 |
| | 5 | 6 | 0 | 1 | 1 | 0 | 0 | 2 | 2 |
| | 5 | 13 | 0 | 1 | 1 | 0 | 0 | 2 | 2 |
| | 5 | 14 | 0 | 1 | 1 | 0 | 0 | 2 | 2 |
| | 6 | 6 | 0 | 1 | 0 | 0 | 0 | 2 | 2 |
| | 6 | 13 | 0 | 1 | 1 | 0 | 0 | 2 | 2 |
| | 6 | 14 | 0 | 1 | 1 | 0 | 0 | 2 | 2 |
| | 13 | 13 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| | 13 | 14 | 0 | 1 | 1 | 0 | 0 | 2 | 2 |
| 14 | 14 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | |

| Table 4.2.2.2.1-1C. Z Translation and/or Roll Rotation and/or Pitch Rotation Jet Groups (Nominal Z Translation) | | | | | | | | |
|--|-------------------------------|------------------------------|-----|-----|------|------|------|------|
| Commands | Failure Locations by Group | Number of Jets Used by Group | | | | | | |
| | | G-4 | G-5 | G-6 | G-11 | G-12 | G-13 | G-14 |
| -Z -PITCH | None | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 5 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 6 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 13 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 14 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 5 5 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 5 6 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 5 13 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 5 14 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 6 6 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 6 13 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 6 14 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 13 13 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 13 14 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 14 14 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | |
| -Z -ROLL +PITCH | None | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 5 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 6 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 13 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 14 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 5 5 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| | 5 6 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 5 13 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 5 14 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 6 6 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| | 6 13 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 6 14 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 13 13 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 13 14 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| 14 14 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | |
| -Z -ROLL | None | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 5 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 6 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 13 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 14 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 5 5 | 0 | 0 | 1 | 0 | 0 | 0 | 2 |
| | 5 6 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 5 13 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 5 14 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 6 6 | 0 | 1 | 0 | 0 | 0 | 0 | 2 |
| | 6 13 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 6 14 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 13 13 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 13 14 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| 14 14 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | |

| Table 4.2.2.2.1-1C. Z Translation and/or Roll Rotation and/or Pitch Rotation Jet Groups (Nominal Z Translation) | | | | | | | | | |
|--|-------------------------------|----|------------------------------|-----|-----|------|------|------|------|
| Commands | Failure Locations by Group | | Number of Jets Used by Group | | | | | | |
| | | | G-4 | G-5 | G-6 | G-11 | G-12 | G-13 | G-14 |
| -Z | None | | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| -ROLL | 5 | | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| -PITCH | 6 | | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 13 | | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 14 | | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 5 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 5 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 5 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 6 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 6 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 6 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 13 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 13 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 14 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |

| Table 4.2.2.1-1D. Jet Groups for No Z Translation with Roll Rotation and/or Pitch Rotation and NO_PLUS_Z_JETS = OFF | | | | | | | | | |
|---|----------------------------|----|------------------------------|-----|-----|------|------|------|------|
| Commands | Failure Locations by Group | | Number of Jets Used by Group | | | | | | |
| | | | G-4 | G-5 | G-6 | G-11 | G-12 | G-13 | G-14 |
| +ROLL +PITCH HIGH ROTATION | None | | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| | 5 | | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| | 6 | | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| | 11 | | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| | 12 | | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| | 5 | 5 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| | 5 | 6 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| | 5 | 11 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| | 5 | 12 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| | 6 | 6 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| | 6 | 11 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| | 6 | 12 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| | 11 | 11 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| | 11 | 12 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| 12 | 12 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | |
| +ROLL +PITCH LOW ROTATION TAIL | None | | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 5 | | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 6 | | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 11 | | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 12 | | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 5 | 5 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 5 | 6 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 5 | 11 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 5 | 12 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 6 | 6 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 6 | 11 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 6 | 12 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 11 | 11 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 11 | 12 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 12 | 12 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | |
| +ROLL +PITCH LOW ROTATION NOSE | None | | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 5 | | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 6 | | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 11 | | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 12 | | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 5 | 5 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 5 | 6 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 5 | 11 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 5 | 12 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 6 | 6 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 6 | 11 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 6 | 12 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 11 | 11 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 11 | 12 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 12 | 12 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | |

| Table 4.2.2.2.1-1D. Jet Groups for No Z Translation with Roll Rotation and/or Pitch Rotation and NO_PLUS_Z_JETS = OFF | | | | | | | | | |
|---|----------------------------|----|------------------------------|-----|-----|------|------|------|------|
| Commands | Failure Locations by Group | | Number of Jets Used by Group | | | | | | |
| | | | G-4 | G-5 | G-6 | G-11 | G-12 | G-13 | G-14 |
| +PITCH HIGH ROTATION | None | | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| | 5 | | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| | 6 | | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| | 11 | | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| | 12 | | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| | 5 | 5 | 0 | 0 | 1 | 1 | 1 | 0 | 0 |
| | 5 | 6 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| | 5 | 11 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| | 5 | 12 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| | 6 | 6 | 0 | 1 | 0 | 1 | 1 | 0 | 0 |
| | 6 | 11 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| | 6 | 12 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| | 11 | 11 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| | 11 | 12 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| 12 | 12 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | |
| +PITCH LOW ROTATION TAIL | None | | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 5 | | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 6 | | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 11 | | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 12 | | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 5 | 5 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 5 | 6 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 5 | 11 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 5 | 12 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 6 | 6 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 6 | 11 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 6 | 12 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 11 | 11 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 11 | 12 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 12 | 12 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | |
| +PITCH LOW ROTATION NOSE | None | | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 5 | | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 6 | | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 11 | | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 12 | | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 5 | 5 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| | 5 | 6 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 5 | 11 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 5 | 12 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 6 | 6 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 6 | 11 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 6 | 12 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 11 | 11 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 11 | 12 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 12 | 12 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | |

| Table 4.2.2.2.1-1D. Jet Groups for No Z Translation with Roll Rotation and/or Pitch Rotation and NO_PLUS_Z_JETS = OFF | | | | | | | | | |
|---|----------------------------|----|------------------------------|-----|-----|------|------|------|------|
| Commands | Failure Locations by Group | | Number of Jets Used by Group | | | | | | |
| | | | G-4 | G-5 | G-6 | G-11 | G-12 | G-13 | G-14 |
| -ROLL +PITCH HIGH ROTATION | None | | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| | 5 | | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| | 6 | | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| | 11 | | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| | 12 | | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| | 5 | 5 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| | 5 | 6 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| | 5 | 11 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| | 5 | 12 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| | 6 | 6 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| | 6 | 11 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| | 6 | 12 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| | 11 | 11 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| 11 | 12 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | |
| 12 | 12 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | |
| -ROLL +PITCH LOW ROTATION TAIL | None | | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 5 | | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 6 | | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 11 | | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 12 | | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 5 | 5 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 5 | 6 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 5 | 11 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 5 | 12 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 6 | 6 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 6 | 11 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 6 | 12 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 11 | 11 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 11 | 12 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | |
| 12 | 12 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | |
| -ROLL +PITCH LOW ROTATION NOSE | None | | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 5 | | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 6 | | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 11 | | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 12 | | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 5 | 5 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 5 | 6 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 5 | 11 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 5 | 12 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 6 | 6 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 6 | 11 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 6 | 12 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 11 | 11 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 11 | 12 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | |
| 12 | 12 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | |

| Table 4.2.2.2.1-1D. Jet Groups for No Z Translation with Roll Rotation and/or Pitch Rotation and NO_PLUS_Z_JETS = OFF | | | | | | | | | |
|---|----------------------------|----|------------------------------|-----|-----|------|------|------|------|
| Commands | Failure Locations by Group | | Number of Jets Used by Group | | | | | | |
| | | | G-4 | G-5 | G-6 | G-11 | G-12 | G-13 | G-14 |
| +ROLL -PITCH HIGH ROTATION | None | | 1 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 4 | | 1 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 13 | | 1 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 14 | | 1 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 4 | 4 | 1 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 4 | 13 | 1 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 4 | 14 | 1 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 13 | 13 | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| | 13 | 14 | 1 | 0 | 0 | 0 | 0 | 2 | 0 |
| 14 | 14 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | |
| +ROLL -PITCH LOW ROTATION TAIL | None | | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 4 | | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 13 | | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 14 | | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 4 | 13 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 4 | 14 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 13 | 13 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | 13 | 14 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| 14 | 14 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | |
| +ROLL -PITCH LOW ROTATION NOSE | None | | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 4 | | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 13 | | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 14 | | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 4 | 13 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 4 | 14 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 13 | 13 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | 13 | 14 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| 14 | 14 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | |
| -PITCH HIGH ROTATION | None | | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 4 | | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 13 | | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 14 | | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 4 | 4 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 4 | 13 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 4 | 14 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 13 | 13 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 13 | 14 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| 14 | 14 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | |

| Table 4.2.2.2.1-1D. Jet Groups for No Z Translation with Roll Rotation and/or Pitch Rotation and NO_PLUS_Z_JETS = OFF | | | | | | | | | |
|---|----------------------------|----|------------------------------|-----|-----|------|------|------|------|
| Commands | Failure Locations by Group | | Number of Jets Used by Group | | | | | | |
| | | | G-4 | G-5 | G-6 | G-11 | G-12 | G-13 | G-14 |
| -PITCH LOW ROTATION TAIL | None | | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 4 | | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 13 | | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 14 | | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 4 | 13 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 4 | 14 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 13 | 13 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 13 | 14 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 14 | 14 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | |
| -PITCH LOW ROTATION NOSE | None | | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 | | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 13 | | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 14 | | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 | 13 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 | 14 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 13 | 13 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 13 | 14 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14 | 14 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | |
| -ROLL -PITCH HIGH ROTATION | None | | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 4 | | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 13 | | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 14 | | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 4 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 4 | 13 | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 4 | 14 | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 13 | 13 | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 13 | 14 | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| 14 | 14 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | |
| -ROLL -PITCH LOW ROTATION TAIL | None | | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 4 | | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 13 | | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 14 | | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 4 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 4 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 13 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 13 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 14 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |

| Table 4.2.2.2.1-1D. Jet Groups for No Z Translation with Roll Rotation and/or Pitch Rotation and NO_PLUS_Z_JETS = OFF | | | | | | | | | |
|---|----------------------------|----|------------------------------|-----|-----|------|------|------|------|
| Commands | Failure Locations by Group | | Number of Jets Used by Group | | | | | | |
| | | | G-4 | G-5 | G-6 | G-11 | G-12 | G-13 | G-14 |
| -ROLL -PITCH LOW ROTATION NOSE | None | | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 4 | | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 13 | | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 14 | | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 4 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 4 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 13 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 13 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 14 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| +ROLL | None | | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| | 12 | | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| | 13 | | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| | 12 | 12 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| | 12 | 13 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| | 13 | 13 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| -ROLL | None | | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| | 11 | | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| | 14 | | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| | 11 | 11 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| | 11 | 14 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| | 14 | 14 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |

| Table 4.2.2.2.1-1E. Jet Groups for No Z Translation with Roll Rotation and/or Pitch Rotation and NO_PLUS_Z_JETS = ON | | | | | | | | | |
|--|----------------------------|----|------------------------------|-----|-----|------|------|------|------|
| Commands | Failure Locations by Group | | Number of Jets Used by Group | | | | | | |
| | | | G-4 | G-5 | G-6 | G-11 | G-12 | G-13 | G-14 |
| +ROLL +PITCH | None | | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 5 | | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 6 | | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 13 | | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 14 | | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 5 | 5 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| | 5 | 6 | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 5 | 13 | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 5 | 14 | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 6 | 6 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| | 6 | 13 | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 6 | 14 | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 13 | 13 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| | 13 | 14 | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | 14 | 14 | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| +PITCH | None | | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 5 | | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 6 | | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 13 | | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 14 | | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 5 | 5 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| | 5 | 6 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 5 | 13 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 5 | 14 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 6 | 6 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 6 | 13 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 6 | 14 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 13 | 13 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 13 | 14 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 14 | 14 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| -ROLL +PITCH | None | | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 5 | | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 6 | | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 13 | | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 14 | | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 5 | 5 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| | 5 | 6 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 5 | 13 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 5 | 14 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 6 | 6 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| | 6 | 13 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 6 | 14 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 13 | 13 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 13 | 14 | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 14 | 14 | 0 | 1 | 1 | 0 | 0 | 0 | 1 |

| Table 4.2.2.2.1-1E. Jet Groups for No Z Translation with Roll Rotation and/or Pitch Rotation and NO_PLUS_Z_JETS = ON | | | | | | | | | |
|--|----------------------------|----|------------------------------|-----|-----|------|------|------|------|
| Commands | Failure Locations by Group | | Number of Jets Used by Group | | | | | | |
| | | | G-4 | G-5 | G-6 | G-11 | G-12 | G-13 | G-14 |
| +ROLL -PITCH | None | | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 5 | | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 6 | | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 13 | | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 14 | | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 5 | 6 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 5 | 13 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 5 | 14 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 6 | 6 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 6 | 13 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 6 | 14 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 13 | 13 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | 13 | 14 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | 14 | 14 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| -PITCH | None | | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 5 | | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 6 | | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 13 | | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 14 | | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 5 | 6 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 5 | 13 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 5 | 14 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 6 | 6 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 6 | 13 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 6 | 14 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 13 | 13 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 13 | 14 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 14 | 14 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| -ROLL -PITCH | None | | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 5 | | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 6 | | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 13 | | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 14 | | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 5 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 5 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 5 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 6 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 6 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 6 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 13 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 13 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 14 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |

| Table 4.2.2.2.1-1E. Jet Groups for No Z Translation with Roll Rotation and/or Pitch Rotation and NO_PLUS_Z_JETS = ON | | | | | | | | |
|--|----------------------------|------------------------------|-----|-----|------|------|------|------|
| Commands | Failure Locations by Group | Number of Jets Used by Group | | | | | | |
| | | G-4 | G-5 | G-6 | G-11 | G-12 | G-13 | G-14 |
| +ROLL | None | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | 5 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | 6 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | 13 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | 14 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | 5 5 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | 5 6 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | 5 13 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | 5 14 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | 6 6 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | 6 13 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | 6 14 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | 13 13 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | 13 14 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | 14 14 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| -ROLL | None | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 5 5 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 5 6 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 5 13 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 5 14 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 6 6 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 6 13 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 6 14 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 13 13 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 13 14 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 14 14 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |

Use of Table 4.2.2.2.1-2:

This table has no subdivisions.

The following inputs mean the following commands:

NOSE_CHK_Y: ON = LO ROT NOSE
 OFF = LOOK AT TAIL_CHK

TAIL_CHK_Y: ON = LO ROT TAIL
 OFF = IF NOT LO ROT NOSE THEN HI ROT

HI_YAW: ON = HI ROT
 OFF = LO ROT

ACOM_{1 TO 2}: IGNORE

ACOM₄: ON = Y TRANSLATION REQUIRED
 OFF = NO Y TRANSLATION REQUIRED

ACOM₃: ON = MINUS SIGN FOR Y TRANSLATION
 OFF = PLUS SIGN FOR Y TRANSLATION

ACOM_{5 TO 10}: IGNORE

ACOM₁₂: ON = YAW ROTATION REQUIRED
 OFF = NO YAW ROTATION REQUIRED

ACOM₁₁: ON = MINUS SIGN FOR YAW ROTATION
 OFF = PLUS SIGN FOR YAW ROTATION

| Table 4.2.2.2.1-2. Y Translation and/or Yaw Rotation Jet Groups | | | | | | |
|---|----------------------------|----|------------------------------|-----|-----|------|
| Commands | Failure Locations by Group | | Number of Jets Used by Group | | | |
| | | | G-2 | G-3 | G-9 | G-10 |
| +Y +YAW | NONE | | 1 | 0 | 0 | 0 |
| | 2 | | 1 | 0 | 0 | 0 |
| | 9 | | 1 | 0 | 0 | 0 |
| | 2 | 2 | 0 | 0 | 0 | 1 |
| | 2 | 9 | 1 | 0 | 0 | 0 |
| | 9 | 9 | 1 | 0 | 0 | 0 |
| +Y | NONE | | 1 | 0 | 1 | 0 |
| | 2 | | 1 | 0 | 1 | 0 |
| | 9 | | 1 | 0 | 1 | 0 |
| | 2 | 2 | 0 | 0 | 0 | 0 |
| | 2 | 9 | 1 | 0 | 1 | 0 |
| | 9 | 9 | 1 | 0 | 1 | 0 |
| +Y -YAW | NONE | | 0 | 0 | 1 | 0 |
| | 2 | | 0 | 0 | 1 | 0 |
| | 9 | | 0 | 0 | 1 | 0 |
| | 2 | 2 | 0 | 0 | 1 | 0 |
| | 2 | 9 | 0 | 0 | 1 | 0 |
| | 9 | 9 | 0 | 0 | 1 | 0 |
| -Y +YAW | NONE | | 0 | 0 | 0 | 1 |
| | 3 | | 0 | 0 | 0 | 1 |
| | 10 | | 0 | 0 | 0 | 1 |
| | 3 | 3 | 0 | 0 | 0 | 1 |
| | 3 | 10 | 0 | 1 | 0 | 1 |
| | 10 | 10 | 0 | 0 | 0 | 1 |
| -Y | NONE | | 0 | 1 | 0 | 1 |
| | 3 | | 0 | 1 | 0 | 1 |
| | 10 | | 0 | 1 | 0 | 1 |
| | 3 | 3 | 0 | 0 | 0 | 0 |
| | 3 | 10 | 0 | 1 | 0 | 1 |
| | 10 | 10 | 0 | 1 | 0 | 1 |
| -Y -YAW | NONE | | 0 | 1 | 0 | 0 |
| | 3 | | 0 | 1 | 0 | 0 |
| | 10 | | 0 | 1 | 0 | 0 |
| | 3 | 3 | 0 | 0 | 1 | 0 |
| | 3 | 10 | 0 | 1 | 0 | 0 |
| | 10 | 10 | 0 | 1 | 0 | 0 |
| +YAW HI ROT | NONE | | 1 | 0 | 0 | 1 |
| | 2 | | 1 | 0 | 0 | 1 |
| | 10 | | 1 | 0 | 0 | 1 |
| | 2 | 2 | 0 | 0 | 0 | 1 |
| | 2 | 10 | 1 | 0 | 0 | 1 |
| | 10 | 10 | 1 | 0 | 0 | 1 |
| +YAW LO ROT TAIL | NONE | | 0 | 0 | 0 | 1 |
| | 2 | | 0 | 0 | 0 | 1 |
| | 10 | | 0 | 0 | 0 | 1 |
| | 2 | 2 | 0 | 0 | 0 | 1 |
| | 2 | 10 | 0 | 0 | 0 | 1 |
| | 10 | 10 | 0 | 0 | 0 | 1 |

| Table 4.2.2.2.1-2. Y Translation and/or Yaw Rotation Jet Groups | | | | | | |
|---|----------------------------|----|------------------------------|-----|-----|------|
| Commands | Failure Locations by Group | | Number of Jets Used by Group | | | |
| | | | G-2 | G-3 | G-9 | G-10 |
| +YAW LO ROT NOSE | NONE | | 1 | 0 | 0 | 0 |
| | 2 | | 1 | 0 | 0 | 0 |
| | 10 | | 1 | 0 | 0 | 0 |
| | 2 | 2 | 0 | 0 | 0 | 1 |
| | 2 | 10 | 1 | 0 | 0 | 0 |
| | 10 | 10 | 1 | 0 | 0 | 0 |
| -YAW HI ROT | NONE | | 0 | 1 | 1 | 0 |
| | 3 | | 0 | 1 | 1 | 0 |
| | 9 | | 0 | 1 | 1 | 0 |
| | 3 | 3 | 0 | 0 | 1 | 0 |
| | 3 | 9 | 0 | 1 | 1 | 0 |
| | 9 | 9 | 0 | 1 | 1 | 0 |
| -YAW LO ROT TAIL | NONE | | 0 | 0 | 1 | 0 |
| | 3 | | 0 | 0 | 1 | 0 |
| | 9 | | 0 | 0 | 1 | 0 |
| | 3 | 3 | 0 | 0 | 1 | 0 |
| | 3 | 9 | 0 | 0 | 1 | 0 |
| | 9 | 9 | 0 | 0 | 1 | 0 |
| -YAW LO ROT NOSE | NONE | | 0 | 1 | 0 | 0 |
| | 3 | | 0 | 1 | 0 | 0 |
| | 9 | | 0 | 1 | 0 | 0 |
| | 3 | 3 | 0 | 0 | 1 | 0 |
| | 3 | 9 | 0 | 1 | 0 | 0 |
| | 9 | 9 | 0 | 1 | 0 | 0 |

Use of Table 4.2.2.2.1-3:

This table has no subdivisions.

The following inputs mean the following commands:

ACOM₂: ON = X TRANSLATION REQUIRED

OFF = NO X TRANSLATION REQUIRED

ACOM₁: ON = MINUS SIGN FOR X TRANSLATION

OFF = PLUS SIGN FOR X TRANSLATION

ACOM_{3 to 12}: IGNORE

CHECK 2: ON = EQUIVALENT TO TWO JET FAILURES IN
 GROUP 1 (TANK CONSTRAINT IN NOSE)

OFF = NO TANK CONSTRAINT, CAN FIRE MORE
 THAN ONE JET IF MORE THAN ONE IS
 AVAILABLE

X_JETS_PLUS_Z: ON = BOTH +X AND -X TRANSLATION
 REQUIRED SIMULTANEOUSLY

OFF = REFER TO PREVIOUS +X OR -X COMMANDS

| Table 4.2.2.2.1-3. X Translation Jet Groups | | | | | |
|---|----------------------------|---|------------------------------|-----|-----|
| Commands | Failure Locations by Group | | Number of Jets Used by Group | | |
| | | | G-1 | G-7 | G-8 |
| +X | NONE | | 0 | 1 | 1 |
| | 7 | | 0 | 1 | 1 |
| | 8 | | 0 | 1 | 1 |
| | 7 | 7 | 0 | 0 | 1 |
| | 7 | 8 | 0 | 1 | 1 |
| | 8 | 8 | 0 | 1 | 0 |
| -X | NONE | | 2 | 0 | 0 |
| | 1 | | 2 | 0 | 0 |
| | 1 | 1 | 1 | 0 | 0 |

Table 4.2.2.2.1-4. PRCs Jet Grouping, Prioritization, and I/O Mapping

| Element Number in NEW_JONLST_JSL, HFAIL_JSL, JET_TABLE, and JET_MAP | JET_TABLE Value and Jet Group | Priority of RCS Jet Within Group* | Principal Thrust Direction of Group | Associated JET_MAP Values (Each Element in a Group Will Have One of These Values, Mapping That Element to the Associated Jet) |
|---|-------------------------------|-----------------------------------|-------------------------------------|---|
| 1 2 3 | 1 1 1 | 1 2 3 | -X | 1(F1F), 5(F2F), 13(F3F) |
| 4 5 | 2 2 | 1 2 | +Y | 2(F1L), 14(F3L) |
| 6 7 | 3 3 | 1 2 | -Y | 6(F2R), 9(F4R) |
| 8 9 10 | 4 4 4 | 1 2 3 | +Z | 3(F1U), 7(F2U), 15(F3U) |
| 11 12 | 5 5 | 1 2 | -Z | 8(F2D), 10(F4D) |
| 13 14 | 6 6 | 1 2 | -Z | 4(F1D), 16(F3D) |
| 15 16 | 7 7 | 1 2 | +X | 4(R1A), 12(R3A) |
| 17 18 | 8 8 | 1 2 | +X | 1(L1A), 9(L3A) |
| 19 20 21 22 | 9 9 9 9 | 1 2 3 4 | +Y | 2(L1L), 17(L2L), 10(L3L), 23(L4L) |
| 23 24 25 26 | 10 10 10 10 | 1 2 3 4 | -Y | 5(R1R), 20(R2R), 13(R3R), 26(R4R) |
| 27 28 29 | 11 11 11 | 1 2 3 | +Z | 3(L1U), 18(L2U), 24(L4U) |
| 30 31 32 | 12 12 12 | 1 2 3 | +Z | 6(R1U), 21(R2U), 27(R4U) |
| 33 34 35 | 13 13 13 | 1 2 3 | -Z | 19(L2D), 11(L3D), 25(L4D) |
| 36 37 38 | 14 14 14 | 1 2 3 | -Z | 22(R2D), 14(R3D), 28(R4D) |

*Note: Lowest number = highest priority (i.e., 1 is selected first)

| ROT_GRP Values and Corresponding Jet Groups | | | | | |
|---|-------|-----------|---|----------------------------------|---|
| ELEMENT NUMBER | VALUE | JET GROUP | DOWN FIRING GROUPS (NO_PLUS_Z_JETS ON) | AFT GROUPS (ALT_JET_OPTION=3) | NOSE & TAIL ROTATION GROUPS (ALT_JET_OPTION=1) |
| 1 | 2 | FXL | | | |
| 2 | 3 | FXR | | | |
| 3 | 5 | FXD(R) | | | |
| 4 | 6 | FXD(L) | | | |
| 5 | 9 | LXL | | | |
| 6 | 10 | RXR | | | |
| 7 | 13 | LXD | | | |
| 8 | 14 | RXD | | | |
| 9 | 11 | LXU | | | |
| 10 | 12 | RXU | | | |
| 11 | 4 | FXU | | | |

FIGURE 4.2.2.2.1-24. ROT_GRP Values and Corresponding Jet Groups

| Table 4.2.2.2.1-4a JET_MAP_PNTR Values | |
|--|-------|
| ELEMENT NUMBER | VALUE |
| 1 | 1 |
| 2 | 4 |
| 3 | 6 |
| 4 | 8 |
| 5 | 11 |
| 6 | 13 |
| 7 | 15 |
| 8 | 17 |
| 9 | 19 |
| 10 | 23 |
| 11 | 27 |
| 12 | 30 |
| 13 | 33 |
| 14 | 36 |
| 15 | 39 |

| Table 4.2.2.2.1-4b. ANG INCREMENTS ARRAY LAYOUT | | |
|---|--------------------|--|
| ELEMENTS | ARRAY LAYOUT | ORDER |
| 1 to 14 | PRIMARY_VERNIER_SW | BY PRIMARY JET GROUP (1 TO 14) |
| 15 to 20 | PRIMARY_VERNIER_SW | VERNIER JETS F5R, F5L, R5R L5L, R5D, L5D |

| Table 4.2.2.2.1-4c. ROT_GRPX_XJETS Values and Corresponding Jet Groups | | | | | |
|--|-------|-----------|---|--|--|
| ELEMENT NUMBER | VALUE | JET GROUP | DOWN FIRING GROUPS PLUS ± XJETS (NO_PLUS_Z_JETS AND XJETS_ACTIVE ON) | AFT GROUPS PLUS ± XJETS (ALT_JET_OPTION = 3) (XJETS_ACTIVE = ON) | NOSE & TAIL ROTATION GROUPS PLUS ± XJETS (ALT_JET_OPTION = 1 & XJETS_ACTIVE = ON) |
| 1 | 1 | FXF | | | |
| 2 | 2 | FXL | | | |
| 3 | 3 | FXR | | | |
| 4 | 5 | FXD(R) | | | |
| 5 | 6 | FXD(L) | | | |
| 6 | 9 | LXL | | | |
| 7 | 10 | RXR | | | |
| 8 | 13 | LXD | | | |
| 9 | 14 | RXD | | | |
| 10 | 7 | RXA | | | |
| 11 | 8 | LXA | | | |
| 12 | 11 | LXU | | | |
| 13 | 12 | RXU | | | |
| 14 | 4 | FXU | | | |

| Table 4.2.2.2.1-5. JET_SELECT Interface Requirements | | | | | | |
|--|--|--|----------------|------------------|-------|------------------|
| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
| INPUTS | | | | | | |
| ALT_ACTIVE | ALT mode active indicator (1 = active) | UNPACK_SW OFC_RECON | B | 0, 1 | none | 12.5 |
| ALT_JET_OPTION | JET Option in ALT mode (1 = nom, 3 = aft only) | DAPLOAD_SELECT | I | 1, 3 | none | 12.5 |
| ANG_INCREMENTS | Angular rate change over 80 ms for each primary jet group and the six vernier jets | DAPLOAD_SELECT | A(20) V(3)S | | deg/s | On demand |
| AVAILABLE_JET_AFT | List of available aft RCS jets (1 = available) | Carryover value from insertion phase PRCS; RCS RM (4.91) | A(28)B | 0,1 | none | 12.5 |
| AVAILABLE_JET_FWD | List of available forward RCS jets (1 = available) | Carryover value from insertion phase PRCS; RCS RM (4.91) | A(16)B | 0,1 | none | 12.5 |
| BYPASS | Open loop control command, by axis (1 = open loop) | OFC_RECON | B(3) | 0,1 for each bit | none | 12.5 |
| CMDSF | Scale factor for ALT mode rotation commands | DAPLOAD_SELECT | A(3)S | 0 to 1 | none | 12.5 |
| CROSSFEED_OPEN_LEFT | Left crossfeed between aft RCS tanks is open (1 = open) | Carryover value from insertion phase; also GN&C SW processor (4.180) | B | 0,1 | none | 12.5 |
| CROSSFEED_OPEN_RIGHT | Right crossfeed between aft RCS tanks is open (1 = open) | Carryover value from insertion phase; also GN&C SW processor (4.180) | B | 0,1 | none | 12.5 |
| DOCKING_ACTIVE | Flag indicating post contact thrusting sequence in progress (1 = ON) | OFC_RECON POST_CONTACT_THRUSTING | B | 0,1 | none | 12.5 |
| ERRORS_WITHIN_DEADBANDS | Flag to indicate that all attitude errors are within deadbands | OFC_RECON | B | 0,1 | none | 12.5 |
| GRP_CMD | The number of jets to be fired in jet groups [G-5,G-6,G-13,G-14] | POST_CONTACT_THRUSTING | A(4)I | 0-3 | none | 12.5 |

Table 4.2.2.2.1-5. JET_SELECT Interface Requirements

| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
|-------------------------|--|--|--------|---------------|-------|------------------|
| HI_LO_Z_TRANS_SW | Z-axis translation acceleration level select (1 = high; 0 = nominal) | UNPACK_SW, OFC_RECON | B | 0,1 | none | 12.5 |
| INIT_JET_SELECT | Module initialization flag | OFC_RECON | B | 0,1 | none | 12.5 |
| JET_STATUS_CHANGE | Flag signifying change in AVAILABLE_JET (1 = changed) | RCS RM (4.91) | B | 0,1 | none | 12.5 |
| JET_MAP | Mapping of jet use preference within group | RCS RM (4.91) or carryover from previous OPS | A(38)I | 1 to 28 | none | 12.5 |
| LO_PITCH_TAIL_NOSE | Tail or nose jet select for low-level pitch rotation (1 = tail; 0 = nose) | DAPLOAD_SELECT | B | 0,1 | none | 12.5 |
| LO_YAW_TAIL_NOSE | Tail or nose jet select for low-level yaw rotation (1 = tail; 0 = nose) | DAPLOAD_SELECT | B | 0,1 | none | 12.5 |
| MAX_DELAY_COUNT | Minimum time between firings, in minor cycles, in ALT mode | OFC_RECON | I | 0 to 1250 | none | 12.5 |
| MAX_ON_COUNT | Maximum firing duration, in minor cycles in ALT mode | DAPLOAD_SELECT | I | 1 to 125 | none | 12.5 |
| MINA_JS_SEL | Flag indicating that the minimum angle jet selection logic has been selected | OFC_RECON | B | 0,1 | none | 12.5 |
| NO_PLUS_Z_JETS | Flag to inhibit use of +Z jets (1 = inhibit) | UNPACK_SW, OFC_RECON | B | 0,1 | none | 12.5 |
| OFF_AXIS_COMP_THRESHOLD | Magnitude of rotation compensation threshold (0 = disable compensation) | DAPLOAD_SELECT | S | ≥ 0 | deg/s | 12.5 |
| PRIMARY_VERNIER_SW | RCS primary/vernier jet select (1 = primary, 0 = vernier) | UNPACK_SW, OFC_RECON | B | 0,1 | none | 12.5 |
| RBST_CONF | Selected reboost configuration | ORB DAP CONFIG DISP | I | 1-4 | none | 12.5 |
| RBST_INTERVAL_DISP | Reference interval between reboost firings | ORB DAP CONFIG DISP | S | 0.08 - 999.99 | sec | 12.5 |
| RBST_DURATION | Duration of reboost from display | UNIV PTG DISP | S | 0- 86400 | sec | On demand |
| RBST_CNCL | Reboost cancel | UNIV POINT PROC, UNIV PTG DISP, OFC_RECON | B | 0,1 | none | 12.5 |
| RBST_ENA | Reboost Enabled Flag | OFC_RECON, UNIV POINT PROC | B | 0,1 | none | 12.5 |

Table 4.2.2.2.1-5. JET_SELECT Interface Requirements

| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
|-----------------|--|--|---------|---------|-------|------------------|
| RBST_OVRD | Group failure override flags | OFC_RECON | A(20) B | 0,1 | none | On demand |
| RCS_NORM | Flag indicating that both OMS to Aft RCS interconnects are closed (1 = both closed; 0 = at least one open) | RCS DISP (6.7) | B | 0,1 | none | 12.5 |
| ROT_HI_LO_SW | Pitch and yaw acceleration level select (1 = nominal; 0 = low) | DAPLOAD_SELECT | A(2)B | 0,1 | none | 12.5 |
| ROT_JET_CMD | Rotation command | PHASE_PLANE, ROT_ACCEL, ROT_PULSE, OFC_RECON | A(3)S | -1 to 1 | none | 12.5 |
| TRANS_JET_CMD | Translation command | TRANS_ACCEL, TRANS_PULSE, OFC_RECON | A(3)I | -1,0,1 | none | 12.5 |
| T1 | Threshold for use of second jet | DAPLOAD_SELECT | S | 0 to 2 | none | 12.5 |
| T2 | Threshold for use of third jet | DAPLOAD_SELECT | S | 0 to 2 | none | 12.5 |
| XJETS_ACTIVE | XJETS for rotation indicator (1 = active) | ORB DAP CONFIG (6.1) OFC_RECON | B | 0,1 | none | 12.5 |
| VFAIL | Flag indicating one or more vernier jets failed (1 = failed) | OFC_RECON | B | 0,1 | none | 12.5 |
| OUTPUTS | | | | | | |
| DELTA_OMEGA_RCS | Modelled body angular rate increment due to RCS torque over minor cycle time | PART2_FILTER | V(3)S | | deg/s | 12.5 |
| FILTER_JETS_ON | Flag indicating one or more jets are currently firing (1 = firing) | OFC_RECON | B | 0,1 | none | 12.5 |
| JETS_ON | Flag indicating at least one RCS jet has been commanded on this pass (1 = commanded) | ORB/RND NAV (4.126) | B | 0,1 | none | 12.5 |
| NEW_JONLST_AFT | RCS aft jet command (1 = on; 0 = off) | ORB RCS CMD SOP (4.91) | A(28)B | 0,1 | none | 12.5 |
| NEW_JONLST_FWD | RCS forward jet command (1 = on; 0 = off) | ORB RCS CMD SOP (4.91) | A(16)B | 0,1 | none | 12.5 |

Table 4.2.2.2.1-5. JET_SELECT Interface Requirements

| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
|---------------------|--|---|-------|---------|----------------------|------------------|
| RBST_ACCEL | Reboost disturbance accelerations | PHASE_PLANE | A(3)S | | deg/sec ² | 12.5 |
| RBST_ENA | Reboost Enable Flag | UNIV POINT PROC, ORB DAP CONFIG DISP, TLM | B | 0,1 | none | 12.5 |
| RBST_TIME_REMAINING | Time remaining in reboost burn | UNIV POINT PROC | S | 0-86400 | sec | 12.5 |
| RBST_CNCL | Reboost cancel | UNIV POINT PROC | B | 0,1 | none | 12.5 |
| VFAIL | Flag indicating one or more vernier jets failed (1 = failed) | OFC_RECON | B | 0,1 | none | 12.5 |

| Table 4.2.2.2.1-6. JET_SELECT I-Loads/Constants | | | | |
|---|--|---------------|-------------------------------------|-------|
| Name | Description | Type | MSID/ Value | Unit |
| ALT_DELAY_FACTOR | Alt Mode delay scaling factor | A(10)S | V96U8533C- V96U8542C | none |
| CANDIDATE_ALT_THRESHOLD | Threshold for allowing jets to become candidates in the minimum angle jet selection with ALT selected | S | V97U6303C | none |
| CANDIDATE_VERN_THRESHOLD | Threshold for allowing jets to become candidates in the minimum angle jet selection with VERN selected | S | V97U6307C | none |
| GRP_LIST | Jet groups that can be used for post contact thrusting [G-5,G-6,G-13,G-14] | A(4)I | [5,6,13,14] | none |
| JET_MAG_THRESHOLD | Threshold for jet magnitude to allow a combination of jets to fire | A(3) | V97U6304C V97U6305C V97U6306C | none |
| JET_MAP_PNTR | List of indices to the first jet in each of the 14 PRCS groups in HFAIL_JSL, plus a 15th value to delimit the group | A(15) I | Refer to Table 4.2.2.2.1-4a | none |
| JET_MIN_IMPULSE | Scaling factor to account for thrust impulse of initial firing of a PRCS jet | S | V97U6302C | none |
| JET_TABLE | Group number for each primary jet (See Table 4.2.2.2.1-4b) | A(38) I | Refer to Table 4.2.2.2.1-4 | none |
| MAX_REPEAT | Number of passes for which the choice of vernier jets remains the same (disregarding any change in the fractional or off-axis preference part of ROT_JET_CMD) if the truncated value of ROT_JET_CMD remains the same | I | V97U2783C | none |
| PRIMARY_ROT_MIN_IMPULSE (Note 1) | Largest value of change in vehicle angular rate in any axis due to 80-ms RCS firing at nominal acceleration level using primary jets | S | V97U2797C | deg/s |
| RBST_GROUPS | Array of vectors of reboost jet groups for selection | A(4) V(6)I | V96U8201C- V96U8224C | none |
| RBST_ON_TIMES | Array of vectors of reboost firing times for jet group | A(4) V(6)S | V96U8225C- V96U8248C | sec |
| RBST_NUMJETS | Array of vectors of reboost number of jets within group | A(4) V(6)I | V96U8381C- V96U8404C | none |
| RBST_START | Array of vectors of reboost jet interval START times | A(4) V(6)S | V96U8420C- V96U8443C | sec |
| RBST_INTERVAL_FACTOR | Reboost scaling factors for reboost firing intervals | A(10)S | V96U8523C- V96U8532C | none |
| ROT2TRANS_DELAY | Reboost rotation to translation delay | S | V96U8522C | sec |
| ROT_GRPS | List of indices to PRCS rotation jet groups, in sequence used by ALT mode | A(11) I | Refer to Figure 4.2.2.2.1-24 | none |
| ROT_GRPS_XJETS | List of indices to PRCS rotation and translation jet groups, in sequence used by Alt Mode when XJETS are available | A(14)I | Refer to Table 4.2.2.2.1-4c | none |
| TRANS2ROT_DELAY | Reboost translation to rotation delay | S | V96U8521C | sec |
| VERNIER_ROT_MIN_IMPULSE (Note 1) | Largest value of change in vehicle angular rate in any axis due to 80-ms firing using vernier jets | S | V97U2882C | deg/s |

Note 1. Mission-dependent I-load parameter.

4.2.2.2.2 PHASE_PLANE

A. Function. For each body axis requiring RCS rotation control and not in the manual rotation acceleration or manual rotation pulse submode, this module determines whether an angular rate change is needed and the sign of the desired rate change. The module also supplies the sign and magnitude of the desired rate error to the OMS processor. If vernier jets are in use, the output commands may also contain magnitude information. The module responds to a set force fire flag by initiating a firing command from any region (except coast regions) of the phase plane and then resets the force fire flag to OFF. The parameters of the limit cycle are selected externally to minimize a weighted combination of response time and RCS fuel use. The module takes into account the undesired vehicle angular acceleration (disturbance torques and rotational coupling from Reboost firings). During payload extended operations, additional logic is used to help reduce shelf-pulsing and to prevent switching line distortion when the undesired acceleration is close to or exceeds the phase plane acceleration.

B. Block Diagram. The detailed block diagrams for the module PHASE_PLANE are shown in Figures 4.2.2.2.2-1 through 4.2.2.2.2-3 and Tables 4.2.2.2.2-1 through 4.2.2.2.2-3.

C. Processing Rate. The module PHASE_PLANE is processed at 12.5 Hz.

D. Interface Requirements. The interface requirements for the module PHASE_PLANE are shown in Table 4.2.2.2.2-4.

E. I-Loads/K-Loads. The I-loads/K-loads for the module PHASE_PLANE are shown in Table 4.2.2.2.2-5.

F. Initialization Requirements. The reboost disturbance accelerations and shelf firing counters are initialized to zero.

$$[\text{RBST_ACCEL}] = 0.0$$

$$[\text{SHELF_CNTR}] = 0$$

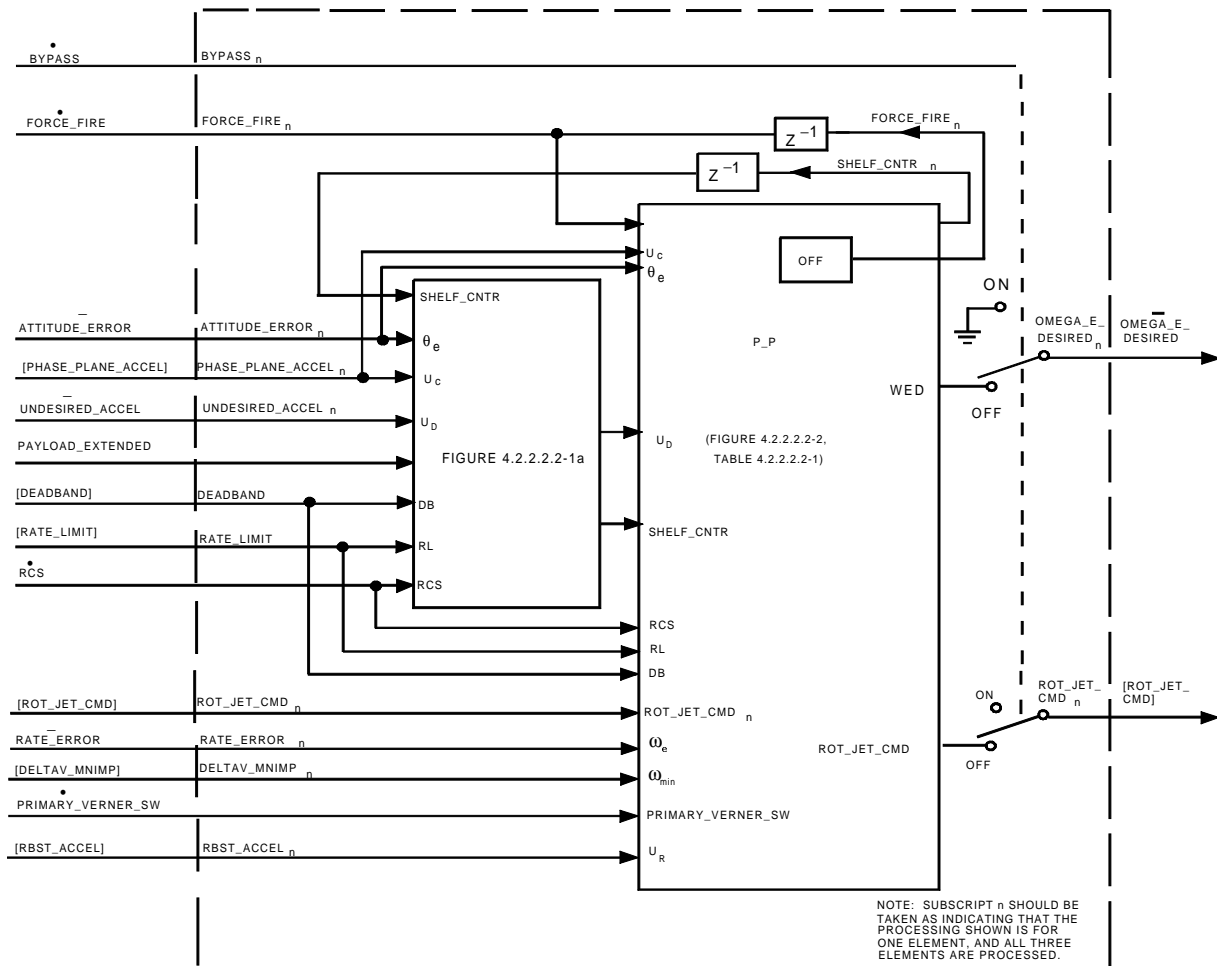


FIGURE 4.2.2.2-1. PHASE_PLANE

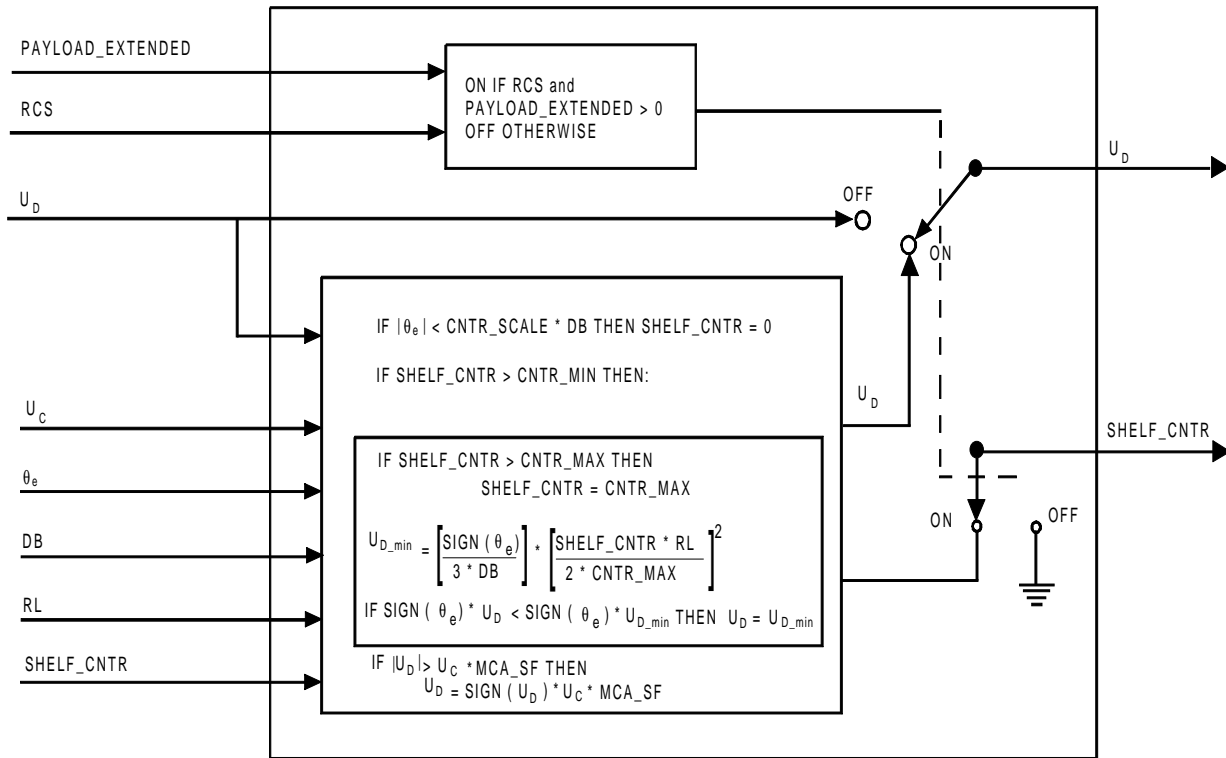
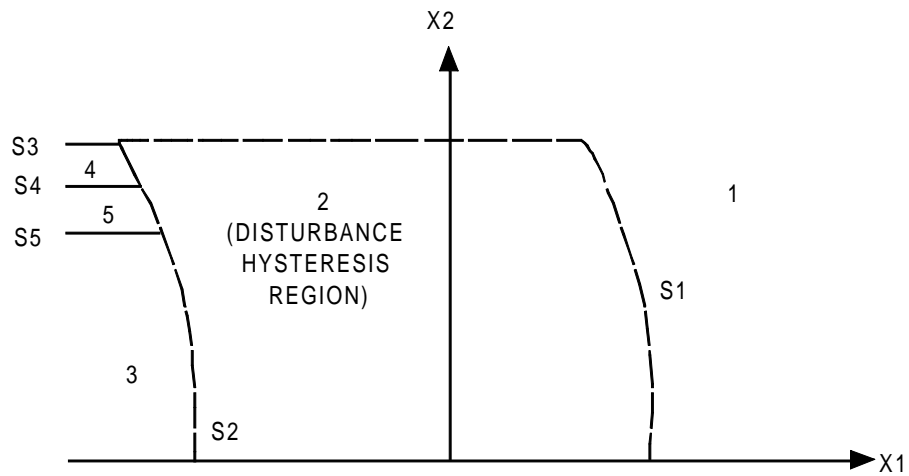


FIGURE 4.2.2.2-1a. U_D Calculation



NOTES:

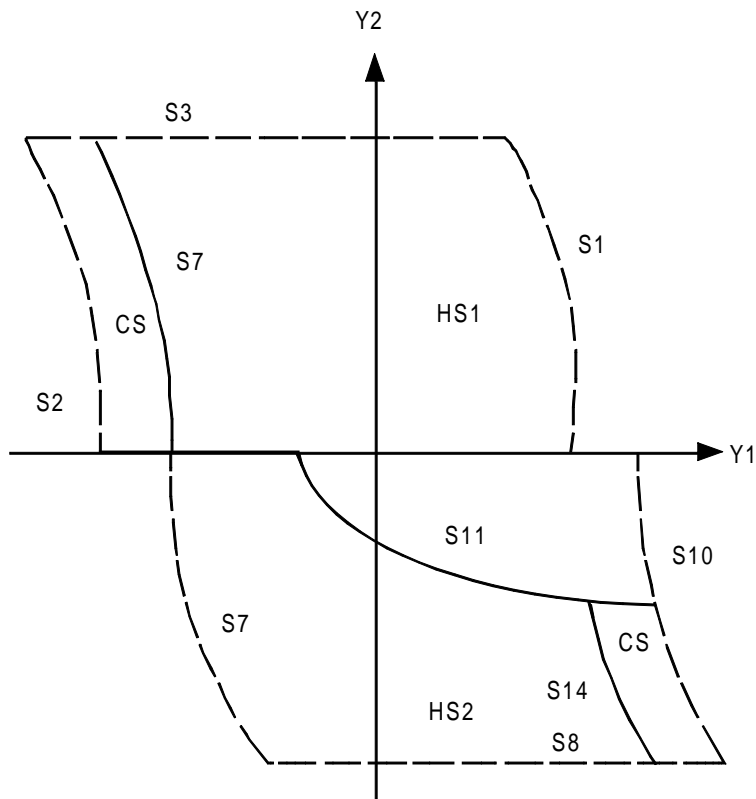
1. X1 AND X2 ARE LOCAL VARIABLES:

$$X1 = \text{SIGN}(\omega_e) \theta_e$$

$$X2 = \text{ABS}(\omega_e)$$

2. DASHED LINES REPRESENT BOUNDARIES BETWEEN PHASE PLANES FOR THE FUNCTION P_P AND FOR THE DISTURBANCE HYSTERESIS LOGIC.

FIGURE 4.2.2.2-2. Phase Plane for Function P_P



NOTES:

1. Y1 AND Y2 ARE LOCAL VARIABLES:

$$Y1 = \text{SIGN}(U_{DR}) \theta_e$$

$$Y2 = \text{SIGN}(U_{DR}) \omega_e$$

$$U_{DR} = U_D + (U_R * \text{RBST_PP_SF})$$
2. REFER TO TABLE 4.2.2.2-3 FOR DEFINITIONS OF SWITCHING LINES.
3. DASHED LINES REPRESENT BOUNDARIES BETWEEN PHASE PLANES FOR THE FUNCTION P_P AND FOR THE DISTURBANCE HYSTERESIS LOGIC.

FIGURE 4.2.2.2-3. Phase Plane for Disturbance Hysteresis Logic

| Table 4.2.2.2-1. Control Actions by Function P_P in Regions of the Phase Plane | | |
|--|--|--|
| Region | Action | Region Definition |
| 1 | ROT_JET_CMD = - SIGN(ω_e) If $X2 \leq S3$ then WED = - SE WLOW else WED = SE WHIGH | $X1 > S1$ or $X2 > S3$ |
| 2 (Disturbance hysteresis region) | Perform disturbance hysteresis logic (Figure 4.2.2.2-3 and Table 4.2.2.2-2) WED = 0 | $S2 \leq X1 \leq S1$ and $X2 \leq S3$ |
| 3 | ROT_JET_CMD = +SIGN(ω_e) WED = SE WLOW | $X1 < S2$ and $X2 < S5$ |
| 4 | If PRIMARY_VERNIER_SW = ON then ROT_JET_CMD = 0 WED = SE WLOW Else If ROT_JET_CMD (from previous cycle) = - SIGN(ω_e) then (leave it at that value) Else ROT_JET_CMD = SIGN(ω_e) WFRATE $\frac{(S4_SCALE\ RL - X2)}{((1 - S4_SCALE)\ RL)}$ | $X1 < S2$ and $S5 \leq X2 \leq S3$ $X1 < S2$ and $S4 \leq X2 \leq S3$ |
| 5 | If PRIMARY_VERNIER_SW = ON then ROT_JET_CMD = 0 WED = SE WLOW Else If ROT_JET_CMD (from previous cycle) = + SIGN (ω_e) then (leave it at that value) Else ROT_JET_CMD = SIGN (ω_e) WFRATE $\frac{(S4_SCALE\ RL - X2)}{((1 - S4_SCALE)\ RL)}$ | $X1 < S2$ and $S5 \leq X2 \leq S3$ $X1 < S2$ and $S5 \leq X2 < S4$ |
| NOTE: SE = SIGN(ω_e) | | |

| Table 4.2.2.2.2-2. Control Action by Disturbance Hysteresis in Regions of the PHASE_PLANE | | |
|---|---|---|
| Region | Action | Region Definition |
| CS | <p>If RCS then</p> $\text{ROT_JET_CMD} = \text{SIGN}(U_{\text{DR}}) \text{WFRATE} \left[\frac{\text{S11}(Y1) - Y2}{\text{RL} + \text{S11}(Y1)} \right]$ <p>else ROT_JET_CMD = 0</p> <p>If $\text{ROT_JET_CMD} \text{ (from previous cycle)} = 1$ then SHELF_CNTR = SHELF_CNTR + 1</p> | <p>$S2 \leq Y1 \leq S7,$ $0 \leq Y2 \leq S3$ or $S14 \leq Y1 \leq S10,$ $S8 \leq Y2 \leq S11$</p> |
| HS1 | <p>If ROT_JET_CMD (from previous cycle) = $-\text{SIGN}(U_{\text{DR}})$ then (leave it at that value)</p> <p>else if $\overline{\text{RCS}}$ then ROT_JET_CMD = 0 else ROT_JET_CMD = SIGN(U_{DR}), if FORCE_FIRE = ON</p> $= \text{SIGN}(U_{\text{DR}}) \text{WFRATE} \left[\frac{Y2 - \text{S11}(Y1)}{\text{RL} - \text{S11}(Y1)} \right]$ <p>otherwise</p> | <p>$(S7 \leq Y1 \leq S1,$ and $0 \leq Y2 \leq S3)$ or $(S7 \leq Y1 \leq S10,$ and $S11 \leq Y2 \leq 0)$</p> |
| HS2 | <p>If ROT_JET_CMD (from previous cycle) = SIGN(U_{DR}) then (leave it at that value) else if $\overline{\text{RCS}}$ then ROT_JET_CMD = 0 else ROT_JET_CMD = SIGN(U_{DR}), if FORCE_FIRE = ON</p> $= \text{SIGN}(U_{\text{DR}}) \text{WFRATE} \left[\frac{\text{S11}(Y1) - Y2}{\text{RL} + \text{S11}(Y1)} \right]$ <p>otherwise</p> | <p>$S7 \leq Y1 \leq S14$ and $S8 \leq Y2 \leq S11$</p> |

| Table 4.2.2.2-3. Definition of Switching Lines | |
|--|--|
| Line | Definition |
| S1 | $S1(X2) = -\frac{X2^2}{2U_{CP}} + DB$ $S1(Y2) = -\frac{Y2^2}{2U_{CP}} + DB$ |
| S2 | $S2(X2) = -\frac{CX2^2}{2U_{CP}} - 1.2 DB - KL$ $S2(Y2) = -\frac{CY2^2}{2U_{CP}} - 1.2 DB - KL$ |
| S3 | S3 = +RL |
| S4 | If PRIMARY_VERNIER_SW = OFF then S4 = S4_SCALE RL else not used |
| S5 | If \overline{RCS} then S5 = LRL_TVC else if PRIMARY_VERNIER_SW = OFF then S5 = S5_SCALE RL else S5 = min (S5_SCALE RL, max (RL - 2W _{min} , 0.02)) |
| S7 | $S7(Y2) = K \frac{Y2^2}{2U_{CP}} - DB, K = -1, Y2 \geq 0$ $K = +1, Y2 < 0$ |
| S8 | S8 = -RL |
| S10 | $S10(Y2) = \frac{CY2^2}{2U_{CP}} + 1.2 DB + KL$ |
| S11 | $S11(Y1) = 0$ $= -\sqrt{2 U_{DR} (Y1 + 0.5 DB)} + W_{MIN},$ if S11(Y1) > 0, then S11(Y1) = 0 if S11(Y1) < -RL + W _{MIN} , then S11(Y1) = -RL + W _{MIN} $-\frac{CX2^2}{2U_{CP}} - 1.2 DB - KL \leq Y1 < -0.5 DB \text{ or } \overline{RCS}$ $-0.5 DB \leq Y1 \leq S10 \text{ and } RCS$ |
| S14 | $S14(Y2) = +\frac{Y2^2}{2U_{CP}} + DB$ <p>Notes: S4_SCALE = (1 + S5_SCALE)/2 If PRIMARY_VERNIER_SW = ON Then KL = KLEDGE Else KL = 0.0 C = 1.25, ROT_JET_CMD ≠ 1 1.0, ROT_JET_CMD = 1 U_{CP} = U_C - SIGN(W_e)U_D</p> |

| Table 4.2.2.2.2-4. PHASE_PLANE Interface Requirements | | | | | | |
|---|--|---|-------|---------------------|----------------------|------------------|
| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
| INPUTS | | | | | | |
| ATTITUDE_ERROR | Body angle error | RCS_ERRORS | V(3)S | | deg | 12.5 |
| BYPASS | Open-loop control, by axis (1 = open loop) | OFC_RECON | B(3) | 0,1 | none | 12.5 |
| DEADBAND | Magnitudes of attitude deadbands | OFC_RECON | A(3)S | ≥ 0 | deg | 12.5 |
| DELTA_V_MINIMP | Magnitudes of changes in vehicle angular rate due to 80 ms RCS firing command | DAPLOAD_SELECT | A(3)S | ≥ 0 | deg/s | 12.5 |
| FORCE_FIRE | Rate damping flag | ROT_DISC | B(3) | 0,1 | none | 12.5 |
| PAYLOAD_EXTENDED | Payload extended flag (0 = payload not extended, 1 through 9 = selected payloads) | DAPLOAD_SELECT | I | 0,1,2,3,4,5,6,7,8,9 | none | 12.5 |
| PHASE_PLANE_ACCEL | Magnitude of average control acceleration available for each axis, scaled for phase plane use | DAPLOAD_SELECT | A(3)S | ≥ 0 | deg/s ² | 12.5 |
| PRIMARY_VERNIER_SW | Flag indicating that primary jets are being used for control (1 = primary jets) | UNPACK_SW, OFC_RECON | B | 0,1 | none | 12.5 |
| RCS | RCS mode indicator | OFC_RECON | B | 0,1 | none | 12.5 |
| ROT_JET_CMD | Rotation command from previous cycle | PHASE_PLANE, OFC_RECON | A(3)S | -1 to +1 | none | 12.5 |
| RATE_ERROR | Body angular rate error | RCS_ERRORS | V(3)S | | deg/s | 12.5 |
| RBST_ACCEL | Reboost disturbance accelerations | JET_SELECT | A(3)S | | deg/sec ² | 12.5 |
| RATE_LIMIT | Magnitudes of rate error limits | OFC_RECON | A(3)S | ≥ 0 | deg/s | 12.5 |
| UNDESIRED_ACCEL | Total undesired body angular acceleration | PART1_FILTER | V(3)S | | deg/s ² | 12.5 |
| OUTPUTS | | | | | | |
| OMEGA_E_DESIRED | Desired angular rate data | TVC_LAW_PITCH_YAW, TVC_LAW_ROLL | V(3)S | -5 to 5 | deg/s | 12.5 |
| ROT_JET_CMD | For primary: command to fire plus or minus jets or no jets. For vernier: command to fire plus or minus jets, no jets, or weighted "preference" for off-axis commands | JET_SELECT, PHASE_PLANE, TVC_LAW_PITCH_YAW, TVC_LAW_ROLL, OFC_RECON | A(3)S | -1 to +1 | none | 12.5 |

| Table 4.2.2.2.2-5. PHASE_PLANE I-Loads/K-Loads | | | | | |
|--|---|------|-----------|-------|-------|
| Name | Description | Type | MSID | Value | Units |
| CNTR_MAX | Maximum value of SHELF_CNTR | I | V97U2399C | * | none |
| CNTR_MIN | Minimum threshold for SHELF_CNTR | I | V97U2400C | * | none |
| CNTR_SCALE | Scale value for SHELF_CNTR reset | S | V97U2401C | * | none |
| MCA_SF | Scale factor to limit worst case U_D | S | V97U2402C | * | none |
| LRL_TVC | TVC lower rate limit | S | V97U2422C | 0.3 | deg/s |
| RBST_PP_SF | Scale factor for reboost acceleration compensation | S | V96U8543C | * | none |
| S5_SCALE | Multiplies RL to define lower drift channel line (S5) | S | V97U9086C | * | none |
| WFRATE | Scale factor for off-axis vernier preference | S | V97U2883C | * | none |
| WHIGH | Upper target rate error for TVC crossfeed | S | V96U9710C | 1.5 | deg/s |
| WLOW | Lower target rate error for TVC crossfeed | S | V96U9711C | 0.5 | deg/s |

* I-Load

Note: S5_SCALE is used to derive S4_SCALE (drift channel center scale factor) per table 4.2.2.2.2-3.

4.2.2.3 State Estimator

The state estimator consists of two parallel Kalman-type filters, one for acceleration estimation and one for rate estimation. The S-plane formulation for the acceleration estimate is:

$$\hat{\alpha}(S) = \frac{\left[\frac{1}{T_M^2} \quad \frac{2K_{\alpha a}}{2 - K_{\omega a}} \right] \alpha(S)}{S^2 + \frac{2K_{\omega a} - K_{\alpha a}}{(2 - K_{\omega a}) T_M} S + \frac{1}{T_M^2} \left[\frac{2K_{\alpha a}}{2 - K_{\omega a}} \right]}$$

where:

T_M = measurement update (PART1_FILTER) period = TMEAS

$K_{\alpha a}$ = ACCEL_GAIN

$K_{\omega a}$ = RATE_GAIN2

The S-plane formulation for the rate estimate is

$$\hat{\omega}(S) = \frac{\frac{K_{\omega r}}{K_o T_M^2} \omega(S)}{S^2 + \frac{K_{\theta r}}{K_o T_M} S + \frac{K_{\omega r}}{K_o T_M^2}} + \frac{\left[\frac{1 - K_{\theta r}}{K_o} S + \frac{K_{\theta r}}{K T_M} \right] \hat{\alpha}(S)}{S^2 + \frac{K_{\theta r}}{K_o T_M} S + \frac{K_{\omega r}}{K_o T_M^2}}$$

where:

T_M = measurement update (PART1_FILTER) period = TMEAS

$K_{\theta r}$ = ATTITUDE_GAIN1

$K_{\omega r}$ = RATE_GAIN1

$$K_o = 1 - \frac{K_{\theta r}}{2} - \frac{K_{\omega r}}{4}$$

Each of the two filters is divided into a measurement incorporation section and an extrapolation section. Measurement incorporation for both filters is performed at the attitude measurement update rate (6.25 Hz) by PART1_FILTER.

Extrapolation for both filters is performed at 12.5 Hz by PART2_FILTER. In addition, PART2_FILTER provides a 12.5-Hz extrapolation of the measured-attitude variable ATTITUDE. This variable is reset to a pure measurement value by PART1_FILTER at 6.25 Hz.

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PART1_FILTER is executed every second OFC pass, at a point after the attitude measurement data become available and before the OFC control law modules are executed. PART2_FILTER is executed every OFC pass at a point after the OFC control law modules are executed, thus making available to the extrapolation algorithms in PART2_FILTER the predicted attitude rate increments due to effector use. When INIT_PART1_FILTER = 2, the PART2_FILTER code is not executed until the first execution of the control law modules after recovery of IMU data (i.e., not in IMU_FAIL mode). Figure 4.2.2.3-1 illustrates the data and rate relationships of the filter modules.

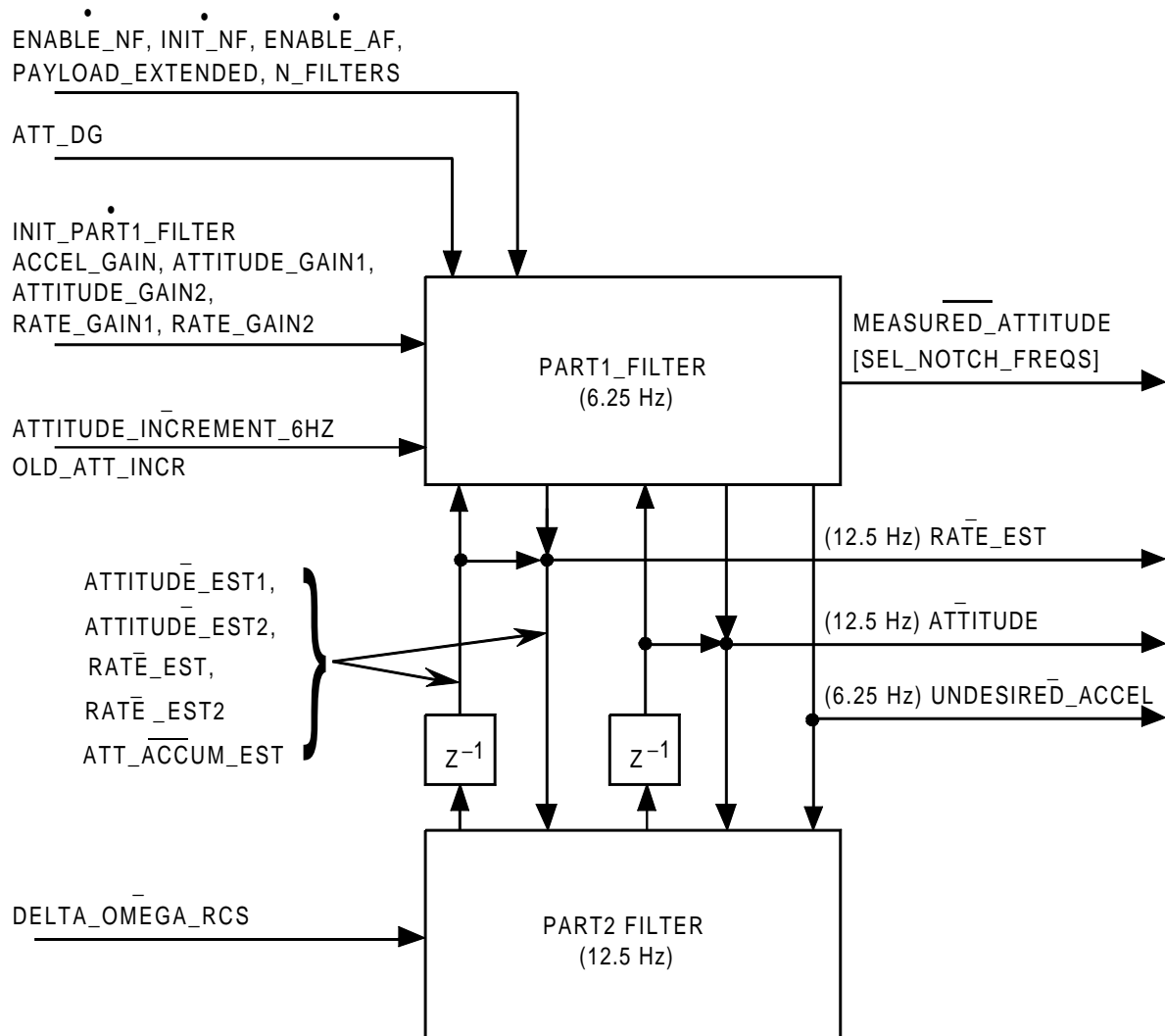


FIGURE 4.2.2.3-1. State Estimator

4.2.2.3.1 PART1_FILTER

A. Function. This module estimates the vehicle state as a function of measured and extrapolated values. It first integrates the body attitude increments to form the attitude. This measured attitude is then filtered with attitude and angular rate extrapolations in two parallel filters (a “rate” filter and an “acceleration” filter) to obtain attitude and angular rate estimates. The acceleration filter uses the attitude residue to obtain an estimate of undesired acceleration. In payload–extended situations, a multiple notch filter is available to attenuate up to six I–loaded vibration frequencies corresponding to the bending mode frequencies of RMS or attached payloads. | N_FILTERS | is the number of notches present. If N_FILTERS ≤ 0, then the notch filter feed forward loop is effectively disabled. Both the acceleration filter and the notch filter are switchable by flags.

B. Block Diagram. The detailed block diagram for the module PART1_FILTER is presented in Figure 4.2.2.3.1–1.

C. Processing Rate. The module PART1_FILTER is processed at 6.25 Hz.

D. Interface Requirements. The interface requirements for the module PART1_FILTER are shown in Table 4.2.2.3.1–1. The variables ATTITUDE, MEASURED_ATTITUDE, ATTITUDE_EST1 and ATTITUDE_EST2 are double precision.

E. I–loads/Constants. The I–loads/constants for the module PART1_FILTER are shown in Table 4.2.2.3.1–2.

F. Initialization Requirements. The initialization requirements for the module PART1_FILTER are shown in Table 4.2.2.3.1–3.

NOTE: Resetting of attitude–related variables is required to prevent them from becoming so large as to lose resolution. If the absolute value of any component of MEASURED_ATTITUDE exceeds 360, that component is incremented by –360 times its sign. The same increment is added to that component of ATTITUDE, ATTITUDE_EST1, ATTITUDE_EST2, and DESIRED_ATTITUDE.

The same increment times (1–K1(K)) is added to that component of the notch filter nodes NODE1(K) and NODE2(K) for K = 1 to | N_FILTERS |.

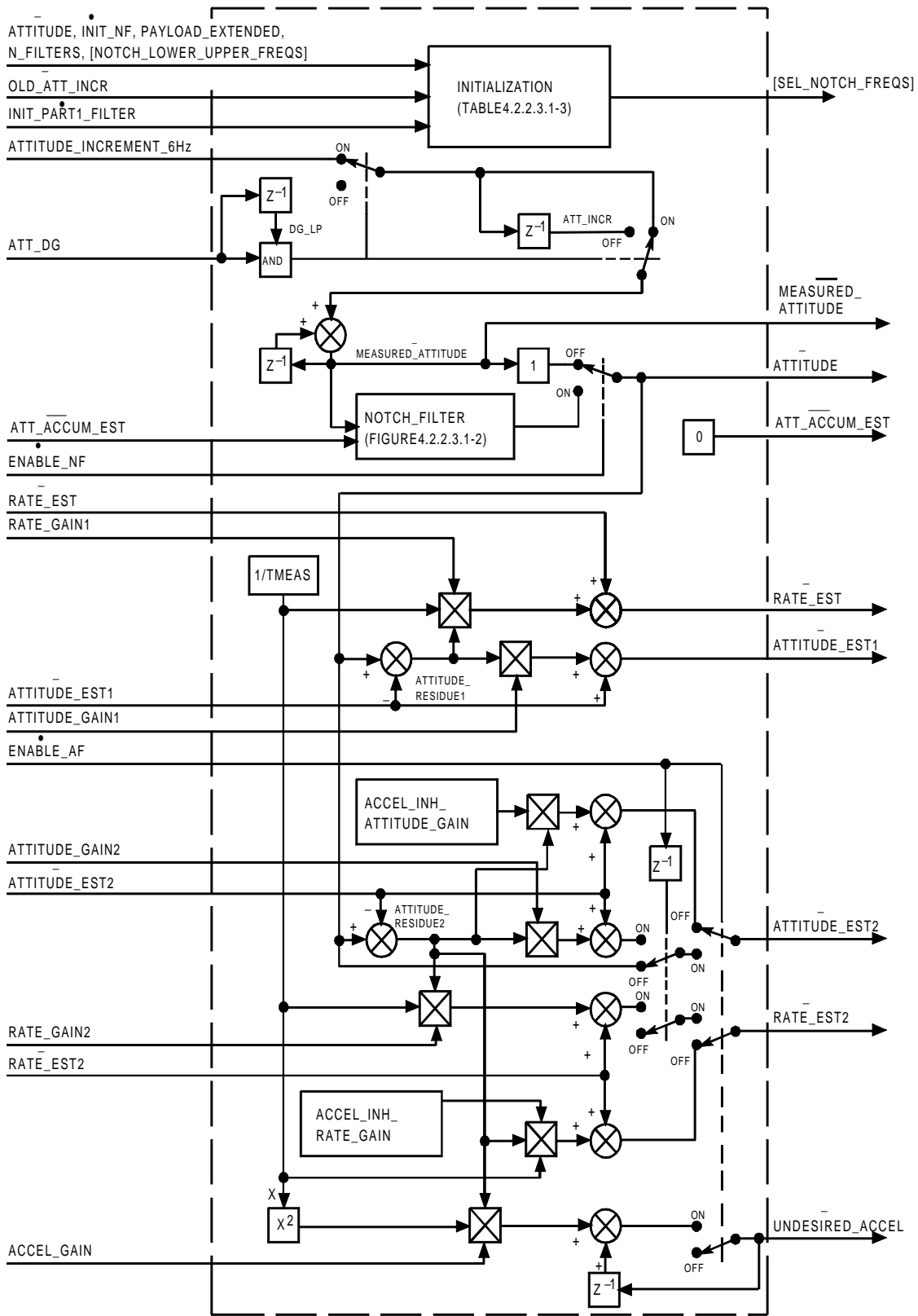


FIGURE 4.2.2.3.1-1. PART1_FILTER

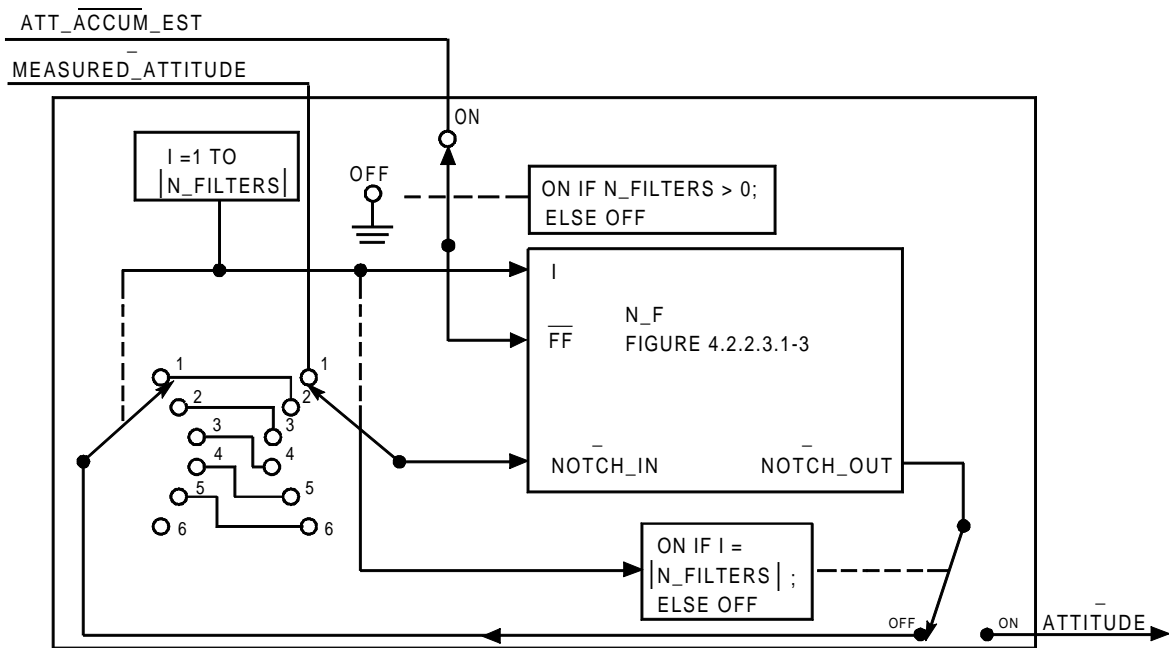
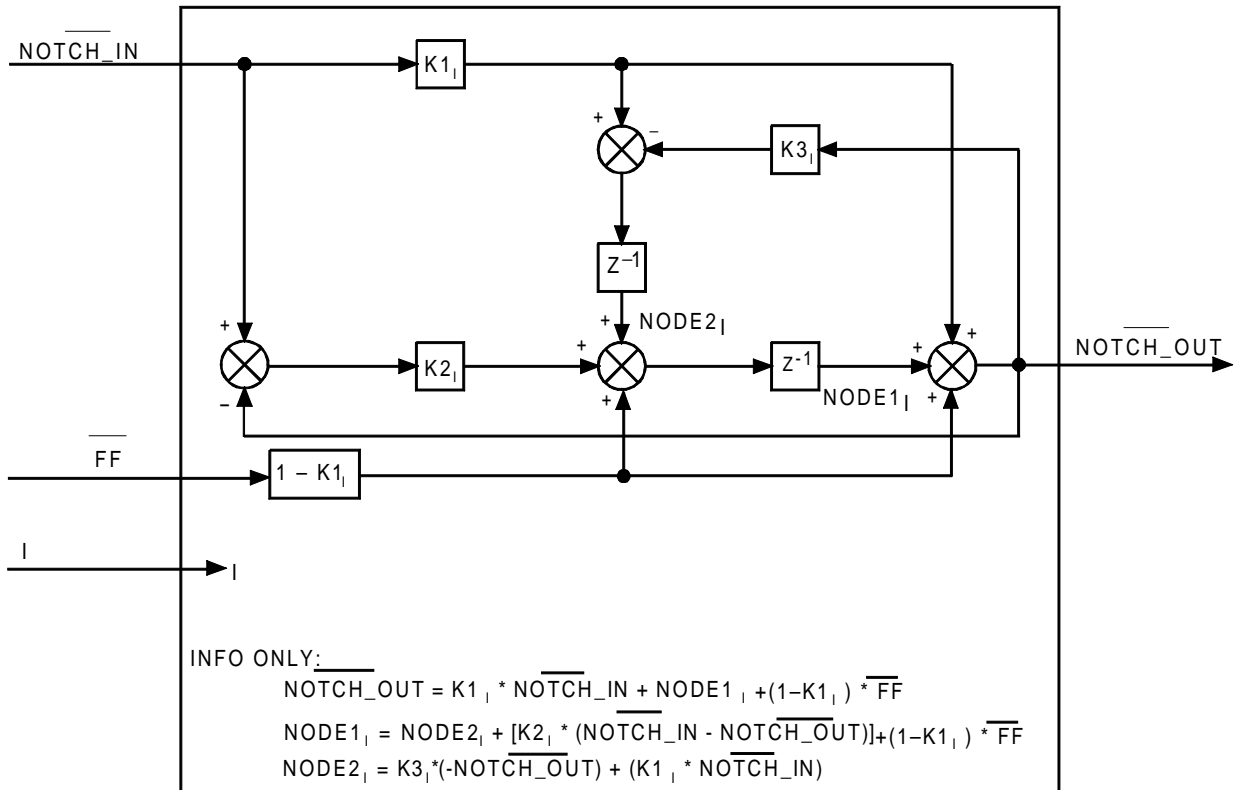


FIGURE 4.2.2.3.1-2. NOTCH_FILTER



NOTE:
The intermediate variables NOTCH_IN and NOTCH_OUT should be declared double precision scalar to avoid negative impacts of loss of precision

FIGURE 4.2.2.3.1-3. N_F

Table 4.2.2.3.1-1. PART1_FILTER Interface Requirements

| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate(Hz) |
|-------------------------|---|-----------------------|-----------|---------------------|-------|-----------------|
| INPUTS | | | | | | |
| ACCEL_GAIN | Filter 2 gain for acceleration term | OFC_RECON | S | ≥ 0 | none | 6.25 |
| ATT_ACCUM_EST | Estimate of accumulated attitude over single measurement cycle | PART2_FILTER | V(3)S | | deg | 6.25 |
| ATT_DG | IMU data good (1 = data good) | IMU RM (4.72) | B | 0,1 | none | 6.25 |
| ATTITUDE | Body angles: summation of body attitude increments | PART2_FILTER | V(3)S | -360 to 360 | deg | 6.25 |
| ATTITUDE_EST1 | Extrapolated filter 1 body angle estimate from previous cycle | PART2_FILTER | V(3)S | | deg | 6.25 |
| ATTITUDE_EST2 | Extrapolated filter 2 body angle estimate from previous cycle | PART2_FILTER | V(3)S | | deg | 6.25 |
| ATTITUDE_GAIN1 | Filter 1 gain for attitude term | OFC_RECON | S | ≥ 0 | none | 6.25 |
| ATTITUDE_GAIN2 | Filter 2 gain for attitude term | OFC_RECON | S | ≥ 0 | none | 6.25 |
| ATTITUDE_INCREMENT_6HZ | Body angle increment over sampling interval | ORB ATT PROC (4.97) | V(3)S | | deg | 6.25 |
| ENABLE_AF | Flag to enable/disable acceleration filter (1 = enable) | OFC_RECON | B | 0,1 | none | 6.25 |
| ENABLE_NF | Flag to enable/disable notch filter (1 = enable) | DAPLOAD_SELECT | B | 0,1 | none | 6.25 |
| INIT_NF | Notch filter initialization flag (1 = init) | DAPLOAD_SELECT | B | 0,1 | none | 6.25 |
| INIT_PART1_FILTER | Module initialization flag (0 = no init; 1 = OPS transition or major mode recall with good IMU data before and after; 2 = recovery of IMU data within an OPS or during a major mode recall) | OFC_RECON | I | 0,1,2 | none | 6.25 |
| N_FILTERS | Absolute value is number of notch filters currently active | DAPLOAD_SELECT | I | -6 to 6 | none | 6.25 |
| NOTCH_LOWER_UPPER_FREQS | Lower, upper frequency pairs for up to six filters for each of nine payload-extended configurations | I-load, DAP_UL_PROC | A(9,6,2)S | 0 - 3.0 | Hz | 6.25 |
| OLD_ATT_INCR | Saved value of ATTITUDE_INCREMENT_6HZ | OFC_RECON | V(3)S | | deg | 6.25 |
| PAYLOAD_EXTENDED | Payload extended flag (0 = payload not extended, 1 through 9 = selected payloads) | DAPLOAD_SELECT | I | 0,1,2,3,4,5,6,7,8,9 | none | 6.25 |
| RATE_EST | Extrapolated filter 1 body angular rate estimate from previous cycle | PART2_FILTER | V(3)S | | deg/s | 6.25 |
| RATE_EST2 | Extrapolated filter 2 body angular rate estimate from previous cycle | PART2_FILTER | V(3)S | | deg/s | 6.25 |
| RATE_GAIN1 | Filter 1 gain for rate term | OFC_RECON | S | ≥ 0 | none | 6.25 |
| RATE_GAIN2 | Filter 2 gain for rate term | OFC_RECON | S | ≥ 0 | none | 6.25 |

Table 4.2.2.3.1-1. PART1_FILTER Interface Requirements

| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate(Hz) |
|-------------------|---|--|------------|-------------|--------------------|-----------------|
| OUTPUTS | | | | | | |
| ATTITUDE | Body angles: summation of body attitude increments | AUTO_MNVR_TRACK, PART2_FILTER, RCS_ERRORS, LVLH_TRACK | V(3)S | -360 to 360 | deg | 6.25 |
| ATTITUDE_EST1 | Filter 1 body angle estimate | PART2_FILTER | V(3)S | | deg | 6.25 |
| ATTITUDE_EST2 | Filter 2 body angle estimate | PART2_FILTER | V(3)S | | deg | 6.25 |
| ATT_ACCUM_EST | Estimate of accumulated attitude over single measurement cycle | PART2_FILTER | V(3)S | | deg | 6.25 |
| MEASURED_ATTITUDE | Body angles: Summation of body attitude increments (unfiltered) | AUTO_MNVR_TRACK, LVLH_TRACK, TLM | V(3)S | -360 to 360 | deg | 6.25 |
| RATE_EST | Filter 1 body angular rate estimate | UNIVERSAL POINTING (4.213), ORB ADI PROC (4.169), STAR TRCK SOP (4.66), GN&C-SM/PL IF (4.111), AUTO_MNVR_TRACK, PART2_FILTER, RCS_ERRORS, TLM, IMU RM (4.72) Roll Component: TVC_LAW_ROLL Pitch and Yaw Components: TVC_LAW_PITCH_YAW | V(3)S | | deg/s | 6.25 |
| RATE_EST2 | Filter 2 body angular rate estimate | PART2_FILTER | V(3)S | | deg/s | 6.25 |
| SEL_NOTCH_FREQS | Lower, upper frequency pairs for up to six filter notches for selected payload-extended configuration | TLM | A (6, 2) S | 0 - 3.0 | Hz | 6.25 |
| UNDESIRED_ACCEL | Undesired body angular acceleration estimate | PHASE_PLANE, PART2_FILTER | V(3)S | | deg/s ² | 6.25 |

Table 4.2.2.3.1-2. PART1_FILTER I-Loads/Constants

| Name | Description | Type | MSID/Value | Unit |
|-------------------------|--|--------------|---|------|
| ACCEL_INH_ATTITUDE_GAIN | State estimator filter 1 gain for attitude during AF inhibit | S | V97U2651C | none |
| ACCEL_INH_RATE_GAIN | State estimator filter 1 gain for rate during AF inhibit | S | V97U2652C | none |
| NOTCH_LOWER_UPPER_FREQS | Lower, upper frequency pairs for up to six filter notches for each of nine payload-extended configurations | S (9,6,2) | V97U3101C through V97U3160C, V97U2598C through V97U2645C | Hz |
| TMEAS | Period of attitude measurement cycle | S | 0.16 | S |

| Table 4.2.2.3.1-3. PART1_FILTER Initialization Requirements | | | | |
|---|----------------------------------|-------------------------|---------------|----------------------------------|
| Initialize on Transition From | Initialize on Transition To | Variable | Initial Value | |
| INIT_PART1_FILTER=0 | INIT_PART1_FILTER=1 | ATTITUDE | 0 | |
| | | ATTITUDE_EST1 | 0 | |
| | | ATTITUDE_EST2 | 0 | |
| | | MEASURED_ATTITUDE | 0 | |
| | | RATE_EST | 0 | |
| | | RATE_EST2 | 0 | |
| | | UNDESIRED_ACCEL | 0 | |
| | | ATT_INCR | OLD_ATT_INCR | |
| | | DG_LP | 1 | |
| | | Past Value of ENABLE_AF | ON | |
| INIT_PART1_FILTER=0 | INIT_PART1_FILTER=2 | ATTITUDE | 0 | |
| | | ATTITUDE_EST1 | 0 | |
| | | ATTITUDE_EST2 | 0 | |
| | | MEASURED_ATTITUDE | 0 | |
| | | RATE_EST | 0 | |
| | | RATE_EST2 | 0 | |
| | | UNDESIRED_ACCEL | 0 | |
| | | DG_LP | 0 | |
| | | Past Value of ENABLE_AF | ON | |
| | | INIT_NF = OFF | INIT_NF = ON | INIT_NF |
| ATT_ACCUM_EST | 0 | | | |
| Do only if N_FILTERS ≠ 0: - - - - - | | | | |
| • | SEL_NOTCH_FREQS | | | NOTCH_LOWER_ |
| • | | | | UPPER_FREQS _{PAYLOAD_} |
| • | | | | EXTENDED,** |
| • | | | | |
| • | J = 1 TO N_FILTERS - - - - - | | | , |
| • • | TEMP1 | | | TAN(pi TMEAS |
| • • | | | | SEL_NOTCH_FREQS _{J,1}) |
| • • | | | | |

Table 4.2.2.3.1-3. PART1_FILTER Initialization Requirements

| Initialize on Transition From | Initialize on Transition To | Variable | Initial Value |
|-------------------------------|-----------------------------|----------------------|--|
| | • • | TEMP2 | TAN(pi TMEAS SEL_NOTCH_FREQS _{1,2}) |
| | • • | | |
| | • • | | |
| | • • | TEMP3 | TEMP2 – TEMP1 |
| | • • | TEMP4 | TEMP1 TEMP2 |
| | • • | TEMP5 | TEMP3 + TEMP4 + 1 |
| | • • | | |
| | • • | K1 _J | (TEMP4 + 1)/TEMP5 |
| | • • | | |
| | • • | K2 _J | 2(TEMP4 – 1)/TEMP5 |
| | • • | | |
| | • • | K3 _J | (1 – TEMP3 + TEMP4)/ TEMP5 |
| | • • | | |
| | • • | NODE1 _{J,*} | (1 – K1 _J) (ATTITUDE) |
| | • • | | |
| | • • | NODE2 _{J,*} | (1 – K1 _J) (ATTITUDE) |
| | • END | ----- | ----- |
| | END | ----- | ----- |

Note: Each of the temporary initialization parameters TEMP1, TEMP2, TEMP3, TEMP4 and TEMP5 is a double precision scalar; each of the gains K1, K2 and K3 is a 6-array of double precision scalars; and each of the filter nodes NODE1 and NODE2 is a 6-array of 3-vectors of double precision scalars.

4.2.2.3.2 PART2_FILTER

A. Function. This module extrapolates the vehicle state for the next FC cycle as a function of the estimated present state and the expected angular rate changes due to control effector use. It first computes the extrapolated angular rate increment as the sum of the control–effector and undesired–acceleration rate increments. This rate increment is then used to extrapolate the attitude and angular rate estimates for the rate filter of the state estimator. PART2_FILTER also extrapolates the measured–attitude variable using the same increment. A similar extrapolated angular rate increment is computed using the control–effector rate increment delayed by three 80 ms cycles. This rate increment is used to extrapolate the attitude and angular rate estimates for the acceleration filter of the state estimator.

An estimate of the accumulated attitude over a single IMU Measurement cycle is calculated for use in PART1_FILTER notch filter processing.

B. Block Diagram. The detailed block diagram for the module PART2_FILTER is presented in Figure 4.2.2.3.2–1.

C. Processing Rate. The module PART2_FILTER is processed at 12.5 Hz.

D. Interface Requirements. The interface requirements for the module PART2_FILTER are shown in Table 4.2.2.3.2–1. The variables ATTITUDE, ATTITUDE_EST1 and ATTITUDE_EST2 are double precision.

E. Constants. The constants for the module PART2_FILTER are shown in Table 4.2.2.3.2–2.

F. Initialization Requirements. The initialization requirements for the module PART2_FILTER are shown in Table 4.2.2.3.2–3.

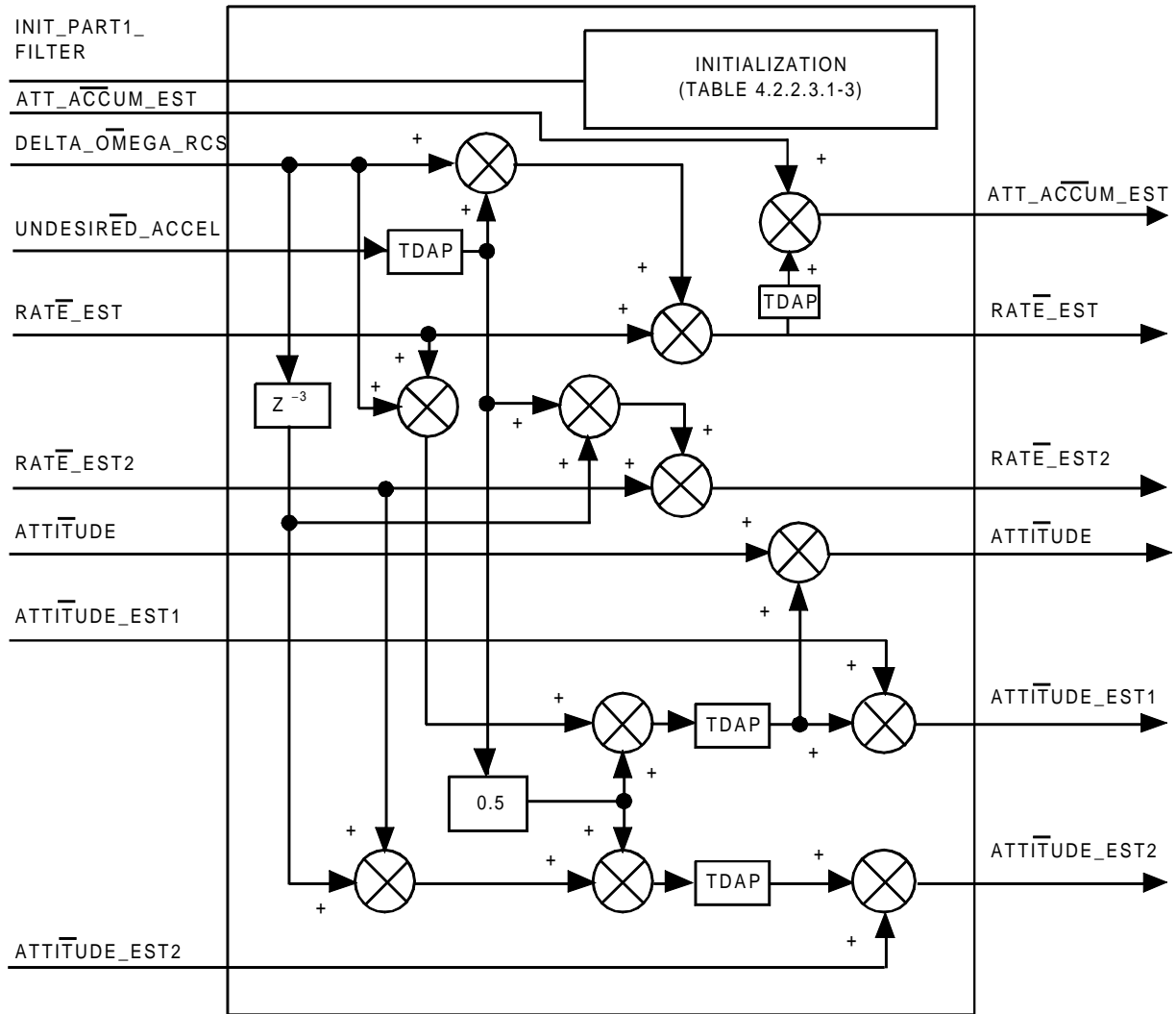


FIGURE 4.2.2.3.2-1. PART2_FILTER

| Table 4.2.2.3.2-1. PART2_FILTER Interface Requirements | | | | | | |
|--|--|---|-------|-------------|--------------------|------------------|
| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
| INPUTS | | | | | | |
| ATTITUDE | Body angles: summation of body attitude increments | PART1_FILTER, PART2_FILTER | V(3)S | -360 to 360 | deg | 12.5 |
| ATTITUDE_EST1 | Filter 1 body angle estimate | PART1_FILTER, PART2_FILTER | V(3)S | | deg | 12.5 |
| ATTITUDE_EST2 | Filter 2 body angle estimate | PART1_FILTER, PART2_FILTER | V(3)S | | deg | 12.5 |
| ATT_ACCUM_EST | Estimate of accumulated attitude over single measurement cycle | PART1_FILTER, PART2_FILTER | V(3)S | | deg | 12.5 |
| DELTA_OMEGA_RCS | Modelled body angular rate increment due to RCS torque over minor cycle time | JET_SELECT | V(3)S | | deg/s | 12.5 |
| INIT_PART1_FILTER | Module initialization flag | OFC_RECON | I | 0,1,2 | none | 12.5 |
| RATE_EST | Filter 1 body angular rate estimate | PART1_FILTER, PART2_FILTER | V(3)S | | deg/s | 12.5 |
| RATE_EST2 | Filter 2 body angular rate estimate | PART1_FILTER, PART2_FILTER | V(3)S | | deg/s | 12.5 |
| UNDESIRED_ACCEL | Total undesired body angular acceleration | PART1_FILTER | V(3)S | | deg/s ² | 12.5 |
| OUTPUTS | | | | | | |
| ATTITUDE | Body angles: summation of body attitude increments RCS_ERRORS, LVLH_TRACK | AUTO_MNVR_TRACK, PART1_FILTER, PART2_FILTER | V(3)S | | deg | 12.5 |
| ATTITUDE_EST1 | Extrapolated filter 1 body angle estimate | PART1_FILTER, PART2_FILTER | V(3)S | | deg | 12.5 |
| ATTITUDE_EST2 | Extrapolated filter 2 body angle estimate | PART1_FILTER, PART2_FILTER | V(3)S | | deg | 12.5 |
| ATT_ACCUM_EST | Estimate of accumulated attitude over single measurement cycle | PART1_FILTER, PART2_FILTER | V(3)S | | deg | 12.5 |
| RATE_EST | Extrapolated filter 1 body angular rate estimate | UNIVERSAL POINTING (4.213), ORB ADI PROC (4.169), STAR TRCK SOP (4.66), GN&C-SM/PL IF (4.111), AUTO_MNVR_TRACK, PART1_FILTER, PART2_FILTER, RCS_ERRORS, TLM, IMU RM (4.72) Roll Component: TVC_LAW_ROLL Pitch and Yaw Components: TVC_LAW_PITCH_YAW | V(3)S | | deg/s | 12.5 |
| RATE_EST2 | Extrapolated filter 2 body angular rate estimate | PART1_FILTER, PART2_FILTER | V(3)S | | deg/s | 12.5 |

| Table 4.2.2.3.2-2. PART2_FILTER Constants | | | | |
|---|--------------------|------|-------|------|
| Name | Description | Type | Value | Unit |
| TDAP | Period of FC cycle | S | 0.08 | s |

| Table 4.2.2.3.2-3. PART2_FILTER Initialization Requirements | | | |
|---|-----------------------------|------------------------------------|---------------|
| Initialize on Transition From | Initialize on Transition To | Variable | Initial Value |
| INIT_PART1_FILTER=0 | INIT_PART1_FILTER=1, 2 | ATTITUDE_EST1 | 0 |
| | | ATTITUDE_EST2 | 0 |
| | | RATE_EST | 0 |
| | | RATE_EST2 | 0 |
| | | UNDESIRED_ACCEL | 0 |
| | | Past values (3) of DELTA_OMEGA_RCS | 0 |

4.2.2.4 OMS TVC Processor

4.2.2.4.1 TVC_LAW_PITCH_YAW

A. Function. This module closes the inner loop of the TVC DAP. Commanded pitch and yaw rates plus the corresponding desired rate errors are subtracted from the estimated rates to form rate errors, which are processed by compensation filters and passed through proportional-plus-integral paths. The integral paths are incremented as a function of the RCS rotation commands. The outputs are limited and passed on as position commands to the OMS engine actuator servos. Initialization of this module consists of subfunctions that are invoked as required. These subfunctions are described separately, and the initialization modes are then summarized.

The pitch and yaw channels each consist of an upstream error-determination and filter section, and a downstream proportional-plus-integral path and limiting section (Figure 4.2.2.4.1-1). A switch between the sections, operated by the initialization flag, allows a trim mode with the downstream section operating alone with input zeroed and a dynamic mode with the sections connected together.

Engine trim angles can be set in by adjusting the values of OMS_PITCH_TRIM and OMS_YAW_TRIM via the maneuver display principal function, or the trim angles may be left alone, in which case they would either be the values carried over from the insertion phase or the values remaining from the previous burn, if any. Operating the downstream section causes the existing trim value to be output from the module as the engine pitch and yaw commands. In case of a mid-burn transition from two OMS engines to one engine, the trim angles are automatically adjusted for thrusting through the c.g., using internally stored constants.

Dynamic gains must also be adjusted as a function of the number of OMS engines operating. Thus, on the first dynamic pass following pre-thrust trimming or upon a two- to one-engine transition, the

reconfiguration module indicates the number of engines via a gain flag and forces a gain calculation via the initialization flag.

The first dynamic pass also requires initialization of the filters. The various initialization modes are summarized below:

| Initialization Flag Value | Description | Action |
|----------------------------------|--|---|
| 0 | Normal dynamic pass | Operate both sections of module |
| 1 | Pre-thrust trim | Zero filter nodes, set trim angles to externally supplied values, and operate downstream section only |
| 2 | Two-to-one engine transition trim | Set trim angles to internal one-engine values, calculate gains, and operate both sections of module |
| 3 | First dynamic pass after pre-thrust trim | Calculate gains and operate both sections |

These modes are sequenced as follows:

| Event | Initialization Flag value |
|--------------------------------------|----------------------------------|
| Pre-thrust trim commanded | 1 |
| Engine(s) ignition | 3 |
| Engine(s) on, subsequent | 0 |
| Midburn two-to-one engine transition | 2 |
| Remainder of burn | 0 |

B. Block Diagram. The detailed block diagram for the module TVC_LAW_PITCH_YAW is presented in Figure 4.2.2.4.1-1.

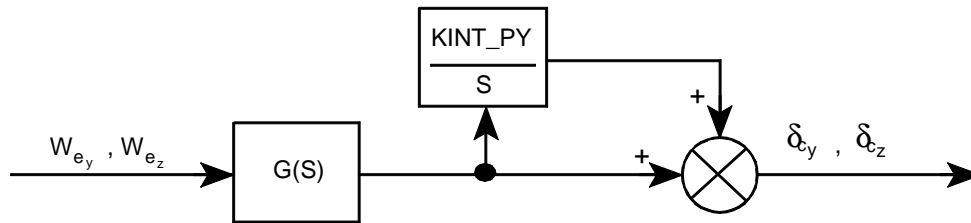
C. Processing Rate. The module TVC_LAW_PITCH_YAW is processed at 12.5 Hz.

D. Interface Requirements. The interface requirements for the module TVC_LAW_PITCH_YAW are shown in Table 4.2.2.4.1-1.

E. K-Loads/Constants. The K-loads/constants for the module TVC_LAW_PITCH_YAW are shown in Table 4.2.2.4.1-2.

F. Initialization Requirements. The initialization requirements for the module TVC_LAW_PITCH_YAW are shown in Table 4.2.2.4.1-3.

G. S-Plane Formulation. The S-plane formulation for the pitch and yaw rate error processing in TVC_LAW_PITCH_YAW is



Where

W_{e_y} = pitch rate error

W_{e_z} = yaw rate error

δ_{c_y} = pitch TVC command before limiting

δ_{c_z} = yaw TVC command before limiting

$$G(s) = \frac{K_v \left[1 + \left(\frac{TDAP}{2} \right) s \right]^3 \cdot \frac{1}{(1-D2)(1-D3+D4)}}{\left[1 + \frac{(1+D2)}{(1-D2)} \left(\frac{TDAP}{2} \right) s \right] \left[1 + \frac{(1-D4)TDAP}{(1-D3+D4)} s + \frac{(1+D3+D4)}{(1-D3+D4)} \left(\frac{TDAP}{2} \right)^2 s^2 \right]}$$

Where

K_v = KP for pitch, KY for yaw

Table 4.2.2.4.1-1. TVC_LAW_PITCH_YAW Interface Requirements

| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
|---|---|---|-------|------------|-------------|------------------|
| INPUTS | | | | | | |
| INIT_TVC_LAW_PITCH_YAW | Module Initialization Flag (0 = Normal dynamic pass; 1 = Pre-thrust Trim; 2 = Two-engine to one-engine transition trim; 3 = First dynamic pass after pre-thrust trim) | OFC_RECON | I | 0, 1, 2, 3 | none | 12.5 |
| KP2 | Pitch filter gain (two engines) | K-load; also carryover from previous OPS; also ORBIT DAP CONFIG (5.8) | S | ≥ 0 | deg/(deg/s) | 1/maneuver |
| KY2 | Yaw filter gain (two engines) | K-load; also carryover from previous OPS; also ORBIT DAP CONFIG (5.8) | S | ≥ 0 | deg/(deg/s) | 1/maneuver |
| OMEGA_C_BODY (pitch and yaw components) | Commanded body angular rate | GUIDANCE_COMPENSATION, MANUAL_TVC | V(3)S | -5 to 5 | deg/s | 12.5 |

Table 4.2.2.4.1-1. TVC_LAW_PITCH_YAW Interface Requirements

| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
|-------------------------------------|---|---|-------|--------------------------------------|-------|------------------|
| OMS_PITCH_TRIM | OMS engines pitch trim angle with respect to center of gimbal travel | K-load; also carryover value from insertion phase; also ORBIT MNVR EXEC (6.35) | S | -6 to 6 | deg | 12.5 |
| OMS_YAW_TRIM | Left and right OMS engines yaw trim angles with respect to center of gimbal travel | K-load; also carryover value from Insertion phase; also ORBIT MNVR EXEC (6.35) | A(2)S | -8 to 8 | deg | 12.5 |
| RATE_EST (pitch and yaw components) | Body angular rate estimate | PART1_FILTER PART2_FILTER | V(3)S | | deg/s | 12.5 |
| TVC_LAW_P_Y_GAIN_FLAG | Gain multiplication factor based on number of OMS engines operating (1 = two engines; 2 = one engine) | OFC_RECON | I | 1, 2 | none | 12.5 |
| OMEGA_E_DESIRED (pitch and yaw) | Desired angular rate error | PHASE_PLANE | V(3)S | -5 to 5 | deg/s | 12.5 |
| ROT_JET_CMD (pitch and yaw) | RCS rotation command | PHASE_PLANE, ROT_ACCEL | A(3)S | -1, 0, 1 | none | 12.5 |
| OUTPUTS | | | | | | |
| OMSL_PITCH_YAW_CMD | Left OMS engine pitch and yaw commands with respect to center of gimbal travel | OMS TVC CMD SOP (4.64), TVC_MIXER | A(2)S | pitch: -5 to 5 yaw: -8 to 8 | deg | 12.5 |
| OMSR_PITCH_YAW_CMD | Right OMS engine pitch and yaw commands with respect to center of gimbal travel | OMS TVC CMD SOP (4.64) | A(2)S | pitch: -5 to 5 yaw: -8 to 8 | deg | 12.5 |
| OMS_PITCH_TRIM | OMS engines pitch trim angle with respect to center of gimbal travel | ORBIT MNVR DIP (4.158), ON-ORB GUID (4.7), TRANS DAP (4.201), ORBIT MNVR EXEC (6.35) | S | -6 to 6 | deg | 12.5 |
| OMS_YAW_TRIM | Left and right OMS engines yaw trim angles with respect to center of gimbal travel | ORBIT MNVR DIP (4.158), ON-ORB GUID (4.7), TRANS DAP (4.201), ORBIT MNVR EXEC (6.35) | A(2)S | -8 to 8 | deg | 12.5 |

Table 4.2.2.4.1-2. TVC_LAW_PITCH_YAW K-Loads/Constants

| Name | Description | Type | MSID | Value | Unit |
|---------|---|------|-----------|--------|------|
| D2 | Filter coefficient | S | V97U2340C | 0.6667 | none |
| D3 | Filter coefficient | S | V97U2341C | 1.5484 | none |
| D4 | Filter coefficient | S | V97U2342C | 0.6774 | none |
| IYLM | Left and right OMS yaw integrator limit | S | V97U1305C | 7.5 | deg |
| IPLM | OMS pitch integrator limit | S | V97U1306C | 5.5 | deg |
| KINT_PY | Integrator gain | S | V97U2352C | 0.075 | none |

| Table 4.2.2.4.1-2. TVC_LAW_PITCH_YAW K-Loads/Constants | | | | | |
|--|---|-------|------------------------|---|-------------|
| Name | Description | Type | MSID | Value | Unit |
| KP2 | Pitch filter gain for TVC (two engines) | S | V97U2354C | 0.268 | deg/(deg/s) |
| KY2 | Yaw filter gain for TVC (two engines) | S | V97U2356C | 0.278 | deg/(deg/s) |
| KXFPY | Pitch and yaw crossfeed gain | S | V96U9708C | 0.17 | deg |
| ONE_ENG_OMS_PITCH_TRIM | OMS engines pitch trim angle for thrusting through c.g. | S | V97U2367C | (1) 0.4 (2) -0.1 (3) -0.31 | deg |
| ONE_ENG_OMS_YAW_TRIM | Left and right OMS engines yaw trim angles for thrusting through c.g. | A(2)S | V97U2368C V97U2369C | (1) +5.21, -5.21 (2) +5.21, -5.21 (3) +5.21, -5.21 | deg |
| PLIM | OMS engines pitch command limit | S | V97U2373C | 4.89 | deg |
| TDAP | Period of TVC DAP cycle | S | | 0.08 | s |
| YLIM1 | Left-negative and right-positive OMS engines yaw command limit | S | V97U2392C | 6.44 | deg |
| YLIM2 | Left-positive and right-negative OMS engines yaw command limit | S | V96U9802C | 7.29 | deg |

| Table 4.2.2.4.1-3. TVC_LAW_PITCH_YAW Requirements | | | |
|---|-----------------------------|---|--|
| Initialize on Transition From | Initialize on Transition To | Variable | Initial Value |
| INIT_TVC_LAW_PITCH_YAW = 0 | INIT_TVC_LAW_PITCH_YAW = 1 | INT_PITCH INT_YAW Nodes (3 for each filter) | OMS_PITCH_TRIM OMS_YAW_TRIM 0 |
| INIT_TVC_LAW_PITCH_YAW = 0 | INIT_TVC_LAW_PITCH_YAW = 2 | INT_PITCH INT_YAW KP KY | ONE_ENG_OMS_PITCH_TRIM ONE_ENG_OMS_YAW_TRIM (KP2) (TVC_LAW_P_Y_GAIN_FLAG) (KY2) (TVC_LAW_P_Y_GAIN_FLAG) |
| INIT_TVC_LAW_PITCH_YAW = 0 | INIT_TVC_LAW_PITCH_YAW = 3 | KP KY | (KP2) (TVC_LAW_P_Y_GAIN_FLAG) (KY2) (TVC_LAW_P_Y_GAIN_FLAG) |

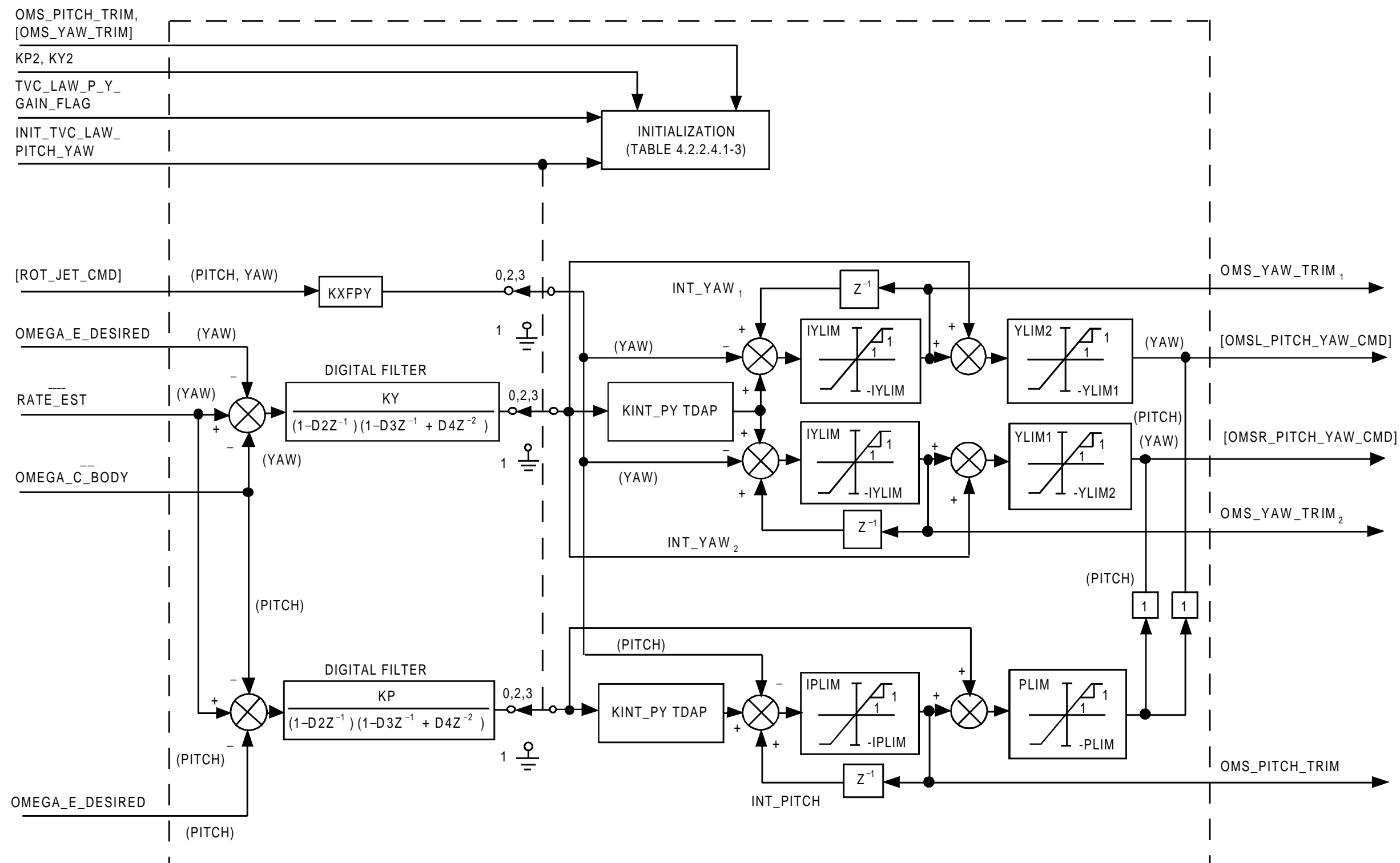


FIGURE 4.2.2.4.1-1. TVC_LAW_PITCH_YAW

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4.2.2.4.2 TVC_LAW_ROLL

A. Function. This module provides control of the vehicle in roll during two engine TVC burns. Commanded roll rate plus desired rate error is subtracted from the estimated rate to form a rate error, which is processed by a compensation filter and passed through proportional-plus-integral paths. The integral path is incremented as a function of the RCS rotation commands and is limited.

B. Block Diagram. The detailed block diagram for the module TVC_LAW_ROLL is presented in Figure 4.2.2.4.2-1.

C. Processing Rate. The module TVC_LAW_ROLL is processed at 12.5 Hz.

D. Interface Requirements. The interface requirements for the module TVC_LAW_ROLL are shown in Table 4.2.2.4.2-1.

E. K-Loads/Constants. The K-loads/constants for the module TVC_LAW_ROLL are shown in Table 4.2.2.4.2-2.

F. Initialization Requirements. The initialization requirements for the module TVC_LAW_ROLL are shown in Table 4.2.2.4.2-3.

G. S-Plane Formulation. The S-plane formulation for the roll rate-error processing in TVC_LAW_ROLL is

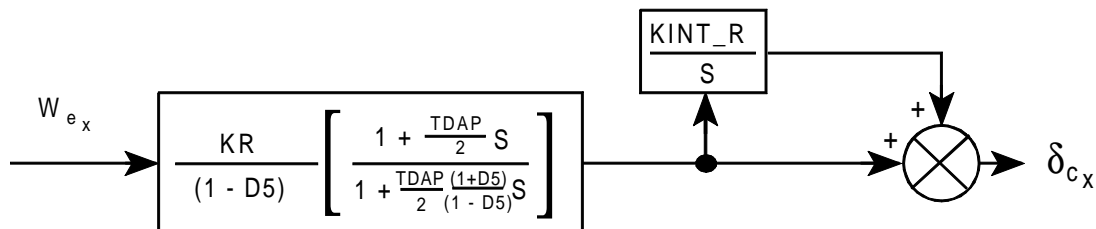


FIGURE 4.2.2.4.2-0. S-Plane Formulation in TVC_LAW_ROLL

Where:

W_{e_x} = roll rate error

δ_{c_x} = roll TVC command before limiting

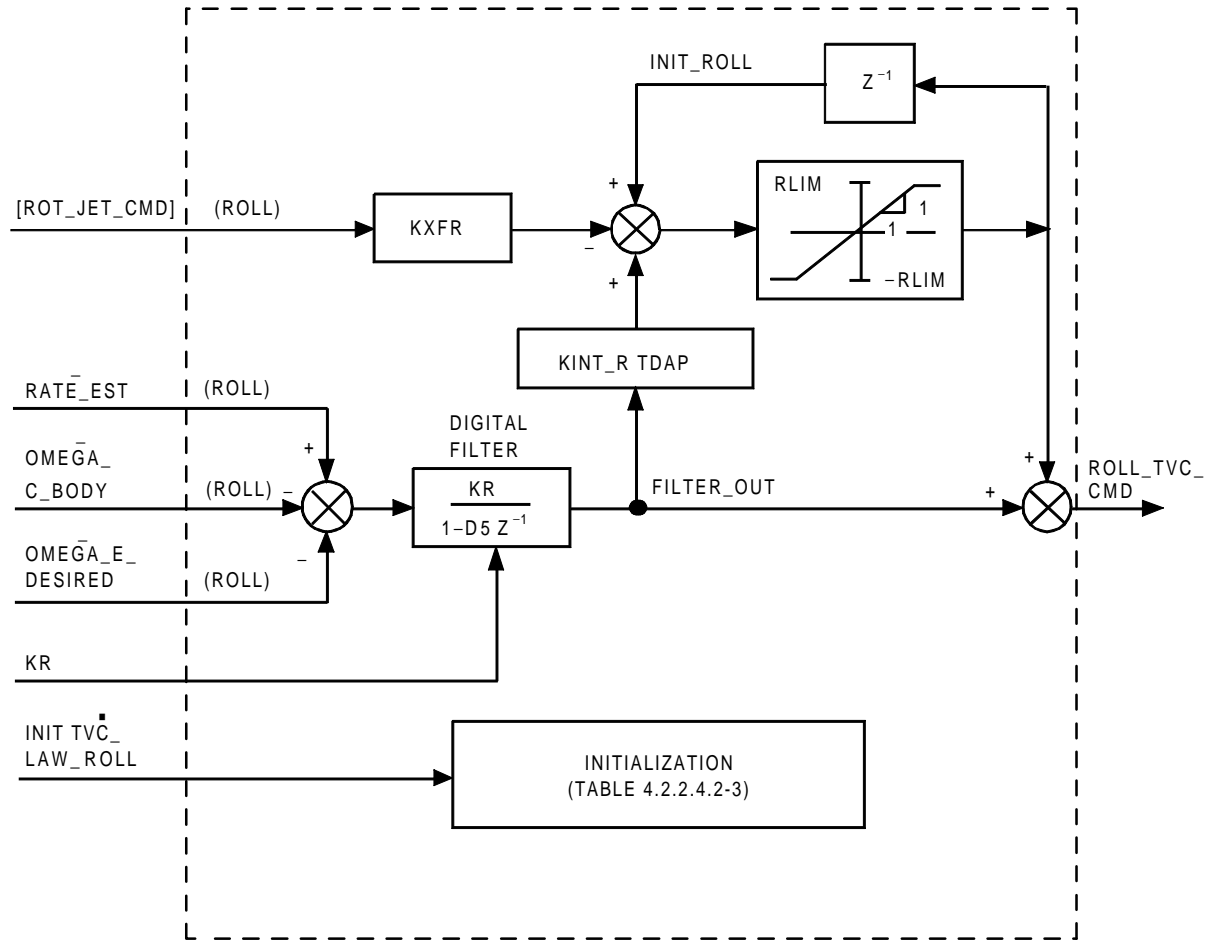


FIGURE 4.2.2.4.2-1. TVC_LAW_ROLL

| Table 4.2.2.4.2-1. TVC_LAW_ROLL Interface Requirements | | | | | | |
|--|---|---|-------|---------|-------------|------------------|
| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
| INPUTS | | | | | | |
| INIT_TVC_LAW_ROLL | Module initialization flag | OFC_RECON | B | 0, 1 | none | 12.5 |
| KR | Roll filter gain | K-LOADS; also carry over from previous OPS ORBIT DAP CONFIG (5.8) | S | ≥ 0 | deg/(deg/s) | 12.5 |
| OMEGA_C_BODY (roll component) | Commanded body angular rate | GUIDANCE_COMPENSATION, MANUAL_TVC | V(3)S | -5 to 5 | deg/s | 12.5 |
| RATE_EST (roll component) | Body angular rate estimate | PART1_FILTER, PART2_FILTER | V(3)S | | deg/s | 12.5 |
| OMEGA_E_DESIRE (roll component) | Desired angular rate error | PHASE_PLANE | V(3)S | -5 to 5 | deg/s | 12.5 |
| ROT_JET_CMD (roll component) | RCS rotation command | PHASE_PLANE, ROT_ACCEL | A(3)S | -1 to 1 | none | 12.5 |
| OUTPUTS | | | | | | |
| ROLL_TVC_CMD | Roll component of pitch command for OMS engines | TVC_MIXER | S | | deg | 12.5 |

| Table 4.2.2.4.2-2. TVC_LAW_ROLL K-Loads/Constants | | | | | | |
|---|--|------|-----------|---------|-------------|--|
| Name | Description | Type | MSID | Value | Unit | |
| D5 | Filter coefficient | S | V97U2343C | 0.85185 | None | |
| KINT_R | Integrator gain | S | V97U2353C | 0.035 | None | |
| KR | Roll filter gain for TVC (two engines) | S | V97U2355C | 0.312 | deg/(deg/s) | |
| KXFR | Roll crossfeed gain | S | V96U9709C | 0.14 | deg | |
| RLIM | Roll integrator limit | S | V97U2389C | 1.0 | deg | |
| TDAP | Period of TVC DAP cycle | S | | 0.08 | S | |

| Table 4.2.2.4.2-3. TVC_LAW_ROLL Initialization Requirements | | | |
|---|--------------------|------------------------|---------------|
| Initialize on Transition | | Variable | Initial Value |
| From | To | | |
| INIT_TVC_ROLL = OFF | INIT_TVC_ROLL = ON | FILTER_OUT INT_ROLL | 0 0 |

4.2.2.4.3 TVC_MIXER

A. Function. This module derives the left and right OMS pitch commands as the difference and sum, respectively, of the pitch and roll TVC commands. The roll command is limited to a value that is a function of the pitch command, such that the total pitch command cannot exceed the desired limit.

B. Block Diagram. The detailed block diagram for the module TVC_MIXER is presented in Figure 4.2.2.4.3-1.

C. Processing Rate. The module TVC_MIXER is processed at 12.5 Hz.

D. Interface Requirements. The interface requirements for the module TVC_MIXER are shown in Table 4.2.2.4.3-1.

E. K-Loads. The K-loads for the module TVC_MIXER are shown in Table 4.2.2.4.3-2.

F. Initialization Requirements. None.

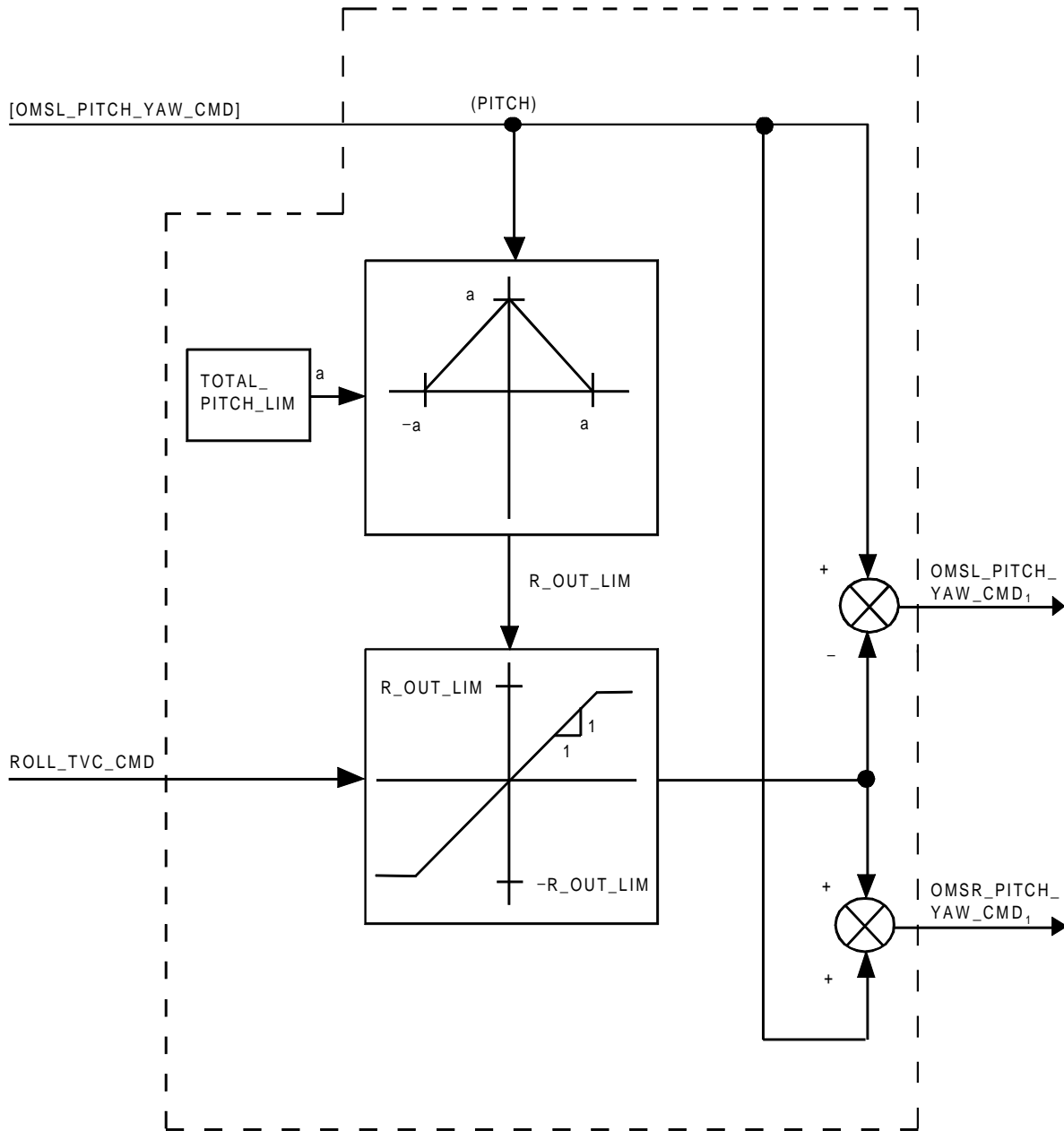


FIGURE 4.2.2.4.3-1. TVC_MIXER

| Table 4.2.2.4.3-1. TVC_MIXER Interface Requirements | | | | | | |
|---|---|------------------------|-------|--------------------------------------|------|------------------|
| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
| INPUTS | | | | | | |
| OMSL_PITCH_YAW_CMD (pitch element) | Left OMS engine pitch and yaw commands with respect to center of gimbal travel | TVC_LAW_PITCH_YAW | A(2)S | Pitch: -5 to 5 Yaw: -8 to 8 | deg | 12.5 |
| ROLL_TVC_CMD | Roll component of pitch command for OMS engines | TVC_LAW_ROLL | S | | deg | 12.5 |
| OUTPUTS | | | | | | |
| OMSL_PITCH_YAW_CMD (pitch element) | Left OMS engine pitch and yaw commands with respect to center of gimbal travel | OMS TVC CMD SOP (4.64) | A(2)S | Pitch -6 to 6 Yaw: -8 to 8 | deg | 12.5 |
| OMSR_PITCH_YAW_CMD (pitch element) | Right OMS engine pitch and yaw commands with respect to center of gimbal travel | OMS TVC CMD SOP (4.64) | A(2)S | Pitch: -6 to 6 Yaw: -8 to 8 | deg | 12.5 |

| Table 4.2.2.4.3-2. TVC_MIXER K-Loads | | | | | |
|--------------------------------------|------------------------------|------|-----------|-------|------|
| Name | Description | Type | MSID | Value | Unit |
| TOTAL_PITCH_LIM | Limit of total pitch command | S | V97U2390C | 5.89 | deg |

4.2.3 Panel Switch/Uplink/Post Contact Thrusting Interfacing

The panel switch interfacing function consists of reading the panel switches, selecting daploads, indicating which modes and options are in effect by providing panel switch lamp drive signals and buffering of uplinked data. An overview of the function is shown in Figure 4.2.3-1.

UNPACK_SW reformats the panel switch input discretes and notifies OFC_RECON when any of the dapload selection discretes (DAPLOAD, ALT_ACTIVE, NO_PLUS_Z_JETS and PRIMARY_VERNIER_SW) have changed via the flag DAPLOAD_CHANGE. OFC_RECON calls DAPLOAD_SELECT upon such notification or upon receiving the external flag indicating a change of DAPLOAD input parameters. DAPLOAD_SELECT is also called if either of PRIMARY_VERNIER_SW or ALT_ACTIVE are modified by OFC_RECON. DAPLOAD_SELECT chooses a subset of RCS DAP parameters from a set that is partially I-loaded and partially input by the crew via a spec function.

When the uplink interface software notifies OFC_RECON via a valid UP_OP_CODE of a request for a notch filter/mass properties update uplink, OFC_RECON calls the DAP_UL_PROC. The DAP uplink processor will either accept or reject the uplink and update a downlisted DAP_UL_STATUS indicator to reflect the status of the uplink.

POST_CONTACT_THRUSTING can overwrite NEW_PANEL_SW_WORD prior to its use by UNPACK_SW when the I-load DOCKING_FLT and OPS_2_INDICATOR are ON to initiate required DAP moding.

OFC_RECON can override certain switch-originated requests and dapload parameters. If a rotational or translational submode change is commanded in any axis with the corresponding hand controller out of detent in any axis, the change is rejected. OFC_RECON resets the option request to its previous value. In the TVC mode, PRIMARY_VERNIER_SW is forced to primary to enable RCS assistance of TVC attitude control, LVLH_MODE and FREE_DRIFT_MODE are forced OFF, and UNPACK_SW is flagged to disregard the LVLH and FREE DRIFT panel switches. In either RCS or TVC mode, attitude control is forced to manual when the RHC is moved out of detent in any axis. Automatic attitude control is reenabled by returning the RHC to detent and then selecting automatic control using the panel switch. In the IMU fail mode, OFC_RECON sets and holds the rotational option request to pulse and initializes the translational option request to pulse. In RCS mode, PRIMARY_VERNIER_SW is forced to primary and ALT_ACTIVE is forced to OFF whenever the THC is deflected and returns to their previous values when the translational firings are completed. In manual free drift mode (FREE_DRIFT_MODE = ON), OFC_RECON sets and holds the rotational option requests to pulse. In RCS mode, whenever INRTL or LVLH is initially selected, OFC_RECON sets the rotational option request to discrete rate via the flag DISC_REQUEST. All the aforementioned overrides are reflected in the panel switch lamp indications. SET_LAMPS checks the moding discretes and turns panel switch lamps on or off to reflect the options in effect.

OFC_RECON also performs some override logic that does not affect the panel switch lamps. In a one-engine TVC burn, RCS roll control is effected in the discrete rate mode. In either RCS or TVC mode, RCS rotation is downmoded to accel when the RHC is deflected beyond soft stop. The submode returns to that previously in effect when the RHC returns to detent. This downmoding logic is independent by axis. The deadband and rate limit requests from DAPLOAD_SELECT are honored in RCS mode and overridden by OFC_RECON in TVC mode.

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In TVC mode, the crew can preselect the RCS rotation and translation submodes to be implemented upon return to RCS mode. In this case, the preselected submode lamps are illuminated, while the actual RCS submodes in effect are determined solely by OFC_RECON. However, the auto/manual, INRTL/LVLH/FREE, DAP A/B, and primary/vernier lamps correctly indicate the current option being implemented. In TVC mode, selection of the manual mode via the PBI (INRTL) will mode the DAP to manual, but it will not set the RCS rotation options to discrete rate. Therefore the DAP will maintain the rotational submodes selected prior to entering TVC or those selected on an individual basis during TVC mode.

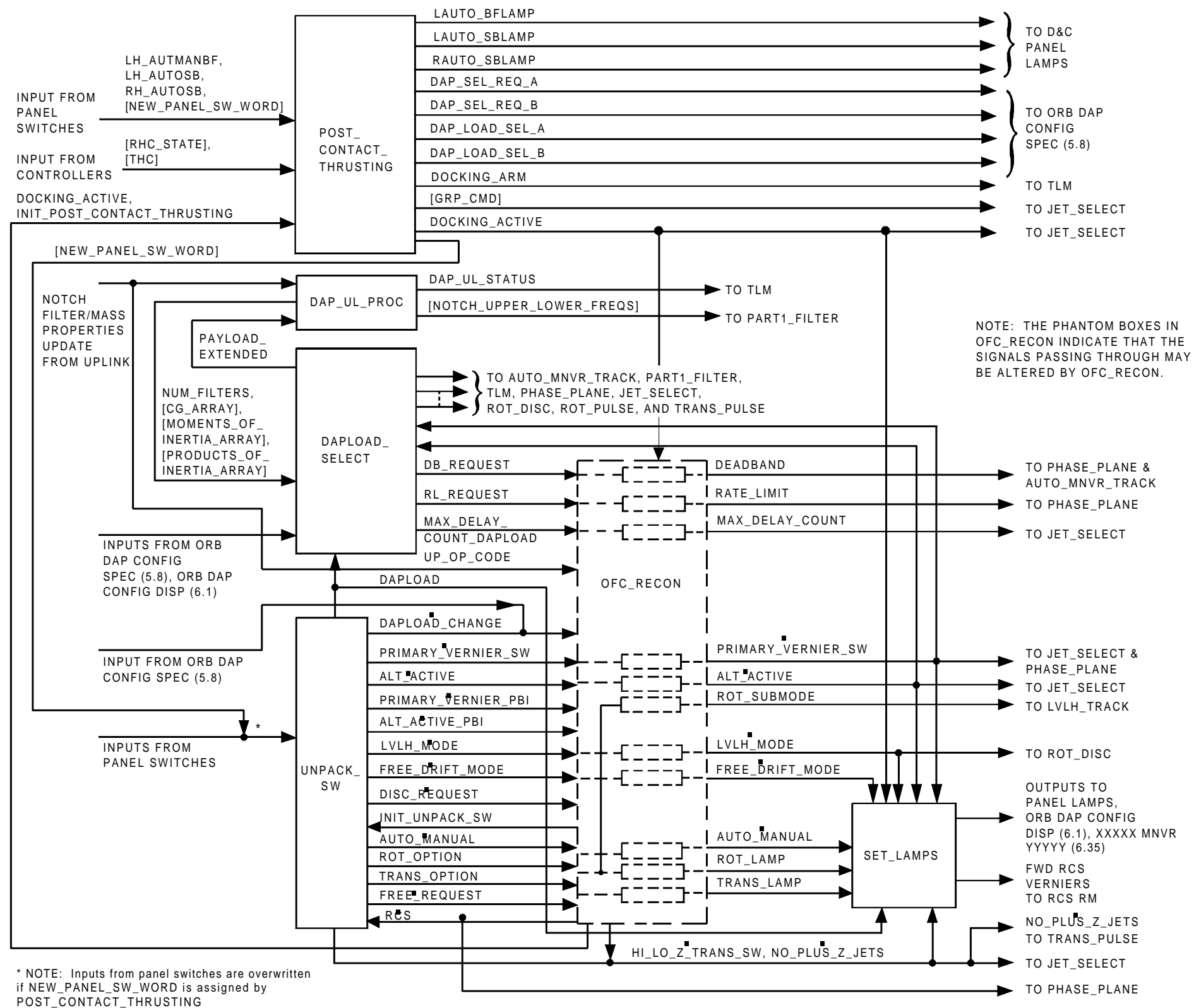


FIGURE 4.2.3-1. Interrelationships of Panel Switch/Uplink/Post Contact Thrusting Interfacing Modules and OFC_RECON

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4.2.3.1 UNPACK_SW

A. Function. Two control panels allow the crew to select submodes for on-orbit RCS translation and rotation as well as several parameters and options. One panel is located at the forward crew station, between the commander's and the pilot's stations. The other is located at the aft control station. Each of these panels consists of 24 momentary push-button switches. Additionally the switch discrettes can come from POST_CONTACT_THRUSTING if this is a Docking Flight and OPS_2_INDICATOR is ON.

UNPACK_SW reformats the panel switch inputs discrettes and notifies OFC_RECON when any of the dapload discrettes (DAPLOAD, ALT_ACTIVE, NO_PLUS_Z_JETS and PRIMARY_VERNIER_SW) have changed via the flag DAPLOAD_CHANGE.

The rotation submode switches for each axis consist of a DISC RATE switch for the discrete rate submode and a PULSE switch for the direct rotation pulse command submode. These switches allow independent selection of one of the two rotation submodes in each of the three axes if either INRTL or LVLH is the current manual mode. The rotation submode switches have no effect if FREE DRIFT is the current manual mode: the rotation submode is repeatedly set to PULSE in OFC_RECON.

The translation submode switches for each axis include a PULSE switch for the direct translation pulse command submode and a NORM switch for the direct translation acceleration command submode. Selection is independent by axis. A HIGH switch for the direct translation acceleration command submode with high-acceleration level along the +Z axis and a low Z switch for the direct translation acceleration or pulse command submode using $\pm X$ jets to implement +Z commands are available for the Z axis only.

The DAP AUTO, INRTL, LVLH and FREE switches allow selection of either manual or automatic steering. In RCS mode the INRTL, LVLH, and FREE switches also select one of the three manual options available. The INRTL switch selects inertial attitude hold about the current attitude, while the LVLH switch selects LVLH attitude hold about the current attitude. Both of these switches cause DISC RATE rotation submode to be selected but allow independent selection by axis of the rotation submode. The FREE switch selects the manual free drift mode by selecting the pulse rotation submode in each axes, and not allowing independent selection of the rotation submodes. The FREE switch state is passed along to OFC_RECON to allow for a reboost abort from a FREE PBI contact. During TVC operations only the DAP AUTO and INRTL switches are active, selecting either auto or manual steering respectively.

The DAPLOAD A and DAPLOAD B switches allow selection of either of two sets of parameters and flags for use by the RCS DAP. The actual selection is performed by DAPLOAD SELECT (Subsection 4.2.3.2).

The PRIM, ALT and VERN switches are mutually exclusive and select the DAP jet selection mode to be used. The primary jets are used for both the primary (PRIM) and alternate (ALT) DAP modes, and the verniers are used for the vernier DAP mode. The flag PRIMARY_VERNIER_SW is used to define the RCS jets to be used, while the flag ALT_ACTIVE defines which of the two modes (PRIM and ALT) is active if the primary RCS is in use. The two flags combine as follows to define the jet mode and jet selection logic to be used:

| PRIMARY_VERNIER_SW | ALT_ACTIVE | Description of Jet Mode |
|--------------------|------------|---------------------------------------|
| 0 | 0 | Vernier Jets |
| 1 | 0 | Primary Jets, Nominal Jet Selection |
| 1 | 1 | Primary Jets, Alternate Jet Selection |

Note: It is not possible for PRIMARY_VERNIER_SW to be off and ALT_ACTIVE to be on.

Unpacking and Priority Logic

The inputs to UNPACK_SW represent the forward and aft station requests ORed together. Additionally, on docking flights (DOCKING_FLT and OPS_2_INDICATOR are ON) the switch inputs can come from POST_CONTACT_THRUSTING. They are momentary; that is, ON when a switch is pressed, OFF when it is released. If an input discrete changes state from OFF to ON, the corresponding switch replica is set to ON, otherwise it is set OFF: i.e. leading edge detection is performed on the input discrettes. For all other switches, the switch replica is set to the state of the input discrete. The interpretation logic converts the switch–replica discrettes for use by OFC. It is recommended that the switch inputs be configured as bit strings, enabling efficient bitstring processing in UNPACK_SW.

Priority logic included in the unpacking logic protects against accidental pressing of two or more panel switches within a mutually exclusive group. The groups are given below; within each group, the panel switches are listed in order of priority, highest first:

| | |
|--------------------------|--|
| DAPLOAD: | DAP A, DAP B |
| Rotation: | INRTL, AUTO, FREE, LVLH |
| Manual Rotation Submode: | discrete, pulse |
| Translation (X, Y): | norm, pulse |
| Translation (Z): | Group 1: norm, pulse, high Group 2: high, low |
| RCS: | primary, vernier, alternate |

Initialization Logic

The initialization of this module sets the moding of the RCS DAP. The flag INIT_UNPACK_SW is set to 1 at OFC_RESTART and to 2 at selected OPS transitions. On receipt of this flag, UNPACK_SW modifies its normal procedure, and performs an initialization procedure. The initialization–pass procedure is to change the value of the inputs to correspond to the desired moding and zero the internal copy of the inputs. All inputs that have been set to ON will then be implemented by UNPACK_SW.

OFC_RESTART moding is:

- Discrete rotation, all axes
- Pulse translation, all axes, low plus Z option OFF
- Primary jets, Alternate jet mode not active
- Automatic mode
- DAPLOAD A

The moding associated with selected OPS transition is controlled by the carried over values of UNPACK_SW outputs.

B. Block Diagram. The detailed block diagram for the module UNPACK_SW is presented in Figure 4.2.3.1-1.

C. Processing Rate. The module UNPACK_SW is processed at 12.5 Hz.

D. Interface Requirements. The interface requirements for the module UNPACK_SW are shown in Table 4.2.3.1-1.

E. Constants. None.

F. Initialization Requirements. The initialization requirements for the module UNPACK_SW are shown in Table 4.2.3.1-2. INIT_UNPACK_SWITCH should be set to zero upon receipt of an initialization request.

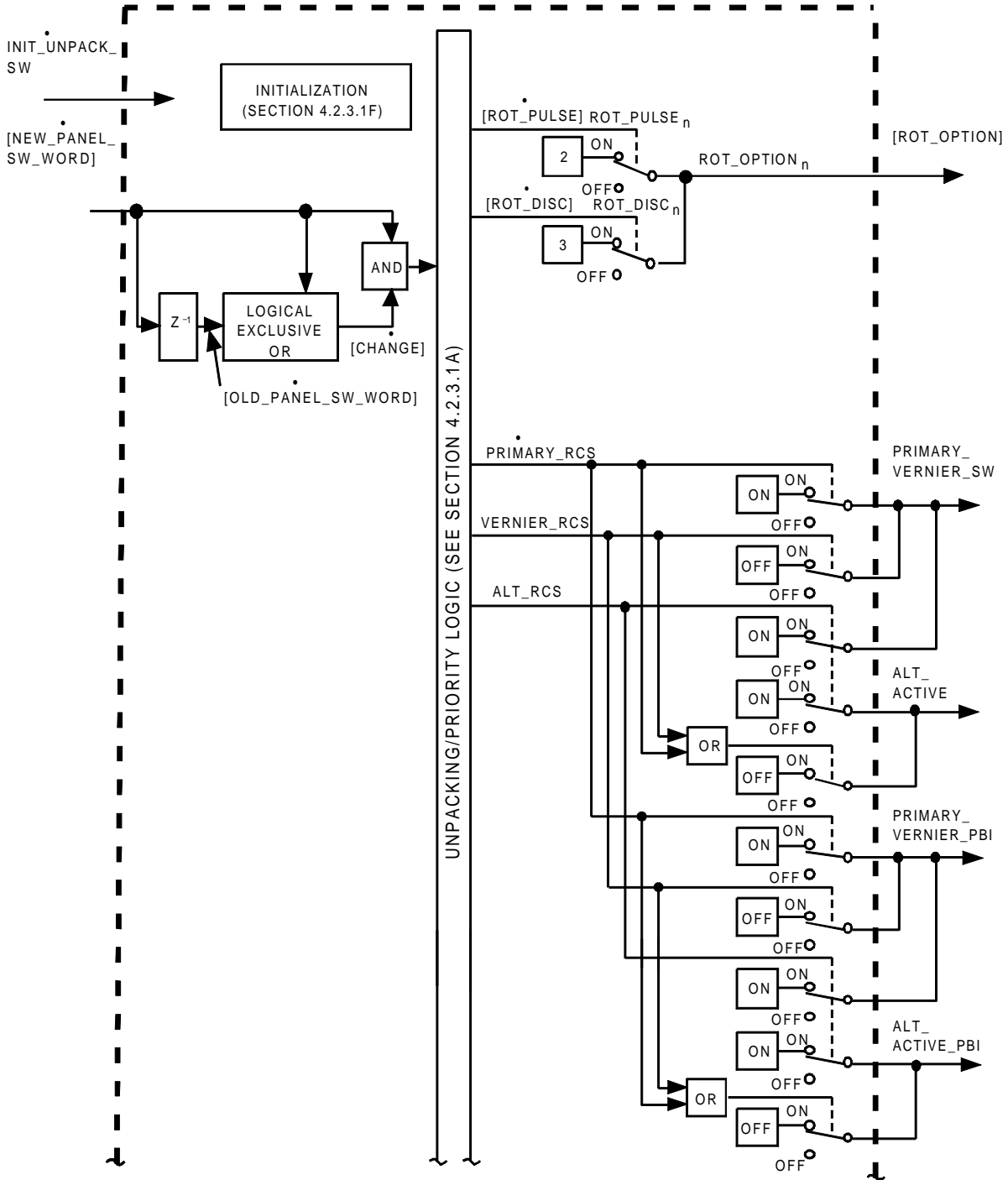


FIGURE 4.2.3.1-1.(1) UNPACK_SW (Sheet 1 of 3)

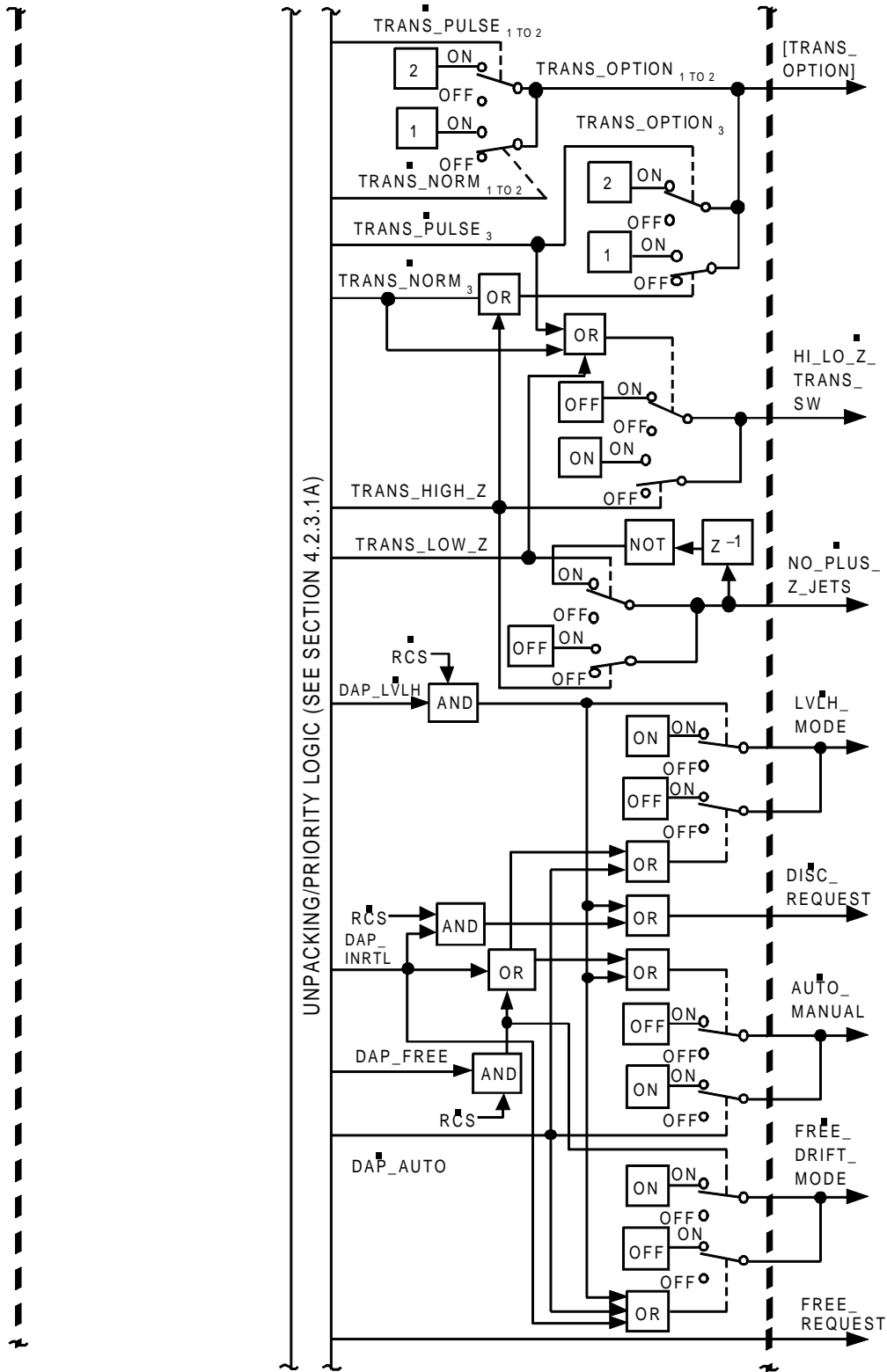


FIGURE 4.2.3.1-1.(2) UNPACK_SW (Sheet 2 of 3)

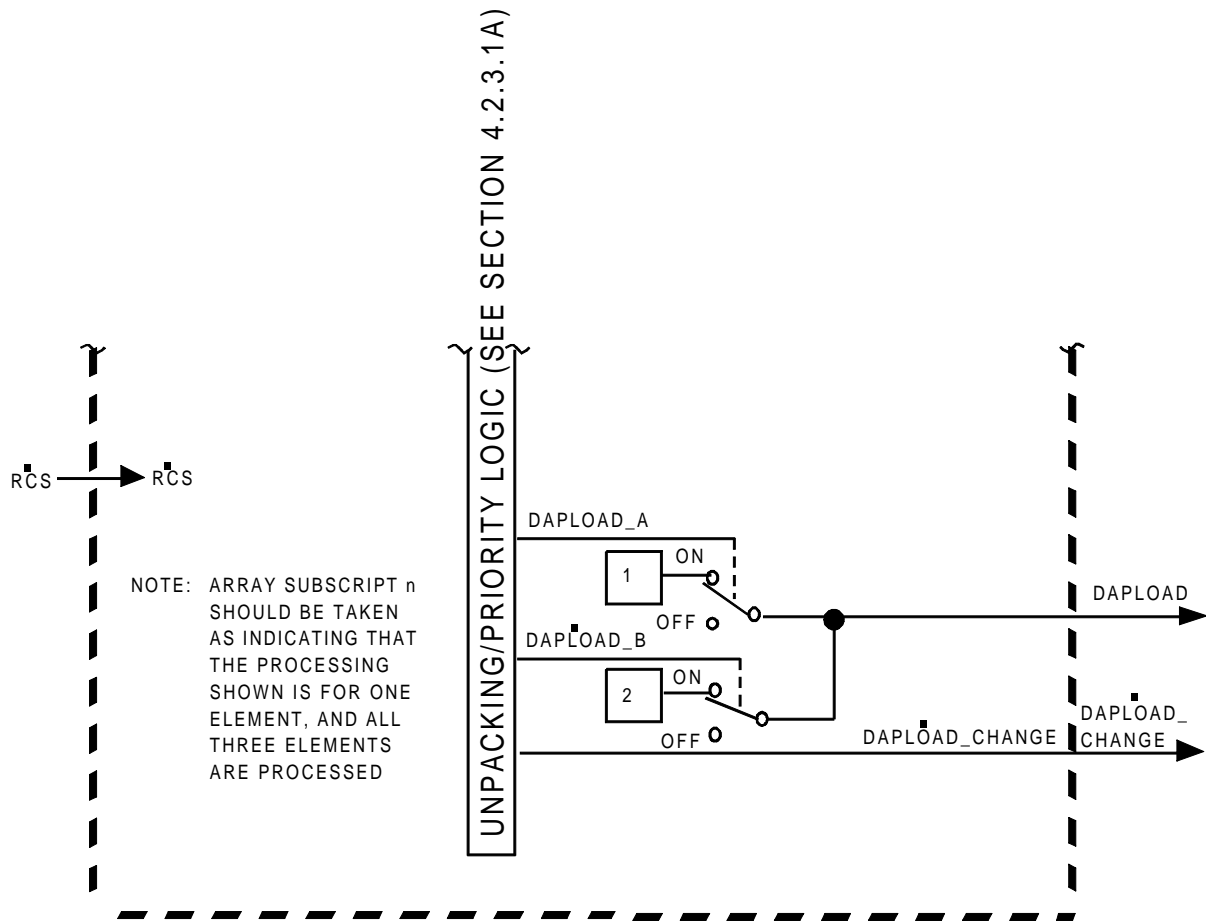


FIGURE 4.2.3.1-1.(3) UNPACK_SW (Sheet 3 of 3)

| Table 4.2.3.1-1. UNPACK_SW Interface Requirements | | | | | | |
|---|---|---|--------|-------------------------|------|------------------|
| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
| INPUTS | | | | | | |
| INIT_UNPACK_SW | Module initialization flag (1 = OFC RESTART INIT; 2 = OPS TRANSITION INIT) | OFC_RECON | I | 0 to 2 | none | 12.5 |
| NEW_PANEL_SW_WORD | Control panel switch states | POST_CONTACT_THRUSTING, FC SWIT PROC (4.216) | A(24)B | 0, 1 | none | 12.5 |
| RCS | RCS mode indicator (1 = RCS mode) | OFC_RECON | B | 0, 1 | none | 12.5 |
| OUTPUTS | | | | | | |
| ALT_ACTIVE | Alternate PRCS DAP mode select (1 = Alternate mode active) | OFC_RECON, JET_SELECT, SET_LAMPS, DAPLOAD_SELECT | B | 0, 1 | none | 12.5 |
| ALT_ACTIVE_PBI | Flag indicating last switch selected state of ALT_ACTIVE (1 = Alternate mode active) | OFC_RECON | B | 0, 1 | none | 12.5 |
| AUTO_MANUAL | Auto/manual select (1 = auto; 0 = manual) | OFC_RECON, SET_LAMPS | B | 0, 1 | none | 12.5 |
| DAPLOAD | DAPLOAD A/B select (1 = DAPLOAD A; 2 = DAPLOAD B) | DAPLOAD_SELECT, SET_LAMPS | I | 1, 2 | none | 12.5 |
| DAPLOAD_CHANGE | Flag signifying change in one or both dapload selection parameters (bit 1 ON = DAPLOAD has changed; bit 2 ON = PRIMARY_VERNIER_SW, NO_PLUS_Z_JETS or ALT_ACTIVE have changed) | OFC_RECON | B(2) | 0, 1 for each bit | none | 12.5 |
| DISC_REQUEST | Request DISC RATE rotation submode be selected in all axes (1 = request) | OFC_RECON | B | 0, 1 | none | 12.5 |
| FREE_DRIFT_MODE | FREE DRIFT MODE indicator (1 = Free Drift) | OFC_RECON, SET_LAMPS | B | 0, 1 | none | 12.5 |
| FREE_REQUEST | FREE drift request from PBI | OFC_RECON | B | 0, 1 | none | 12.5 |
| HI_LO_Z_TRANS_SW | Z-axis translational acceleration level select (1 = high; 0 = low) | SET_LAMPS, JET_SELECT | B | 0, 1 | none | 12.5 |
| LVLH_MODE | LVLH MODE indicator (1 = LVLH) | OFC_RECON, SET_LAMPS | B | 0, 1 | none | 12.5 |

| Table 4.2.3.1-1. UNPACK_SW Interface Requirements | | | | | | |
|---|--|---|-------|-------|------|------------------|
| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
| NO_PLUS_Z_JETS | Flag to inhibit use of +Z jets (1 = inhibit) | SET_LAMPS, JET_SELECT, TRANS_PULSE, DAPLOAD_SELECT, OFC_RECON | B | 0, 1 | none | 12.5 |
| PRIMARY_VERNIER_PBI | Flag indicating the last state of the NORM and VERN PBI's on the Orbit DAP Panel | OFC_RECON | B | 0, 1 | none | 12.5 |
| PRIMARY_VERNIER_SW | RCS primary/vernier jet select (1 = primary; 0 = vernier) | OFC_RECON, DAPLOAD_SELECT, SET_LAMPS, PHASE_PLANE, JET_SELECT | B | 0, 1 | none | 12.5 |
| ROT_OPTION | Manual rotation submode select (2 = pulse; 3 = discrete) | OFC_RECON | A(3)I | 2, 3 | none | 12.5 |
| TRANS_OPTION | Manual translation submode select (1 = accel; 2 = pulse) | OFC_RECON | A(3)I | 1, 2 | none | 12.5 |

| Table 4.2.3.1-2. UNPACK_SW Initialization Requirements | | | |
|--|--------------------|---|---|
| Initialize on Transition | | Variable | Initial Value |
| From | To | | |
| INIT_UNPACK_SW = 0 | INIT_UNPACK_SW = 1 | NEW_PANEL_SW_WORD: Rotation submode (all axes) Translation submode (all axes) DAP AUTO/INRTL/LVLH/FREE PRI/ALT/VERN RCS DAPLOAD A/B OLD_PANEL_SW_WORD | DISC_RATE PULSE AUTO PRI A 0 |
| INIT_UNPACK_SW = 0 | INIT_UNPACK_SW = 2 | NO_PLUS_Z_JETS NEW_PANEL_SW_WORD OLD_PANEL_SW_WORD | OFF 0 0 |

4.2.3.2 DAPLOAD_SELECT

A. Function. This module selects a set of RCS parameters and flags as a function of the dapload selected, the primary/vernier RCS jet select discretely, LowZ option, X jets active indicator, and Alternate PRCS mode active indicator. A further selection of certain vehicle inertia-dependent parameters is made based on jet mode and/or the selected payload extended configuration.

Referring to Figure 4.2.3.2-1 and Table 4.2.3.2-1, the “C” parameters, as well as ROT_HI_LO_SW, LO_PITCH_TAIL_NOSE, and LO_YAW_TAIL_NOSE, are chosen solely on the basis of the dapload A/B select discrete. The “D” parameters, as well as DB_REQUEST, are chosen as a function of both the dapload A/B select discrete and the primary/vernier RCS jet select discrete. The “E” parameters, used in Alternate PRCS mode, are specified through the DAP configuration display. The RL_REQUEST parameter, chosen as a function of both the dapload A/B discrete and the primary/vernier RCS jet select discrete, is replaced in the ALT_ON_OFF routine by the corresponding “E” parameter value when the Alternate PRCS mode is active. Referring to Figure 4.2.3.2-4, the desired values of the vehicle cg, moments of inertia and products of inertia are selected from the I-loaded or uplinked arrays based on one of the “C” parameters, indicating the current PAYLOAD_EXTENDED selection. These values are then used to calculate the current values of the jet angular increments (ANG_INCREMENTS), estimating the angular rate change over 80 ms for each PRCS jet group and the six VRCS jets. The selected values of cg, moment of inertia and product of inertia are then output to TLM. The ANG_INCREMENTS are then used in Figure 4.2.3.2-5 to calculate the current estimate of the average magnitude of control acceleration (MAG_CONTROL_ACCEL). Calculation of this acceleration is also based on the current values of the primary/vernier RCS jet selection discrete, the Alternate PRCS mode active indicator, the XJETS_ACTIVE indicator, and the Alternate PRCS selected maximum number of simultaneously firing jets. If the primary/vernier discrete is OFF or the Alternate PRCS mode active indicator is ON a pseudo jet selection (Figure 4.2.3.2-6) is executed to calculate the estimated acceleration based on the Alternate Jet option and NO_PLUS_Z_JETS flag, the XJETS_ACTIVE indicator, and/or the primary/vernier RCS jet selection discrete. Once the basic acceleration value is found, it is output as MAG_CONTROL_ACCEL and multiplied by two constants to obtain PHASE_PLANE_ACCEL and DELTAV_MINIMP.

The subroutine ALT_ON_OFF is called to initialize and derive parameters when Alternate PRCS mode is active. Using the “F” parameters, counters and counter thresholds are set for the jet delay and on time commands, the time bias is set for AUTO_MANEUVER_TRACK module, and the control accelerations MAG_CONTROL_ACCEL and PHASE_PLANE_ACCEL are multiplied by a scale factor to adjust for the delay between firings. In preparation for the JET_SELECT module, scale factor CMDSF is derived and a selection of the jet select thresholds is made. If the Alternate PRCS mode is not active, all input values remain unchanged and the jet select thresholds and jet on time/delay counters default to values that allow nominal jet select.

The notch filter reset logic (Figure 4.2.3.2-3) controls two flags governing behavior of the state estimator notch filter section and selects the parameter that sets the number of filters from an I-loaded array depending on the current payload-extended configuration. The logic operates as follows. Whenever PAYLOAD_EXTENDED changes, the value of N_FILTERS is updated. If PAYLOAD_EXTENDED is zero, N_FILTERS is set to zero; otherwise N_FILTERS is selected from the array NUM_FILTERS indexed by PAYLOAD_EXTENDED. If N_FILTERS is nonzero, the notch filter section is initially enabled by setting the enable and initialization flags ENABLE_NF and INIT_NF to ON. The crew can then disable or enable the notch filter section via item entry in the DAP CONFIG display, and each time the section is re-enabled, INIT_NF is set to ON. If N_FILTERS is zero, the reset logic holds ENABLE_NF OFF, disabling the notch filter section.

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B. Block Diagram. The detailed block diagram for the module DAPLOAD_SELECT is presented in Figure 4.2.3.2-1.

C. Processing Rate. As required.

D. Interface Requirements. The interface requirements for the module DAPLOAD_SELECT are shown in Table 4.2.3.2-1.

E. I-Loads/K-Loads/Constants. The I-loads/K-loads/Constants for the module DAPLOAD_SELECT are shown in Table 4.2.3.2-2.

F. Initialization Requirements. The initialization requirements for the module DAPLOAD_SELECT are shown in Table 4.2.3.2-3.

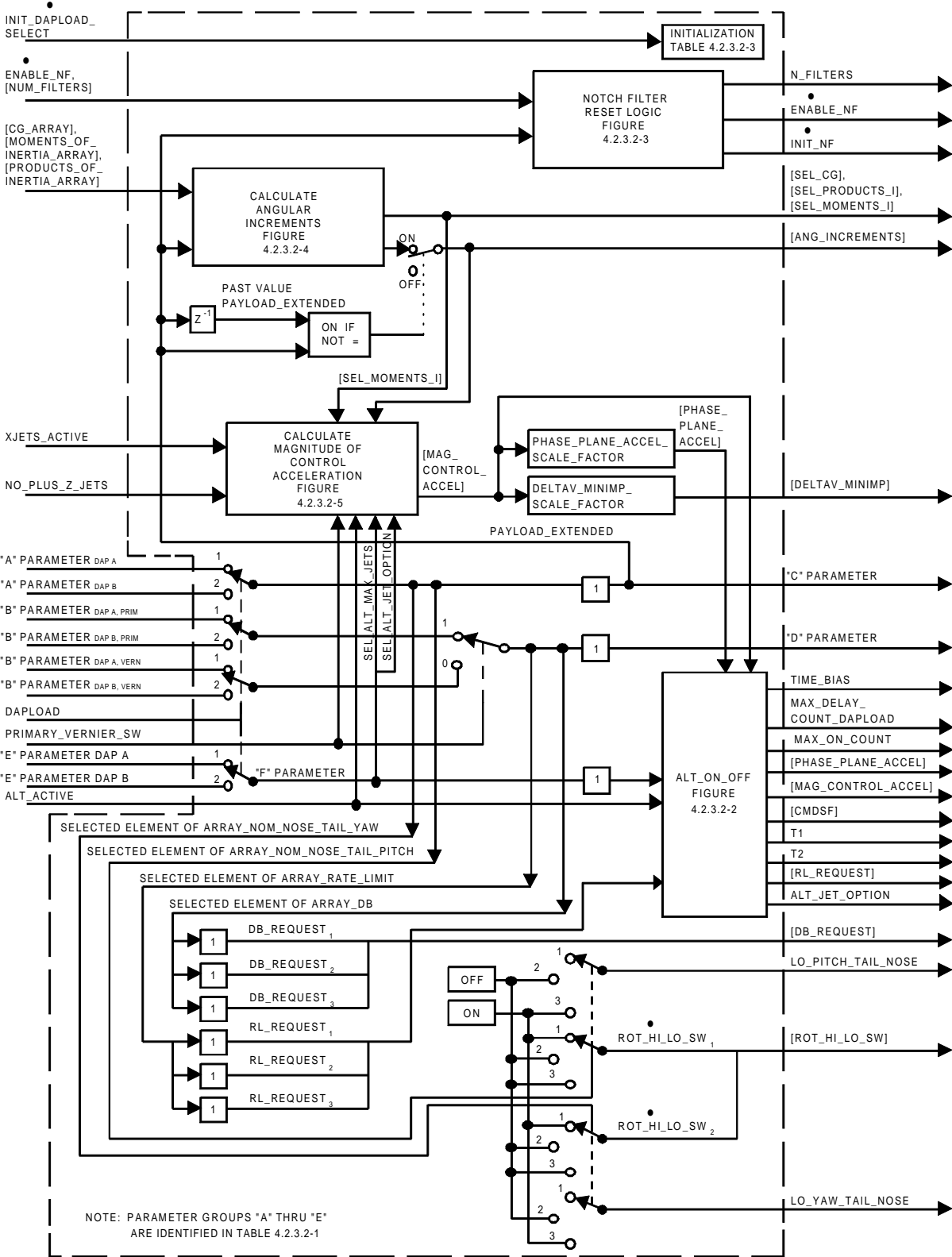


FIGURE 4.2.3.2-1. DAPLOAD_SELECT

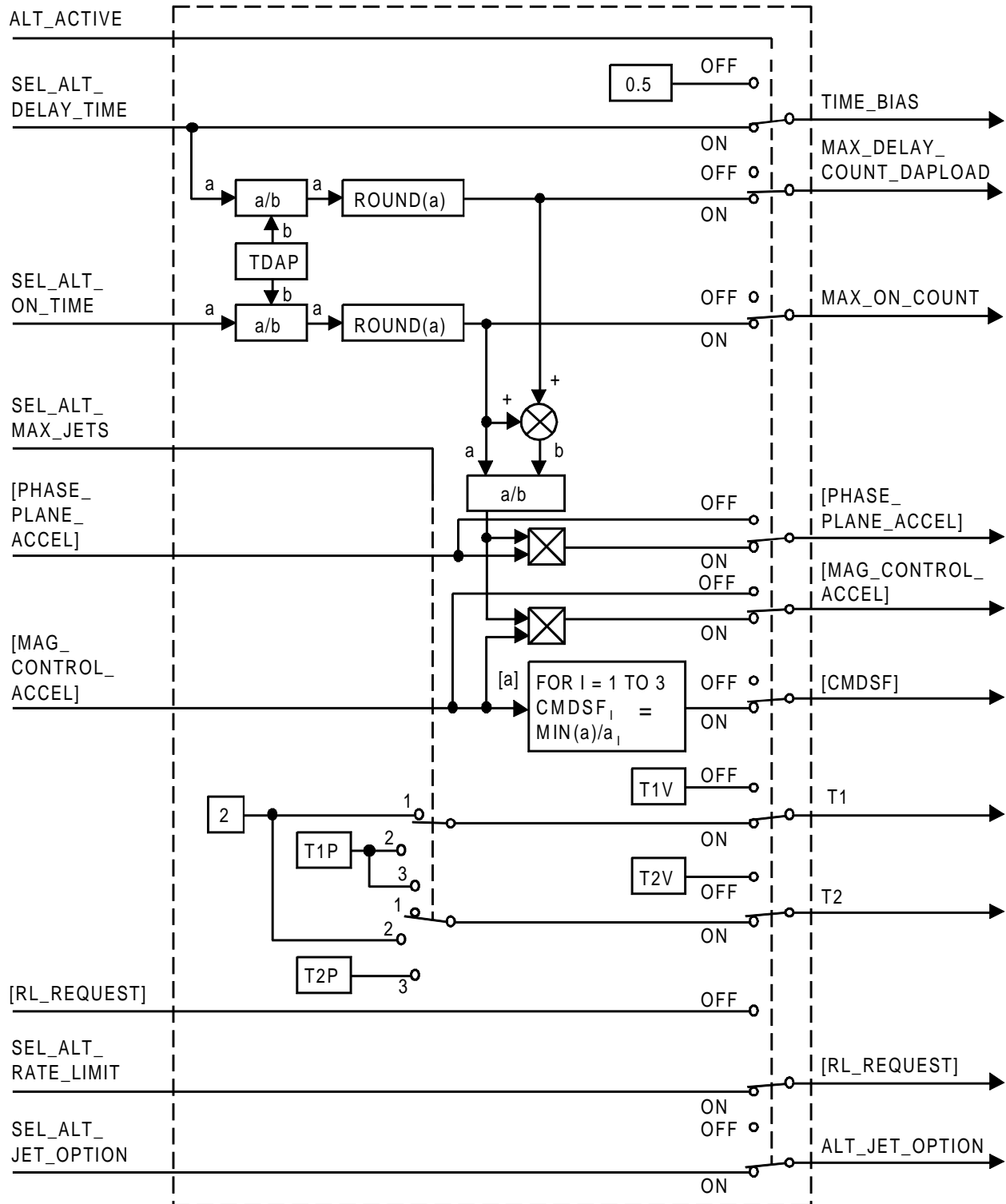


FIGURE 4.2.3.2-2. ALT_ON_OFF

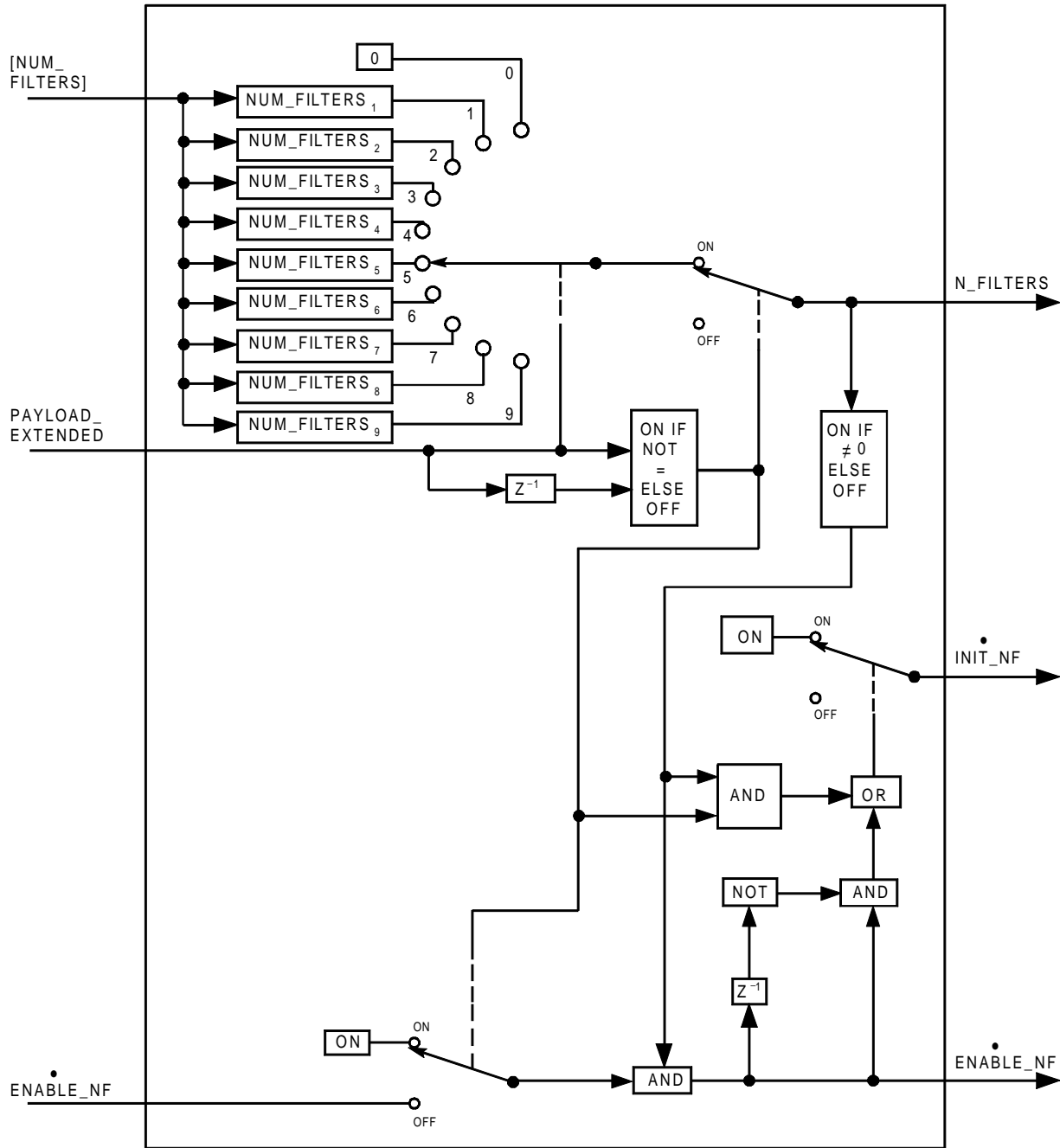


FIGURE 4.2.3.2-3. Notch Filter Reset Logic

PAYLOAD_EXTENDED

[CG_ARRAY],
[MOMENTS_OF_INERTIA_ARRAY],
[PRODUCTS_OF_INERTIA_ARRAY]

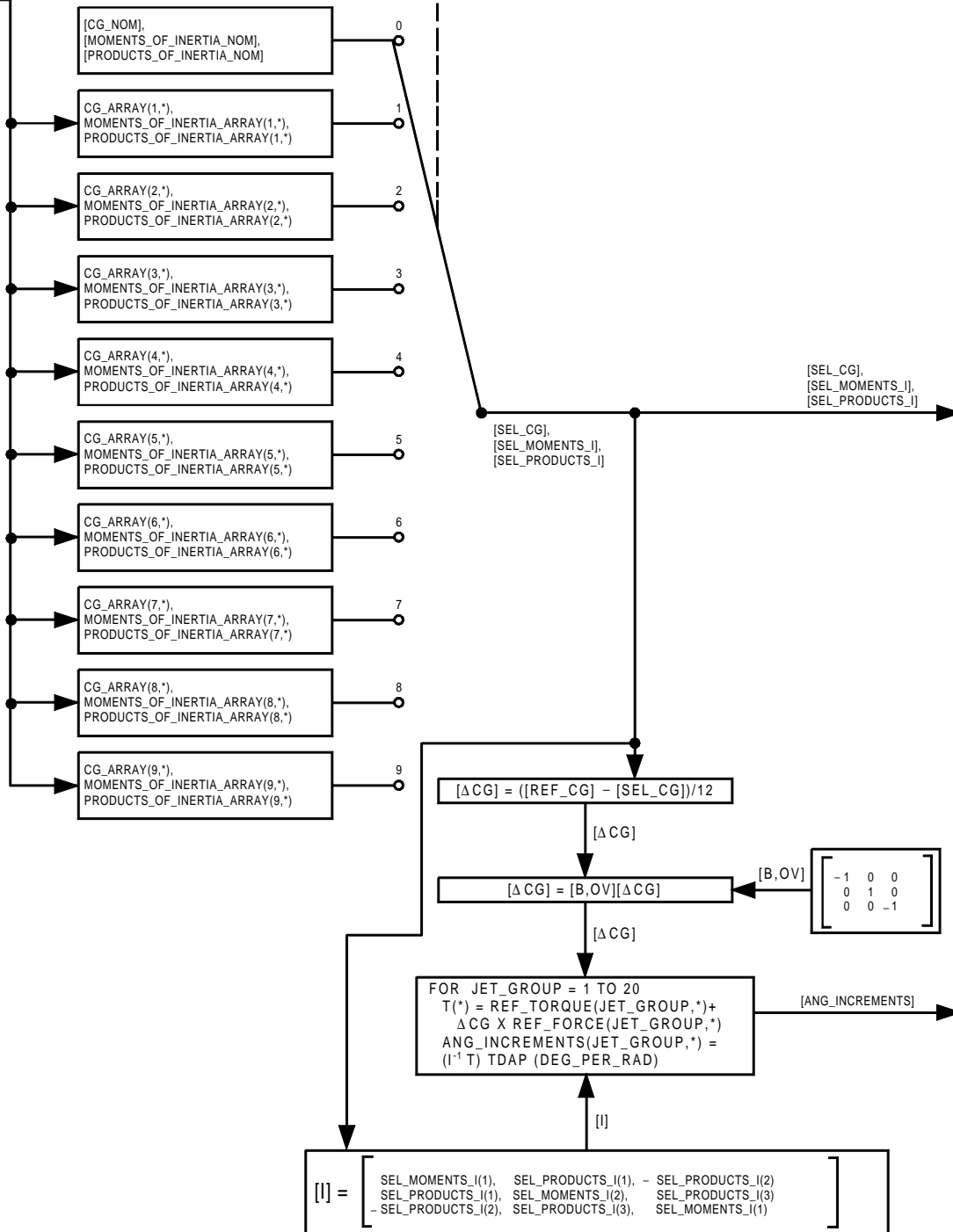


FIGURE 4.2.3.2-4. Calculate Angular Increments

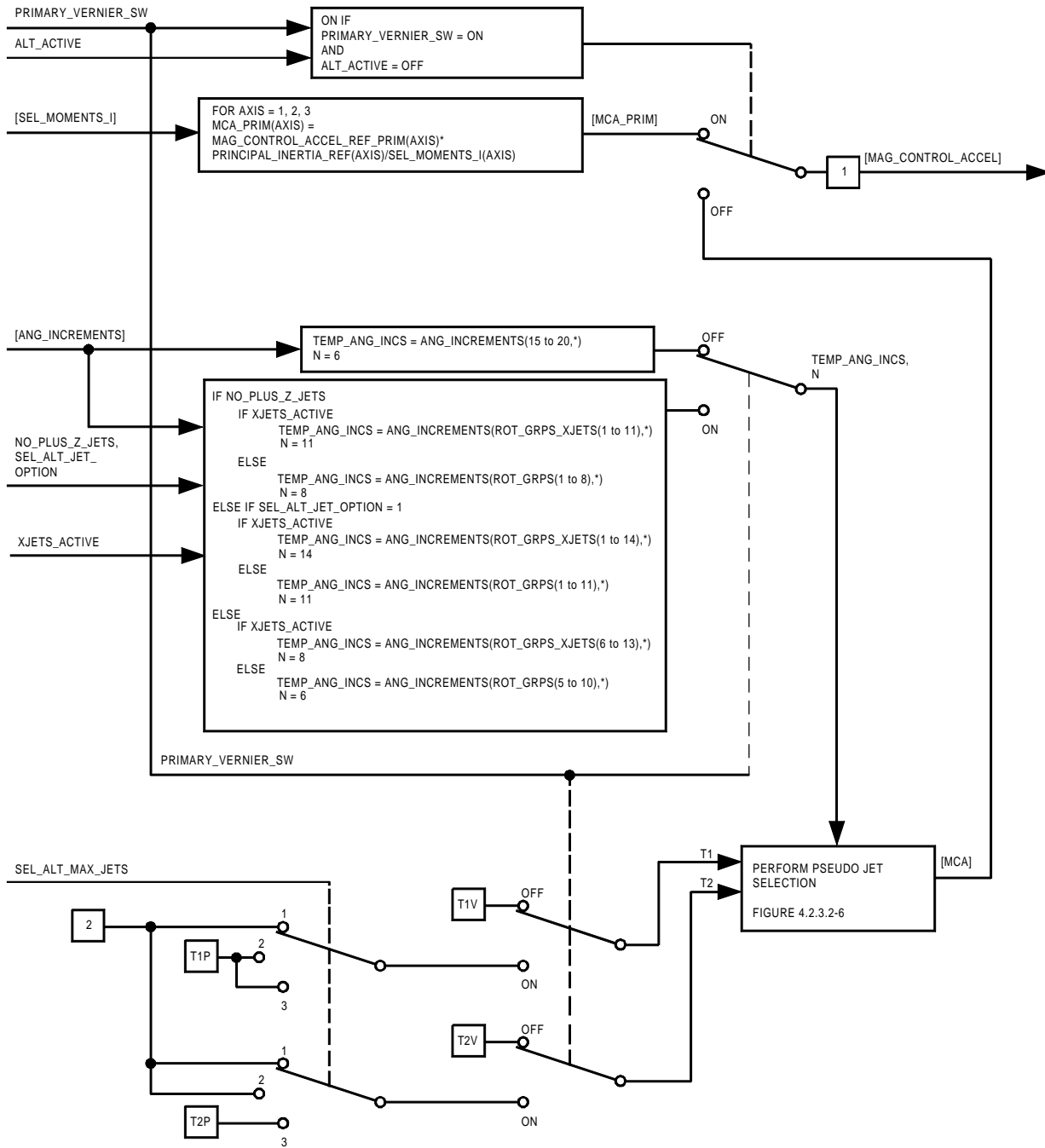


FIGURE 4.2.3.2-5. Calculate Magnitude of Control Acceleration

REPEAT FOR AXIS = 1, 2, 3

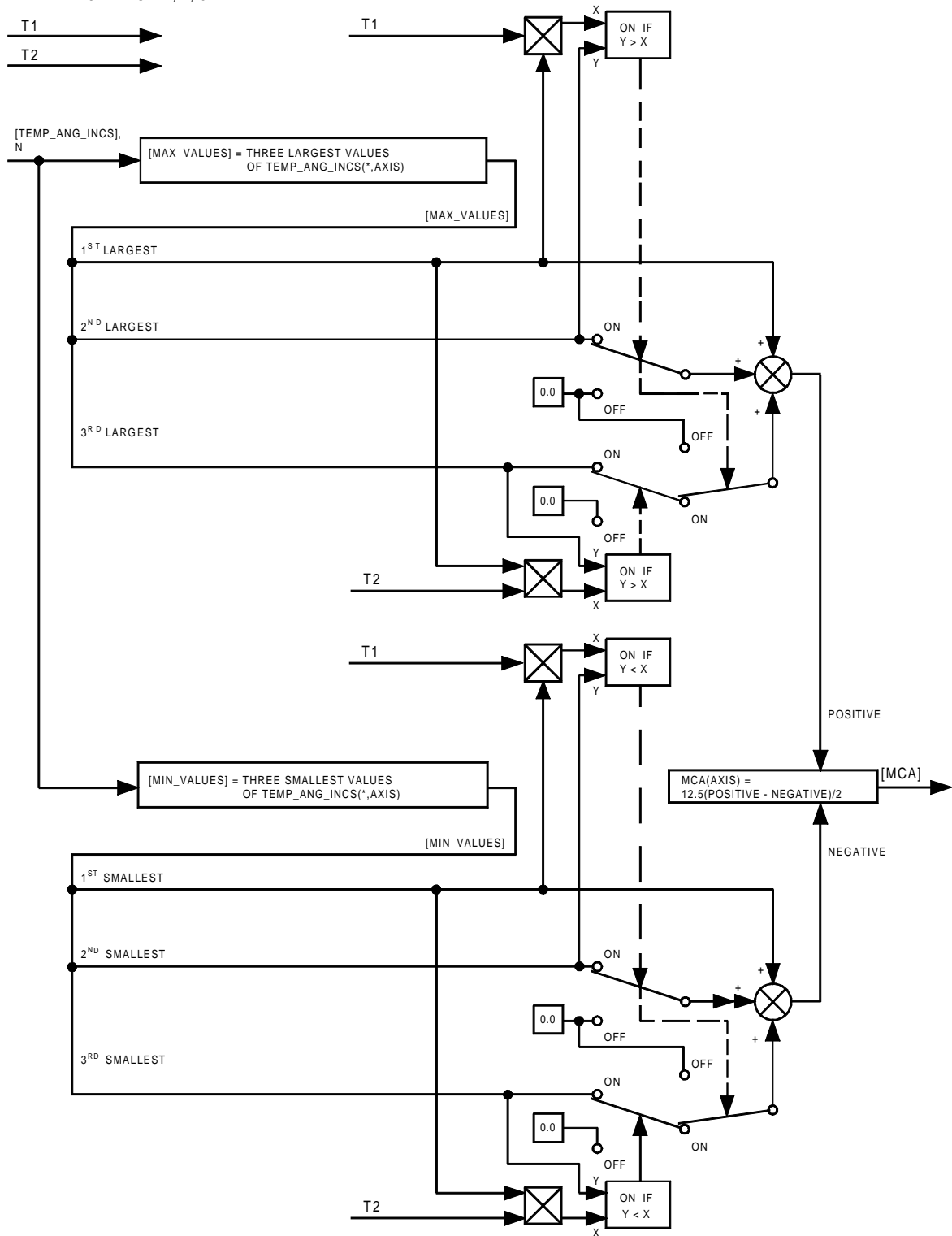


FIGURE 4.2.3.2-6. Perform Pseudo Jet Selection

Table 4.2.3.2-1. DAPLOAD_SELECT Interface Requirements

| Parameter Group (Ref. Fig. 4.2.3.2-1) | Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
|---------------------------------------|---------------------------|--|---|---------|---------------|-------|------------------|
| INPUTS | | | | | | | |
| — | ALT_ACTIVE | Alternate PRCS DAP mode active indicator (1 = active) | OFC_RECON, UNPACK_SW | B | 0, 1 | none | On demand |
| E | ARRAY_ALT_MAX_JETS | Array of maximum number of jets to be commanded ON in alternate PRCS mode | ORB DAP CONFIG (6.1), ORB DAP CONFIG SPEC (5.8) | A(2)I | 1, 2, 3 | none | On demand |
| E | ARRAY_ALT_DELAY_TIME | Array of requested minimum time between firings in alternate PRCS mode | ORB DAP CONFIG (6.1), ORB DAP CONFIG SPEC (5.8) | A(2)S | 0.00 to 99.99 | s | On demand |
| E | ARRAY_ALT_ON_TIME | Array of requested maximum firing duration in alternate PRCS mode | ORB DAP CONFIG (6.1), ORB DAP CONFIG SPEC (5.8) | A(2)S | 0.08 to 9.99 | s | On demand |
| E | ARRAY_ALT_JET_OPTION | Array of requested jet options in the alternate PRCS mode (1 = FWD and AFT, 3 = AFT only) | ORB DAP CONFIG (6.1), ORB DAP CONFIG SPEC (5.8) | A(2)I | 1, 3 | none | On demand |
| E | ARRAY_ALT_RATE_LIMIT | Array of requested rate limit for alternate PRCS mode | ORB DAP CONFIG (6.1), ORB DAP CONFIG SPEC (5.8) | A(2)S | 0.05 to 5.0 | deg/s | On demand |
| B | ARRAY_COMP_THRESHOLD | Array of magnitudes of rotation compensation thresholds (0 = disable compensation) | ORB DAP CONFIG (6.1), ORB DAP CONFIG SPEC (5.8) | A(2,2)S | ≥ 0 | deg/s | On demand |
| B | ARRAY_DB | Array of magnitudes of phase plane attitude deadband requests | ORB DAP CONFIG (6.1), ORB DAP CONFIG SPEC (5.8) | A(2,2)S | > 0 | deg | On demand |
| B | ARRAY_MNVR_RATE | Array of magnitudes of discrete maneuver rates (about body axes for manual discrete rate submode; about eigenaxis for auto mode) | ORB DAP CONFIG (6.1), ORB DAP CONFIG SPEC (5.8) | A(2,2)S | > 0 | deg/s | On demand |
| A | ARRAY_NOM_NOSE_TAIL_PITCH | Array of pitch acceleration options (1 = nominal; 2 = low nose; 3 = low tail) | ORB DAP CONFIG (6.1), ORB DAP CONFIG SPEC (5.8) | A(2)I | 1,2,3 | none | On demand |
| A | ARRAY_NOM_NOSE_TAIL_YAW | Array of yaw acceleration options (1 = nominal; 2 = low nose; 3 = low tail) | ORB DAP CONFIG (6.1), ORB DAP CONFIG SPEC (5.8) | A(2)I | 1,2,3 | none | On demand |

Table 4.2.3.2-1. DAPLOAD_SELECT Interface Requirements

| Parameter Group (Ref. Fig. 4.2.3.2-1) | Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
|---------------------------------------|---------------------------|---|---|----------------|---------------------|----------------------|------------------|
| A | ARRAY_PAYLOAD_EXTENDED | Array of payload extended flags (0 = payload not extended; 1 through 9 = selected payloads) | ORB DAP CONFIG (6.1), ORB DAP CONFIG SPEC (5.8) | A(2)I | 0,1,2,3,4,5,6,7,8,9 | none | On demand |
| B | ARRAY_RATE_LIMIT | Array of magnitudes of phase plane rate error limit requests | ORB DAP CONFIG (6.1), ORB DAP CONFIG SPEC (5.8) | A(2,2)S | > 0 | deg/s | On demand |
| B | ARRAY_ROT_PULSE | Array of magnitudes of rotation pulses | ORB DAP CONFIG (6.1), ORB DAP CONFIG SPEC (5.8) | A(2,2)S | > 0 | deg/s | On demand |
| A | ARRAY_TRANS_PULSE | Array of magnitudes of translation pulses | ORB DAP CONFIG (6.1), ORB DAP CONFIG SPEC (5.8) | A(2)S | > 0 | ft/s | On demand |
| — | CG_ARRAY | Array of vehicle cg's in the OV frame | I-load, DAP_UL_PROC | A(9) V(3)S | | inches | On demand |
| — | DAPLOAD | Dapload A/B select (1 = dapload A; 2 = dapload B) | UNPACK_SW | I | 1,2 | none | On demand |
| — | ENABLE_NF | Flag to enable/disable notch filter (1 = enable) | ORBIT DAP CONFIG (6.1) | B | 0,1 | none | as req'd |
| — | INIT_DAPLOAD_SELECT | Module initialization flag (1 = init) | OFC_RECON | B | 0,1 | none | as req'd |
| — | MOMENTS_OF_INERTIA_ARRAY | Array of vehicle moments of inertia in the OV frame | I-load, DAP_UL_PROC | A(9,3)S | | slug-ft ² | On demand |
| — | NO_PLUS_Z_JETS | Flag to inhibit use of +Z jets (1 = inhibit) | UNPACK_SW | B | 0,1 | none | On demand |
| — | NUM_FILTERS | Absolute value is number of notch filters active for each of nine payload-extended configurations | I-load, DAP_UL_PROC | A(9)I | -6 to 6 | none | as req'd |
| — | PRIMARY_VERNIER_SW | RCS primary/vernier jet select (1 = primary; 0 = vernier) | UNPACK_SW, OFC_RECON | B | 0,1 | none | On demand |
| — | PRODUCTS_OF_INERTIA_ARRAY | Array of vehicle products of inertia in the OV frame | I-load, DAP_UL_PROC | A(9,3)S | | slug-ft ² | On demand |
| — | XJETS_ACTIVE | XJETS active indicator (1 = active) | OFC_RECON, ORB DAP CONFIG (6.1) | B | 0,1 | none | On demand |
| OUTPUTS | | | | | | | |
| — | ALT_JET_OPTION | JET Option in ALT mode (1 = NOM, 3 = Tail only) | JET_SELECT | I | 1,3 | none | On demand |
| — | ANG_INCREMENTS | Angular rate change over 80 ms for each primary jet group and the six vernier jets | JET_SELECT | A(20) V(3)S | | deg/s | On demand |
| — | CMDSF | Scale factor for ALT mode rotation commands | JET_SELECT | A(3)S | 0 to 1 | none | On demand |
| — | DB_REQUEST | Magnitudes of phase plane attitude deadbands requested by crew | OFC_RECON, TLM, UNIV POINT PROC (4.213) | A(3)S | ≥ 0 | deg | On demand |

Table 4.2.3.2-1. DAPLOAD_SELECT Interface Requirements

| Parameter Group (Ref. Fig. 4.2.3.2-1) | Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
|---------------------------------------|-------------------------|---|---|-------|---------------------|----------------------|------------------|
| — | DELTA_V_MINIMP | Magnitudes of changes in vehicle angular rate due to minimum impulse RCS firing | PHASE_PLANE | A(3)S | ≥ 0 | deg/s | On demand |
| — | ENABLE_NF | Flag to enable/disable notch filter (1 = enable) | PART1_FILTER, ORBIT DAP CONFIG (6.1), TLM | B | 0,1 | none | as req'd |
| — | INIT_NF | Notch filter initialization flag (1 = init) | PART1_FILTER | B | 0,1 | none | as req'd |
| — | LO_PITCH_TAIL_NOSE | Tail or nose jet select for low level pitch rotation (1 = tail; 0 = nose) | JET_SELECT, TLM | B | 0,1 | none | On demand |
| — | LO_YAW_TAIL_NOSE | Tail or nose jet select for low level yaw rotation (1 = tail; 0 = nose) | JET_SELECT, TLM | B | 0,1 | none | On demand |
| — | MAG_CONTROL_ACCEL | Magnitude of average control acceleration available for each axis | AUTO_MNVR_TRACK, ROT_PULSE, TLM | A(3)S | ≥ 0 | deg/s ² | On demand |
| D | MAG_MNVR_RATE | Magnitude of discrete maneuver rate (about body axes for manual discrete rate submode; about eigenaxis for auto mode) | AUTO_MNVR_TRACK, ROT_DISC, TLM | S | ≥ 0 | deg/s | On demand |
| — | MAX_DELAY_COUNT_DAPLOAD | Minimum time between firings, in minor cycles, in ALT mode | OFC_RECON | I | 0 to 1250 | none | On demand |
| — | MAX_ON_COUNT | Maximum firing duration, in minor cycles, in ALT mode | JET_SELECT | I | 1 to 125 | none | On demand |
| — | N_FILTERS | Absolute value is number of notch filters currently active | PART1_FILTER, TLM | I | -6 to 6 | none | as req'd |
| D | OFF_AXIS_COMP_THRESHOLD | Magnitude of rotation compensation threshold (0. = disable compensation) | JET_SELECT | S | ≥ 0 | deg/s | On demand |
| C | PAYLOAD_EXTENDED | Payload extended flag (0 = payload not extended; 1 through 9 = selected payloads) | DAP_UL_PROC, OFC_RECON, PART1_FILTER | I | 0,1,2,3,4,5,6,7,8,9 | none | On demand |
| — | PHASE_PLANE_ACCEL | Magnitude of average control acceleration available for each axis, scaled for phase plane use | PHASE_PLANE | A(3)S | ≥ 0 | deg/s ² | On demand |
| — | RL_REQUEST | Magnitudes of phase plane rate error limits requested by crew | OFC_RECON, TLM | A(3)S | ≥ 0 | deg/s | On demand |
| — | ROT_HI_LO_SW | Pitch and yaw acceleration level select (1 = nominal; 0 = low) | JET_SELECT, TLM | A(2)B | 0,1 | none | On demand |
| D | ROT_PULSE_SIZE | Magnitude of desired body angular rate change per deflection of rotational hand controller in manual pulse rotation submode | ROT_PULSE, TLM | S | ≥ 0 | deg/s | On demand |
| — | SEL_CG | Selected values of vehicle cg. In the OV frame | TLM | A(3)S | | inches | On demand |
| — | SEL_MOMENTS_I | Selected values of vehicle moments of inertia. In the OV frame | TLM | A(3)S | | slug-ft ² | On demand |
| — | SEL_PRODUCTS_I | Selected values of vehicle products of inertia. In the OV frame, positive integrals. | TLM | A(3)S | | slug-ft ² | On demand |
| F | SEL_ALT_DELAY_TIME | Requested minimum time between firings in ALT mode | TLM | S | 0.00 to 99.99 | sec | On demand |
| F | SEL_ALT_JET_OPTION | Requested jet option in ALT mode (1 = FWD and AFT, 3 = AFT only) | TLM | I | 1, 3 | none | On demand |
| F | SEL_ALT_MAX_JETS | Maximum number of jets to be commanded ON in ALT mode | TLM | I | 1, 2, 3 | none | On demand |

Table 4.2.3.2-1. DAPLOAD_SELECT Interface Requirements

| Parameter Group (Ref. Fig. 4.2.3.2-1) | Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
|---------------------------------------|--------------------|--|-----------------------|------|---------------|-------|------------------|
| F | SEL_ALT_ON_TIME | Requested maximum firing duration in ALT mode | TLM | S | 0.08 to 9.99 | sec | On demand |
| F | SEL_ALT_RATE_LIMIT | Requested rate limit for ALT mode | TLM | S | 0.05 to 5.0 | deg/s | On demand |
| — | TIME_BIAS | Average time delay for computing bias angle | AUTO_MNVR_TRACK | I | 0.00 to 99.99 | S | On demand |
| C | TRANS_PULSE_SIZE | Magnitude of desired velocity change per deflection of translational hand controller in manual pulse translation submode | TRANS_PULSE, TLM | S | ≥ 0 | ft/s | On demand |
| — | T1 | Threshold for use of second jet | JET_SELECT | S | 0 to 2 | | On demand |
| — | T2 | Threshold for use of third jet | JET_SELECT | S | 0 to 2 | | On demand |

| Table 4.2.3.2-2. DAPLOAD_SELECT I-Loads/K-Loads/Constants | | | | |
|---|---|----------------|---|----------------------|
| Name | Description | Type | MSID | Unit |
| CG_ARRAY | Array of vehicle cg's in the OV frame | A(9) V(3)S | V97U2511C through V97U2537C | inches |
| CG_NOM | Vector of nominal vehicle cg's in the OV frame | V(3)S | V97U2508C through V97U2510C | inches |
| DEG_PER_RAD | Degrees per radian | S | 180/π | deg/rad |
| DELTA_V_MINIMP_SCALE_FACTOR | Scale factor for phase plane minimum impulse angular rate change values | S | V97U2664C | s |
| MAG_CONTROL_ACCEL_REF_PRIM | Magnitude of average control acceleration available for each axis with the STD PRCS mode | A(3)S | V98U9941C through V98U9943C | deg/s ² |
| MOMENTS_OF_INERTIA_ARRAY | Array of vehicle moments of inertia in the OV frame | A(9,3)S | V97U2541C through V97U2567C | slug-ft ² |
| MOMENTS_OF_INERTIA_NOM | Array of nominal vehicle moments of inertia in the OV frame | A(3)S | V97U2538C through V97U2540C | slug-ft ² |
| NUM_FILTERS | Absolute value is number of notch filters active for each of nine payload-extended configurations | A(9)I | V97U3161C through V97U3165C, V97U2646C through V97U2649C | none |
| PRINCIPAL_INERTIA_REF | Diagonals of nominal vehicle inertia matrix (body-axis moments of inertia) | A(3)S | V98U9938C through V98U9940C | slug-ft ² |
| PRODUCTS_OF_INERTIA_ARRAY | Array of vehicle products of inertia in the OV frame | A(9,3)S | V97U2571C through V97U2597C | slug-ft ² |
| PRODUCTS_OF_INERTIA_NOM | Array of nominal vehicle products of inertia in the OV frame | A(3)S | V97U2568C through V97U2570C | slug-ft ² |
| PHASE_PLANE_ACCEL_SCALE_FACTOR | Scale factor for phase plane control acceleration values | S | V97U2795C | none |
| REF_CG | Reference cg's in the OV frame | V(3)S | V97U6400C through V97U6402C | inches |
| REF_FORCE | Reference forces for each of six vernier jets and 14 primary jet groups | A(20) V(3)S | V97U6403C through V97U6462C | lbs |
| REF_TORQUE | Reference torques for each of six vernier jets and 14 primary jet groups | A(20) V(3)S | V97U6463C through V97U6522C | ft-lbs |
| ROT_GRP | List of indices to PRCS rotation jet groups, in sequence used by ALT mode | A(11)I | Refer to Figure 4.2.2.2.1-24 | none |
| ROT_GRP_XJETS | List of indices to PRCS rotation and translation jet groups, in sequence used by ALT Mode when XJETS are available. | A(14)I | Refer to Table 4.2.2.2.1-4c | none |
| TDAP | Period of FC cycle | S | 0.08 | S |
| T1P | Threshold for use of second primary jet in alternate PRCS mode | S | V98U9169C | none |
| T1V | Threshold for use of second vernier jet | S | V97U2879C | none |
| T2P | Threshold for use of third primary jet in alternate PRCS mode | S | V98U9170C | none |
| T2V | Threshold for use of third vernier jet | S | V97U2880C | none |

| Table 4.2.3.2-3. DAPLOAD_SELECT Initialization Requirements | | | |
|---|-----------------------------|---|---------------|
| Initialize on Transition From | Initialize on Transition To | Variable | Initial Value |
| INIT_DAPLOAD_SELECT=0 | INIT_DAPLOAD_SELECT=1 | ENABLE_NF | OFF |
| | | Past value of ENABLE_NF (Figure 4.2.3.2-3) | OFF |
| | | INIT_NF | OFF |
| | | Past value of PAYLOAD_EXTENDED (Figure 4.2.3.2-3) | -1 |

4.2.3.3 SET LAMPS

A. Function. The switches are so driven that when a switch command has been issued and implemented, the switch is illuminated. Activation of any switch and subsequent illumination will also cause all of its complements to be deactivated and the corresponding switch lamps to go off. Thus, for example, no two submode switches in any axis can be illuminated at the same time. If a command is rejected by the software, that complement to the command which was previously in effect will remain so. The lamp corresponding to that complement will remain on, and the lamp for the rejected command will not be illuminated. At any time, nine to eleven switches are illuminated:

1. Three rotation submode switches
 2. Two X, Y translation submode switches
 3. A Z translation submode switch/high Z
 4. DAP AUTO/INRTL/LVLH/FREE
 5. DAPLOAD A/DAPLOAD B
 6. RCS NORM/RCS ALT/RCS VERN
 7. LOW Z (if selected)
- } one per axis

If this is a docking flight (DOCKING_FLT and OPS_2_INDICATOR are ON) an additional lamp maybe illuminated. The SPARE lamp will be illuminated if DOCKING_ACTIVE = ON, to indicate that the post contact docking firing is in progress.

When a submode switch is activated with the related hand controller in detent (the nominal case), the lamp corresponding to the previously selected submode will go off, and that corresponding to the new selection will be lit. It is recommended that the lamp outputs be configured as bit strings, enabling efficient bit-string processing in SET_LAMPS.

In addition to illuminating the switch, the RCS primary/vernier jet select processing will also signal the RCS RM to change to the I-loaded on-orbit vernier thresholds for vernier leak detection.

B. Block Diagram. The detailed block diagram for the module SET_LAMPS is presented in Figure 4.2.3.3-1.

C. Processing Rate. The module SET_LAMPS is processed at 12.5 Hz.

D. Interface Requirements. The interface requirements for the module SET_LAMPS are shown in Table 4.2.3.3-1.

E. Constants. None.

F. Initialization Requirements. None.

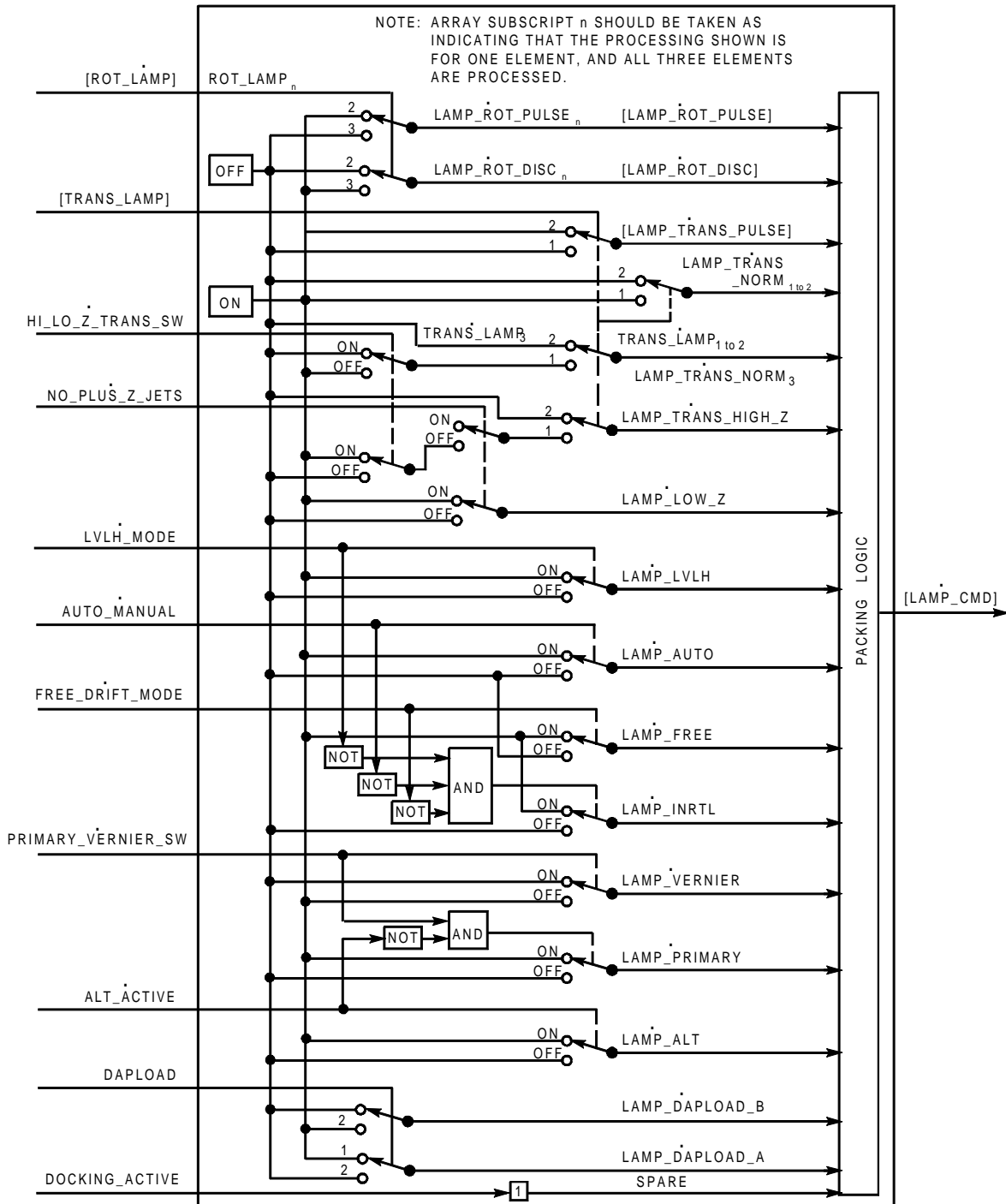


FIGURE 4.2.3.3-1. SET_LAMPS

| Table 4.2.3.3-1. SET_LAMPS Interface Requirements | | | | | | |
|---|---|---|--------|--------|------|-----------|
| Name | Description | Source or Destination | Type | Range | Unit | Rate (Hz) |
| INPUTS | | | | | | |
| ALT_ACTIVE | Alternate PRCS DAP mode select (1 = Alternate mode active) | UNPACK_SW, OFC_RECON | B | 0,1 | none | 12.5 |
| AUTO_MANUAL | Auto/manual select (1 = auto; 0 = manual) | UNPACK_SW, OFC_RECON | B | 0,1 | none | 12.5 |
| DOCKING_ACTIVE | Flag indicating post contact thrusting sequence in progress (1=ON) | OFC_RECON, POST_CONTACT_THRUSTING | B | 0,1 | none | 12.5 |
| FREE_DRIFT_MODE | Free Drift mode indicator (1 = FREE_DRIFT) | UNPACK_SW, OFC_RECON | B | 0,1 | none | 12.5 |
| DAPLOAD | DAPLOAD A/B select | UNPACK_SW | I | 0,1 | none | 12.5 |
| HL_LO_Z_TRANS_SW | Z-axis translational acceleration level select (1 = high; 0 = low) | UNPACK_SW, OFC_RECON | B | 0,1 | none | 12.5 |
| LVLH_MODE | LVLH mode indicator (1 = LVLH) | UNPACK_SW, OFC_RECON | B | 0,1 | none | 12.5 |
| NO_PLUS_Z_JETS | Flag to inhibit use of +Z jets (1 = inhibit) | UNPACK_SW, OFC_RECON | B | 0,1 | none | 12.5 |
| PRIMARY_VERNIER_SW | RCS primary/vernier jet select (1 = primary; 0 = vernier) | UNPACK_SW, OFC_RECON, RCS RM (4.91) | B | 0,1 | none | 12.5 |
| ROT_LAMP | Rotational submode indicator drive signal (2 = pulse; 3 = discrete) | OFC_RECON | A(3)I | 1 to 3 | none | 12.5 |
| TRANS_LAMP | Translational submode indicator drive signal (1 = accel; 2 = pulse) | OFC_RECON | A(3)I | 1 to 2 | none | 12.5 |
| OUTPUT | | | | | | |
| LAMP_CMD | Discrete lamp off/on commands | Hardware, FC SWIT PROC (4.216), UNIVERSAL POINTING (4.213), RCS RM (4.91), ORB DAP CONFIG (6.1), ORB 3-AX RHC SOP (4.199), XXXXX MNVR YYYYYY (6.35) | A(24)B | 0, 1 | none | 12.5 |

4.2.3.4 DAP_UL_PROC

A. Function. This module is called when a notch filter/mass properties parameter load is uplinked. The uplink is to contain an integer indicating the target payload–extended slot for the uplink data and the associated data. The uplink may contain either notch filter data, mass properties data, or both. Notch filter data can be uplinked independently of mass properties data by setting all the mass property data to zero and vice versa. A status flag, DAP_UL_STATUS, will be updated and downlisted to reflect the status of the uplink, 0 = rejected, 1 = notch filter data only accepted, 2 = mass properties data only accepted, 3 = both notch filter and mass properties data accepted.

The uplink processor will check the validity and homogeneity of the uplinked data and verify that data is not targeted for the active payload–extended selection, else the uplink will be rejected. First the uplink processor will check to see if the target slot identified by PAYLOAD_EXTENDED_UL is valid (1–9) and does not target the active selection, PAYLOAD_EXTENDED. Otherwise the uplink is rejected and the DAP_UL_STATUS is set to 0. Next, N_FILTERS_UL is checked to insure it is within range of the number of allowable filters –6 to 6. A negative number indicates to the notch filter processing that the feed forward loop is to be disabled. If the uplink data for N_FILTERS_UL, (number of notch filters required), is zero, it is assumed that no notches are being uplinked and the notch filter data in the uplink is ignored. If N_FILTERS_UL is non zero and any of the associated NF_FREQS_UL, (upper and lower frequency data), are less than zero or greater than three, the uplink is assumed to be corrupted and is rejected. If all of the mass property data fields are zero in the uplink, the uplink is assumed not to contain mass properties data. If some of the mass properties fields contain non zero data and any of the mass properties elements (Xcg, Zcg, moments of inertia) is less than or equal to zero, the mass properties data is assumed to be corrupted and the uplink is rejected. If the uplink passes the sanity and range checks, the uplinked data is accepted and placed in the targeted PAYLOAD_EXTENDED slot.

B. Block Diagram. A detailed block diagram of the module DAP_UL_PROC is presented in Figure 4.2.3.4–1.

C. Processing Rate. As required.

D. Interface Requirements. The interface requirements for the module DAP_UL_PROC are shown in Table 4.2.3.4–1.

E. I–loads. None.

F. Initialization Requirements. None.

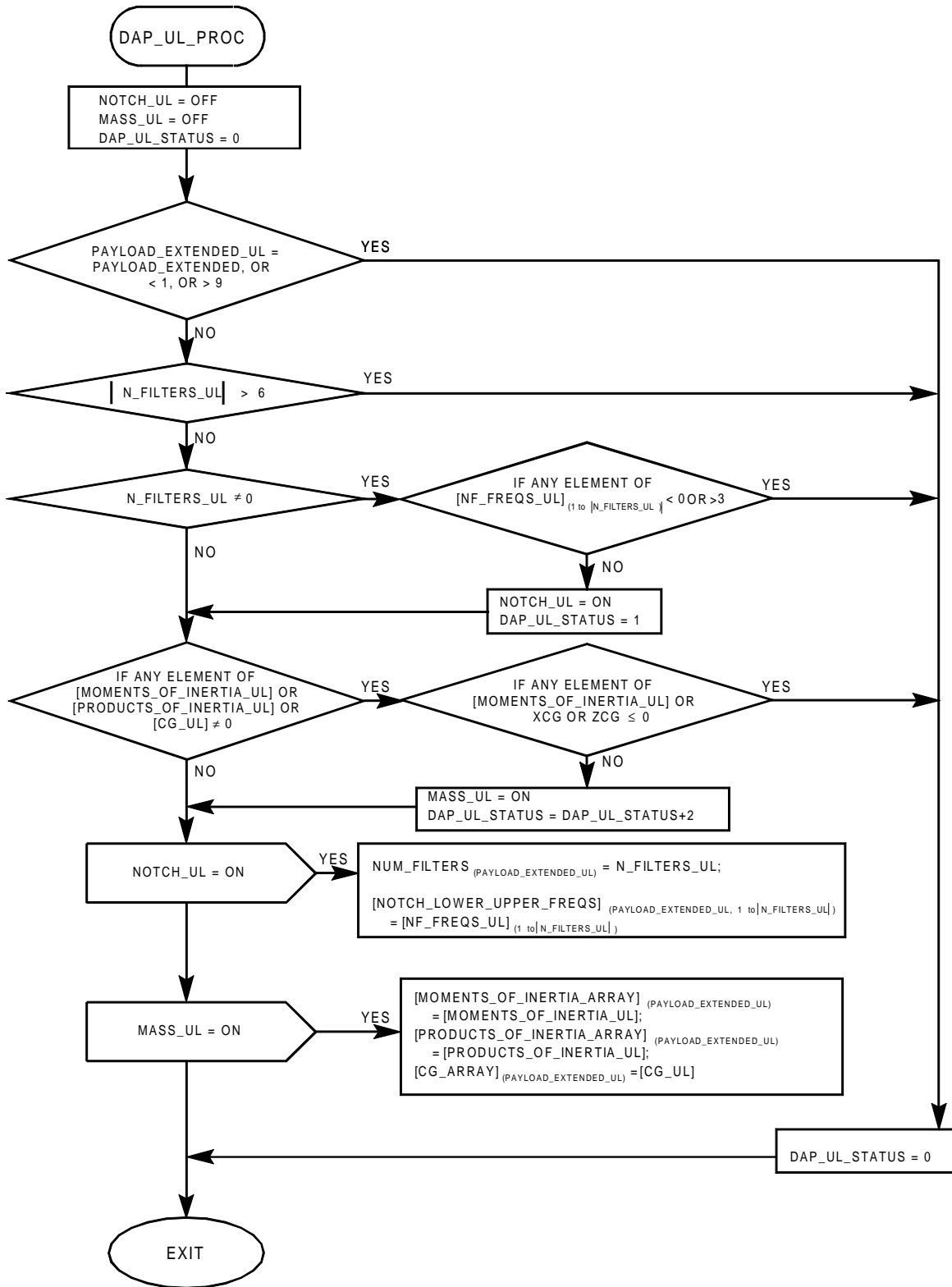


FIGURE 4.2.3.4-1. DAP_UL_PROC

Table 4.2.3.4-1. DAP_UL_PROC Interface Requirements

| Name | Description | Source or Destination | Type | Range | Unit | Rate (Hz) |
|---------------------------|---|-----------------------|-----------|---------------------|----------------------|-----------|
| INPUTS | | | | | | |
| CG_ARRAY | Array of vehicle cg's in the OV frame | I-load, DAP_UL_PROC | A(9)V(3)S | | inches | On demand |
| CG_UL | Uplinked center of gravity | UPLINK | A(3)S | | inches | On demand |
| MOMENTS_OF_INERTIA_ARRAY | Array of vehicle moments of inertia in the OV frame | I-load, DAP_UL_PROC | A(9,3)S | | slug-ft ² | On demand |
| MOMENTS_OF_INERTIA_UL | Uplinked moments of inertia | UPLINK | A(3)S | | slug-ft ² | On demand |
| NF_FREQS_UL | Lower, upper frequency pairs for up to six filters for current notch filter/mass properties update | UPLINK | A(6,2)S | ≥ 0 | Hz | On demand |
| NOTCH_LOWER_UPPER_FREQS | Lower, upper frequency pairs for up to six filters for each of nine payload-extended configurations | I-load, DAP_UL_PROC | A(9,6,2)S | | Hz | On demand |
| N_FILTERS_UL | Absolute value is number of notch filters active for current notch filter/mass properties update | UPLINK | I | -6 to 6 | none | On demand |
| NUM_FILTERS | Absolute value is number of notch filters active for each of nine payload-extended configurations | I-load, DAP_UL_PROC | A(9)I | -6 to 6 | none | On demand |
| PAYLOAD_EXTENDED | Payload-extended flag (0 = payload not extended, 1 through 9 = selected payload configurations) | DAPLOAD_SELECT | I | 0,1,2,3,4,5,6,7,8,9 | none | On demand |
| PAYLOAD_EXTENDED_UL | Payload-extended slot for uplink | UPLINK | I | 1,2,3,4,5,6,7,8,9 | none | On demand |
| PRODUCTS_OF_INERTIA_ARRAY | Array of vehicle products of inertia in the OV frame | I-load, DAP_UL_PROC | A(9,3)S | | slug-ft ² | On demand |
| PRODUCTS_OF_INERTIA_UL | Uplinked products of inertia | UPLINK | A(3)S | | slug-ft ² | On demand |
| OUTPUTS | | | | | | |
| CG_ARRAY | Array of vehicle cg's in the OV frame | DAPLOAD_SELECT | A(9)V(3)S | | inches | On demand |
| DAP_UL_STATUS | Integer indicating status of most recent notch filter/mass properties update uplink (0 = refused, 1 = notch only, 2 = mass only, 3 = both accepted) | TLM | I | 0,1,2,3 | none | On demand |
| MOMENTS_OF_INERTIA_ARRAY | Array of vehicle moments of inertia in the OV frame | DAPLOAD_SELECT | A(9,3)S | | slug-ft ² | On demand |
| NOTCH_LOWER_UPPER_FREQS | Lower, upper frequency pairs for up to six filters for each of nine payload-extended configurations | PART 1_FILTER | A(9,6,2)S | | Hz | On demand |
| NUM_FILTERS | Absolute value is number of notch filters active for each of nine payload-extended configurations | DAPLOAD_SELECT | A(9)I | -6 to 6 | none | On demand |
| PRODUCTS_OF_INERTIA_ARRAY | Array of vehicle products of inertia in the OV frame | DAPLOAD_SELECT | A(9,3)S | | slug-ft ² | On demand |

4.2.3.5 POST_CONTACT_THRUSTING

A. Function. This module is called by OFC_RECON when DOCKING_FLT and OPS_2_INDICATOR are ON. The POST CONTACT DOCKING LOGIC will be executed first and performs the logic required to ARM/DISARM the sequence, activate/deactivate the sequence and to command the I-loaded jet firing pattern. This logic first checks to see if the sequence has been armed or disarmed via the left or right SPEED BRAKE PBI. If it is disarmed, it returns control to OFC_RECON. If it has just been disarmed it performs the appropriate reset actions before returning. If the sequence is armed, the logic will first check to see if the sequence is being activated or deactivated via the SPARE PBI or the LH_AUTMANBF PBI or deactivated via the THC, the RHC or the FREE PBI. If the sequence has been activated via the SPARE PBI or the LH_AUTMANBF PBI, DOCKING_ACTIVE is set true to indicate the post-contact firing has been activated, the firing counters are initialized by performing the INITIATE COUNTERS logic. If the sequence has been deactivated, DOCKING_ACTIVE is set OFF to indicate the sequence has been terminated and NEW_PANEL_SW_WORD is set to the I-loaded Post-Contact Thrusting DAP (PCT DAP). Additionally, the required DAP CONFIG parameters are set to load a new dapload and the DAP CONFIG (5.8) principal function is forced to load the new daploads. Finally if the sequence is active, the DETERMINE JET GROUPS logic is performed to determine the jet groups to be commanded based on the I-loaded jet firing pattern and the NEW_PANEL_SW_WORD is repeatedly set to the CONTACT_DAP values. POST_CONTACT_THRUSTING will then return to the OFC_RECON processing.

In the POST CONTACT THRUSTING LOGIC the comparison of the LH_AUTOSB PBI, RH_AUTOSB PBI, LH_AUTMANBF PBI, SPARE PBI and FREE PBI to their past values indicates leading edge detection should be performed on the hardware switch inputs.

B. Block Diagram. A detailed block diagram of the module POST_CONTACT_THRUSTING is presented in Figure 4.2.3.5-1.

C. Processing Rate. As required.

D. Interface Requirements. The interface requirements for the module POST_CONTACT_THRUSTING are shown in Table 4.2.3.5-1.

E. I-loads/Constants. The I-loads for the module POST_CONTACT_THRUSTING are shown in Table 4.2.3.5-2. The constants for the module POST_CONTACT_THRUSTING are shown in Table 4.2.3.5-3.

F. Initialization Requirements. The initialization requirements for the module POST_CONTACT_THRUSTING are shown in Table 4.2.3.5-4.

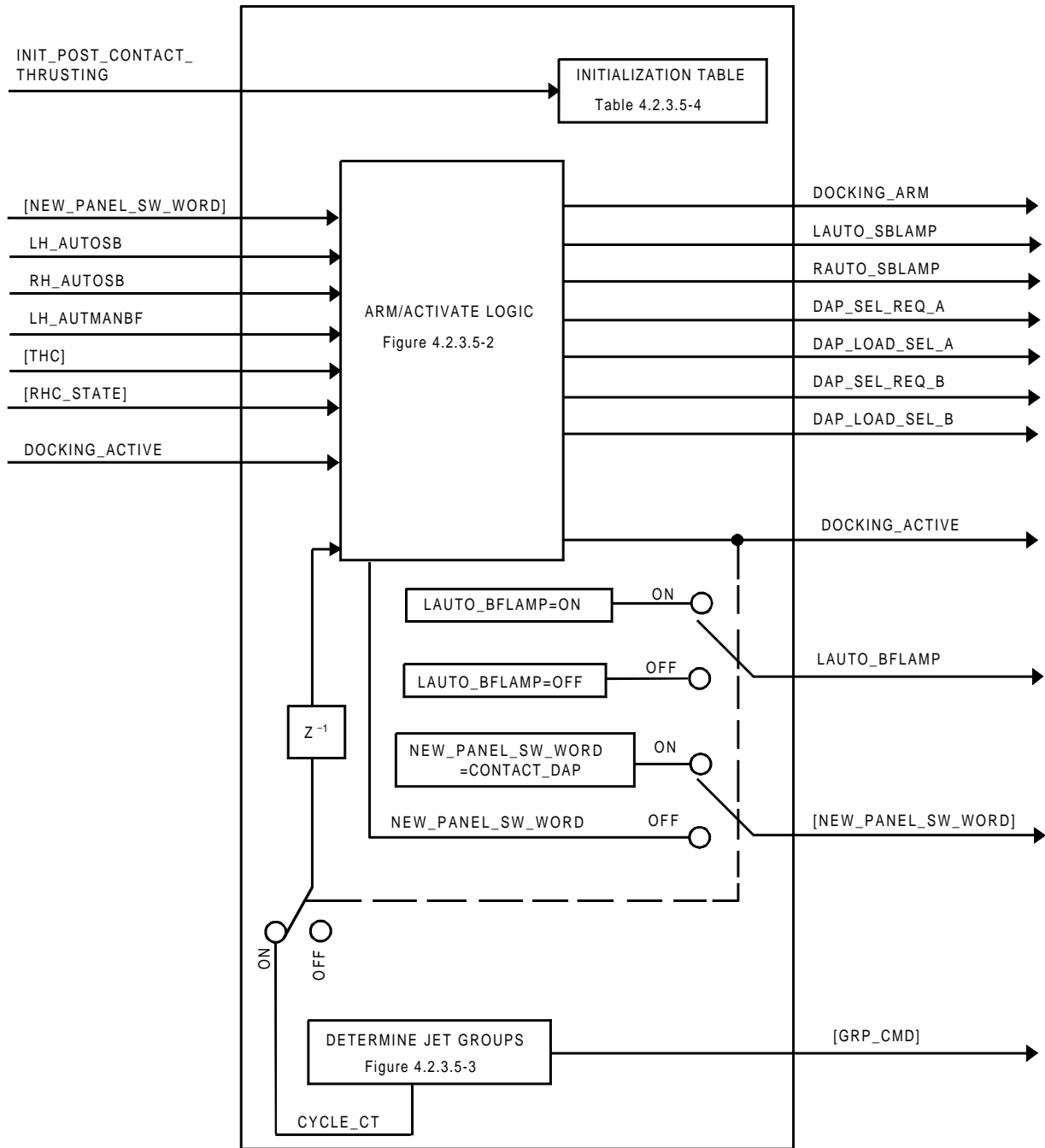
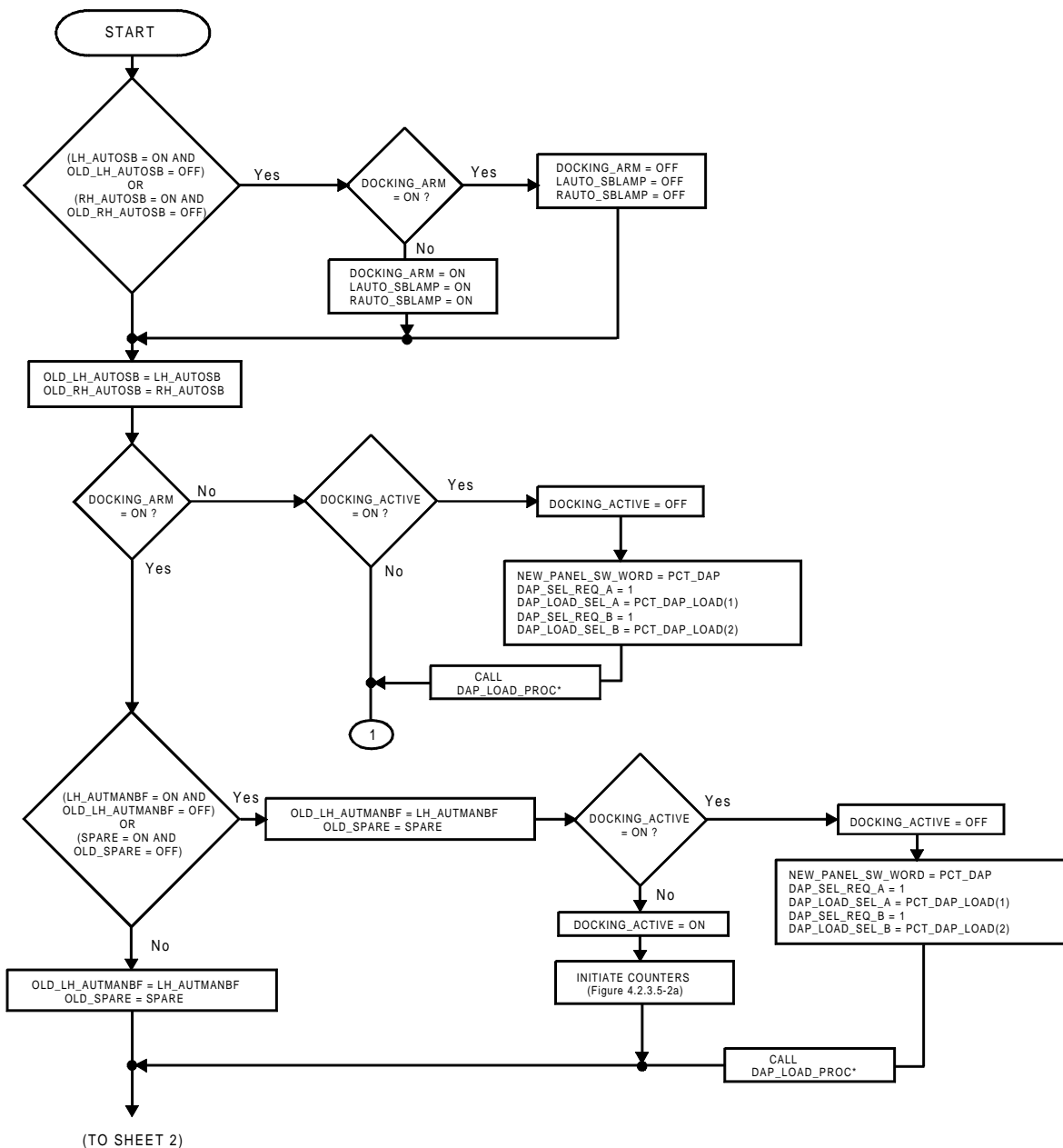
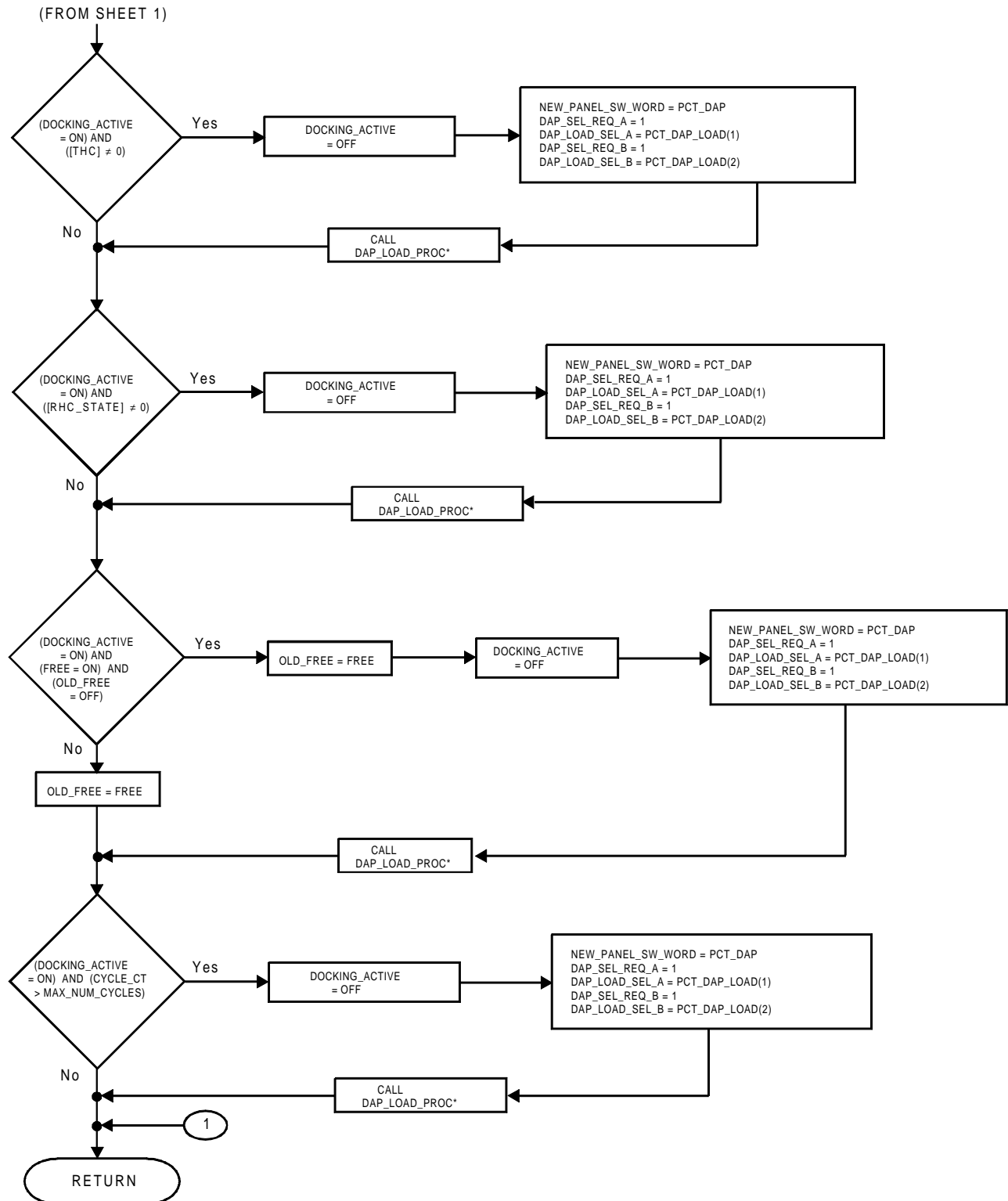


FIGURE 4.2.3.5-1. POST CONTACT THRUSTING LOGIC



* DAP_LOAD_PROC IS A MODULE WITHIN THE ORBIT DAP CONFIG SPEC FUNCTION (5.8)

FIGURE 4.2.3.5-2.(1) ARM/ACTIVATE LOGIC (SHEET 1 OF 2)

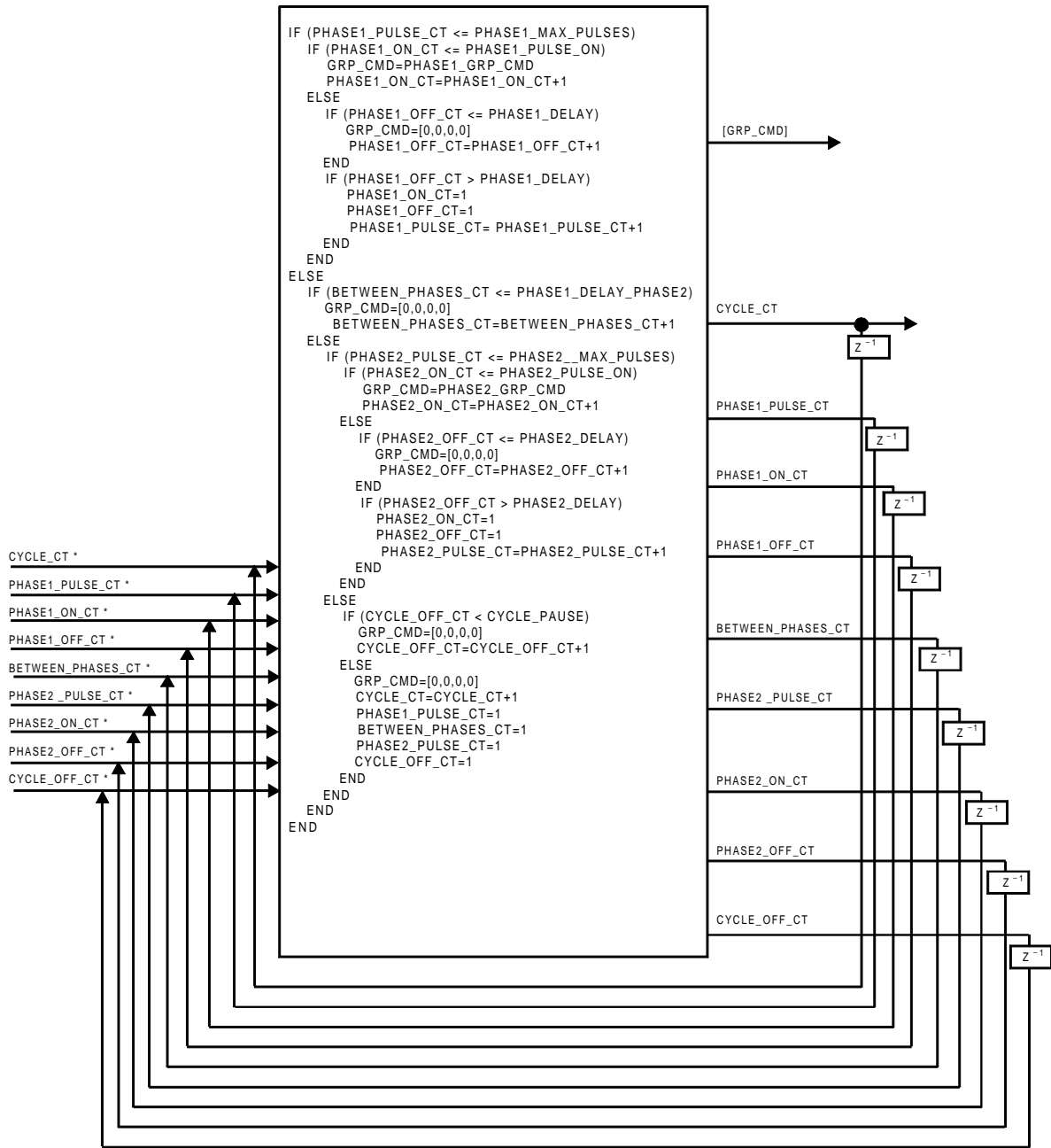


* DAP_LOAD_PROC IS A MODULE WITHIN THE ORBIT DAP CONFIG SPEC FUNCTION (5.8)

FIGURE 4.2.3.5-2.(2) ARM/ACTIVATE LOGIC (SHEET 2 OF 2)

```
CYCLE_CT=1  
PHASE1_PULSE_CT=1  
PHASE1_ON_CT=1  
PHASE1_OFF_CT=1  
BETWEEN_PHASES_CT=1  
PHASE2_PULSE_CT=1  
PHASE2_ON_CT=1  
PHASE2_OFF_CT=1  
CYCLE_OFF_CT=1
```

FIGURE 4.2.3.5-2a. Initiate Counters



* These signals are overwritten when they are assigned external to this module

FIGURE 4.2.3.5-3. Determine Jet Groups

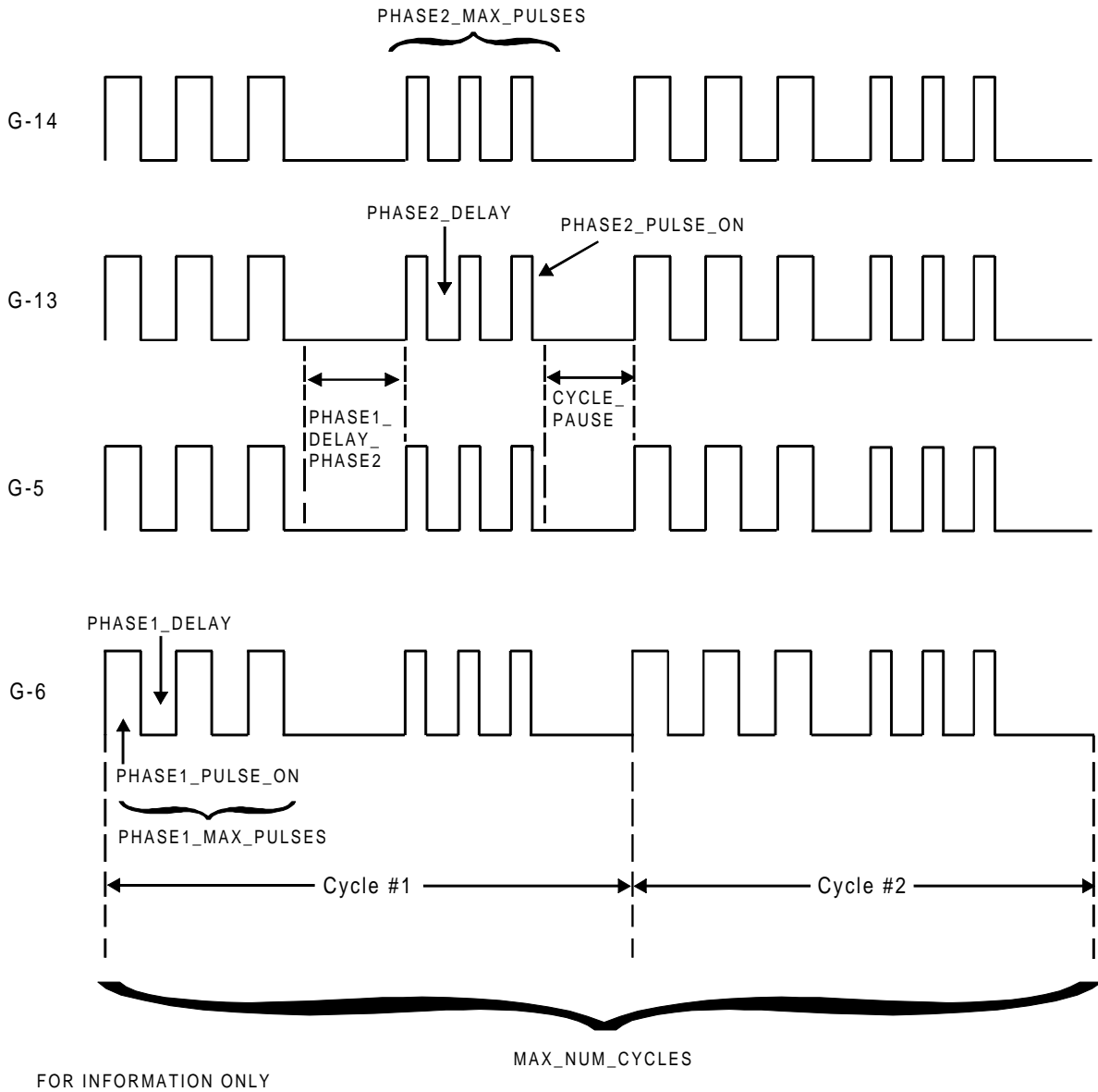


FIGURE 4.2.3.5-4. Post Contact Thrusting Firing Sequence

| Table 4.2.3.5-1. POST_CONTACT_THRUSTING Interface Requirements | | | | | | |
|--|--|----------------------------------|--------|--------|------|------------------|
| Name | Description | Source or Destination | Type | Range | Unit | Sample Rate (Hz) |
| INPUTS | | | | | | |
| DOCKING_ACTIVE | Flag indicating post contact thrusting sequence in progress (1 = ON) | OFC_RECON | B | 0,1 | none | On demand |
| INIT_POST_CONTACT_THRUSTING | Module initialization flag (1 = init) | OFC_RECON | B | 0,1 | none | as req'd |
| LH_AUTMANBF | Selected LH AUTO/MAN BODY FLAP SW | GN&C SW RM (4.180) | B | 0,1 | none | On demand |
| LH_AUTOSB | Selected LH SPD BK/THROT AUTO/MAN | GN&C SW RM (4.180) | B | 0,1 | none | On demand |
| NEW_PANEL_SW_WORD | Control panel switch states (1 = pressed) | FC SWIT PROC (4.216) | A(24)B | 0,1 | none | On demand |
| RH_AUTOSB | Selected RH SPD BK/THROT AUTO/MAN | GN&C SW RM (4.180) | B | 0,1 | none | On demand |
| RHC_STATE | Rotational hand controller out-of-detent indication | ORB 3-AX RHC SOP (4.199) | A(3)I | -1,0,1 | none | On demand |
| THC | Translation hand controller command | THC SOP (4.54) | A(3)I | -1,0,1 | none | On demand |
| OUTPUTS | | | | | | |
| DAP_LOAD_SEL_A | ID of display requested select DAP A | ORB DAP CONFIG SPEC | I | 0-15 | none | On demand |
| DAP_LOAD_SEL_B | ID of display requested select DAP B | ORB DAP CONFIG SPEC | I | 0-15 | none | On demand |
| DAP_SEL_REQ_A | Flag requesting DAP A load selection | ORB DAP CONFIG SPEC | B | 0,1 | none | On demand |
| DAP_SEL_REQ_B | Flag requesting DAP B load selection | ORB DAP CONFIG SPEC | B | 0,1 | none | On demand |
| DOCKING_ACTIVE | Flag indicating post contact thrusting sequence in progress (1 = ON) | OFC_RECON, SET_LAMPS, JET_SELECT | B | 0,1 | none | On demand |
| DOCKING_ARM | Status of Post Contact Thrusting sequence ARM (1 = on; 0 = off) | TLM | B | 0,1 | none | On demand |
| GRP_CMD | The number of jets to be fired in groups [G-5,G-6,G-13,G-14] | JET_SELECT | A(4)I | 0-3 | none | On demand |
| LAUTO_BFLAMP | Lamp command for left hand bodyflap auto PBI lamp | D&C panel | B | 0,1 | none | On demand |
| LAUTO_SBLAMP | Lamp command for left hand speedbrake auto PBI lamp | D&C panel | B | 0,1 | none | On demand |
| RAUTO_SBLAMP | Lamp command for right hand speedbrake auto PBI lamp | D&C panel | B | 0,1 | none | On demand |
| NEW_PANEL_SW_WORD | Control panel switch states (1 = pressed) | UNPACK_SW | A(24)B | 0,1 | none | On demand |

Table 4.2.3.5-2. POST_CONTACT_THRUSTING I-Loads

| Name | Description | Type | Unit | MSID |
|---------------------|--|--------|------|--|
| MAX_NUM_CYCLES | Maximum number of cycles allowed prior to automatically stopping the post contact thrusting sequence. | I | none | V99U5729C |
| PHASE1_MAX_PULSES | Number of pulses for phase one jets in one cycle of the post contact thrusting sequence. | I | none | V99U5730C |
| PHASE1_PULSE_ON | The duration, in number of 0.08 sec DAP cycles, of each phase one jet pulse. | I | none | V99U5731C |
| PHASE1_DELAY | The time delay, in number of 0.08 sec DAP cycles, after each phase one pulse, required prior to initiating the next phase one pulse. | I | none | V99U5732C |
| PHASE1_DELAY_PHASE2 | The time delay, in number of 0.08 sec DAP cycles, after each phase one pulse delay in a cycle prior to initiating the first phase two pulse. | I | none | V99U5733C |
| PHASE2_MAX_PULSES | Number of pulses for phase two jets in one cycle of the post contact firing sequence. | I | none | V99U5734C |
| PHASE2_PULSE_ON | The duration, in number of 0.08 sec DAP cycles, of each phase two jet pulse. | I | none | V99U5735C |
| PHASE2_DELAY | The time delay, in number of 0.08 sec DAP cycles, after each phase two pulse, required prior to initiating the next phase two pulse. | I | none | V99U5736C |
| CYCLE_PAUSE | The time delay, in number of 0.08 sec DAP cycles, after each phase two pulse delay in a cycle prior to initiating the next cycle. | I | none | V99U5737C |
| PCT_DAP | The control panel switch signal if the contact sequence is deactivated or expires. | A(24)B | none | See Table 4.2.3.5-2a |
| PCT_DAP_LOAD | The numbers of the DAP A and B to be used if the contact sequence is deactivated or expires. | A(2)I | none | V99U5762C V99U5763C |
| PHASE1_GRP_CMD | The number of jets to be fired in phase 1. [G-5,G-6,G-13,G-14] | A(4)I | none | V97U7460C V97U7461C V97U7462C V97U7463C |
| PHASE2_GRP_CMD | The number of jets to be fired in phase 2. [G-5,G-6,G-13,G-14] | A(4)I | none | V97U7464C V97U7465C V97U7466C V97U7467C |

| Table 4.2.3.5-2a. Control Panel Switch Signal for Docking Capture, Timeout, RHC Abort or THC Abort (PCT_DAP) MSIDs | | | |
|--|-----------|-----------------|-----------|
| Panel Switch | MSID | Panel Switch | MSID |
| DAP A | V99U5738C | Disc rate roll | V99U5752C |
| DAP B | V99U5739C | Disc rate pitch | V99U5753C |
| Auto Mode | V99U5740C | Disc rate yaw | V99U5754C |
| Manual INRTL mode | V99U5741C | Pulse roll | V99U5755C |
| Primary RCS | V99U5742C | Pulse pitch | V99U5756C |
| Vernier RCS | V99U5743C | Pulse yaw | V99U5757C |
| ALT RCS | V99U5744C | Manual LVLH | V99U5758C |
| Norm X | V99U5745C | Manual FREE | V99U5759C |
| Norm Y | V99U5746C | Low Z | V98U5760C |
| High Z | V99U5747C | Spare | V99U5761C |
| Norm Z | V99U5748C | | |
| Pulse X | V99U5749C | | |
| Pulse Y | V99U5750C | | |
| Pulse Z | V99U5751C | | |

| Table 4.2.3.5-3. POST_CONTACT_THRUSTING Constants | | | | |
|---|---|--------|----------------------|------|
| Name | Description | Type | Value | Unit |
| CONTACT_DAP | The control panel switch signal when the post contact thrusting sequence is activated | A(24)B | See Table 4.2.3.5-3a | none |

| Table 4.2.3.5-3a. Control Panel Switch Signal when the docking sequence is activated (CONTACT_DAP) constants | | | |
|--|----------|-----------------|----------|
| Panel Switch | Constant | Panel Switch | Constant |
| DAP A | 0 | Disc rate roll | 0 |
| DAP B | 0 | Disc rate pitch | 0 |
| Auto Mode | 0 | Disc rate yaw | 0 |
| Manual INRTL mode | 0 | Pulse roll | 1 |
| Primary RCS | 1 | Pulse pitch | 1 |
| Vernier RCS | 0 | Pulse yaw | 1 |
| ALT RCS | 0 | Manual LVLH | 0 |
| Norm X | 0 | Manual FREE | 1 |
| Norm Y | 0 | Low Z | 0 |
| High Z | 0 | Spare | 1 |
| Norm Z | 0 | | |
| Pulse X | 1 | | |
| Pulse Y | 1 | | |
| Pulse Z | 1 | | |

| Table 4.2.3.5-4. POST_CONTACT_THRUSTING Initialization Requirements | | | |
|---|---------------------------------|-----------------|---------------|
| Initialize on Transition | | Variable | Initial Value |
| From | To | | |
| INIT_POST_CONTACT_THRUSTING = 0 | INIT_POST_CONTACT_THRUSTING = 1 | OLD_FREE | OFF |
| | | DOCKING_ARM | OFF |
| | | OLD_LH_AUTOSB | OFF |
| | | OLD_RH_AUTOSB | OFF |
| | | OLD_LH_AUTMANBF | OFF |
| | | OLD_SPARE | OFF |
| | | LAUTO_SBLAMP | OFF |
| | | LAUTO_BFLAMP | OFF |
| | | RAUTO_SBLAMP | OFF |

4.2.4 Parameter Tables for On-Orbit DAP Interface Support Functions

The IDD inputs and outputs are listed in Tables 4.2.4-1 and 4.2.4-2. Values for the I-loads are contained in the I-loads requirements document (JSC-19350); however, I-load definitions applicable to this principal function are listed in Table 4.2.4-3. K-loads are listed in Table 4.2.4-4. Constants are listed in Table 4.2.4-5. On-Orbit DAP input variable cross-reference information is identified as follows:

| On-Orbit DAP Input Variable Cross-Reference | | |
|---|-----------------------------------|----------------------------------|
| MSID | Local FSSR Name | Functional Parameter Source Name |
| V94U3980C | Q_B_M50_CMD_PREBURN | Q_CB_M50_S |
| V94U3981C | Q_B_M50_CMD_PREBURN | Q_CB_M50_V(1) |
| V94U3982C | Q_B_M50_CMD_PREBURN | Q_CB_M50_V(2) |
| V94U3983C | Q_B_M50_CMD_PREBURN | Q_CB_M50_V(3) |
| V90H0004C | RHC | DYMAN/RHC(1) |
| V90H0005C | RHC | DAMAN/RHC(2) |
| V90H0007C | RHC | DEMAN/RHC(3) |
| V90H2143C | ATTITUDE_ERROR | DAP_ERR(1) |
| V90H2141C | ATTITUDE_ERROR | DAP_ERR(2) |
| V90H2142C | ATTITUDE_ERROR | DAP_ERR(3) |
| V90R2176C | SELECTED_MNVR_TRACK_RATE | DAP_RATE |
| V96X1069X | SOFT_STOP | RSS_EXCEED/SOFT_STOP(1) |
| V96X1070X | SOFT_STOP | PSS_EXCEED/SOFT_STOP(2) |
| V96X1071X | SOFT_STOP | YSS_EXCEED/SOFT_STOP(3) |
| V95W2201C | T_CMD | GMTR/T_CMD |
| V95W2301C | T_NOW | GMTC/T_NOW |
| V90U1961C | VEHICLE_MASS (I-load = V97U2910C) | M/CURR_ORB_MASS/WEIGHT |

TABLE 4.2.4-1. INPUT FUNCTIONAL PARAMETERS FOR ONORBIT DIGITAL AUTOPILOT (G4.35)

| FSSR NAME | M/S ID | NOMENCLATURE | SOURCE | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|------------------------------|------------|--------------------------|---------------------|-------|-----------|---------|---------|-------|
| ALT_PRCs | V95X2411X | ALT PRCs DAP MODE | FC SWIT PROC | | BD | | 90900D | |
| ARRAY_ALT_DELAY_TIME(1) | V93W1955C | ALT PRIMARY DELAY TIME A | ORB DAP CONFIG DISP | S | BSS | | 79862F | |
| ARRAY_ALT_DELAY_TIME(1) | V93W1955CA | ALT PRIMARY DELAY TIME A | ORB DAP CONFIG SPEC | S | BSS | | 79862F | |
| ARRAY_ALT_DELAY_TIME(2) | V93W1960C | ALT PRIMARY DELAY TIME B | ORB DAP CONFIG DISP | S | BSS | | 79862F | |
| ARRAY_ALT_DELAY_TIME(2) | V93W1960CA | ALT PRIMARY DELAY TIME B | ORB DAP CONFIG SPEC | S | BSS | | 79862F | |
| ARRAY_ALT_JET_OPTION(1) | V93U1952C | ALT PRIMARY JET OPTION A | ORB DAP CONFIG DISP | | VAR | | 79862F | |
| ARRAY_ALT_JET_OPTION(1) | V93U1952CA | ALT PRIMARY JET OPTION A | ORB DAP CONFIG SPEC | | VAR | | 79862F | |
| ARRAY_ALT_JET_OPTION(2) | V93U1957C | ALT PRIMARY JET OPTION B | ORB DAP CONFIG DISP | | VAR | | 79862F | |
| ARRAY_ALT_JET_OPTION(2) | V93U1957CA | ALT PRIMARY JET OPTION B | ORB DAP CONFIG SPEC | | VAR | | 79862F | |
| ARRAY_ALT_MAX_JETS(1) | V93U1953C | ALT PRIMARY MAX JETS A | ORB DAP CONFIG DISP | | VAR | | 79862F | |
| ARRAY_ALT_MAX_JETS(1) | V93U1953CA | ALT PRIMARY MAX JETS A | ORB DAP CONFIG SPEC | | VAR | | 79862F | |
| ARRAY_ALT_MAX_JETS(2) | V93U1958C | ALT PRIMARY MAX JETS B | ORB DAP CONFIG DISP | | VAR | | 79862F | |
| ARRAY_ALT_MAX_JETS(2) | V93U1958CA | ALT PRIMARY MAX JETS B | ORB DAP CONFIG SPEC | | VAR | | 79862F | |
| ARRAY_ALT_ON_TIME(1) | V93W1954C | ALT PRIMARY ON TIME A | ORB DAP CONFIG DISP | S | BSS | | 90708C | |
| ARRAY_ALT_ON_TIME(1) | V93W1954CA | ALT PRIMARY ON TIME A | ORB DAP CONFIG SPEC | S | BSS | | 79862F | |
| ARRAY_ALT_ON_TIME(2) | V93W1959C | ALT PRIMARY ON TIME B | ORB DAP CONFIG DISP | S | BSS | | 79862F | |
| ARRAY_ALT_ON_TIME(2) | V93W1959CA | ALT PRIMARY ON TIME B | ORB DAP CONFIG SPEC | S | BSS | | 79862F | |
| ARRAY_ALT_RATE_LIMIT(1) | V93R1951C | ALT PRIMARY RATE LIMIT A | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_ALT_RATE_LIMIT(1) | V93R1951CA | ALT PRIMARY RATE LIMIT A | ORB DAP CONFIG SPEC | DEG/S | BSS | | 79862F | |
| ARRAY_ALT_RATE_LIMIT(2) | V93R1956C | ALT PRIMARY RATE LIMIT B | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_ALT_RATE_LIMIT(2) | V93R1956CA | ALT PRIMARY RATE LIMIT B | ORB DAP CONFIG SPEC | DEG/S | BSS | | 79862F | |
| ARRAY_COMP_THRESHOLD(1,1) | V93H5741C | NORM ROT CMPNT DBD A | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_COMP_THRESHOLD(1,1) | V93H5741CA | NORM ROT CMPNT DBD A | ORB DAP CONFIG SPEC | DEG/S | BSS | | 79862F | |
| ARRAY_COMP_THRESHOLD(1,2) | V93H5745C | VERN ROT CMPNT DBD A | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_COMP_THRESHOLD(1,2) | V93H5745CA | VERN ROT CMPNT DBD A | ORB DAP CONFIG SPEC | DEG/S | BSS | | 79862F | |
| ARRAY_COMP_THRESHOLD(2,1) | V93H5742C | NORM ROT CMPNT DBD B | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_COMP_THRESHOLD(2,1) | V93H5742CA | NORM ROT CMPNT DBD B | ORB DAP CONFIG SPEC | DEG/S | BSS | | 79862F | |
| ARRAY_COMP_THRESHOLD(2,2) | V93H5746C | VERN ROT CMPNT DBD B | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_COMP_THRESHOLD(2,2) | V93H5746CA | VERN ROT CMPNT DBD B | ORB DAP CONFIG SPEC | DEG/S | BSS | | 79862F | |
| ARRAY_DB(1,1) | V93H5766C | NORM ATT DEADBAND A | ORB DAP CONFIG DISP | DEG | VAR | | 79862F | |
| ARRAY_DB(1,1) | V93H5766CA | NORM ATT DEADBAND A | ORB DAP CONFIG SPEC | DEG | VAR | | 79862F | |
| ARRAY_DB(1,2) | V93H5768C | VERN ATT DEADBAND A | ORB DAP CONFIG DISP | DEG | VAR | | 79862F | |
| ARRAY_DB(1,2) | V93H5768CA | VERN ATT DEADBAND A | ORB DAP CONFIG SPEC | DEG | VAR | | 79862F | |
| ARRAY_DB(2,1) | V93H5767C | NORM ATT DEADBAND B | ORB DAP CONFIG DISP | DEG | VAR | | 79862F | |
| ARRAY_DB(2,1) | V93H5767CA | NORM ATT DEADBAND B | ORB DAP CONFIG SPEC | DEG | VAR | | 79862F | |
| ARRAY_DB(2,2) | V93H5769C | VERN ATT DEADBAND B | ORB DAP CONFIG DISP | DEG | VAR | | 79862F | |
| ARRAY_DB(2,2) | V93H5769CA | VERN ATT DEADBAND B | ORB DAP CONFIG SPEC | DEG | VAR | | 79862F | |
| ARRAY_MNVR_RATE(1,1) | V93R5705C | NORM DISCRETE RATE A | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_MNVR_RATE(1,1) | V93R5705CA | NORM DISCRETE RATE A | ORB DAP CONFIG SPEC | DEG/S | BSS | | 79862F | |
| ARRAY_MNVR_RATE(1,2) | V93R5709C | VERN DISCRETE RATE A | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_MNVR_RATE(1,2) | V93R5709CA | VERN DISCRETE RATE A | ORB DAP CONFIG SPEC | DEG/S | BSS | | 79862F | |
| ARRAY_MNVR_RATE(2,1) | V93R5706C | NORM DISCRETE RATE B | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_MNVR_RATE(2,1) | V93R5706CA | NORM DISCRETE RATE B | ORB DAP CONFIG SPEC | DEG/S | BSS | | 79862F | |
| ARRAY_MNVR_RATE(2,2) | V93R5710C | VERN DISCRETE RATE B | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_MNVR_RATE(2,2) | V93R5710CA | VERN DISCRETE RATE B | ORB DAP CONFIG SPEC | DEG/S | BSS | | 79862F | |
| ARRAY_NOM_NOSE_TAIL_PITCH(1) | V93J5750C | P NOM/NOSE/TAIL JET A | ORB DAP CONFIG DISP | | VAR | | 92789C | |

TABLE 4.2.4-1. INPUT FUNCTIONAL PARAMETERS FOR ONORBIT DIGITAL AUTOPILOT (G4.35)

| FSSR NAME | M/S ID | NOMENCLATURE | SOURCE | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|------------------------------|------------|----------------------------------|---------------------|-------|--------------|------------------|---------|-------------|
| ARRAY_NOM_NOSE_TAIL_PITCH(1) | V93J5750CA | P NOM/NOSE/TAIL JET A | ORB DAP CONFIG SPEC | | VAR | | 92789C | |
| ARRAY_NOM_NOSE_TAIL_PITCH(2) | V93J5751C | P NOM/NOSE/TAIL JET B | ORB DAP CONFIG DISP | | VAR | | 92789C | |
| ARRAY_NOM_NOSE_TAIL_PITCH(2) | V93J5751CA | P NOM/NOSE/TAIL JET B | ORB DAP CONFIG SPEC | | VAR | | 92789C | |
| ARRAY_NOM_NOSE_TAIL_YAW(1) | V93J5754C | Y NOM/NOSE/TAIL JET A | ORB DAP CONFIG DISP | | VAR | | 79862F | |
| ARRAY_NOM_NOSE_TAIL_YAW(1) | V93J5754CA | Y NOM/NOSE/TAIL JET A | ORB DAP CONFIG SPEC | | VAR | | 79862F | |
| ARRAY_NOM_NOSE_TAIL_YAW(2) | V93J5755C | Y NOM/NOSE/TAIL JET B | ORB DAP CONFIG DISP | | VAR | | 79862F | |
| ARRAY_NOM_NOSE_TAIL_YAW(2) | V93J5755CA | Y NOM/NOSE/TAIL JET B | ORB DAP CONFIG SPEC | | VAR | | 79862F | |
| ARRAY_PAYLOAD_EXTENDED(1) | V93J5758C | CNTL ACCEL A | ORB DAP CONFIG DISP | | HXS | | 93017G | * |
| ARRAY_PAYLOAD_EXTENDED(1) | V93J5758CA | CNTL ACCEL A | ORB DAP CONFIG SPEC | | HXS | | 90708C | |
| ARRAY_PAYLOAD_EXTENDED(2) | V93J5759C | CNTL ACCEL B | ORB DAP CONFIG DISP | | HXS | | 93017G | * |
| ARRAY_PAYLOAD_EXTENDED(2) | V93J5759CA | CNTL ACCEL B | ORB DAP CONFIG SPEC | | HXS | | 90708C | |
| ARRAY_RATE_LIMIT(1,1) | V93R5726C | NORM RATE LIMIT A | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_RATE_LIMIT(1,1) | V93R5726CA | NORM RATE LIMIT A | ORB DAP CONFIG SPEC | DEG/S | BSS | | 79862F | |
| ARRAY_RATE_LIMIT(1,2) | V93R5730C | VERN RATE LIMIT A | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_RATE_LIMIT(1,2) | V93R5730CA | VERN RATE LIMIT A | ORB DAP CONFIG SPEC | DEG/S | BSS | | 79862F | |
| ARRAY_RATE_LIMIT(2,1) | V93R5727C | NORM RATE LIMIT B | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_RATE_LIMIT(2,1) | V93R5727CA | NORM RATE LIMIT B | ORB DAP CONFIG SPEC | DEG/S | BSS | | 79862F | |
| ARRAY_RATE_LIMIT(2,2) | V93R5731C | VERN RATE LIMIT B | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_RATE_LIMIT(2,2) | V93R5731CA | VERN RATE LIMIT B | ORB DAP CONFIG SPEC | DEG/S | BSS | | 79862F | |
| ARRAY_ROT_PULSE(1,1) | V93R5714C | NORM ROT PULSE LEVEL A | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_ROT_PULSE(1,1) | V93R5714CA | NORM ROT PULSE LEVEL A | ORB DAP CONFIG SPEC | DEG/S | BSS | | 79862F | |
| ARRAY_ROT_PULSE(1,2) | V93R5718C | VERN ROT PULSE LEVEL A | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_ROT_PULSE(1,2) | V93R5718CA | VERN ROT PULSE LEVEL A | ORB DAP CONFIG SPEC | DEG/S | BSS | | 79862F | |
| ARRAY_ROT_PULSE(2,1) | V93R5715C | NORM ROT PULSE LEVEL B | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_ROT_PULSE(2,1) | V93R5715CA | NORM ROT PULSE LEVEL B | ORB DAP CONFIG SPEC | DEG/S | BSS | | 79862F | |
| ARRAY_ROT_PULSE(2,2) | V93R5719C | VERN ROT PULSE LEVEL B | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_ROT_PULSE(2,2) | V93R5719CA | VERN ROT PULSE LEVEL B | ORB DAP CONFIG SPEC | DEG/S | BSS | | 79862F | |
| ARRAY_TRANS_PULSE(1) | V93R5700C | TRANS PULSE LEVEL A | ORB DAP CONFIG DISP | FT/S | BSS | | 79862F | |
| ARRAY_TRANS_PULSE(1) | V93R5700CA | TRANS PULSE LEVEL A | ORB DAP CONFIG SPEC | DEG/S | BSS | | 79862F | |
| ARRAY_TRANS_PULSE(2) | V93R5701C | TRANS PULSE LEVEL B | ORB DAP CONFIG DISP | FT/S | BSS | | 79862F | |
| ARRAY_TRANS_PULSE(2) | V93R5701CA | TRANS PULSE LEVEL B | ORB DAP CONFIG SPEC | DEG/S | BSS | | 79862F | |
| ATTITUDE_INCREMENT(1) | V90U2333C | ATTITUDE INCREMENT-HI RATE ROLL | A/E ATT PROC | DEG | | | 89688A | |
| ATTITUDE_INCREMENT(2) | V90U2334C | ATTITUDE INCREMENT-HI RATE PITCH | A/E ATT PROC | DEG | | | 89688A | |
| ATTITUDE_INCREMENT(3) | V90U2335C | ATTITUDE INCREMENT-HI RATE YAW | A/E ATT PROC | DEG | | | 89688A | |
| ATT_DG | V90X2555X | ATTITUDE DATA GOOD FLAG | IMU RM | | | | 93017G | * |
| ATT_INC_6HZ(1) | V90H2285CA | ATTITUDE INCREMENT-LO RATE ROLL | ORB ATT PROC | DEG | | | | |
| ATT_INC_6HZ(2) | V90H2213C | ATTITUDE INCREMENT-LO RATE PITCH | ORB ATT PROC | DEG | | | | |
| ATT_INC_6HZ(3) | V90H2214C | ATTITUDE INCREMENT-LO RATE YAW | ORB ATT PROC | DEG | | | | |
| AUTO_MANF_CLOSE | V90X0434X | RCS AUTO MANIFOLD CLOSE FLAG | RCS RM | | BD | | 92871C | |
| AVAILABLE_JET_AFT(01) | V90X4520X | JET L1A AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_AFT(02) | V90X4521X | JET L1L AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_AFT(03) | V90X4522X | JET L1U AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_AFT(04) | V90X4534X | JET R1A AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_AFT(05) | V90X4535X | JET R1R AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_AFT(06) | V90X4536X | JET R1U AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_AFT(07) | V90X4532X | JET L5D AVAILABLE | RCS RM | | BD | | 93017G | * |

TABLE 4.2.4-1. INPUT FUNCTIONAL PARAMETERS FOR ONORBIT DIGITAL AUTOPILOT (G4.35)

| FSSR NAME | M/S ID | NOMENCLATURE | SOURCE | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------------------|------------|----------------------|---------------------|-------|-----------|---------|---------|-------|
| AVAILABLE_JET_AFT(08) | V90X4533X | JET L5L AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_AFT(09) | V90X4526X | JET L3A AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_AFT(10) | V90X4527X | JET L3L AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_AFT(11) | V90X4528X | JET L3D AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_AFT(12) | V90X4540X | JET R3A AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_AFT(13) | V90X4541X | JET R3R AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_AFT(14) | V90X4542X | JET R3D AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_AFT(15) | V90X4547X | JET R5R AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_AFT(16) | V90X4546X | JET R5D AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_AFT(17) | V90X4523X | JET L2L AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_AFT(18) | V90X4524X | JET L2U AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_AFT(19) | V90X4525X | JET L2D AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_AFT(20) | V90X4537X | JET R2R AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_AFT(21) | V90X4538X | JET R2U AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_AFT(22) | V90X4539X | JET R2D AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_AFT(23) | V90X4529X | JET L4L AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_AFT(24) | V90X4530X | JET L4U AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_AFT(25) | V90X4531X | JET L4D AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_AFT(26) | V90X4543X | JET R4R AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_AFT(27) | V90X4544X | JET R4U AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_AFT(28) | V90X4545X | JET R4D AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_FWD(01) | V90X4548X | JET F1F AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_FWD(02) | V90X4549X | JET F1L AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_FWD(03) | V90X4550X | JET F1U AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_FWD(04) | V90X4551X | JET F1D AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_FWD(05) | V90X4552X | JET F2F AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_FWD(06) | V90X4553X | JET F2R AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_FWD(07) | V90X4554X | JET F2U AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_FWD(08) | V90X4555X | JET F2D AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_FWD(09) | V90X4560X | JET F4R AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_FWD(10) | V90X4561X | JET F4D AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_FWD(11) | V90X4562X | JET F5L AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_FWD(12) | V90X4563X | JET F5R AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_FWD(13) | V90X4556X | JET F3F AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_FWD(14) | V90X4557X | JET F3L AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_FWD(15) | V90X4558X | JET F3U AVAILABLE | RCS RM | | BD | | 93017G | * |
| AVAILABLE_JET_FWD(16) | V90X4559X | JET F3D AVAILABLE | RCS RM | | BD | | 93017G | * |
| CG_UL(1) | V96U1585C | X-CENTER OF GRAVITY | UL | IN | SPL | | 90708C | |
| CG_UL(2) | V96U1586C | Y-CENTER OF GRAVITY | UL | IN | SPL | | 90708C | |
| CG_UL(3) | V96U1587C | Z-CENTER OF GRAVITY | UL | IN | SPL | | 90708C | |
| DAMAN/RHC(1) | V96H0005CC | MANUAL ROLL CMD | ORB 3-AX RHC SOP | DEG | | | | |
| DAPLOAD_A | V95X2403X | DAP LOAD A SELECT | FC SWIT PROC | | | | | |
| DAPLOAD_B | V95X2404X | DAP LOAD B SELECT | FC SWIT PROC | | | | | |
| DAPLOAD_CHANGE | V93X3656X | DAPLOAD CHANGE | ORB DAP CONFIG SPEC | | | | 79862F | |
| DAP_AUTO | V95X2401X | DAP AUTO SELECT | FC SWIT PROC | | | | | |
| DAP_DATA_CHANGE | V93X5774X | DAP DATA CHANGE FLAG | ORB DAP CONFIG DISP | | | | | |

TABLE 4.2.4-1. INPUT FUNCTIONAL PARAMETERS FOR ONORBIT DIGITAL AUTOPILOT (G4.35)

| FSSR NAME | M/S ID | NOMENCLATURE | SOURCE | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|----------------------|------------|------------------------------|---------------------|-------|-----------|---------|---------|-------|
| DAP_DATA_CHANGE | V93X5774XA | DAP DATA CHANGE FLAG | ORB DAP CONFIG SPEC | | | | 79862F | |
| DAP_FREE | V95X2405X | DAP MANUAL FREE DRIFT SELECT | FC SWIT PROC | | BD | | 90900D | |
| DAP_INRTL | V95X2402X | DAP MANUAL INRTL HOLD SELECT | FC SWIT PROC | | | | 90900D | |
| DAP_LVLH | V95X2414X | DAP LVLH SELECT | FC SWIT PROC | | | | | |
| DEMAN/RHC(2) | V96H0007CC | MANUAL PITCH CMD | ORB 3-AX RHC SOP | DEG | | | | |
| DVB_SEC(1) | V90L2696C | 1 SEC VEL INC-X | ORB ATT PROC | FT/S | SPL | | 93017G | * |
| DVB_SEC(2) | V90L2697C | 1 SEC VEL INC-Y | ORB ATT PROC | FT/S | SPL | | 93017G | * |
| DVB_SEC(3) | V90L2698C | 1 SEC VEL INC-Z | ORB ATT PROC | FT/S | SPL | | 93017G | * |
| DYMAN/RHC(3) | V96H0004CB | MANUAL YAW COMMAND | ORB 3-AX RHC SOP | DEG | | | | |
| ENABLE_NF | V93X5344XA | NOTCH FILTER ENA FLAG | ORB DAP CONFIG DISP | | | | 90314H | |
| GMTC/T_NOW | V90W2310CB | M50 TO BODY QUAT TIME | ORB ATT PROC | S | | | 93017G | * |
| GMTR/T_CMD | V95W2201C | GMT OF REQD BODY QUATERNION | UNIV POINT PROC | S | | | 89662B | |
| GUIDED_DELTA_V_BURN | V90X8647X | GUIDED DELTA V BURN IND | MSC | | | | 89599C | |
| JET_FAIL_CHANGE_FLAG | V90X4619X | JET STATUS CHANGED | RCS RM | | | | 89688A | |
| JET_MAP(01) | V90J5727C | 1ST PRIORITY JET IN GROUP 1 | RCS RM | | | | | |
| JET_MAP(02) | V90J5728C | 2ND PRIORITY JET IN GROUP 1 | RCS RM | | | | | |
| JET_MAP(03) | V90J5729C | 3RD PRIORITY JET IN GROUP 1 | RCS RM | | | | | |
| JET_MAP(04) | V90J5730C | 1ST PRIORITY JET IN GROUP 2 | RCS RM | | | | | |
| JET_MAP(05) | V90J5731C | 2ND PRIORITY JET IN GROUP 2 | RCS RM | | | | | |
| JET_MAP(06) | V90J5732C | 1ST PRIORITY JET IN GROUP 3 | RCS RM | | | | | |
| JET_MAP(07) | V90J5733C | 2ND PRIORITY JET IN GROUP 3 | RCS RM | | | | | |
| JET_MAP(08) | V90J5734C | 1ST PRIORITY JET IN GROUP 4 | RCS RM | | | | | |
| JET_MAP(09) | V90J5735C | 2ND PRIORITY JET IN GROUP 4 | RCS RM | | | | | |
| JET_MAP(10) | V90J5736C | 3RD PRIORITY JET IN GROUP 4 | RCS RM | | | | | |
| JET_MAP(11) | V90J5737C | 1ST PRIORITY JET IN GROUP 5 | RCS RM | | | | | |
| JET_MAP(12) | V90J5738C | 2ND PRIORITY JET IN GROUP 5 | RCS RM | | | | | |
| JET_MAP(13) | V90J5739C | 1ST PRIORITY JET IN GROUP 6 | RCS RM | | | | | |
| JET_MAP(14) | V90J5740C | 2ND PRIORITY JET IN GROUP 6 | RCS RM | | | | | |
| JET_MAP(15) | V90J5741C | 1ST PRIORITY JET IN GROUP 7 | RCS RM | | | | | |
| JET_MAP(16) | V90J5742C | 2ND PRIORITY JET IN GROUP 7 | RCS RM | | | | | |
| JET_MAP(17) | V90J5743C | 1ST PRIORITY JET IN GROUP 8 | RCS RM | | | | | |
| JET_MAP(18) | V90J5744C | 2ND PRIORITY JET IN GROUP 8 | RCS RM | | | | | |
| JET_MAP(19) | V90J5745C | 1ST PRIORITY JET IN GROUP 9 | RCS RM | | | | | |
| JET_MAP(20) | V90J5746C | 2ND PRIORITY JET IN GROUP 9 | RCS RM | | | | | |
| JET_MAP(21) | V90J5747C | 3RD PRIORITY JET IN GROUP 9 | RCS RM | | | | | |
| JET_MAP(22) | V90J5748C | 4TH PRIORITY JET IN GROUP 9 | RCS RM | | | | | |
| JET_MAP(23) | V90J5749C | 1ST PRIORITY JET IN GROUP 10 | RCS RM | | | | | |
| JET_MAP(24) | V90J5750C | 2ND PRIORITY JET IN GROUP 10 | RCS RM | | | | | |
| JET_MAP(25) | V90J5751C | 3RD PRIORITY JET IN GROUP 10 | RCS RM | | | | | |
| JET_MAP(26) | V90J5752C | 4TH PRIORITY JET IN GROUP 10 | RCS RM | | | | | |
| JET_MAP(27) | V90J5753C | 1ST PRIORITY JET IN GROUP 11 | RCS RM | | | | | |
| JET_MAP(28) | V90J5754C | 2ND PRIORITY JET IN GROUP 11 | RCS RM | | | | | |
| JET_MAP(29) | V90J5755C | 3RD PRIORITY JET IN GROUP 11 | RCS RM | | | | | |
| JET_MAP(30) | V90J5756C | 1ST PRIORITY JET IN GROUP 12 | RCS RM | | | | | |
| JET_MAP(31) | V90J5757C | 2ND PRIORITY JET IN GROUP 12 | RCS RM | | | | | |
| JET_MAP(32) | V90J5758C | 3RD PRIORITY JET IN GROUP 12 | RCS RM | | | | | |

TABLE 4.2.4-1. INPUT FUNCTIONAL PARAMETERS FOR ONORBIT DIGITAL AUTOPILOT (G4.35)

| FSSR NAME | M/S ID | NOMENCLATURE | SOURCE | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|--------------------------|------------|-----------------------------------|---------------------|-------------|-----------|---------|---------|-------|
| JET_MAP(33) | V90J5759C | 1ST PRIORITY JET IN GROUP 13 | RCS RM | | | | | |
| JET_MAP(34) | V90J5760C | 2ND PRIORITY JET IN GROUP 13 | RCS RM | | | | | |
| JET_MAP(35) | V90J5761C | 3RD PRIORITY JET IN GROUP 13 | RCS RM | | | | | |
| JET_MAP(36) | V90J5762C | 1ST PRIORITY JET IN GROUP 14 | RCS RM | | | | | |
| JET_MAP(37) | V90J5763C | 2ND PRIORITY JET IN GROUP 14 | RCS RM | | | | | |
| JET_MAP(38) | V90J5764C | 3RD PRIORITY JET IN GROUP 14 | RCS RM | | | | | |
| KP2 | V95U8847C | OMS TVC FILTER GAIN-PITCH | ORB DAP CONFIG SPEC | DEG/(DEG/S) | | | 90185A | |
| KR | V95U8848C | OMS TVC FILTER GAIN-ROLL | ORB DAP CONFIG SPEC | DEG/(DEG/S) | | | 90185A | |
| KY2 | V95U8849C | OMS TVC FILTER GAIN-YAW | ORB DAP CONFIG SPEC | DEG/(DEG/S) | | | 90185A | |
| LAMC(X) | V90U1954CE | X-COMP OF M50 REF THR VECTOR | ORB GUID | | | | 93017G | * |
| LAMC(Y) | V90U1955CE | Y-COMP OF M50 REF THR VECTOR | ORB GUID | | | | 93017G | * |
| LAMC(Z) | V90U1956CE | Z-COMP OF M50 REF THR VECTOR | ORB GUID | | | | 93017G | * |
| LH_AUTMANBF | V90X6501X | SELECTED LH AUTO/MAN BODY FLAP SW | GN&C SW RM | | BD | | 93017G | * |
| LH_AUTOSB | V90U6811C | SEL LH SPD BK/THROT AUTO/MAN | GN&C SW RM | | | | 90837G | |
| M/CURR_ORB_MASS/WEIGHT | V90U1961CJ | CURRENT VEHICLE MASS | ORB MNVR DIP | SLUGS | | | 89250B | |
| MNVR_TRACK_OPTION | V95X2222X | MANEUVER/TRACKING OPTION DISCRETE | UNIV POINT PROC | | | | | |
| MOMENTS_OF_INERTIA_UL(1) | V96U1588C | IXX-MOMENTS OF INERTIA | UL | SLUG-FT2 | SPL | | 90708C | |
| MOMENTS_OF_INERTIA_UL(2) | V96U1589C | IYY-MOMENTS OF INERTIA | UL | SLUG-FT2 | SPL | | 90708C | |
| MOMENTS_OF_INERTIA_UL(3) | V96U1590C | IZZ-MOMENTS OF INERTIA | UL | SLUG-FT2 | SPL | | 90708C | |
| NF_FREQS_UL(1,1) | V96F1603C | NOTCH FILTER 1 LOWER FREQ. | UL | HZ | SPL | | 90708C | |
| NF_FREQS_UL(1,2) | V96F1604C | NOTCH FILTER 1 UPPER FREQ. | UL | HZ | SPL | | 90708C | |
| NF_FREQS_UL(2,1) | V96F1605C | NOTCH FILTER 2 LOWER FREQ. | UL | HZ | SPL | | 90708C | |
| NF_FREQS_UL(2,2) | V96F1606C | NOTCH FILTER 2 UPPER FREQ. | UL | HZ | SPL | | 90708C | |
| NF_FREQS_UL(3,1) | V96F1607C | NOTCH FILTER 3 LOWER FREQ. | UL | HZ | SPL | | 90708C | |
| NF_FREQS_UL(3,2) | V96F1608C | NOTCH FILTER 3 UPPER FREQ. | UL | HZ | SPL | | 90708C | |
| NF_FREQS_UL(4,1) | V96F1609C | NOTCH FILTER 4 LOWER FREQ. | UL | HZ | SPL | | 90708C | |
| NF_FREQS_UL(4,2) | V96F1610C | NOTCH FILTER 4 UPPER FREQ. | UL | HZ | SPL | | 90708C | |
| NF_FREQS_UL(5,1) | V96F1611C | NOTCH FILTER 5 LOWER FREQ. | UL | HZ | SPL | | 90708C | |
| NF_FREQS_UL(5,2) | V96F1612C | NOTCH FILTER 5 UPPER FREQ. | UL | HZ | SPL | | 90708C | |
| NF_FREQS_UL(6,1) | V96F1613C | NOTCH FILTER 6 LOWER FREQ. | UL | HZ | SPL | | 90708C | |
| NF_FREQS_UL(6,2) | V96F1614C | NOTCH FILTER 6 UPPER FREQ. | UL | HZ | SPL | | 90708C | |
| N_FILTERS_UL | V96J1602C | NUMBER OF NOTCH FILTERS | UL | | | | 90708C | |
| OMS_L_ON_CMD_IND | V90X8271X | OMS-L ON CMD IND | OMS FIRE SEQ | | | | 90120B | |
| OMS_PITCH_TRIM | V93H6915CA | OMS PITCH TRIM INTEGRATOR | XXXXX MNVR DISP | DEG | SPL | | 93017G | * |
| OMS_PITCH_TRIM | V93H6915CC | OMS PITCH TRIM INTEGRATOR | TRANS DAP | DEG | SPL | | 93017G | * |
| OMS_PITCH_TRIM | V93H6915CD | OMS PITCH TRIM | UL | DEG | SPL | | 89645A | |
| OMS_R_ON_CMD_IND | V90X8272X | OMS-R ON CMD IND | OMS FIRE SEQ | | | | 90120B | |
| OMS_YAW_TRIM(1) | V93H6916CA | OMS L YAW TRIM INTEGRATOR | XXXXX MNVR DISP | DEG | SPL | | 93017G | * |
| OMS_YAW_TRIM(1) | V93H6916CC | OMS L YAW TRIM INTEGRATOR | TRANS DAP | DEG | SPL | | 93017G | * |
| OMS_YAW_TRIM(1) | V93H6916CD | OMS L YAW TRIM | UL | DEG | SPL | | 89645A | |
| OMS_YAW_TRIM(2) | V93H6918CA | OMS R YAW TRIM INTEGRATOR | XXXXX MNVR DISP | DEG | SPL | | 93017G | * |
| OMS_YAW_TRIM(2) | V93H6918CC | OMS R YAW TRIM INTEGRATOR | TRANS DAP | DEG | SPL | | 93017G | * |
| OMS_YAW_TRIM(2) | V93H6918CD | OMS R YAW TRIM | UL | DEG | SPL | | 89645A | |
| OPS_2_INDICATOR | V90X8633X | OPS 2 IND | MSC | | | | 90837G | |
| PAYLOAD_EXTENDED_UL | V96J1601C | P/L CONFIG SLOT I/D | UL | | HXS | | 90708C | |
| PREBURN_MNVR | V93X6912X | PREBURN MNVR CMD | XXXXX MNVR DISP | | BD | | 89688A | |

TABLE 4.2.4-1. INPUT FUNCTIONAL PARAMETERS FOR ONORBIT DIGITAL AUTOPILOT (G4.35)

| FSSR NAME | M/S ID | NOMENCLATURE | SOURCE | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|---------------------------|------------|-----------------------------------|---------------------|----------|--------------|------------------|---------|-------------|
| PRIMARY_RCS | V95X2409X | NORMAL RCS JETS | FC SWIT PROC | | | | 90900D | |
| PRODUCTS_OF_INERTIA_UL(1) | V96U1591C | PXY-PRODUCTS OF INERTIA | UL | SLUG-FT2 | SPL | | 90708C | |
| PRODUCTS_OF_INERTIA_UL(2) | V96U1592C | PXZ-PRODUCTS OF INERTIA | UL | SLUG-FT2 | SPL | | 90708C | |
| PRODUCTS_OF_INERTIA_UL(3) | V96U1593C | PYZ-PRODUCTS OF INERTIA | UL | SLUG-FT2 | SPL | | 90708C | |
| PSS_EXCEED/SOFT_STOP(2) | V96X1070XC | PITCH RHC SOFT-STOP FLAG | ORB 3-AX RHC SOP | | | | 89752A | |
| Q_BOD_M50(1)/Q_B_M50(1) | V90U2240CB | M50 TO BODY QUAT MEASURED ELEM 1 | ORB ATT PROC | | SPL | | 93017G | * |
| Q_BOD_M50(2)/Q_B_M50(2) | V90U2241CB | M50 TO BODY QUAT MEASURED ELEM 2 | ORB ATT PROC | | SPL | | 93017G | * |
| Q_BOD_M50(3)/Q_B_M50(3) | V90U2242CB | M50 TO BODY QUAT MEASURED ELEM 3 | ORB ATT PROC | | SPL | | 93017G | * |
| Q_BOD_M50(4)/Q_B_M50(4) | V90U2243CB | M50 TO BODY QUAT MEASURED ELEM 4 | ORB ATT PROC | | SPL | | 93017G | * |
| Q_CB_M50_S | V94U3980CA | M50 TO BODY QUAT ELEM 1 | ORB MNVR DIP | | | | | |
| Q_CB_M50_S | V94U3980CD | M50 TO BODY QUAT ELEM 1 | ORB GUID | | | | | |
| Q_CB_M50_V(1) | V94U3981CA | M50 TO BODY QUAT ELEM 2 | ORB MNVR DIP | | | | | |
| Q_CB_M50_V(1) | V94U3981CD | M50 TO BODY QUAT ELEM 2 | ORB GUID | | | | | |
| Q_CB_M50_V(2) | V94U3982CA | M50 TO BODY QUAT ELEM 3 | ORB MNVR DIP | | | | | |
| Q_CB_M50_V(2) | V94U3982CD | M50 TO BODY QUAT ELEM 3 | ORB GUID | | | | | |
| Q_CB_M50_V(3) | V94U3983CA | M50 TO BODY QUAT ELEM 4 | ORB MNVR DIP | | | | | |
| Q_CB_M50_V(3) | V94U3983CD | M50 TO BODY QUAT ELEM 4 | ORB GUID | | | | | |
| Q_M50_LVLH(1) | V90U2641CA | M50 WRT LVLH QUAT 1 | ORB ATT PROC | | | | 93017G | * |
| Q_M50_LVLH(2) | V90U2642CA | M50 WRT LVLH QUAT 2 | ORB ATT PROC | | | | 93017G | * |
| Q_M50_LVLH(3) | V90U2643CA | M50 WRT LVLH QUAT 3 | ORB ATT PROC | | | | 93017G | * |
| Q_M50_LVLH(4) | V90U2644CA | M50 WRT LVLH QUAT 4 | ORB ATT PROC | | | | 93017G | * |
| Q_RBOD_M50(1) | V95U2209C | M50 TO BODY QUAT REQUIRED ELEM 1 | UNIV POINT PROC | | | | | |
| Q_RBOD_M50(2) | V95U2210C | M50 TO BODY QUAT REQUIRED ELEM 2 | UNIV POINT PROC | | | | | |
| Q_RBOD_M50(3) | V95U2211C | M50 TO BODY QUAT REQUIRED ELEM 3 | UNIV POINT PROC | | | | | |
| Q_RBOD_M50(4) | V95U2212C | M50 TO BODY QUAT REQUIRED ELEM 4 | UNIV POINT PROC | | | | | |
| RBST_CNCL | V94X0217XA | REBOOST CANCEL | UNIV PTG DISP | | BD | | 92187F | |
| RBST_CNCL | V94X0217XC | REBOOST CANCEL | UNIV POINT PROC | | BD | | 92187F | |
| RBST_CONF | V94U0218C | REBOOST CONFIGURATION | ORB DAP CONFIG DISP | | HXS | | 93017G | * |
| RBST_DURATION | V94W0213CA | REBOOST DURATION | UNIV PTG DISP | S | SPL | | 93017G | * |
| RBST_ENA | V90X0442XB | REBOOST ENABLE | UNIV POINT PROC | | BD | | 93017G | * |
| RBST_INTERVAL_DISP | V94W0219C | REBOOST FIRING INTERVAL | ORB DAP CONFIG DISP | S | SPL | | 93017G | * |
| RCS_NORM | V93X5117X | RCS NORM | RM RCS DISP | | BD | | 92320D | |
| REQD_BRATE(1) | V95R2216C | X-COMP OF REQD BODY ATTITUDE RATE | UNIV POINT PROC | DEG/S | | | 89111C | |
| REQD_BRATE(2) | V95R2217C | Y-COMP OF REQD BODY ATTITUDE RATE | UNIV POINT PROC | DEG/S | | | 90882B | |
| REQD_BRATE(3) | V95R2218C | Z-COMP OF REQD BODY ATTITUDE RATE | UNIV POINT PROC | DEG/S | | | 90882B | |
| RHC_STATE(1) | V96J0015CC | RHC OUT OF DETENT ROLL | ORB 3-AX RHC SOP | | | | | |
| RHC_STATE(2) | V96J0017CC | RHC OUT OF DETENT PITCH | ORB 3-AX RHC SOP | | | | | |
| RHC_STATE(3) | V96J0019CB | RHC OUT OF DETENT YAW | ORB 3-AX RHC SOP | | | | 89688A | |
| RH_AUTOSB | V90U6911C | SEL RH SPD BK/THROT AUTO/MAN | GN&C SW RM | | | | 90837G | |
| ROT_DISC(1) | V95X2430X | MAN MODE ROTATION,ROLL DISCRETE | FC SWIT PROC | | | | 90900D | |
| ROT_DISC(2) | V95X2431X | MAN MODE ROTATION,PITCH DISCRETE | FC SWIT PROC | | | | 90900D | |
| ROT_DISC(3) | V95X2432X | MAN MODE ROTATION,YAW DISCRETE | FC SWIT PROC | | | | 90900D | |
| ROT_PULSE(1) | V95X2439X | MAN MODE ROTATION,ROLL PULSE | FC SWIT PROC | | | | 90900D | |
| ROT_PULSE(2) | V95X2440X | MAN MODE ROTATION,PITCH PULSE | FC SWIT PROC | | | | 90900D | |
| ROT_PULSE(3) | V95X2441X | MAN MODE ROTATION,YAW PULSE | FC SWIT PROC | | | | 90900D | |
| RSS_EXCEED/SOFT_STOP(1) | V96X1069XB | ROLL RHC SOFT-STOP FLAG | ORB 3-AX RHC SOP | | | | 89752A | |

TABLE 4.2.4-1. INPUT FUNCTIONAL PARAMETERS FOR ONORBIT DIGITAL AUTOPILOT (G4.35)

| FSSR NAME | M/S ID | NOMENCLATURE | SOURCE | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-------------------------|------------|------------------------------------|---------------------|-------|-----------|---------|---------|-------|
| SPARE_PBI | V95X2408X | SPARE PBI | FC SWIT PROC | | BD | | 89921C | |
| THC(1) | V96J0401C | TRANS HAND CTLR X CMD | THC SOP | | | | | |
| THC(2) | V96J0402C | TRANS HAND CTLR Y CMD | THC SOP | | | | | |
| THC(3) | V96J0403C | TRANS HAND CTLR Z CMD | THC SOP | | | | | |
| TRANS_HIGH_Z | V95X2416X | MAN MODE TRANS,Z HIGH | FC SWIT PROC | | | | 90900D | |
| TRANS_LOW_Z | V95X2415X | MAN MODE TRANS,Z LOW | FC SWIT PROC | | | | 90900D | |
| TRANS_NORM(1) | V95X2417X | MAN MODE TRANS,X NORM | FC SWIT PROC | | | | 90900D | |
| TRANS_NORM(2) | V95X2418X | MAN MODE TRANS,Y NORM | FC SWIT PROC | | | | 90900D | |
| TRANS_NORM(3) | V95X2419X | MAN MODE TRANS,Z NORM | FC SWIT PROC | | | | 90900D | |
| TRANS_PULSE(1) | V95X2420X | MAN MODE TRANS,X PLSE | FC SWIT PROC | | | | 90900D | |
| TRANS_PULSE(2) | V95X2421X | MAN MODE TRANS,Y PLSE | FC SWIT PROC | | | | 90900D | |
| TRANS_PULSE(3) | V95X2422X | MAN MODE TRANS,Z PLSE | FC SWIT PROC | | | | 90900D | |
| UP_OP_CODE | V96J3521C | OP CODE FOR UPLINK | UL | | HXS | | 92067D | |
| VERNIER_RCS | V95X2410X | VERNIER RCS JETS | FC SWIT PROC | | | | 90900D | |
| XJETS_ACTIVE | V93X0992X | XJETS ACTIVE FLAG | ORB DAP CONFIG DISP | EVENT | BD | | 93017G | * |
| YSS_EXCEED/SOFT_STOP(3) | V96X1071XB | YAW RHC SOFT-STOP FLAG | ORB 3-AX RHC SOP | | | | 89752A | |
| | V90X7501X | SEL RCS MASTER CROSSFEED FROM LEFT | GN&C SW RM | | BD | | 93017G | * |
| | V90X7502X | SEL RCS MASTER CROSSFEED FROM RT | GN&C SW RM | | BD | | 93017G | * |
| | V90X8643X | TRIM OMS GIMBALS FLAG | MSC | | | | | |
| | V90X8646X | MM 202 FROM MM 201 FLAG | MSC | | | | 92355B | |

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

TABLE 4.2.4-2. OUTPUT FUNCTIONAL PARAMETERS FROM ONORBIT DIGITAL AUTOPILOT (G4.35)

| FSSR NAME | M/S ID | NOMENCLATURE | DESTINATION | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------------|------------|------------------------------------|---------------------|-------|-----------|---------|---------|-------|
| AUTO_MANF_CLOSE | V90X0434XA | RCS AUTO MANIFOLD CLOSE FLAG | RCS RM | | BD | | 92871C | |
| DAP_ERR(1) | V90H2143C | BODY ATTITUDE ERROR-ROLL | DL FMT 22/A | DEG | SPL | | 93017G | * |
| | | | ORB ADI PROC | | | | | |
| | | | UNIV POINT PROC | | | | | |
| DAP_ERR(2) | V90H2141C | BODY ATTITUDE ERROR-PITCH | DL FMT 22/A | DEG | SPL | | 93017G | * |
| | | | ORB ADI PROC | | | | | |
| | | | UNIV POINT PROC | | | | | |
| DAP_ERR(3) | V90H2142C | BODY ATTITUDE ERROR-YAW | DL FMT 22/A | DEG | SPL | | 93017G | * |
| | | | ORB ADI PROC | | | | | |
| | | | UNIV POINT PROC | | | | | |
| DAP_LOAD_SEL_A | V93J5779CB | DAP LOAD SEL A | ORB DAP CONFIG SPEC | | HXS | | 90837G | |
| DAP_LOAD_SEL_B | V93J5780CB | DAP LOAD SEL B | ORB DAP CONFIG SPEC | | HXS | | 90837G | |
| DAP_RATE | V90R2176C | SELECTED DAP MANEUVER RATE | DL FMT 22/1 | DEG/S | SPL | | 93017G | * |
| | | | UNIV POINT PROC | | | | | |
| DAP_SEL_REQ_A | V93X5785XB | DAP SEL REQ A | ORB DAP CONFIG SPEC | | BD | | 90837G | |
| DAP_SEL_REQ_B | V93X5786XB | DAP SEL REQ B | ORB DAP CONFIG SPEC | | BD | | 90837G | |
| DAP_UL_STATUS | V93J5439C | DAP UPLINK STATUS | DL FMT 22/1 | | HXS | | 93017G | * |
| DB_REQUEST(1) | V90H2785C | PHASE PLANE ATT DBD-MAG REQ(ROLL) | DL FMT 22/1 | DEG | SPL | | 93017G | * |
| | | | UNIV POINT PROC | | | | | |
| DB_REQUEST(2) | V90H2820C | PHASE PLANE ATT DBD-MAG REQ(PITCH) | DL FMT 22/1 | DEG | SPL | | 93017G | * |
| DB_REQUEST(3) | V90H2821C | PHASE PLANE ATT DBD-MAG REQ(YAW) | DL FMT 22/1 | DEG | SPL | | 93017G | * |
| DOCKING_ARM | V90X0109X | DOCKING ARM | DL FMT 22/1 | | BD | | 93017G | * |
| ENABLE_NF | V93X5344XB | NOTCH FILTER ENA FLAG | DL FMT 22/1 | | BD | | 93017G | * |
| | | | ORB DAP CONFIG DISP | | | | | |
| JETS_ON | V90X2349X | RCS JET FIRING INDICATION FLAG | ORB/RND NAV | | | | | |
| LAMP_ALT | V72X2896X | FWD ALT PRCS MODE (LIGHT) | DL FMT 22/A | EVENT | BD | | 93017G | * |
| | | | DL FMT 32/A | | | | | |
| | | | FWD PNL | | | | | |
| | | | ORB DAP CONFIG DISP | | | | | |
| LAMP_ALT | V72X6416X | AFT ALT PRCS MODE(LIGHT) | AFT PNL | | BD | | 90900D | |
| LAMP_AUTO | V72X2850XA | FWD DAP AUTO (LIGHT) | DL FMT 22/A | | | | 93017G | * |
| | | | DL FMT 32/B | | | | | |
| | | | FWD PNL | | | | | |
| | | | ORB 3-AX RHC SOP | | | | | |
| | | | UNIV POINT PROC | | | | | |
| | | | XXXXX MNVR DISP | | | | | |
| LAMP_AUTO | V72X6498XA | AFT DAP AUTO (LIGHT) | AFT PNL | | | | 90900D | |
| LAMP_DAPLOAD_A | V72X2807X | FWD DAP SELECT A (LIGHT) | DL FMT 21/A | | BD | | 93017G | * |
| | | | DL FMT 22/A | | | | | |
| | | | DL FMT 32/B | | | | | |
| | | | FWD PNL | | | | | |
| | | | ORB DAP CONFIG DISP | | | | | |
| LAMP_DAPLOAD_A | V72X6421X | AFT DAP SELECT A (LIGHT) | AFT PNL | | BD | | 93017G | * |
| | | | DL FMT 23/1 | | | | | |
| | | | DL FMT 32/2 | | | | | |

TABLE 4.2.4-2. OUTPUT FUNCTIONAL PARAMETERS FROM ONORBIT DIGITAL AUTOPILOT (G4.35)

| FSSR NAME | M/S ID | NOMENCLATURE | DESTINATION | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|------------------|------------|---------------------------------|--|-------|-----------|---------|---------|-------|
| LAMP_DAPLOAD_B | V72X2808X | FWD DAP SELECT B (LIGHT) | DL FMT 21/A DL FMT 22/A DL FMT 23/A DL FMT 32/A FWD PNL ORB DAP CONFIG DISP | | BD | | 93017G | * |
| LAMP_DAPLOAD_B | V72X6422X | AFT DAP SELECT B (LIGHT) | AFT PNL DL FMT 21/A DL FMT 22/A DL FMT 23/A DL FMT 32/1 | | BD | | 93017G | * |
| LAMP_FREE | V72X2897X | FWD FREE DRIFT MODE (LIGHT) | DL FMT 21/A DL FMT 22/A DL FMT 23/A DL FMT 32/A FWD PNL XXXXX MNVR DISP | EVENT | BD | | 93017G | * |
| LAMP_FREE | V72X6417X | AFT FREE DRIFT MODE(LIGHT) | FWD PNL | | BD | | 90900D | |
| LAMP_INRTL | V72X2849XA | FWD DAP MAN INRTL (LIGHT) | DL FMT 22/A DL FMT 32/A FWD PNL XXXXX MNVR DISP | | | | 93017G | * |
| LAMP_INRTL | V72X6499XA | AFT DAP MAN INRTL(LIGHT) | AFT PNL | | | | 90900D | |
| LAMP_LOW_Z | V72X2878X | FWD TRANSLATION Y LOW Z (LIGHT) | DL FMT 22/A DL FMT 32/A FWD PNL | | BD | | 93017G | * |
| LAMP_LOW_Z | V72X6545X | AFT TRANSLATION Z LOW (LIGHT) | AFT PNL | | BD | | 90900D | |
| LAMP_LVLH | V72X2868X | FWD MANUAL LVLH (LIGHT) | DL FMT 21/A DL FMT 22/A DL FMT 32/B FWD PNL XXXXX MNVR DISP | | BD | | 93017G | * |
| LAMP_LVLH | V72X6542X | AFT MANUAL LVLH (LIGHT) | AFT PNL | | BD | | 90900D | |
| LAMP_PRIMARY | V72X2855X | FWD RCS JETS NORM (LIGHT) | DL FMT 22/A DL FMT 32/A FWD PNL ORB DAP CONFIG DISP | | BD | | 93017G | * |
| LAMP_PRIMARY | V72X6502X | AFT RCS JETS NORMAL (LIGHT) | AFT PNL | | BD | | 90900D | |
| LAMP_ROT_DISC(1) | V72X2790XA | FWD ROTATION ROLL DSCR (LIGHT) | DL FMT 22/A DL FMT 32/A FWD PNL | | | | 93017G | * |
| LAMP_ROT_DISC(2) | V72X2793XA | FWD ROTATION PITCH DSCR (LIGHT) | DL FMT 22/A DL FMT 32/A FWD PNL | | | | 93017G | * |

TABLE 4.2.4-2. OUTPUT FUNCTIONAL PARAMETERS FROM ONORBIT DIGITAL AUTOPILOT (G4.35)

| FSSR NAME | M/S ID | NOMENCLATURE | DESTINATION | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|---------------------|------------|----------------------------------|---|-------|-----------|---------|---------|-------|
| LAMP_ROT_DISC(3) | V72X2796XA | FWD ROTATION YAW DSCR (LIGHT) | DL FMT 22/A DL FMT 32/A FWD PNL | | | | 93017G | * |
| LAMP_ROT_PULSE(1) | V72X2792XA | FWD ROTATION ROLL PULSE (LIGHT) | DL FMT 22/A DL FMT 32/A FWD PNL | | | | 93017G | * |
| LAMP_ROT_PULSE(2) | V72X2795XA | FWD ROTATION PITCH PULSE (LIGHT) | DL FMT 22/A DL FMT 32/A FWD PNL | | | | 93017G | * |
| LAMP_ROT_PULSE(3) | V72X2798XA | FWD ROTATION YAW PULSE (LIGHT) | DL FMT 22/A DL FMT 32/A FWD PNL | | | | 93017G | * |
| LAMP_TRANS_HIGH_Z | V72X2888X | FWD TRANSLATION Z HIGH (LIGHT) | DL FMT 21/1 DL FMT 22/A DL FMT 23/1 DL FMT 32/A FWD PNL | | BD | | 93017G | * |
| LAMP_TRANS_HIGH_Z | V72X6548X | AFT TRANSLATION Z HIGH (LIGHT) | AFT PNL | | BD | | 90900D | |
| LAMP_TRANS_NORM(1) | V72X2866X | FWD TRANSLATION X NORM (LIGHT) | DL FMT 22/A DL FMT 32/A FWD PNL | | BD | | 93017G | * |
| LAMP_TRANS_NORM(1) | V72X6540X | AFT TRANSLATION X NORM (LIGHT) | AFT PNL | | BD | | 90900D | |
| LAMP_TRANS_NORM(2) | V72X2876X | FWD TRANSLATION Y NORM (LIGHT) | DL FMT 22/A DL FMT 32/A FWD PNL | | BD | | 93017G | * |
| LAMP_TRANS_NORM(2) | V72X6543X | AFT TRANSLATION Y NORM (LIGHT) | AFT PNL | | BD | | 90900D | |
| LAMP_TRANS_NORM(3) | V72X2886X | FWD TRANSLATION Z NORM (LIGHT) | DL FMT 21/1 DL FMT 22/A DL FMT 23/1 DL FMT 32/A FWD PNL | | BD | | 93017G | * |
| LAMP_TRANS_NORM(3) | V72X6546X | AFT TRANSLATION Z NORM (LIGHT) | AFT PNL | | BD | | 90900D | |
| LAMP_TRANS_PULSE(1) | V72X2867X | FWD TRANSLATION X PULSE (LIGHT) | DL FMT 22/A DL FMT 32/A FWD PNL | | BD | | 93017G | * |
| LAMP_TRANS_PULSE(1) | V72X6541X | AFT TRANSLATION X PULSE (LIGHT) | AFT PNL | | BD | | 90900D | |
| LAMP_TRANS_PULSE(2) | V72X2877X | FWD TRANSLATION Y PULSE (LIGHT) | DL FMT 22/A DL FMT 32/A FWD PNL | | BD | | 93017G | * |
| LAMP_TRANS_PULSE(2) | V72X6544X | AFT TRANSLATION Y PULSE (LIGHT) | AFT PNL | | BD | | 90900D | |
| LAMP_TRANS_PULSE(3) | V72X2887X | FWD TRANSLATION Z PULSE (LIGHT) | DL FMT 21/1 DL FMT 22/A DL FMT 23/1 DL FMT 32/A FWD PNL | | BD | | 93017G | * |
| LAMP_TRANS_PULSE(3) | V72X6547X | AFT TRANSLATION Z PULSE (LIGHT) | AFT PNL | | BD | | 90900D | |

TABLE 4.2.4-2. OUTPUT FUNCTIONAL PARAMETERS FROM ONORBIT DIGITAL AUTOPILOT (G4.35)

| FSSR NAME | M/S ID | NOMENCLATURE | DESTINATION | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|----------------------|------------|------------------------------------|--|--------|-----------|---------|---------|-------|
| LAMP_VERNIER | V72X2856X | FWD RCS JETS VERNIER (LIGHT) | DL FMT 22/A DL FMT 32/A FWD PNL ORB DAP CONFIG DISP RCS RM | | BD | | 93017G | * |
| LAMP_VERNIER | V72X6503X | AFT RCS JETS VERNIER (LIGHT) | AFT PNL | | BD | | 90900D | |
| LAUTO_BFLAMP | V72X4996XC | LH BODY FLAP AUTO | D&C PNL | | | | 90837G | |
| LAUTO_SBLAMP | V72X5136XD | LH SPEEDBRAKE AUTO | D&C PNL | | | | 90837G | |
| LO_PITCH_TAIL_NOSE | V90X2788X | JET SELECT LO PITCH ROT-NOSE/TAIL | DL FMT 22/1 | | BD | | 93017G | * |
| LO_YAW_TAIL_NOSE | V90X2789X | JET SELECT LO YAW ROT-NOSE/TAIL | DL FMT 22/1 | | BD | | 93017G | * |
| LVLH_MODE | V90X2174X | LVLH MODE INDICATOR | ORB ATT PROC UNIV POINT PROC | | | | | |
| MAG_CNTL_ACCEL(1) | V90U2798C | AVAIL AXIS CNTRL ACCEL-AVG MAG R | DL FMT 22/1 | DEG/S2 | SPL | | 93017G | * |
| MAG_CNTL_ACCEL(2) | V90U2828C | AVAIL AXIS CNTRL ACCEL-AVG MAG P | DL FMT 22/1 | DEG/S2 | SPL | | 93017G | * |
| MAG_CNTL_ACCEL(3) | V90U2829C | AVAIL AXIS CNTRL ACCEL-AVG MAG YAW | DL FMT 22/1 | DEG/S2 | SPL | | 93017G | * |
| MAG_MNVR_RATE | V90U2787C | DISCRETE MANEUVER RATE-MAGNITUDE | DL FMT 22/1 | DEG/S | SPL | | 93017G | * |
| MEASURED_ATTITUDE(1) | V93H0997C | MEASURED ATTITUDE UNFILTERED X | DL FMT 22/2 | DEG | DPL | | 93017G | * |
| MEASURED_ATTITUDE(2) | V93H0998C | MEASURED ATTITUDE UNFILTERED Y | DL FMT 22/2 | DEG | DPL | | 93017G | * |
| MEASURED_ATTITUDE(3) | V93H0999C | MEASURED ATTITUDE UNFILTERED Z | DL FMT 22/2 | DEG | DPL | | 93017G | * |
| MINA_JS_SEL | V90X6500X | MIN ANGLE JET SEL LOGIC SELECTED | DL FMT 22/1 | | BD | | 93017G | * |
| MNVR_CMPL_TIME_TGO | V95W7240CB | PREBURN MNVR TIME TO GO | ORB MNVR DIP | S | SPL | | 92510E | |
| NEW_JONLST_AFT(01) | V90X1455XB | RCS JET L1A ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_AFT(02) | V90X1673XD | RCS JET L1L ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_AFT(03) | V90X1674XD | RCS JET L1U ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_AFT(04) | V90X1457XB | RCS JET R1A ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_AFT(05) | V90X1683XD | RCS JET R1R ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_AFT(06) | V90X1684XD | RCS JET R1U ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_AFT(07) | V90X2159X | RCS JET L5D ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_AFT(08) | V90X2158X | RCS JET L5L ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_AFT(09) | V90X1456XB | RCS JET L3A ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_AFT(10) | V90X1678XD | RCS JET L3L ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_AFT(11) | V90X1679XD | RCS JET L3D ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_AFT(12) | V90X1459XB | RCS JET R3A ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_AFT(13) | V90X1688XD | RCS JET R3R ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_AFT(14) | V90X1689XD | RCS JET R3D ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_AFT(15) | V90X2172X | RCS JET R5R ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_AFT(16) | V90X2173X | RCS JET R5D ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_AFT(17) | V90X1675XD | RCS JET L2L ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_AFT(18) | V90X1676XD | RCS JET L2U ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_AFT(19) | V90X1677XD | RCS JET L2D ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_AFT(20) | V90X1685XD | RCS JET R2R ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_AFT(21) | V90X1686XD | RCS JET R2U ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_AFT(22) | V90X1687XD | RCS JET R2D ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_AFT(23) | V90X1680XD | RCS JET L4L ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_AFT(24) | V90X1681XD | RCS JET L4U ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_AFT(25) | V90X1682XD | RCS JET L4D ON CMD | ORB RCS CMD SOP | | | | 89490C | |

TABLE 4.2.4-2. OUTPUT FUNCTIONAL PARAMETERS FROM ONORBIT DIGITAL AUTOPILOT (G4.35)

| FSSR NAME | M/S ID | NOMENCLATURE | DESTINATION | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|--------------------------|------------|--------------------------------|-----------------|-------|-----------|---------|---------|-------|
| NEW_JONLST_AFT(26) | V90X1690XD | RCS JET R4R ON CMD | ORB RCS CMD SOP | | | | | |
| NEW_JONLST_AFT(27) | V90X1691XD | RCS JET R4U ON CMD | ORB RCS CMD SOP | | | | | |
| NEW_JONLST_AFT(28) | V90X1692XD | RCS JET R4D ON CMD | ORB RCS CMD SOP | | | | | |
| NEW_JONLST_FWD(01) | V90X1441XB | RCS JET F1F ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_FWD(02) | V90X1442XC | RCS JET F1L ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_FWD(03) | V90X1443XC | RCS JET F1U ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_FWD(04) | V90X1444XC | RCS JET F1D ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_FWD(05) | V90X1445XB | RCS JET F2F ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_FWD(06) | V90X1446XC | RCS JET F2R ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_FWD(07) | V90X1447XC | RCS JET F2U ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_FWD(08) | V90X1448XC | RCS JET F2D ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_FWD(09) | V90X1453XC | RCS JET F4R ON CMD | ORB RCS CMD SOP | | | | 89490C | |
| NEW_JONLST_FWD(10) | V90X1454XC | RCS JET F4D ON CMD | ORB RCS CMD SOP | | | | | |
| NEW_JONLST_FWD(11) | V90X2139X | RCS JET F5L ON CMD | ORB RCS CMD SOP | | | | | |
| NEW_JONLST_FWD(12) | V90X2140X | RCS JET F5R ON CMD | ORB RCS CMD SOP | | | | 89490B | |
| NEW_JONLST_FWD(13) | V90X1449XB | RCS JET F3F ON CMD | ORB RCS CMD SOP | | | | | |
| NEW_JONLST_FWD(14) | V90X1450XC | RCS JET F3L ON CMD | ORB RCS CMD SOP | | | | | |
| NEW_JONLST_FWD(15) | V90X1451XC | RCS JET F3U ON CMD | ORB RCS CMD SOP | | | | | |
| NEW_JONLST_FWD(16) | V90X1452XC | RCS JET F3D ON CMD | ORB RCS CMD SOP | | | | | |
| N_FILTERS | V93J5417C | NO. OF NOTCH FILS ACTIVE | DL FMT 22/1 | | HXS | | 93017G | * |
| OMSL_PITCH_YAW_CMD(1) | V90H2180CB | OMS CMD PITCH LEFT | OMS TVC CMD SOP | DEG | | | | |
| OMSL_PITCH_YAW_CMD(2) | V90H2181CB | OMS CMD YAW LEFT | OMS TVC CMD SOP | DEG | | | 89645A | |
| OMSR_PITCH_YAW_CMD(1) | V90H2730CB | OMS CMD PITCH RIGHT | OMS TVC CMD SOP | DEG | | | | |
| OMSR_PITCH_YAW_CMD(2) | V90H2182CB | OMS CMD YAW RIGHT | OMS TVC CMD SOP | DEG | | | 89645A | |
| OMS_PITCH_TRIM | V93H6915CB | OMS PITCH TRIM | ORB GUID | DEG | SPL | | 89645A | |
| | | | ORB MNVR DIP | | | | | |
| | | | TRANS DAP | | | | | |
| | | | XXXXX MNVR DISP | | | | | |
| OMS_YAW_TRIM(1) | V93H6916CB | OMS L YAW TRIM | ORB GUID | DEG | SPL | | 89645A | |
| | | | ORB MNVR DIP | | | | | |
| | | | TRANS DAP | | | | | |
| | | | XXXXX MNVR DISP | | | | | |
| OMS_YAW_TRIM(2) | V93H6918CB | OMS R YAW TRIM | ORB GUID | DEG | SPL | | 89645A | |
| | | | ORB MNVR DIP | | | | | |
| | | | TRANS DAP | | | | | |
| | | | XXXXX MNVR DISP | | | | | |
| PREBURN_MNVR_IN_PROGRESS | V90X1589XB | PRE-BURN MNVR-IN-PROGRESS FLAG | ORB MNVR DIP | | | | 92510E | |
| | | | UNIV POINT PROC | | | | | |
| | | | XXXXX MNVR DISP | | | | | |
| Q_B_I_CMD_DISPLAY(1) | V90H2721CB | CMD BODY WRT M50 QUAT ELEM 1 | ORB ATT PROC | | | | | |
| Q_B_I_CMD_DISPLAY(2) | V90H2722CB | CMD BODY WRT M50 QUAT ELEM 2 | ORB ATT PROC | | | | | |
| Q_B_I_CMD_DISPLAY(3) | V90H2723CB | CMD BODY WRT M50 QUAT ELEM 3 | ORB ATT PROC | | | | | |
| Q_B_I_CMD_DISPLAY(4) | V90H2724CB | CMD BODY WRT M50 QUAT ELEM 4 | ORB ATT PROC | | | | | |
| RATE_ERROR(1) | V90R2704C | BODY ANGULAR RATE ERROR-X | DL FMT 22/1 | DEG/S | SPL | | 93017G | * |
| | | | DL FMT 32/1 | | | | | |

TABLE 4.2.4-2. OUTPUT FUNCTIONAL PARAMETERS FROM ONORBIT DIGITAL AUTOPILOT (G4.35)

| FSSR NAME | M/S ID | NOMENCLATURE | DESTINATION | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-------------------------|------------|------------------------------------|--|-------|-----------|---------|---------|-------|
| RATE_ERROR(2) | V90R2705C | BODY ANGULAR RATE ERROR-Y | DL FMT 22/1 DL FMT 32/1 | DEG/S | SPL | | 93017G | * |
| RATE_ERROR(3) | V90R2706C | BODY ANGULAR RATE ERROR-Z | DL FMT 22/1 DL FMT 32/1 | DEG/S | SPL | | 93017G | * |
| RATE_EST(1)/BOD_RATE(1) | V90R2223C | IMU DERIVED BODY RATE X-AXIS | DL FMT 22/1 GN&C/SM-PL IF IMU RM ORB ADI PROC STAR TRCK SOP UNIV POINT PROC | DEG/S | SPL | | 93017G | * |
| RATE_EST(2)/BOD_RATE(2) | V90R2224C | IMU DERIVED BODY RATE Y-AXIS | DL FMT 22/1 GN&C/SM-PL IF IMU RM ORB ADI PROC STAR TRCK SOP UNIV POINT PROC | DEG/S | SPL | | 93017G | * |
| RATE_EST(3)/BOD_RATE(3) | V90R2225C | IMU DERIVED BODY RATE Z-AXIS | DL FMT 22/1 GN&C/SM-PL IF IMU RM ORB ADI PROC STAR TRCK SOP UNIV POINT PROC | DEG/S | SPL | | 93017G | * |
| RAUTO_SBLAMP | V72X5134XD | RH SPEEDBRAKE AUTO | D&C PNL | | | | 90837G | |
| RBST_CNCL | V94X0217XB | REBOOST CANCEL | UNIV POINT PROC | | BD | | 92187F | |
| RBST_ENA | V90X0442XA | REBOOST ENABLE | DL FMT 22/1 ORB DAP CONFIG DISP UNIV POINT PROC | | BD | | 93017G | * |
| RBST_TIME_REMAINING | V90W0443C | REBOOST TIME REMAINING | UNIV POINT PROC | S | SPL | | 92187F | |
| RL_REQUEST(1) | V90U2786C | PHS PLANE RATE ERR LIM-MAG REQ R | DL FMT 22/1 | DEG/S | SPL | | 93017G | * |
| RL_REQUEST(2) | V90U2824C | PHS PLANE RATE ERR LIM-MAG REQ P | DL FMT 22/1 | DEG/S | SPL | | 93017G | * |
| RL_REQUEST(3) | V90U2825C | PHS PLANE RATE ERR LIM-MAG REQ YAW | DL FMT 22/1 | DEG/S | SPL | | 93017G | * |
| ROT_COMMAND(1) | V90U2416C | RCS ROT CMD FOR DISPLAY(ROLL) | RCS ACT LT | | | | 89921C | |
| ROT_COMMAND(2) | V90U2417C | RCS ROT CMD FOR DISPLAY(PITCH) | RCS ACT LT | | | | 89921C | |
| ROT_COMMAND(3) | V90U2418C | RCS ROT CMD FOR DISPLAY(YAW) | RCS ACT LT | | | | 89921C | |
| ROT_DISC(1) | V90X2184X | AFT ROT LIGHT ROLL DSCR | FC SWIT PROC | | | | 90900D | |
| ROT_DISC(2) | V90X2187X | AFT ROT LIGHT PITCH DSCR | FC SWIT PROC | | | | 90900D | |
| ROT_DISC(3) | V90X2190X | AFT ROT LIGHT YAW DSCR | FC SWIT PROC | | | | 90900D | |
| ROT_HI_LO_SW | V90X2793X | PITCH ROT ACCEL LVL LOW | DL FMT 22/1 | | BD | | 93017G | * |
| ROT_HI_LO_SW(2) | V90X2817X | YAW ACCELERATION LEVEL LOW | DL FMT 22/1 | | BD | | 93017G | * |
| ROT_PULSE(1) | V90X2186X | AFT ROT LIGHT ROLL PULSE | FC SWIT PROC | | | | 90900D | |
| ROT_PULSE(2) | V90X2189X | AFT ROT LIGHT PITCH PULSE | FC SWIT PROC | | | | 90900D | |
| ROT_PULSE(3) | V90X2192X | AFT ROT LIGHT YAW PULSE | FC SWIT PROC | | | | 90900D | |
| ROT_PULSE_SIZE | V90U2794C | BODY ANG RATE CHG-MAG PER PULSE | DL FMT 22/1 | DEG/S | SPL | | 93017G | * |
| SEL_ALT_DELAY_TIME | V93W1971C | SELECTED ARRAY ALT DELAY TIME | DL FMT 22/1 DL FMT 32/1 | S | SPL | | 93017G | * |

TABLE 4.2.4-2. OUTPUT FUNCTIONAL PARAMETERS FROM ONORBIT DIGITAL AUTOPILOT (G4.35)

| FSSR NAME | M/S ID | NOMENCLATURE | DESTINATION | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|----------------------|------------|----------------------------------|--|----------|--------------|------------------|---------|-------------|
| SEL_ALT_JET_OPTION | V93U1975C | SELECTED ARRAY ALT JET OPTION | DL FMT 22/1 DL FMT 32/1 | | HXS | | 93017G | * |
| SEL_ALT_MAX_JETS | V93U1973C | SELECTED ARRAY ALT MAX JETS | DL FMT 22/1 DL FMT 32/1 | | HXS | | 93017G | * |
| SEL_ALT_ON_TIME | V93W1972C | SELECTED ARRAY ALT ON TIME | DL FMT 22/1 DL FMT 32/1 | S | SPL | | 93017G | * |
| SEL_ALT_RATE_LIMIT | V93R1974C | SELECTED ARRAY ALT RATE LIMIT | DL FMT 22/1 DL FMT 32/1 | DEG/S | SPL | | 93017G | * |
| SEL_CG(1) | V93U5430C | SELECTED CG-X | DL FMT 22/1 | IN | SPL | | 93017G | * |
| SEL_CG(2) | V93U5431C | SELECTED CG-Y | DL FMT 22/1 | IN | SPL | | 93017G | * |
| SEL_CG(3) | V93U5432C | SELECTED CG-Z | DL FMT 22/1 | IN | SPL | | 93017G | * |
| SEL_MOMENTS_I(1) | V93U5436C | SELECTED MOMENTS OF INERTIA IXX | DL FMT 22/1 | SLUG-FT2 | SPL | | 93017G | * |
| SEL_MOMENTS_I(2) | V93U5437C | SELECTED MOMENTS OF INERTIA IYY | DL FMT 22/1 | SLUG-FT2 | SPL | | 93017G | * |
| SEL_MOMENTS_I(3) | V93U5438C | SELECTED MOMENTS OF INERTIA IZZ | DL FMT 22/1 | SLUG-FT2 | SPL | | 93017G | * |
| SEL_NOTCH_FREQS(1,1) | V93F5418C | NOTCH FIL NO. 1 LO FREQ | DL FMT 22/1 | HZ | SPL | | 93017G | * |
| SEL_NOTCH_FREQS(1,2) | V93F5419C | NOTCH FIL NO. 1 HI FREQ | DL FMT 22/1 | HZ | SPL | | 93017G | * |
| SEL_NOTCH_FREQS(2,1) | V93F5420C | NOTCH FIL NO. 2 LO FREQ | DL FMT 22/1 | HZ | SPL | | 93017G | * |
| SEL_NOTCH_FREQS(2,2) | V93F5421C | NOTCH FIL NO. 2 HI FREQ | DL FMT 22/1 | HZ | SPL | | 93017G | * |
| SEL_NOTCH_FREQS(3,1) | V93F5422C | NOTCH FIL NO. 3 LO FREQ | DL FMT 22/1 | HZ | SPL | | 93017G | * |
| SEL_NOTCH_FREQS(3,2) | V93F5423C | NOTCH FIL NO. 3 HI FREQ | DL FMT 22/1 | HZ | SPL | | 93017G | * |
| SEL_NOTCH_FREQS(4,1) | V93F5424C | NOTCH FIL NO. 4 LO FREQ | DL FMT 22/1 | HZ | SPL | | 93017G | * |
| SEL_NOTCH_FREQS(4,2) | V93F5425C | NOTCH FIL NO. 4 HI FREQ | DL FMT 22/1 | HZ | SPL | | 93017G | * |
| SEL_NOTCH_FREQS(5,1) | V93F5426C | NOTCH FIL NO. 5 LO FREQ | DL FMT 22/1 | HZ | SPL | | 93017G | * |
| SEL_NOTCH_FREQS(5,2) | V93F5427C | NOTCH FIL NO. 5 HI FREQ | DL FMT 22/1 | HZ | SPL | | 93017G | * |
| SEL_NOTCH_FREQS(6,1) | V93F5428C | NOTCH FIL NO. 6 LO FREQ | DL FMT 22/1 | HZ | SPL | | 93017G | * |
| SEL_NOTCH_FREQS(6,2) | V93F5429C | NOTCH FIL NO. 6 HI FREQ | DL FMT 22/1 | HZ | SPL | | 93017G | * |
| SEL_PRODUCTS_I(1) | V93U5433C | SELECTED PRODUCTS OF INERTIA PXY | DL FMT 22/1 | SLUG-FT2 | SPL | | 93017G | * |
| SEL_PRODUCTS_I(2) | V93U5434C | SELECTED PRODUCTS OF INERTIA PXZ | DL FMT 22/1 | SLUG-FT2 | SPL | | 93017G | * |
| SEL_PRODUCTS_I(3) | V93U5435C | SELECTED PRODUCTS OF INERTIA PYZ | DL FMT 22/1 | SLUG-FT2 | SPL | | 93017G | * |
| SPARE | V72X2889X | FWD SPARE_PBI (LT) | DL FMT 22/A DL FMT 32/A FWD PNL | EVENT | BD | | 93017G | * |
| SPARE | V72X6402X | AFT SPARE PBI (LT) | AFT PNL | EVENT | BD | | 90837G | |
| TRANS_PULSE_SIZE | V90U2795C | TRANS VEL CHANGE-MAG PER PULSE | DL FMT 22/1 | FT/S | SPL | | 93017G | * |
| XJETS_ACTIVE | V93X0992XA | XJETS ACTIVE FLAG | DL FMT 22/1 | EVENT | BD | | 93017G | * |
| | | | ORB DAP CONFIG DISP | | | | | |
| | V72M6625PB | MDM FF01 DSCR OUT SET | CD 02 CH 1 DL FMT 21/A DL FMT 22/A DL FMT 32/B | | | | 93017G | * |
| | V72M6626PA | MDM FF01 DSCR OUT SET | CD 02 CH 2 DL FMT 21/A DL FMT 22/A DL FMT 23/A DL FMT 32/A | | | | 93017G | * |
| | V72M6631P | MDM FF01 DSCR OUT SET | CD 10 CH 1 DL FMT 22/A DL FMT 32/A | | | | 93017G | * |

TABLE 4.2.4-2. OUTPUT FUNCTIONAL PARAMETERS FROM ONORBIT DIGITAL AUTOPILOT (G4.35)

| FSSR NAME | M/S ID | NOMENCLATURE | DESTINATION | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-----------|------------|-----------------------------|-------------|--|-----------|---------|---------|-------|
| | V72M6632P | MDM FF01 DSCR OUT SET | CD 10 CH 2 | DL FMT 21/1 DL FMT 22/A DL FMT 23/1 DL FMT 32/A | | | 93017G | * |
| | V72M6725PA | MDM FF03 DSCR OUT SET | CD 02 CH 1 | DL FMT 23/1 DL FMT 32/2 | | | 93017G | * |
| | V72M6726P | MDM FF03 DSCR OUT SET | CD 02 CH 2 | DL FMT 21/A DL FMT 22/A DL FMT 23/A DL FMT 32/1 | | | 93017G | * |
| | V90M3133P | CGCB_LO_YAW_TAIL_NOSE | | DL FMT 22/1 | | | 93017G | * |
| | V90M3139P | CGCB ORBIT DAP FLAGS | | DL FMT 22/1 | | | 93017G | * |
| | V90M3174PA | FLIGHT CONTROL MFB DOWNLIST | | DL FMT 22/1 | | | 93017G | * |
| | V93M0509PC | CGZB_28_FLAG_WD1 | | DL FMT 22/1 | | | 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 4.2.4-3. ONORBIT DIGITAL AUTOPILOT (G4.35) I-LOADS

| FSSR NAME | MSID | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R E V |
|--------------------------|-----------|-----------|----|----|---|---|---------|----|-----|---------|-------------|
| ACCEL_GAIN_PRIMARY | V97U2500C | ND | F | S | D | P | G4.35 | 00 | OSE | 90708C | |
| ACCEL_GAIN_TVC | V96U9810C | NONE | F | S | D | P | G4.35 | 00 | ZSP | 90708C | |
| ACCEL_GAIN_UNIQUE | V97U2665C | NONE | F | S | M | P | G4.35 | 00 | OSE | 90708C | |
| ACCEL_GAIN_VERNIER | V97U2502C | ND | F | S | D | P | G4.35 | 00 | OSE | 90708C | |
| ACCEL_INH_ATTITUDE_GAIN | V97U2651C | NONE | F | S | M | P | G4.35 | 00 | OSE | 90708C | |
| ACCEL_INH_RATE_GAIN | V97U2652C | NONE | F | S | M | P | G4.35 | 00 | OSE | 90708C | |
| AF_INH_COUNT | V97U3166C | ND | I | S | D | P | G4.35 | 00 | OSE | 90708C | |
| AF_OVR_DLY_COUNT | V97U3167C | ND | I | S | M | P | G4.35 | 00 | OSE | 90708C | |
| AF_OVR_ON_COUNT | V97U3168C | ND | I | S | D | P | G4.35 | 00 | OSE | 90708C | |
| ALT_DELAY_FACTOR(1) | V96U8533C | NONE | F | S | M | P | G4.35 | 00 | OAD | 92187F | |
| ALT_DELAY_FACTOR(10) | V96U8542C | NONE | F | S | M | P | G4.35 | 00 | OAD | 92187F | |
| ALT_DELAY_FACTOR(2) | V96U8534C | NONE | F | S | M | P | G4.35 | 00 | OAD | 92187F | |
| ALT_DELAY_FACTOR(3) | V96U8535C | NONE | F | S | M | P | G4.35 | 00 | OAD | 92187F | |
| ALT_DELAY_FACTOR(4) | V96U8536C | NONE | F | S | M | P | G4.35 | 00 | OAD | 92187F | |
| ALT_DELAY_FACTOR(5) | V96U8537C | NONE | F | S | M | P | G4.35 | 00 | OAD | 92187F | |
| ALT_DELAY_FACTOR(6) | V96U8538C | NONE | F | S | M | P | G4.35 | 00 | OAD | 92187F | |
| ALT_DELAY_FACTOR(7) | V96U8539C | NONE | F | S | M | P | G4.35 | 00 | OAD | 92187F | |
| ALT_DELAY_FACTOR(8) | V96U8540C | NONE | F | S | M | P | G4.35 | 00 | OAD | 92187F | |
| ALT_DELAY_FACTOR(9) | V96U8541C | NONE | F | S | M | P | G4.35 | 00 | OAD | 92187F | |
| ALT_MNVR_SCALE_FACTOR | V97U2671C | NONE | F | S | M | P | G4.35 | 00 | ZSP | 90708C | |
| ATTITUDE_GAIN1_PRIMARY | V97U2655C | ND | F | S | D | P | G4.35 | 00 | OSE | 90708C | |
| ATTITUDE_GAIN1_TVC | V96U9811C | NONE | F | S | D | P | G4.35 | 00 | ZSP | 90708C | |
| ATTITUDE_GAIN1_UNIQUE | V97U2666C | NONE | F | S | M | P | G4.35 | 00 | OSE | 90708C | |
| ATTITUDE_GAIN1_VERNIER | V97U2657C | ND | F | S | D | P | G4.35 | 00 | OSE | 90708C | |
| ATTITUDE_GAIN2_PRIMARY | V97U2658C | ND | F | S | D | P | G4.35 | 00 | OSE | 90708C | |
| ATTITUDE_GAIN2_TVC | V96U9812C | NONE | F | S | D | P | G4.35 | 00 | ZSP | 90708C | |
| ATTITUDE_GAIN2_UNIQUE | V97U2667C | NONE | F | S | M | P | G4.35 | 00 | OSE | 90708C | |
| ATTITUDE_GAIN2_VERNIER | V97U2660C | ND | F | S | D | P | G4.35 | 00 | OSE | 90708C | |
| CANDIDATE_ALT_THRESHOLD | V97U6303C | NONE | F | S | M | P | G4.35 | 00 | OVJ | 90709B | |
| CANDIDATE_VERN_THRESHOLD | V97U6307C | NONE | F | S | M | P | G4.35 | 00 | OVJ | 90709B | |
| CG_ARRAY(1,1) | V97U2511C | IN | F | S | M | P | G4.35 | 00 | OA1 | 90708C | |
| CG_ARRAY(1,2) | V97U2512C | IN | F | S | M | P | G4.35 | 00 | OA1 | 90708C | |
| CG_ARRAY(1,3) | V97U2513C | IN | F | S | M | P | G4.35 | 00 | OA1 | 90708C | |
| CG_ARRAY(2,1) | V97U2514C | IN | F | S | M | P | G4.35 | 00 | OA2 | 90708C | |
| CG_ARRAY(2,2) | V97U2515C | IN | F | S | M | P | G4.35 | 00 | OA2 | 90708C | |
| CG_ARRAY(2,3) | V97U2516C | IN | F | S | M | P | G4.35 | 00 | OA2 | 90708C | |
| CG_ARRAY(3,1) | V97U2517C | IN | F | S | M | P | G4.35 | 00 | OA3 | 90708C | |
| CG_ARRAY(3,2) | V97U2518C | IN | F | S | M | P | G4.35 | 00 | OA3 | 90708C | |
| CG_ARRAY(3,3) | V97U2519C | IN | F | S | M | P | G4.35 | 00 | OA3 | 90708C | |
| CG_ARRAY(4,1) | V97U2520C | IN | F | S | M | P | G4.35 | 00 | OA4 | 90708C | |
| CG_ARRAY(4,2) | V97U2521C | IN | F | S | M | P | G4.35 | 00 | OA4 | 90708C | |
| CG_ARRAY(4,3) | V97U2522C | IN | F | S | M | P | G4.35 | 00 | OA4 | 90708C | |
| CG_ARRAY(5,1) | V97U2523C | IN | F | S | M | P | G4.35 | 00 | OA5 | 90708C | |
| CG_ARRAY(5,2) | V97U2524C | IN | F | S | M | P | G4.35 | 00 | OA5 | 90708C | |
| CG_ARRAY(5,3) | V97U2525C | IN | F | S | M | P | G4.35 | 00 | OA5 | 90708C | |
| CG_ARRAY(6,1) | V97U2526C | IN | F | S | M | P | G4.35 | 00 | OA6 | 90708C | |
| CG_ARRAY(6,2) | V97U2527C | IN | F | S | M | P | G4.35 | 00 | OA6 | 90708C | |

TABLE 4.2.4-3. ONORBIT DIGITAL AUTOPILOT (G4.35) I-LOADS

| FSSR NAME | MSID | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R E V |
|--------------------------------|-----------|------------|----|----|---|---|---------|----|-----|---------|-------------|
| CG_ARRAY (6,3) | V97U2528C | IN | F | S | M | P | G4.35 | 00 | OA6 | 90708C | |
| CG_ARRAY (7,1) | V97U2529C | IN | F | S | M | P | G4.35 | 00 | OA7 | 90708C | |
| CG_ARRAY (7,2) | V97U2530C | IN | F | S | M | P | G4.35 | 00 | OA7 | 90708C | |
| CG_ARRAY (7,3) | V97U2531C | IN | F | S | M | P | G4.35 | 00 | OA7 | 90708C | |
| CG_ARRAY (8,1) | V97U2532C | IN | F | S | M | P | G4.35 | 00 | OA8 | 90708C | |
| CG_ARRAY (8,2) | V97U2533C | IN | F | S | M | P | G4.35 | 00 | OA8 | 90708C | |
| CG_ARRAY (8,3) | V97U2534C | IN | F | S | M | P | G4.35 | 00 | OA8 | 90708C | |
| CG_ARRAY (9,1) | V97U2535C | IN | F | S | M | P | G4.35 | 00 | OA9 | 90708C | |
| CG_ARRAY (9,2) | V97U2536C | IN | F | S | M | P | G4.35 | 00 | OA9 | 90708C | |
| CG_ARRAY (9,3) | V97U2537C | IN | F | S | M | P | G4.35 | 00 | OA9 | 90708C | |
| CG_NOM (1) | V97U2508C | IN | F | S | M | P | G4.35 | 00 | OMI | 90708C | |
| CG_NOM (2) | V97U2509C | IN | F | S | M | P | G4.35 | 00 | OMI | 90708C | |
| CG_NOM (3) | V97U2510C | IN | F | S | M | P | G4.35 | 00 | OMI | 90708C | |
| CNTR_MAX | V97U2399C | NONE | I | S | D | P | G4.35 | 00 | ZSP | 93081A | |
| CNTR_MIN | V97U2400C | NONE | I | S | D | P | G4.35 | 00 | ZSP | 93081A | |
| CNTR_SCALE | V97U2401C | NONE | F | S | D | P | G4.35 | 00 | ZSP | 93081A | |
| CYCLE_PAUSE | V99U5737C | ND | I | S | M | P | G4.35 | 00 | ODS | 90837G | |
| DELTAV_MINIMP_SCALE_FACTOR | V97U2664C | SEC | F | S | D | P | G4.35 | 00 | ZSP | 90708C | |
| DOCKING_FLT | V99U5728C | ND | D | | M | P | G4.35 | 00 | ODS | 90837G | |
| JET_MAG_THRESHOLD (1) | V97U6304C | NONE | F | S | M | P | G4.35 | 00 | OVJ | 90709B | |
| JET_MAG_THRESHOLD (2) | V97U6305C | NONE | F | S | M | P | G4.35 | 00 | OVJ | 90709B | |
| JET_MAG_THRESHOLD (3) | V97U6306C | NONE | F | S | M | P | G4.35 | 00 | OVJ | 90709B | |
| JET_MIN_IMPULSE | V97U6302C | NONE | F | S | M | P | G4.35 | 00 | OVJ | 90709B | |
| KH | V97U9041C | ND | F | S | D | P | G4.35 | 00 | ZSP | 90708C | |
| KLEDGE | V99U7609C | DEG | F | S | D | P | G4.35 | 00 | OPR | 90708C | |
| KTRK | V96U8095C | ND | F | S | D | P | G4.35 | 00 | ZSP | 90708C | |
| MAG_CONTROL_ACCEL_REF_PRIM (1) | V98U9941C | DEG/SEC**2 | F | S | M | P | G4.35 | 00 | OPR | 90708C | |
| MAG_CONTROL_ACCEL_REF_PRIM (2) | V98U9942C | DEG/SEC**2 | F | S | M | P | G4.35 | 00 | OPR | 90708C | |
| MAG_CONTROL_ACCEL_REF_PRIM (3) | V98U9943C | DEG/SEC**2 | F | S | M | P | G4.35 | 00 | OPR | 90708C | |
| MAG_CONTROL_FORCE (1) | V97U2957C | LB | F | S | D | P | G4.35 | 00 | ZFP | 79862F | |
| | | | | | | | G6.1 | | | | |
| MAG_CONTROL_FORCE (2) | V97U2958C | LB | F | S | D | P | G4.35 | 00 | ZFP | 79862F | |
| | | | | | | | G6.1 | | | | |
| MAG_CONTROL_FORCE (3) | V97U2959C | LB | F | S | D | P | G4.35 | 00 | ZFP | 79862F | |
| | | | | | | | G6.1 | | | | |
| MAX_NUM_CYCLES | V99U5729C | ND | I | S | M | P | G4.35 | 00 | ODS | 90837G | |
| MAX_REPEAT | V97U2783C | ND | I | S | D | P | G4.35 | 00 | OVJ | 90709B | |
| MCA_SF | V97U2402C | NONE | F | S | D | P | G4.35 | 00 | ZSP | 93081A | |
| MIN_ANGLE_JET_SEL_VALUE | V97U6301C | NONE | I | S | M | P | G4.35 | 00 | OVJ | 90709B | |
| MOMENTS_OF_INERTIA_ARRAY (1,1) | V97U2541C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA1 | 90708C | |
| MOMENTS_OF_INERTIA_ARRAY (1,2) | V97U2542C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA1 | 90708C | |
| MOMENTS_OF_INERTIA_ARRAY (1,3) | V97U2543C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA1 | 90708C | |
| MOMENTS_OF_INERTIA_ARRAY (2,1) | V97U2544C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA2 | 90708C | |
| MOMENTS_OF_INERTIA_ARRAY (2,2) | V97U2545C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA2 | 90708C | |
| MOMENTS_OF_INERTIA_ARRAY (2,3) | V97U2546C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA2 | 90708C | |
| MOMENTS_OF_INERTIA_ARRAY (3,1) | V97U2547C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA3 | 90708C | |
| MOMENTS_OF_INERTIA_ARRAY (3,2) | V97U2548C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA3 | 90708C | |

TABLE 4.2.4-3. ONORBIT DIGITAL AUTOPILOT (G4.35) I-LOADS

| FSSR NAME | MSID | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R E V |
|--------------------------------|-----------|------------|----|----|---|---|---------|----|-----|---------|-------------|
| MOMENTS_OF_INERTIA_ARRAY(3,3) | V97U2549C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA3 | 90708C | |
| MOMENTS_OF_INERTIA_ARRAY(4,1) | V97U2550C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA4 | 90708C | |
| MOMENTS_OF_INERTIA_ARRAY(4,2) | V97U2551C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA4 | 90708C | |
| MOMENTS_OF_INERTIA_ARRAY(4,3) | V97U2552C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA4 | 90708C | |
| MOMENTS_OF_INERTIA_ARRAY(5,1) | V97U2553C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA5 | 90708C | |
| MOMENTS_OF_INERTIA_ARRAY(5,2) | V97U2554C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA5 | 90708C | |
| MOMENTS_OF_INERTIA_ARRAY(5,3) | V97U2555C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA5 | 90708C | |
| MOMENTS_OF_INERTIA_ARRAY(6,1) | V97U2556C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA6 | 90708C | |
| MOMENTS_OF_INERTIA_ARRAY(6,2) | V97U2557C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA6 | 90708C | |
| MOMENTS_OF_INERTIA_ARRAY(6,3) | V97U2558C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA6 | 90708C | |
| MOMENTS_OF_INERTIA_ARRAY(7,1) | V97U2559C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA7 | 90708C | |
| MOMENTS_OF_INERTIA_ARRAY(7,2) | V97U2560C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA7 | 90708C | |
| MOMENTS_OF_INERTIA_ARRAY(7,3) | V97U2561C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA7 | 90708C | |
| MOMENTS_OF_INERTIA_ARRAY(8,1) | V97U2562C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA8 | 90708C | |
| MOMENTS_OF_INERTIA_ARRAY(8,2) | V97U2563C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA8 | 90708C | |
| MOMENTS_OF_INERTIA_ARRAY(8,3) | V97U2564C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA8 | 90708C | |
| MOMENTS_OF_INERTIA_ARRAY(9,1) | V97U2565C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA9 | 90708C | |
| MOMENTS_OF_INERTIA_ARRAY(9,2) | V97U2566C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA9 | 90708C | |
| MOMENTS_OF_INERTIA_ARRAY(9,3) | V97U2567C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA9 | 90708C | |
| MOMENTS_OF_INERTIA_NOM(1) | V97U2538C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OMI | 90708C | |
| MOMENTS_OF_INERTIA_NOM(2) | V97U2539C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OMI | 90708C | |
| MOMENTS_OF_INERTIA_NOM(3) | V97U2540C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OMI | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(1,1,1) | V97U3101C | HZ | F | S | M | P | G4.35 | 00 | OA1 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(1,1,2) | V97U3102C | HZ | F | S | M | P | G4.35 | 00 | OA1 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(1,2,1) | V97U3103C | HZ | F | S | M | P | G4.35 | 00 | OA1 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(1,2,2) | V97U3104C | HZ | F | S | M | P | G4.35 | 00 | OA1 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(1,3,1) | V97U3105C | HZ | F | S | M | P | G4.35 | 00 | OA1 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(1,3,2) | V97U3106C | HZ | F | S | M | P | G4.35 | 00 | OA1 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(1,4,1) | V97U3107C | HZ | F | S | M | P | G4.35 | 00 | OA1 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(1,4,2) | V97U3108C | HZ | F | S | M | P | G4.35 | 00 | OA1 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(1,5,1) | V97U3109C | HZ | F | S | M | P | G4.35 | 00 | OA1 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(1,5,2) | V97U3110C | HZ | F | S | M | P | G4.35 | 00 | OA1 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(1,6,1) | V97U3111C | HZ | F | S | M | P | G4.35 | 00 | OA1 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(1,6,2) | V97U3112C | HZ | F | S | M | P | G4.35 | 00 | OA1 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(2,1,1) | V97U3113C | HZ | F | S | M | P | G4.35 | 00 | OA2 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(2,1,2) | V97U3114C | HZ | F | S | M | P | G4.35 | 00 | OA2 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(2,2,1) | V97U3115C | HZ | F | S | M | P | G4.35 | 00 | OA2 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(2,2,2) | V97U3116C | HZ | F | S | M | P | G4.35 | 00 | OA2 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(2,3,1) | V97U3117C | HZ | F | S | M | P | G4.35 | 00 | OA2 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(2,3,2) | V97U3118C | HZ | F | S | M | P | G4.35 | 00 | OA2 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(2,4,1) | V97U3119C | HZ | F | S | M | P | G4.35 | 00 | OA2 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(2,4,2) | V97U3120C | HZ | F | S | M | P | G4.35 | 00 | OA2 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(2,5,1) | V97U3121C | HZ | F | S | M | P | G4.35 | 00 | OA2 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(2,5,2) | V97U3122C | HZ | F | S | M | P | G4.35 | 00 | OA2 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(2,6,1) | V97U3123C | HZ | F | S | M | P | G4.35 | 00 | OA2 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(2,6,2) | V97U3124C | HZ | F | S | M | P | G4.35 | 00 | OA2 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(3,1,1) | V97U3125C | HZ | F | S | M | P | G4.35 | 00 | OA3 | 90708C | |

TABLE 4.2.4-3. ONORBIT DIGITAL AUTOPILOT (G4.35) I-LOADS

| FSSR NAME | MSID | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R E V |
|--------------------------------|-----------|-----------|----|----|---|---|---------|----|-----|---------|-------------|
| NOTCH_LOWER_UPPER_FREQS(3,1,2) | V97U3126C | HZ | F | S | M | P | G4.35 | 00 | OA3 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(3,2,1) | V97U3127C | HZ | F | S | M | P | G4.35 | 00 | OA3 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(3,2,2) | V97U3128C | HZ | F | S | M | P | G4.35 | 00 | OA3 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(3,3,1) | V97U3129C | HZ | F | S | M | P | G4.35 | 00 | OA3 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(3,3,2) | V97U3130C | HZ | F | S | M | P | G4.35 | 00 | OA3 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(3,4,1) | V97U3131C | HZ | F | S | M | P | G4.35 | 00 | OA3 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(3,4,2) | V97U3132C | HZ | F | S | M | P | G4.35 | 00 | OA3 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(3,5,1) | V97U3133C | HZ | F | S | M | P | G4.35 | 00 | OA3 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(3,5,2) | V97U3134C | HZ | F | S | M | P | G4.35 | 00 | OA3 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(3,6,1) | V97U3135C | HZ | F | S | M | P | G4.35 | 00 | OA3 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(3,6,2) | V97U3136C | HZ | F | S | M | P | G4.35 | 00 | OA3 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(4,1,1) | V97U3137C | HZ | F | S | M | P | G4.35 | 00 | OA4 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(4,1,2) | V97U3138C | HZ | F | S | M | P | G4.35 | 00 | OA4 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(4,2,1) | V97U3139C | HZ | F | S | M | P | G4.35 | 00 | OA4 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(4,2,2) | V97U3140C | HZ | F | S | M | P | G4.35 | 00 | OA4 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(4,3,1) | V97U3141C | HZ | F | S | M | P | G4.35 | 00 | OA4 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(4,3,2) | V97U3142C | HZ | F | S | M | P | G4.35 | 00 | OA4 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(4,4,1) | V97U3143C | HZ | F | S | M | P | G4.35 | 00 | OA4 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(4,4,2) | V97U3144C | HZ | F | S | M | P | G4.35 | 00 | OA4 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(4,5,1) | V97U3145C | HZ | F | S | M | P | G4.35 | 00 | OA4 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(4,5,2) | V97U3146C | HZ | F | S | M | P | G4.35 | 00 | OA4 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(4,6,1) | V97U3147C | HZ | F | S | M | P | G4.35 | 00 | OA4 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(4,6,2) | V97U3148C | HZ | F | S | M | P | G4.35 | 00 | OA4 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(5,1,1) | V97U3149C | HZ | F | S | M | P | G4.35 | 00 | OA5 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(5,1,2) | V97U3150C | HZ | F | S | M | P | G4.35 | 00 | OA5 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(5,2,1) | V97U3151C | HZ | F | S | M | P | G4.35 | 00 | OA5 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(5,2,2) | V97U3152C | HZ | F | S | M | P | G4.35 | 00 | OA5 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(5,3,1) | V97U3153C | HZ | F | S | M | P | G4.35 | 00 | OA5 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(5,3,2) | V97U3154C | HZ | F | S | M | P | G4.35 | 00 | OA5 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(5,4,1) | V97U3155C | HZ | F | S | M | P | G4.35 | 00 | OA5 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(5,4,2) | V97U3156C | HZ | F | S | M | P | G4.35 | 00 | OA5 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(5,5,1) | V97U3157C | HZ | F | S | M | P | G4.35 | 00 | OA5 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(5,5,2) | V97U3158C | HZ | F | S | M | P | G4.35 | 00 | OA5 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(5,6,1) | V97U3159C | HZ | F | S | M | P | G4.35 | 00 | OA5 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(5,6,2) | V97U3160C | HZ | F | S | M | P | G4.35 | 00 | OA5 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(6,1,1) | V97U2598C | HZ | F | S | M | P | G4.35 | 00 | OA6 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(6,1,2) | V97U2599C | HZ | F | S | M | P | G4.35 | 00 | OA6 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(6,2,1) | V97U2600C | HZ | F | S | M | P | G4.35 | 00 | OA6 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(6,2,2) | V97U2601C | HZ | F | S | M | P | G4.35 | 00 | OA6 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(6,3,1) | V97U2602C | HZ | F | S | M | P | G4.35 | 00 | OA6 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(6,3,2) | V97U2603C | HZ | F | S | M | P | G4.35 | 00 | OA6 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(6,4,1) | V97U2604C | HZ | F | S | M | P | G4.35 | 00 | OA6 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(6,4,2) | V97U2605C | HZ | F | S | M | P | G4.35 | 00 | OA6 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(6,5,1) | V97U2606C | HZ | F | S | M | P | G4.35 | 00 | OA6 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(6,5,2) | V97U2607C | HZ | F | S | M | P | G4.35 | 00 | OA6 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(6,6,1) | V97U2608C | HZ | F | S | M | P | G4.35 | 00 | OA6 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(6,6,2) | V97U2609C | HZ | F | S | M | P | G4.35 | 00 | OA6 | 90708C | |

TABLE 4.2.4-3. ONORBIT DIGITAL AUTOPILOT (G4.35) I-LOADS

| FSSR NAME | MSID | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R E V |
|--------------------------------|-----------|-----------|----|----|---|---|---------|----|-----|---------|-------------|
| NOTCH_LOWER_UPPER_FREQS(7,1,1) | V97U2610C | HZ | F | S | M | P | G4.35 | 00 | OA7 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(7,1,2) | V97U2611C | HZ | F | S | M | P | G4.35 | 00 | OA7 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(7,2,1) | V97U2612C | HZ | F | S | M | P | G4.35 | 00 | OA7 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(7,2,2) | V97U2613C | HZ | F | S | M | P | G4.35 | 00 | OA7 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(7,3,1) | V97U2614C | HZ | F | S | M | P | G4.35 | 00 | OA7 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(7,3,2) | V97U2615C | HZ | F | S | M | P | G4.35 | 00 | OA7 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(7,4,1) | V97U2616C | HZ | F | S | M | P | G4.35 | 00 | OA7 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(7,4,2) | V97U2617C | HZ | F | S | M | P | G4.35 | 00 | OA7 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(7,5,1) | V97U2618C | HZ | F | S | M | P | G4.35 | 00 | OA7 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(7,5,2) | V97U2619C | HZ | F | S | M | P | G4.35 | 00 | OA7 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(7,6,1) | V97U2620C | HZ | F | S | M | P | G4.35 | 00 | OA7 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(7,6,2) | V97U2621C | HZ | F | S | M | P | G4.35 | 00 | OA7 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(8,1,1) | V97U2622C | HZ | F | S | M | P | G4.35 | 00 | OA8 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(8,1,2) | V97U2623C | HZ | F | S | M | P | G4.35 | 00 | OA8 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(8,2,1) | V97U2624C | HZ | F | S | M | P | G4.35 | 00 | OA8 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(8,2,2) | V97U2625C | HZ | F | S | M | P | G4.35 | 00 | OA8 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(8,3,1) | V97U2626C | HZ | F | S | M | P | G4.35 | 00 | OA8 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(8,3,2) | V97U2627C | HZ | F | S | M | P | G4.35 | 00 | OA8 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(8,4,1) | V97U2628C | HZ | F | S | M | P | G4.35 | 00 | OA8 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(8,4,2) | V97U2629C | HZ | F | S | M | P | G4.35 | 00 | OA8 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(8,5,1) | V97U2630C | HZ | F | S | M | P | G4.35 | 00 | OA8 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(8,5,2) | V97U2631C | HZ | F | S | M | P | G4.35 | 00 | OA8 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(8,6,1) | V97U2632C | HZ | F | S | M | P | G4.35 | 00 | OA8 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(8,6,2) | V97U2633C | HZ | F | S | M | P | G4.35 | 00 | OA8 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(9,1,1) | V97U2634C | HZ | F | S | M | P | G4.35 | 00 | OA9 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(9,1,2) | V97U2635C | HZ | F | S | M | P | G4.35 | 00 | OA9 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(9,2,1) | V97U2636C | HZ | F | S | M | P | G4.35 | 00 | OA9 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(9,2,2) | V97U2637C | HZ | F | S | M | P | G4.35 | 00 | OA9 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(9,3,1) | V97U2638C | HZ | F | S | M | P | G4.35 | 00 | OA9 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(9,3,2) | V97U2639C | HZ | F | S | M | P | G4.35 | 00 | OA9 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(9,4,1) | V97U2640C | HZ | F | S | M | P | G4.35 | 00 | OA9 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(9,4,2) | V97U2641C | HZ | F | S | M | P | G4.35 | 00 | OA9 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(9,5,1) | V97U2642C | HZ | F | S | M | P | G4.35 | 00 | OA9 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(9,5,2) | V97U2643C | HZ | F | S | M | P | G4.35 | 00 | OA9 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(9,6,1) | V97U2644C | HZ | F | S | M | P | G4.35 | 00 | OA9 | 90708C | |
| NOTCH_LOWER_UPPER_FREQS(9,6,2) | V97U2645C | HZ | F | S | M | P | G4.35 | 00 | OA9 | 90708C | |
| NUM_FILTERS(1) | V97U3161C | ND | I | S | M | P | G4.35 | 00 | OA1 | 90708C | |
| NUM_FILTERS(2) | V97U3162C | ND | I | S | M | P | G4.35 | 00 | OA2 | 90708C | |
| NUM_FILTERS(3) | V97U3163C | ND | I | S | M | P | G4.35 | 00 | OA3 | 90708C | |
| NUM_FILTERS(4) | V97U3164C | ND | I | S | M | P | G4.35 | 00 | OA4 | 90708C | |
| NUM_FILTERS(5) | V97U3165C | ND | I | S | M | P | G4.35 | 00 | OA5 | 90708C | |
| NUM_FILTERS(6) | V97U2646C | ND | I | S | M | P | G4.35 | 00 | OA6 | 90708C | |
| NUM_FILTERS(7) | V97U2647C | ND | I | S | M | P | G4.35 | 00 | OA7 | 90708C | |
| NUM_FILTERS(8) | V97U2648C | ND | I | S | M | P | G4.35 | 00 | OA8 | 90708C | |
| NUM_FILTERS(9) | V97U2649C | ND | I | S | M | P | G4.35 | 00 | OA9 | 90708C | |
| PCT_ALT_RCS | V99U5744C | ND | D | | M | P | G4.35 | 00 | ODS | 92323 | |
| PCT_AUTO | V99U5740C | ND | D | | M | P | G4.35 | 00 | ODS | 92323 | |

TABLE 4.2.4-3. ONORBIT DIGITAL AUTOPILOT (G4.35) I-LOADS

| FSSR NAME | MSID | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R E V |
|--------------------------------|-----------|------------|----|----|---|---|---------------|----|-----|---------|-------------|
| PCT_DAP_A | V99U5738C | ND | D | | M | P | G4.35 | 00 | ODS | 92323 | |
| PCT_DAP_B | V99U5739C | ND | D | | M | P | G4.35 | 00 | ODS | 92323 | |
| PCT_DAP_LOAD(1) | V99U5762C | ND | I | S | M | P | G4.35 | 00 | ODS | 92323 | |
| PCT_DAP_LOAD(2) | V99U5763C | ND | I | S | M | P | G4.35 | 00 | ODS | 92323 | |
| PCT_DISC_RATE_PITCH | V99U5753C | ND | D | | M | P | G4.35 | 00 | ODS | 92323 | |
| PCT_DISC_RATE_ROLL | V99U5752C | ND | D | | M | P | G4.35 | 00 | ODS | 92323 | |
| PCT_DISC_RATE_YAW | V99U5754C | ND | D | | M | P | G4.35 | 00 | ODS | 92323 | |
| PCT_HIGH_Z | V99U5747C | ND | D | | M | P | G4.35 | 00 | ODS | 92323 | |
| PCT_LOW_Z | V99U5760C | ND | D | | M | P | G4.35 | 00 | ODS | 92323 | |
| PCT_MANUAL_INRTL | V99U5741C | ND | D | | M | P | G4.35 | 00 | ODS | 92323 | |
| PCT_MAN_FREE | V99U5759C | ND | D | | M | P | G4.35 | 00 | ODS | 92323 | |
| PCT_MAN_LVLH | V99U5758C | ND | D | | M | P | G4.35 | 00 | ODS | 92323 | |
| PCT_NORM_X | V99U5745C | ND | D | | M | P | G4.35 | 00 | ODS | 92323 | |
| PCT_NORM_Y | V99U5746C | ND | D | | M | P | G4.35 | 00 | ODS | 92323 | |
| PCT_NORM_Z | V99U5748C | ND | D | | M | P | G4.35 | 00 | ODS | 92323 | |
| PCT_PRCS | V99U5742C | ND | D | | M | P | G4.35 | 00 | ODS | 92323 | |
| PCT_PULSE_PITCH | V99U5756C | ND | D | | M | P | G4.35 | 00 | ODS | 92323 | |
| PCT_PULSE_ROLL | V99U5755C | ND | D | | M | P | G4.35 | 00 | ODS | 92323 | |
| PCT_PULSE_X | V99U5749C | ND | D | | M | P | G4.35 | 00 | ODS | 92323 | |
| PCT_PULSE_Y | V99U5750C | ND | D | | M | P | G4.35 | 00 | ODS | 92323 | |
| PCT_PULSE_YAW | V99U5757C | ND | D | | M | P | G4.35 | 00 | ODS | 92323 | |
| PCT_PULSE_Z | V99U5751C | ND | D | | M | P | G4.35 | 00 | ODS | 92323 | |
| PCT_SPARE | V99U5761C | ND | D | | M | P | G4.35 | 00 | ODS | 92323 | |
| PCT_VRCS | V99U5743C | ND | D | | M | P | G4.35 | 00 | ODS | 92323 | |
| PHASE1_DELAY | V99U5732C | ND | I | S | M | P | G4.35 | 00 | ODS | 90837G | |
| PHASE1_DELAY_PHASE2 | V99U5733C | ND | I | S | M | P | G4.35 | 00 | ODS | 90837G | |
| PHASE1_GRP_CMD(1) | V97U7460C | ND | I | S | M | P | G4.35 | 00 | ODS | 90952B | |
| PHASE1_GRP_CMD(2) | V97U7461C | ND | I | S | M | P | G4.35 | 00 | ODS | 90952B | |
| PHASE1_GRP_CMD(3) | V97U7462C | ND | I | S | M | P | G4.35 | 00 | ODS | 90952B | |
| PHASE1_GRP_CMD(4) | V97U7463C | ND | I | S | M | P | G4.35 | 00 | ODS | 90952B | |
| PHASE1_MAX_PULSES | V99U5730C | ND | I | S | M | P | G4.35 | 00 | ODS | 90837G | |
| PHASE1_PULSE_ON | V99U5731C | ND | I | S | M | P | G4.35 | 00 | ODS | 90837G | |
| PHASE2_DELAY | V99U5736C | ND | I | S | M | P | G4.35 | 00 | ODS | 90837G | |
| PHASE2_GRP_CMD(1) | V97U7464C | ND | I | S | M | P | G4.35 | 00 | ODS | 90952B | |
| PHASE2_GRP_CMD(2) | V97U7465C | ND | I | S | M | P | G4.35 | 00 | ODS | 90952B | |
| PHASE2_GRP_CMD(3) | V97U7466C | ND | I | S | M | P | G4.35 | 00 | ODS | 90952B | |
| PHASE2_GRP_CMD(4) | V97U7467C | ND | I | S | M | P | G4.35 | 00 | ODS | 90952B | |
| PHASE2_MAX_PULSES | V99U5734C | ND | I | S | M | P | G4.35 | 00 | ODS | 90837G | |
| PHASE2_PULSE_ON | V99U5735C | ND | I | S | M | P | G4.35 | 00 | ODS | 90837G | |
| PHASE_PLANE_ACCEL_SCALE_FACTOR | V97U2795C | ND | F | S | D | P | G4.35 | 00 | ZSP | 90708C | |
| PRIMARY_ROT_MIN_IMPULSE | V97U2797C | DEG/SEC | F | S | M | P | G4.35 | 00 | OPR | 90708C | |
| PRINCIPAL_INERTIA_REF(1) | V98U9938C | SLUG*FT**2 | F | S | M | P | G4.35 G5.8 | 00 | OMI | 90708C | |
| PRINCIPAL_INERTIA_REF(2) | V98U9939C | SLUG*FT**2 | F | S | M | P | G4.35 G5.8 | 00 | OMI | 90708C | |
| PRINCIPAL_INERTIA_REF(3) | V98U9940C | SLUG*FT**2 | F | S | M | P | G4.35 G5.8 | 00 | OMI | 90708C | |

TABLE 4.2.4-3. ONORBIT DIGITAL AUTOPILOT (G4.35) I-LOADS

| FSSR NAME | MSID | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R E V |
|--------------------------------|-----------|------------|----|----|---|---|---------|----|-----|---------|-------------|
| PRODUCTS_OF_INERTIA_ARRAY(1,1) | V97U2571C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA1 | 90708C | |
| PRODUCTS_OF_INERTIA_ARRAY(1,2) | V97U2572C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA1 | 90708C | |
| PRODUCTS_OF_INERTIA_ARRAY(1,3) | V97U2573C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA1 | 90708C | |
| PRODUCTS_OF_INERTIA_ARRAY(2,1) | V97U2574C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA2 | 90708C | |
| PRODUCTS_OF_INERTIA_ARRAY(2,2) | V97U2575C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA2 | 90708C | |
| PRODUCTS_OF_INERTIA_ARRAY(2,3) | V97U2576C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA2 | 90708C | |
| PRODUCTS_OF_INERTIA_ARRAY(3,1) | V97U2577C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA3 | 90708C | |
| PRODUCTS_OF_INERTIA_ARRAY(3,2) | V97U2578C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA3 | 90708C | |
| PRODUCTS_OF_INERTIA_ARRAY(3,3) | V97U2579C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA3 | 90708C | |
| PRODUCTS_OF_INERTIA_ARRAY(4,1) | V97U2580C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA4 | 90708C | |
| PRODUCTS_OF_INERTIA_ARRAY(4,2) | V97U2581C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA4 | 90708C | |
| PRODUCTS_OF_INERTIA_ARRAY(4,3) | V97U2582C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA4 | 90708C | |
| PRODUCTS_OF_INERTIA_ARRAY(5,1) | V97U2583C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA5 | 90708C | |
| PRODUCTS_OF_INERTIA_ARRAY(5,2) | V97U2584C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA5 | 90708C | |
| PRODUCTS_OF_INERTIA_ARRAY(5,3) | V97U2585C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA5 | 90708C | |
| PRODUCTS_OF_INERTIA_ARRAY(6,1) | V97U2586C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA6 | 90708C | |
| PRODUCTS_OF_INERTIA_ARRAY(6,2) | V97U2587C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA6 | 90708C | |
| PRODUCTS_OF_INERTIA_ARRAY(6,3) | V97U2588C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA6 | 90708C | |
| PRODUCTS_OF_INERTIA_ARRAY(7,1) | V97U2589C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA7 | 90708C | |
| PRODUCTS_OF_INERTIA_ARRAY(7,2) | V97U2590C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA7 | 90708C | |
| PRODUCTS_OF_INERTIA_ARRAY(7,3) | V97U2591C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA7 | 90708C | |
| PRODUCTS_OF_INERTIA_ARRAY(8,1) | V97U2592C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA8 | 90708C | |
| PRODUCTS_OF_INERTIA_ARRAY(8,2) | V97U2593C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA8 | 90708C | |
| PRODUCTS_OF_INERTIA_ARRAY(8,3) | V97U2594C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA8 | 90708C | |
| PRODUCTS_OF_INERTIA_ARRAY(9,1) | V97U2595C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA9 | 90708C | |
| PRODUCTS_OF_INERTIA_ARRAY(9,2) | V97U2596C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA9 | 90708C | |
| PRODUCTS_OF_INERTIA_ARRAY(9,3) | V97U2597C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OA9 | 90708C | |
| PRODUCTS_OF_INERTIA_NOM(1) | V97U2568C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OMI | 90708C | |
| PRODUCTS_OF_INERTIA_NOM(2) | V97U2569C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OMI | 90708C | |
| PRODUCTS_OF_INERTIA_NOM(3) | V97U2570C | SLUG*FT**2 | F | S | M | P | G4.35 | 00 | OMI | 90708C | |
| RATE_GAIN1_PRIMARY | V97U2952C | ND | F | S | D | P | G4.35 | 00 | OSE | 90708C | |
| RATE_GAIN1_TVC | V96U9813C | NONE | F | S | D | P | G4.35 | 00 | ZSP | 90708C | |
| RATE_GAIN1_UNIQUE | V97U2668C | NONE | F | S | M | P | G4.35 | 00 | OSE | 90708C | |
| RATE_GAIN1_VERNIER | V97U2822C | ND | F | S | D | P | G4.35 | 00 | OSE | 90708C | |
| RATE_GAIN2_PRIMARY | V97U2823C | ND | F | S | D | P | G4.35 | 00 | OSE | 90708C | |
| RATE_GAIN2_TVC | V96U9814C | NONE | F | S | D | P | G4.35 | 00 | ZSP | 90708C | |
| RATE_GAIN2_UNIQUE | V97U2669C | NONE | F | S | M | P | G4.35 | 00 | OSE | 90708C | |
| RATE_GAIN2_VERNIER | V97U2825C | ND | F | S | D | P | G4.35 | 00 | OSE | 90708C | |
| RBST_GROUPS(1,1) | V96U8201C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_GROUPS(1,2) | V96U8202C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_GROUPS(1,3) | V96U8203C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_GROUPS(1,4) | V96U8204C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_GROUPS(1,5) | V96U8205C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_GROUPS(1,6) | V96U8206C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_GROUPS(2,1) | V96U8207C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_GROUPS(2,2) | V96U8208C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_GROUPS(2,3) | V96U8209C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |

TABLE 4.2.4-3. ONORBIT DIGITAL AUTOPILOT (G4.35) I-LOADS

| FSSR NAME | MSID | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R E V |
|--------------------------|-----------|-----------|----|----|---|---|---------|----|-----|---------|-------------|
| RBST_GROUPS(2,4) | V96U8210C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_GROUPS(2,5) | V96U8211C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_GROUPS(2,6) | V96U8212C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_GROUPS(3,1) | V96U8213C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_GROUPS(3,2) | V96U8214C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_GROUPS(3,3) | V96U8215C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_GROUPS(3,4) | V96U8216C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_GROUPS(3,5) | V96U8217C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_GROUPS(3,6) | V96U8218C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_GROUPS(4,1) | V96U8219C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_GROUPS(4,2) | V96U8220C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_GROUPS(4,3) | V96U8221C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_GROUPS(4,4) | V96U8222C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_GROUPS(4,5) | V96U8223C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_GROUPS(4,6) | V96U8224C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_INTERVAL_FACTOR(1) | V96U8523C | NONE | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_INTERVAL_FACTOR(10) | V96U8532C | NONE | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_INTERVAL_FACTOR(2) | V96U8524C | NONE | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_INTERVAL_FACTOR(3) | V96U8525C | NONE | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_INTERVAL_FACTOR(4) | V96U8526C | NONE | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_INTERVAL_FACTOR(5) | V96U8527C | NONE | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_INTERVAL_FACTOR(6) | V96U8528C | NONE | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_INTERVAL_FACTOR(7) | V96U8529C | NONE | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_INTERVAL_FACTOR(8) | V96U8530C | NONE | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_INTERVAL_FACTOR(9) | V96U8531C | NONE | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_NUMJETS(1,1) | V96U8381C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_NUMJETS(1,2) | V96U8382C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_NUMJETS(1,3) | V96U8383C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_NUMJETS(1,4) | V96U8384C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_NUMJETS(1,5) | V96U8385C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_NUMJETS(1,6) | V96U8386C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_NUMJETS(2,1) | V96U8387C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_NUMJETS(2,2) | V96U8388C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_NUMJETS(2,3) | V96U8389C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_NUMJETS(2,4) | V96U8390C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_NUMJETS(2,5) | V96U8391C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_NUMJETS(2,6) | V96U8392C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_NUMJETS(3,1) | V96U8393C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_NUMJETS(3,2) | V96U8394C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_NUMJETS(3,3) | V96U8395C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_NUMJETS(3,4) | V96U8396C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_NUMJETS(3,5) | V96U8397C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_NUMJETS(3,6) | V96U8398C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_NUMJETS(4,1) | V96U8399C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_NUMJETS(4,2) | V96U8400C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_NUMJETS(4,3) | V96U8401C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_NUMJETS(4,4) | V96U8402C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |

TABLE 4.2.4-3. ONORBIT DIGITAL AUTOPILOT (G4.35) I-LOADS

| FSSR NAME | MSID | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R E V |
|--------------------|-----------|-----------|----|----|---|---|---------|----|-----|---------|-------------|
| RBST_NUMJETS(4,5) | V96U8403C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_NUMJETS(4,6) | V96U8404C | NONE | I | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_ON_TIMES(1,1) | V96U8225C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_ON_TIMES(1,2) | V96U8226C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_ON_TIMES(1,3) | V96U8227C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_ON_TIMES(1,4) | V96U8228C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_ON_TIMES(1,5) | V96U8229C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_ON_TIMES(1,6) | V96U8230C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_ON_TIMES(2,1) | V96U8231C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_ON_TIMES(2,2) | V96U8232C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_ON_TIMES(2,3) | V96U8233C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_ON_TIMES(2,4) | V96U8234C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_ON_TIMES(2,5) | V96U8235C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_ON_TIMES(2,6) | V96U8236C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_ON_TIMES(3,1) | V96U8237C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_ON_TIMES(3,2) | V96U8238C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_ON_TIMES(3,3) | V96U8239C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_ON_TIMES(3,4) | V96U8240C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_ON_TIMES(3,5) | V96U8241C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_ON_TIMES(3,6) | V96U8242C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_ON_TIMES(4,1) | V96U8243C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_ON_TIMES(4,2) | V96U8244C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_ON_TIMES(4,3) | V96U8245C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_ON_TIMES(4,4) | V96U8246C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_ON_TIMES(4,5) | V96U8247C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_ON_TIMES(4,6) | V96U8248C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_PP_SF | V96U8543C | NONE | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| RBST_START(1,1) | V96U8420C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92333B | |
| RBST_START(1,2) | V96U8421C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92333B | |
| RBST_START(1,3) | V96U8422C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92333B | |
| RBST_START(1,4) | V96U8423C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92333B | |
| RBST_START(1,5) | V96U8424C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92333B | |
| RBST_START(1,6) | V96U8425C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92333B | |
| RBST_START(2,1) | V96U8426C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92333B | |
| RBST_START(2,2) | V96U8427C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92333B | |
| RBST_START(2,3) | V96U8428C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92333B | |
| RBST_START(2,4) | V96U8429C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92333B | |
| RBST_START(2,5) | V96U8430C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92333B | |
| RBST_START(2,6) | V96U8431C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92333B | |
| RBST_START(3,1) | V96U8432C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92333B | |
| RBST_START(3,2) | V96U8433C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92333B | |
| RBST_START(3,3) | V96U8434C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92333B | |
| RBST_START(3,4) | V96U8435C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92333B | |
| RBST_START(3,5) | V96U8436C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92333B | |
| RBST_START(3,6) | V96U8437C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92333B | |
| RBST_START(4,1) | V96U8438C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92333B | |
| RBST_START(4,2) | V96U8439C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92333B | |

TABLE 4.2.4-3. ONORBIT DIGITAL AUTOPILOT (G4.35) I-LOADS

| FSSR NAME | MSID | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R E V |
|-------------------------------|-----------|-----------|----|----|---|---|---------|----|-----|---------|-------------|
| RBST_START(4,3) | V96U8440C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92333B | |
| RBST_START(4,4) | V96U8441C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92333B | |
| RBST_START(4,5) | V96U8442C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92333B | |
| RBST_START(4,6) | V96U8443C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92333B | |
| ROT2TRANS_DELAY | V96U8522C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| S5_SCALE | V97U9086C | ND | F | S | D | P | G4.35 | 00 | ZSP | 92611B | |
| T1P | V98U9169C | ND | F | S | M | P | G4.35 | 00 | OVJ | 90709B | |
| T1V | V97U2879C | ND | F | S | D | P | G4.35 | 00 | OVJ | 90709B | |
| T2P | V98U9170C | ND | F | S | M | P | G4.35 | 00 | OVJ | 90709B | |
| T2V | V97U2880C | ND | F | S | D | P | G4.35 | 00 | OVJ | 90709B | |
| TRANS2ROT_DELAY | V96U8521C | SEC | F | S | M | P | G4.35 | 00 | RBS | 92187F | |
| UNIQUE_FILTER_SELECTION_VALUE | V97U2670C | NONE | I | S | M | P | G4.35 | 00 | OSE | 90809A | |
| VEHICLE_MASS | V97U2910C | SLUGS | F | S | M | P | G4.35 | 00 | OMI | 90708C | |
| VERNIER_ROT_MIN_IMPULSE | V97U2882C | DEG/SEC | F | S | M | P | G4.35 | 00 | OVR | 90708C | |
| WFRATE | V97U2883C | ND | F | S | D | P | G4.35 | 00 | ZSP | 90708C | |

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

TABLE 4.2.4-4. ONORBIT DIGITAL AUTOPILOT (G4.35) K-LOADS

| FSSR NAME DESCRIPTION | MSID | MC | KLOAD VALUE | ENG UNITS | DT | P R | S | PR FCTN | LAST CR | R E V |
|---|-----------|----|-------------|------------------|----|--------|---|-----------------|---------|-------------|
| D2 TVC FILTER COEFF(PITCH & YAW) | V97U2340C | 00 | +6.667 | E-01 ND | F | S | P | G4.201 G4.35 | 90353G | |
| D3 TVC FILTER COEFF(PITCH & YAW) | V97U2341C | 00 | +1.5484 | E+00 ND | F | S | P | G4.201 G4.35 | 90353G | |
| D4 TVC FILTER COEFF(PITCH & YAW) | V97U2342C | 00 | +6.774 | E-01 ND | F | S | P | G4.201 G4.35 | 90353G | |
| D5 TVC FILTER COEFF(ROLL) | V97U2343C | 00 | +8.5185 | E-01 ND | F | S | P | G4.201 G4.35 | 90353G | |
| DB_TVC(1) PHASE PLANE ATT DEADBD-OMS BURN | V97U2338C | 00 | +5.0000000 | E+00 DEG | F | S | C | G4.201 G4.35 | 90353G | |
| DB_TVC(2) | V97U2404C | 00 | +1.0 | E+01 DEG | F | S | P | G4.201 G4.35 | 90353G | |
| DB_TVC(3) | V97U2405C | 00 | +1.0 | E+01 DEG | F | S | P | G4.201 G4.35 | 90353G | |
| GUID_COMP_GAIN_ONE_ENGINE(1) FILTER GAIN-GUID COMPEN 1 ENG TVC | V97U2344C | 00 | +5.656 | E-04 ND | F | S | P | G4.201 G4.35 | 90353G | |
| GUID_COMP_GAIN_ONE_ENGINE(2) FILTER GAIN-GUID COMPEN 1 ENG TVC | V97U2345C | 00 | +0.0 | E+00 ND | F | S | P | G4.201 G4.35 | 90353G | |
| GUID_COMP_GAIN_ONE_ENGINE(3) FILTER GAIN-GUID COMPEN 1 ENG TVC | V97U2346C | 00 | +9.92 | E-01 ND | F | S | P | G4.201 G4.35 | 90353G | |
| GUID_COMP_GAIN_TWO_ENGINE(1) FILTER GAIN-GUID COMPEN 2 ENG TVC | V97U2347C | 00 | +2.3543 | E-02 ND | F | S | P | G4.201 G4.35 | 90353G | |
| GUID_COMP_GAIN_TWO_ENGINE(2) FILTER GAIN-GUID COMPEN 2 ENG TVC | V97U2348C | 00 | +2.2532 | E-02 ND | F | S | P | G4.201 G4.35 | 90353G | |
| GUID_COMP_GAIN_TWO_ENGINE(3) FILTER GAIN-GUID COMPEN 2 ENG TVC | V97U2349C | 00 | +9.864 | E-01 ND | F | S | P | G4.201 G4.35 | 90353G | |
| IPLIM OMS PITCH INTEGRATOR LIMIT | V97U1306C | 00 | +5.5 | E+00 DEG | F | S | C | G4.201 G4.35 | 90353G | |
| IYLIM OMS YAW INTEGRATOR | V97U1305C | 00 | +7.5 | E+00 DEG | F | S | C | G4.201 G4.35 | 90353G | |
| KINT_PY TVC INTEGRATOR GAIN | V97U2352C | 00 | +7.5 | E-02 ND | F | S | P | G4.201 G4.35 | 90353G | |
| KINT_R TVC INTEGRATOR GAIN | V97U2353C | 00 | +3.5 | E-02 ND | F | S | P | G4.201 G4.35 | 90353G | |
| KP2 PITCH FILTER GAIN FOR TVC -2 ENG | V97U2354C | 00 | +2.68 | E-01 DEG/DEG/SEC | F | S | P | G4.201 G4.35 | 90353G | |
| KR ROLL FILTER GAIN FOR TVC -2 ENG | V97U2355C | 00 | +3.12 | E-01 SEC | F | S | P | G4.201 G4.35 | 90353G | |
| KXFPY | V96U9708C | 00 | +1.7 | E-01 DEG | F | S | P | G4.201 G4.35 | 90353G | |
| KXFR | V96U9709C | 00 | +1.4 | E-01 DEG | F | S | P | G4.201 G4.35 | 90353G | |
| KY2 YAW FILTER GAIN FOR TVC - 2 ENGIN | V97U2356C | 00 | +2.78 | E-01 DEG/DEG/SEC | F | S | P | G4.201 G4.35 | 90353G | |
| LRL_TVC | V97U2422C | 00 | +3.0 | E-01 DEG/SEC | F | S | C | G4.201 G4.35 | 90353G | |

TABLE 4.2.4-4. ONORBIT DIGITAL AUTOPILOT (G4.35) K-LOADS

| FSSR NAME DESCRIPTION | MSID | MC | KLOAD VALUE | ENG UNITS | DT | P R | S | PR FCTN | LAST CR | R E V |
|-----------------------------------|-----------|----|-------------|-----------|---------------|--------|---|----------|---------|-------------|
| MIN_DVB | V97U2784C | 00 | +6.0 | E-01 | FT/SEC | F | S | P G4.201 | 90353G | |
| MIN SENCED DV FOR CF STEERING | | | | | | | | G4.35 | | |
| MR(1) | V97U2357C | 00 | +2.0000000 | E+00 | DEG/SEC | F | S | C G4.201 | 90353G | |
| MAX ANGULAR RATE DURING OMS TVC | | | | | | | | G4.35 | | |
| MR(2) | V97U2358C | 00 | +2.0000000 | E+00 | DEG/SEC | F | S | C G4.201 | 90353G | |
| MAX ANGULAR RATE DURING OMS TVC | | | | | | | | G4.35 | | |
| MR(3) | V97U2359C | 00 | +2.0000000 | E+00 | DEG/SEC | F | S | C G4.201 | 90353G | |
| MAX ANGULAR RATE DURING OMS TVC | | | | | | | | G4.35 | | |
| ONE_ENG_OMS_PITCH_TRIM | V97U2367C | 01 | +4.0 | E-01 | DEG | F | S | X G4.158 | 90353G | |
| OMS ENG PITCH TRIM ANG THRUST -CG | | 02 | -1.0 | E-01 | | | | G4.201 | | |
| | | 03 | -3.1 | E-01 | | | | G4.209 | | |
| | | | | | | | | G4.210 | | |
| | | | | | | | | G4.211 | | |
| | | | | | | | | G4.3 | | |
| | | | | | | | | G4.35 | | |
| | | | | | | | | G4.7 | | |
| ONE_ENG_OMS_YAW_TRIM(1) | V97U2368C | 01 | +5.2100000 | E+00 | DEG | F | S | C G4.158 | 90353G | |
| OMS ENG YAW TRIM ANG THRUST - CG | | 02 | +5.2100000 | E+00 | | | | G4.201 | | |
| | | 03 | +5.2100000 | E+00 | | | | G4.209 | | |
| | | | | | | | | G4.210 | | |
| | | | | | | | | G4.211 | | |
| | | | | | | | | G4.3 | | |
| | | | | | | | | G4.35 | | |
| | | | | | | | | G4.7 | | |
| ONE_ENG_OMS_YAW_TRIM(2) | V97U2369C | 01 | -5.2100000 | E+00 | DEG | F | S | C G4.158 | 90353G | |
| OMS ENG YAW TRIM ANG THRUST - CG | | 02 | -5.2100000 | E+00 | | | | G4.201 | | |
| | | 03 | -5.2100000 | E+00 | | | | G4.209 | | |
| | | | | | | | | G4.210 | | |
| | | | | | | | | G4.211 | | |
| | | | | | | | | G4.3 | | |
| | | | | | | | | G4.35 | | |
| | | | | | | | | G4.7 | | |
| PLIM | V97U2373C | 00 | +4.89 | E+00 | DEG | F | S | C G4.201 | 90353G | |
| TVC PITCH COMMAND LIMIT | | | | | | | | G4.35 | | |
| PROPGRAD(1) | V97U2374C | 00 | +1.0 | E-01 | (DEG/SEC)/DEG | F | S | C G4.201 | 90353G | |
| MANUAL TVC STICK GAIN | | | | | | | | G4.35 | | |
| PROPGRAD(2) | V97U2375C | 00 | +1.0 | E-01 | (DEG/SEC)/DEG | F | S | C G4.201 | 90353G | |
| MANUAL TVC STICK GAIN | | | | | | | | G4.35 | | |
| PROPGRAD(3) | V97U2376C | 00 | +1.8750000 | E-01 | (DEG/SEC)/DEG | F | S | C G4.201 | 90353G | |
| MANUAL TVC STICK GAIN | | | | | | | | G4.35 | | |
| REF_CG(1) | V97U6400C | 00 | +1.0767 | E+03 | IN | F | S | P G4.35 | 90708C | |
| REF_CG(2) | V97U6401C | 00 | +0.0 | E+00 | IN | F | S | P G4.35 | 90708C | |
| REF_CG(3) | V97U6402C | 00 | +3.75 | E+02 | IN | F | S | P G4.35 | 90708C | |

TABLE 4.2.4-4. ONORBIT DIGITAL AUTOPILOT (G4.35) K-LOADS

| FSSR NAME DESCRIPTION | MSID | MC | KLOAD VALUE | ENG UNITS | DT | P R | S | PR FCTN | LAST CR | R E V |
|--------------------------|-----------|----|-------------|-----------|----|--------|---|---------|---------|-------------|
| REF_FORCE(1,1) | V97U6403C | 00 | -8.751 | E+02 LBS | F | S | P | G4.35 | 90953C | |
| REF_FORCE(1,2) | V97U6404C | 00 | +0.0 | E+00 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(1,3) | V97U6405C | 00 | +1.509 | E+02 LBS | F | S | P | G4.35 | 90953C | |
| REF_FORCE(10,1) | V97U6430C | 00 | +1.3 | E+00 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(10,2) | V97U6431C | 00 | -8.698 | E+02 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(10,3) | V97U6432C | 00 | -1.17 | E+01 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(11,1) | V97U6433C | 00 | +0.0 | E+00 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(11,2) | V97U6434C | 00 | +3.93 | E+01 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(11,3) | V97U6435C | 00 | +8.711 | E+02 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(12,1) | V97U6436C | 00 | +0.0 | E+00 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(12,2) | V97U6437C | 00 | -3.93 | E+01 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(12,3) | V97U6438C | 00 | +8.711 | E+02 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(13,1) | V97U6439C | 00 | +1.96 | E+02 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(13,2) | V97U6440C | 00 | +3.051 | E+02 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(13,3) | V97U6441C | 00 | -5.887 | E+02 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(14,1) | V97U6442C | 00 | +1.96 | E+02 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(14,2) | V97U6443C | 00 | -3.051 | E+02 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(14,3) | V97U6444C | 00 | -5.887 | E+02 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(15,1) | V97U6445C | 00 | -8.0 | E-01 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(15,2) | V97U6446C | 00 | -1.7 | E+01 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(15,3) | V97U6447C | 00 | -1.76 | E+01 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(16,1) | V97U6448C | 00 | -8.0 | E-01 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(16,2) | V97U6449C | 00 | +1.7 | E+01 LBS | F | S | P | G4.35 | 90708C | |

TABLE 4.2.4-4. ONORBIT DIGITAL AUTOPILOT (G4.35) K-LOADS

| FSSR NAME DESCRIPTION | MSID | MC | KLOAD VALUE | ENG UNITS | DT | P R | S | PR FCTN | LAST CR | R E V |
|--------------------------|-----------|----|-------------|-----------|----|--------|---|---------|---------|-------------|
| REF_FORCE(16,3) | V97U6450C | 00 | -1.76 | E+01 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(17,1) | V97U6451C | 00 | +0.0 | E+00 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(17,2) | V97U6452C | 00 | -2.4 | E+01 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(17,3) | V97U6453C | 00 | -6.0 | E-01 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(18,1) | V97U6454C | 00 | +0.0 | E+00 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(18,2) | V97U6455C | 00 | +2.4 | E+01 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(18,3) | V97U6456C | 00 | -6.0 | E-01 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(19,1) | V97U6457C | 00 | +3.91 | E+00 LBS | F | S | P | G4.35 | 92322 | |
| REF_FORCE(19,2) | V97U6458C | 00 | -4.35 | E+00 LBS | F | S | P | G4.35 | 92322 | |
| REF_FORCE(19,3) | V97U6459C | 00 | -1.307 | E+01 LBS | F | S | P | G4.35 | 92322 | |
| REF_FORCE(2,1) | V97U6406C | 00 | -2.1 | E+01 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(2,2) | V97U6407C | 00 | +8.703 | E+02 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(2,3) | V97U6408C | 00 | +5.0 | E-01 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(20,1) | V97U6460C | 00 | +3.91 | E+00 LBS | F | S | P | G4.35 | 92322 | |
| REF_FORCE(20,2) | V97U6461C | 00 | +4.35 | E+00 LBS | F | S | P | G4.35 | 92322 | |
| REF_FORCE(20,3) | V97U6462C | 00 | -1.307 | E+01 LBS | F | S | P | G4.35 | 92322 | |
| REF_FORCE(3,1) | V97U6409C | 00 | -2.1 | E+01 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(3,2) | V97U6410C | 00 | -8.703 | E+02 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(3,3) | V97U6411C | 00 | +5.0 | E-01 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(4,1) | V97U6412C | 00 | -3.19 | E+01 LBS | F | S | P | G4.35 | 90809A | |
| REF_FORCE(4,2) | V97U6413C | 00 | +0.0 | E+00 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(4,3) | V97U6414C | 00 | +8.735 | E+02 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(5,1) | V97U6415C | 00 | -2.48 | E+01 LBS | F | S | P | G4.35 | 90708C | |

TABLE 4.2.4-4. ONORBIT DIGITAL AUTOPILOT (G4.35) K-LOADS

| FSSR NAME DESCRIPTION | MSID | MC | KLOAD VALUE | ENG UNITS | DT | P R | S | PR FCTN | LAST CR | R E V |
|--------------------------|-----------|----|-------------|-------------|----|--------|---|---------|---------|-------------|
| REF_FORCE(5,2) | V97U6416C | 00 | -6.126 | E+02 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(5,3) | V97U6417C | 00 | -6.394 | E+02 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(6,1) | V97U6418C | 00 | -2.48 | E+01 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(6,2) | V97U6419C | 00 | +6.126 | E+02 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(6,3) | V97U6420C | 00 | -6.394 | E+02 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(7,1) | V97U6421C | 00 | +8.568 | E+02 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(7,2) | V97U6422C | 00 | +0.0 | E+00 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(7,3) | V97U6423C | 00 | +1.511 | E+02 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(8,1) | V97U6424C | 00 | +8.568 | E+02 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(8,2) | V97U6425C | 00 | +0.0 | E+00 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(8,3) | V97U6426C | 00 | +1.511 | E+02 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(9,1) | V97U6427C | 00 | +1.3 | E+00 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(9,2) | V97U6428C | 00 | +8.698 | E+02 LBS | F | S | P | G4.35 | 90708C | |
| REF_FORCE(9,3) | V97U6429C | 00 | -1.17 | E+01 LBS | F | S | P | G4.35 | 90708C | |
| REF_TORQUE(1,1) | V97U6463C | 00 | +0.0 | E+00 FT-LBS | F | S | P | G4.35 | 90708C | |
| REF_TORQUE(1,2) | V97U6464C | 00 | -8.263 | E+03 FT-LBS | F | S | P | G4.35 | 90953C | |
| REF_TORQUE(1,3) | V97U6465C | 00 | +0.0 | E+00 FT-LBS | F | S | P | G4.35 | 90708C | |
| REF_TORQUE(10,1) | V97U6490C | 00 | -6.0541 | E+03 FT-LBS | F | S | P | G4.35 | 90708C | |
| REF_TORQUE(10,2) | V97U6491C | 00 | -5.7356 | E+02 FT-LBS | F | S | P | G4.35 | 90708C | |
| REF_TORQUE(10,3) | V97U6492C | 00 | +3.369634 | E+04 FT-LBS | F | S | P | G4.35 | 90708C | |
| REF_TORQUE(11,1) | V97U6493C | 00 | -8.587 | E+03 FT-LBS | F | S | P | G4.35 | 90708C | |
| REF_TORQUE(11,2) | V97U6494C | 00 | +3.379165 | E+04 FT-LBS | F | S | P | G4.35 | 90708C | |
| REF_TORQUE(11,3) | V97U6495C | 00 | -1.537 | E+03 FT-LBS | F | S | P | G4.35 | 90708C | |

TABLE 4.2.4-4. ONORBIT DIGITAL AUTOPILOT (G4.35) K-LOADS

| FSSR NAME DESCRIPTION | MSID | MC | KLOAD VALUE | ENG UNITS | DT | P R | S | PR FCTN | LAST CR | R E V |
|--------------------------|-----------|----|-------------|-----------|--------|--------|---|---------|---------|-------------|
| REF_TORQUE(12,1) | V97U6496C | 00 | +8.587 | E+03 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(12,2) | V97U6497C | 00 | +3.379165 | E+04 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(12,3) | V97U6498C | 00 | +1.537 | E+03 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(13,1) | V97U6499C | 00 | +7.22542 | E+03 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(13,2) | V97U6500C | 00 | -2.404527 | E+04 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(13,3) | V97U6501C | 00 | -1.002469 | E+04 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(14,1) | V97U6502C | 00 | -7.22542 | E+03 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(14,2) | V97U6503C | 00 | -2.404527 | E+04 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(14,3) | V97U6504C | 00 | +1.002469 | E+04 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(15,1) | V97U6505C | 00 | -5.246 | E+01 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(15,2) | V97U6506C | 00 | +1.09614 | E+03 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(15,3) | V97U6507C | 00 | -1.05639 | E+03 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(16,1) | V97U6508C | 00 | +5.246 | E+01 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(16,2) | V97U6509C | 00 | +1.09614 | E+03 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(16,3) | V97U6510C | 00 | +1.05639 | E+03 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(17,1) | V97U6511C | 00 | -1.7549 | E+02 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(17,2) | V97U6512C | 00 | -2.442 | E+01 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(17,3) | V97U6513C | 00 | +9.7668 | E+02 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(18,1) | V97U6514C | 00 | +1.7549 | E+02 | FT-LBS | F | S | P G4.35 | 90809A | |
| REF_TORQUE(18,2) | V97U6515C | 00 | -2.442 | E+01 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(18,3) | V97U6516C | 00 | -9.7668 | E+02 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(19,1) | V97U6517C | 00 | -1.4332 | E+02 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(19,2) | V97U6518C | 00 | -5.4139 | E+02 | FT-LBS | F | S | P G4.35 | 90708C | |

TABLE 4.2.4-4. ONORBIT DIGITAL AUTOPILOT (G4.35) K-LOADS

| FSSR NAME DESCRIPTION | MSID | MC | KLOAD VALUE | ENG UNITS | DT | P R | S | PR FCTN | LAST CR | R E V |
|--------------------------|-----------|----|-------------|-----------|--------|--------|---|---------|---------|-------------|
| REF_TORQUE(19,3) | V97U6519C | 00 | +1.704 | E+02 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(2,1) | V97U6466C | 00 | -1.14308 | E+03 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(2,2) | V97U6467C | 00 | -5.718 | E+01 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(2,3) | V97U6468C | 00 | +5.151388 | E+04 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(20,1) | V97U6520C | 00 | +1.4332 | E+02 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(20,2) | V97U6521C | 00 | -5.4139 | E+02 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(20,3) | V97U6522C | 00 | -1.704 | E+02 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(3,1) | V97U6469C | 00 | +1.14308 | E+03 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(3,2) | V97U6470C | 00 | -5.718 | E+01 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(3,3) | V97U6471C | 00 | -5.151388 | E+04 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(4,1) | V97U6472C | 00 | +0.0 | E+00 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(4,2) | V97U6473C | 00 | -5.27287 | E+04 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(4,3) | V97U6474C | 00 | +0.0 | E+00 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(5,1) | V97U6475C | 00 | -2.6841 | E+03 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(5,2) | V97U6476C | 00 | +3.876776 | E+04 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(5,3) | V97U6477C | 00 | -3.703873 | E+04 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(6,1) | V97U6478C | 00 | +2.6841 | E+03 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(6,2) | V97U6479C | 00 | +3.876776 | E+04 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(6,3) | V97U6480C | 00 | +3.703873 | E+04 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(7,1) | V97U6481C | 00 | +1.72556 | E+03 | FT-LBS | F | S | P G4.35 | 90809A | |
| REF_TORQUE(7,2) | V97U6482C | 00 | -9.7343 | E+02 | FT-LBS | F | S | P G4.35 | 90708C | |
| REF_TORQUE(7,3) | V97U6483C | 00 | -9.78466 | E+03 | FT-LBS | F | S | P G4.35 | 90809A | |
| REF_TORQUE(8,1) | V97U6484C | 00 | -1.72556 | E+03 | FT-LBS | F | S | P G4.35 | 90809A | |

TABLE 4.2.4-4. ONORBIT DIGITAL AUTOPILOT (G4.35) K-LOADS

| FSSR NAME DESCRIPTION | MSID | MC | KLOAD VALUE | ENG UNITS | DT | P R | S | PR FCTN | LAST CR | R E V |
|--|-----------|----|-------------|--------------|----|--------|---|-----------------|---------|-------------|
| REF_TORQUE(8,2) | V97U6485C | 00 | -9.7343 | E+02 FT-LBS | F | S | P | G4.35 | 90708C | |
| REF_TORQUE(8,3) | V97U6486C | 00 | +9.78466 | E+03 FT-LBS | F | S | P | G4.35 | 90874D | |
| REF_TORQUE(9,1) | V97U6487C | 00 | +6.0541 | E+03 FT-LBS | F | S | P | G4.35 | 90708C | |
| REF_TORQUE(9,2) | V97U6488C | 00 | -5.9775 | E+02 FT-LBS | F | S | P | G4.35 | 90708C | |
| REF_TORQUE(9,3) | V97U6489C | 00 | -3.463648 | E+04 FT-LBS | F | S | P | G4.35 | 90708C | |
| RLIM TVC ROLL COMMAND LIMIT | V97U2389C | 00 | +1.0 | E+00 DEG | F | S | P | G4.201 G4.35 | 90353G | |
| RL_TVC(1) PHAS PLANE ANG RATE ERR LIM- OMS | V97U2386C | 00 | +2.05 | E+00 DEG/SEC | F | S | C | G4.201 G4.35 | 90353G | |
| RL_TVC(2) PHAS PLANE ANG RATE ERR LIM- OMS | V97U2387C | 00 | +2.05 | E+00 DEG/SEC | F | S | P | G4.201 G4.35 | 90353G | |
| RL_TVC(3) PHAS PLANE ANG RATE ERR LIM- OMS | V97U2388C | 00 | +2.05 | E+00 DEG/SEC | F | S | P | G4.201 G4.35 | 90353G | |
| TOTAL_PITCH_LIM LIMIT OF TOTAL PITCH COMMANDN | V97U2390C | 00 | +5.89 | E+00 DEG | F | S | C | G4.201 G4.35 | 90353G | |
| WHIGH | V96U9710C | 00 | +1.5 | E+00 DEG/SEC | F | S | P | G4.201 G4.35 | 90353G | |
| WLOW | V96U9711C | 00 | +5.0 | E-01 DEG/SEC | F | S | P | G4.201 G4.35 | 90353G | |
| YLIM1 TVC YAW COMMAND LIMIT | V97U2392C | 00 | +6.44 | E+00 DEG | F | S | C | G4.201 G4.35 | 90353G | |
| YLIM2 | V96U9802C | 00 | +7.29 | E+00 DEG | F | S | P | G4.201 G4.35 | 90353G | |

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

TABLE 4.2.4-5. ONORBIT DIGITAL AUTOPILOT (G4.35) CONSTANTS

| FSSR NAME DESCRIPTION | MSID | MC | CONSTANT VALUE | ENG UNITS | DT | P R | S | PR FCTN | LAST CR | R E V |
|---|-----------|----|--------------------|-----------|----|--------|---|---|---------|-------------|
| 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 | |

TABLE 4.2.4-5. ONORBIT DIGITAL AUTOPILOT (G4.35) CONSTANTS

| FSSR NAME DESCRIPTION | MSID | MC | CONSTANT VALUE | ENG UNITS | DT | P R | S | PR FCTN | LAST CR | R E V |
|---|-----------|----|----------------|-----------|---------|--------|---|---|---------|-------------|
| RAD_PER_DEG DEGREE TO RADIAN CONVERSION FACTOR | V97U0383C | 00 | +1.7453293 | E-02 | RAD/DEG | F | S | C A6.9 G4.1 G4.126 G4.127 G4.128 G4.144 G4.15 G4.158 G4.175 G4.20 G4.201 G4.204 G4.205 G4.209 G4.210 G4.211 G4.213 G4.220 G4.223 G4.226 G4.227 G4.236 G4.237 G4.3 G4.35 G4.36 G4.7 G4.72 G4.9 G4.97 G5.27 | 93090E | |
| TDAP PERIOD OF RCS DAP CYCLE | V97U6233C | 00 | +8.0 | E-02 | SEC | F | D | C G4.201 | 90374C | |
| TMEAS PERIOD OF ATTITUDE MEASUREMENTS CYCLE | V97U6234C | 00 | +1.6 | E-01 | SEC | F | D | C G4.35 | 90374C | |

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

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4.3 ON-ORBIT ATTITUDE PROCESSOR (ATT_PROC_ORBIT)

A. Function. The function of the attitude processor is to provide common coding to derive attitude and attitude rate information for several user functions during OPS-2 and OPS-8. These include FCS and displays. ATT_PROC_ORBIT uses IMU SOP and Nav outputs to calculate these data. An overview flow diagram for ATT_PROC_ORBIT is given in Figure 4.3-1. It shows the relationships among the three function modules which form ATT_PROC_ORBIT. Table 4.3-1 lists the function and utility modules that make up ATT_PROC_ORBIT, together with the subsections describing them.

B. Processing Requirements. ATT_PROC_ORBIT is performed at 6.25 Hz except that modules ATT_PROC_ORBIT_INIT and ADI_QUAT_UPLINK are performed only on demand.

C. Interface Requirements. ATT_PROC_ORBIT interface requirements are shown in Table 4.3-2.

D. Constants and Initialization Requirements. Attitude processor initialization is accomplished by carryover from OPS-1 or OPS-3 and the internal module ATT_PROC_ORBIT_INIT. Assumed initial values and constants are shown in Tables 4.3-3 and 4.3-6, respectively.

E. Carryover Values. Carryover values from OPS-1 or OPS-3 operation are shown in Table 4.3-4.

F. I-Load Variables. I-Load variables are shown in Table 4.3-5.

G. Notation. In this section, the notation M_{AB} represents a matrix transformation of Frame B with respect to Frame A. Similarly, Q_{B_A} represents the equivalent quaternion. All quaternions Q_{B_A} are understood to be structures of a scalar and a vector:

$$Q_{B_A} = [Q_{B_A_S}, \bar{Q}_{B_A_V}]$$

The conjugate of a quaternion Q_{B_A} is represented by $Q_{B_A}^*$, where

$$Q_{B_A}^* = [Q_{B_A_S}, -\bar{Q}_{B_A_V}] = Q_{A_B}$$

Quaternion multiplication is indicated explicitly here, although in coding a utility function (QUAT_MULT) will be required. Then

$$Q_{C_A} = Q_{C_B} Q_{B_A}$$

The FSSR is written to present software requirements clearly and is not presented as desirable coding. As an example, the variables $SRPL_K$, $SRMN_K$, SP_K , SY_K , $K = \text{IMU } 1, 2, 3$, might simply be coded as a 3×4 array, saving several update equations presented here for the unarrayed variables. However, it is felt that clarity is added to the FSSR by use of names representing physical angles.

| Table 4.3-1. ATT_PROC_ORBIT Function Modules | |
|--|---------------------|
| Subsection | Function Module |
| 4.3.1 | ATT_PROC_ORBIT_INIT |
| 4.3.2 | ATT_PROC_ORBIT_LOOP |
| 4.3.3 | ATT_PROC_ORBIT_DISP |
| 4.3.4 | RV_TO_QLVLH |
| 4.3.5 | QUAT_TO_EULER |
| 4.3.6 | QUAT_TO_ADI_ANG |
| 4.3.7 | QUAT_XFORM |
| 4.3.8 | MAT_TO_QUAT |
| 4.3.9 | ADI_QUAT_UPLINK |
| 4.3.10 | QUAT_MULT |

Table 4.3-2. ATT_PROC_ORBIT Interface Requirements

| Name | Description | MSID | Source/ Destination | Type | Range | Unit | Sample Rate (Hz) | User Rate (Hz) |
|------------------------|---|--|---------------------------|----------------|----------------------|--------|---------------------|-------------------|
| INPUTS | | | | | | | | |
| IMU_QUAT_UPD_REQ | IMU reference quaternion update request | V95X0532X | IMU ORB A/CAL (4.208) | B | 0, 1 | – | 6.25 | On demand |
| T_CLUSTERM50(K) | M50 wrt cluster matrix IMU K, K = 1, 2, 3 | V99U3450CA to V99U3476CA | IMU ORB A/CAL (4.208) | A(3)M | ± 1 | – | On demand | On demand |
| IMU_ALIGN_DISP | IMU_ALIGN_DISP active flag | V90X8020X | MSC Table 3.3 | B | 0, 1 | – | 1.04 | On demand |
| SEL_IMU_ID | Selected IMU number | V90J2560C | IMU RM (4.72) | I | 1, 2, 3 | – | 6.25 | 6.25 |
| ORANG(K) | Outer roll gimbal angle. IMU K, K = 1, 2, 3 | V95H0054CA V95H1054CA V95H2054CA | IMU INT PROC (4.38) | A(3) S | 0 - 360 | deg | 6.25 | 6.25 |
| PANG(K) | Pitch gimbal angle, IMU K, K = 1, 2, 3 | V95H0050CA V95H1050CA V95H2050CA | IMU INT PROC (4.38) | A(3) S | 0 - 360 | deg | 6.25 | 6.25 |
| IRANG(K) | Inner roll gimbal angle, IMU K, K = 1, 2, 3 | V95H0053CA V95H1053CA V95H2053CA | IMU INT PROC (4.38) | A(3) S | 0 - 15, 345 - 360 | deg | 6.25 | 6.25 |
| AZANG(K) | Azimuth gimbal angle, IMU K, K = 1, 2, 3 | V95H0051CA V95H1051CA V95H2051CA | IMU INT PROC (4.38) | A(3) S | 0 - 360 | deg | 6.25 | 6.25 |
| T_IMUS_GA | IMU gimbal angles data time tag | V95W0002C | IMU INT PROC (4.38) | S | TBD | sec | 6.25 | 6.25 |
| \bar{V} _IMU_CURRENT | Selected total accumulated sensed velocity | V90L2557C to V90L2559C | IMU RM (4.72) | V | ± 10 ⁶ | ft/sec | 1.04 | 1.04 |
| \bar{R} _AVGG | Shuttle position vector, M50 | V95H0185CF to V95H0187CF | ORB UPP (4.22) | V | TBD | ft | 0.52 | 0.52 |
| \bar{V} _AVGG | Shuttle velocity vector, M50 | V95L0190CF to V95L0192CF | ORB UPP (4.22) | V | ± 30K | ft/sec | 0.52 | 0.52 |
| SENSE_SW | Aft ADI sense switch | V90X7700X | GN&C SW RM (4.180) | B | 0, 1 | – | 3.125 | 3.125 |
| ATT_SEL_SW(K) | ADI mode switch ADI K, K = left forward (1), right forward (2), aft (3) | V90J7503C V90J7504C V90X7744X | GN&C SW RM (4.180) | A(3) I | -1, 0, +1 | – | 3.125 | 3.125 |
| Q_B_M50_CMD_DISPLAY | Commanded body attitude for error needle calculations | V90H2721CB to V90H2724CB | ORB DAP (4.35) | Struc: S, V | ± 1 | – | 6.25 | 6.25 |
| LVLH_MODE | LVLH indicator mode | V90X2174X | ORB DAP (4.35) | B | 0, 1 | – | 6.25 | 6.25 |
| FWD_ATT_REF_PB | Attitude reference PB (LH or RH) | V90X7897X | GN&C SW RM (4.180) | B | 0, 1 | – | 3.125 | 3.125 |
| AFT_ATT_REF_PB | Attitude reference PB (aft) | V90X7701X | GN&C SW RM (4.180) | B | 0, 1 | – | 3.125 | 3.125 |
| DESEL | COAS deselect cmd | V93X6647X | S TRK/COAS CNTL (6.44) | I | 0, 1 | – | 3.125 | On demand |
| DOING_ST_RR_COAS | Angles Selected- ST TRK/RR/COAS | V90J4872C | ORB/RND NAV (4.126) | I | 1, 2, 3 | – | 3.125 | On demand |

Table 4.3-2. ATT_PROC_ORBIT Interface Requirements

| Name | Description | MSID | Source/ Destination | Type | Range | Unit | Sample Rate (Hz) | User Rate (Hz) |
|--|---|--------------------------------------|--|--------------------|-------------------------------|------|-----------------------------|--|
| ATT_DG | Attitude data good flag | V90X2555X | IMU RM (4.72) | B | 0, 1 | – | 6.25 | 6.25 |
| Q_M50_INRTL_UL | Uplink M50 wrt inertial quaternion | V97U2214CC to V97U2217CC | Uplink buffer | Struc: S, V | ± 1 | – | On demand | On demand |
| Q_M50_REF_UL | Uplinked M50 wrt reference quaternion | V97U2218CC to V97U2221CC | Uplink buffer | Struc: S, V | ± 1 | – | On demand | On demand |
| Q_LVLH_ BIASLVLH_UL | Uplinked LVLH wrt BIASLVLH quaternion | V97U2210CC to V97U2213CC | Uplink buffer | Struc: S, V | ± 1 | – | On demand | On demand |
| OP_CODE | Uplink operation code | V96J3524C | Uplink buffer | B I | 0011000 0011101 0011110 | – | On demand | On demand |
| OUTPUTS | | | | | | | | |
| Q_B_M50 | Body wrt M50 quaternion | V90U2240CB to V90U2243CB | REL NAV SPEC (5.24) ORB/RND NAV (4.126) A/E ATT PROC (4.226)* ORB DAP (4.35) TLM GN&C/ SM-PL IF (4.111) ORB GUID (4.7) UNIV POINT PROC (4.213) RR SOP (4.229) IMU RM (4.72) | Struc: S, V | ± 1 | – | Update Rate (Hz) 6.25 | User Rate (Hz) 1.04 6.25 12.5 |
| * Carryover from OPS 2 or OPS 8 to OPS 3 | | | | | | | | |
| T_NOW | Time tag of Q_B_M50 | V90W2310CB | ORB DAP (4.35) UNIV POINT PROC (4,213) TLM GN&C/SM-PL IF (4.111) | S | > 0 | sec | 6.25 | 6.25 |
| ATTITUDE_ INCREMENT_6HZ | Attitude increment | V90H2285CA V90H2213C V90H2214C | ORB DAP (4.35) | V | ± 10 | deg | 6.25 | 6.25 |
| Q_SM_SM(K) | Stable member wrt stable member quaternion, IMU pair K, K = 1, 2, 3 | V90U2255CB to V90U2266CB | IMU RM (4.72) | Struc: (3) S, V | ± 1 | – | 6.25 | 6.25 |

Table 4.3-2. ATT_PROC_ORBIT Interface Requirements

| Name | Description | MSID | Source/ Destination | Type | Range | Unit | Sample Rate (Hz) | User Rate (Hz) |
|---------------------|---|--|---|----------------|---------------------|--------|---------------------|-------------------|
| DVB_SEC | Body $\Delta\bar{V}$ over last 0.96 s | V90L2696C to V90L2698C | OMS RM (4.92) ORB DAP (4.35) TLM | V | ± 10 | ft/sec | 1.04 | 1.04 |
| BODY_ERR_ANG | Error angles from body to commanded body attitude | V90H2233CB V90H2234CB V90H2235C | ORB ADI PROC (4.169) | V | ± 180 | deg | 6.25 | 6.25 |
| PTCHSINE(K) | ADI pitch sine, ADI K, K = 1, 2, 3 | V90H2221CB V90H2220CB V90H2291C | ORB ADI PROC (4.169) | A(3)S | ± 1 | – | 3.125 | 3.125 |
| PTCHCOS(K) | ADI pitch cosine, ADI K, K = 1, 2, 3 | V90H2222CB V90H2218CB V90H2292C | ORB ADI PROC (4.169) TLM* | A(3)S | ± 1 | – | 3.125 | 3.125 |
| YAWSINE(K) | ADI yaw sine, ADI K, K = 1, 2, 3 | V90H2231CB V90H2293CB V90H2295C | ORB ADI PROC (4.169) TLM* | A(3)S | ± 1 | – | 3.125 | 3.125 |
| Q_M50_REF | M50 wrt reference quaternion | V97U2218CA to V97U2221CA | TLM* | Struc: S, V | ± 1 | – | 3.125 | 3.125 |
| Q_M50_INRTL | M50 wrt INRTL quaternion | V97U2214CA to V97U2217CA | TLM* | Struc: S, V | ± 1 | – | 3.125 | 3.125 |
| Q_M50_LVLH | M50 wrt LVLH quaternion | V90U2641CA to V90U2644CA | TLM, ORB DAP (4.35) ORB MNVR DIP (4.158) | Struc: S, V | ± 1 | – | 0.52 | 1.04 |
| Q_LVLH_ BIASLVLH | LVLH wrt BIASLVLH quaternion | V97U2210CA to V97U2213CA | TLM | Struc: S, V | ± 1 | – | 0.52 | 1.04 |
| YAWCOS(K) | ADI yaw cosine, ADI K, K = 1, 2, 3 | V90H2232CB V90H2294CB V90H2296C | ORB ADI PROC (4.169) TLM* | A(3) S | 0 - 1 | – | 3.125 | 3.125 |
| ROLLSINE(K) | ADI roll sine, ADI K, K = 1, 2, 3 | V90H2208CB V90H2206CB V90H2289C | ORB ADI PROC (4.169) TLM* | A(3) S | ± 1 | – | 3.125 | 3.125 |
| ROLLCOS(K) | ADI roll cosine, ADI K, K = 1, 2, 3 | V90H2209CB V90H2207CB V90H2290C | ORB ADI PROC (4.169) TLM* | A(3) S | ± 1 | – | 3.125 | 3.125 |
| PSI(K) | First Euler angle, M50 to body, IMU K, K = 1, 2, 3 | V90H2311CA V90H2312CA V90H2313CA | IMU ALIGN (6.26) | A(3) S | 0 - 360 | deg | 1.04 | 1.04 |
| THETA(K) | Second Euler angle, M50 to body, IMU K, K = 1, 2, 3 | V90H2314CA V90H2315CA V90H2316CA | IMU ALIGN (6.26) | A(3) S | 0 - 90 270 - 360 | deg | 1.04 | 1.04 |
| PHI(K) | Third Euler angle, M50 to body, IMU K, K = 1, 2, 3 | V90H2317CA V90H2318CA V90H2319CA | IMU ALIGN (6.26) | A(3) S | 0 - 360 | deg | 1.04 | 1.04 |
| PAYLOAD_PITCH | EF to body pitch Euler angle | V95L3887CB | GN&C/SM-PL IF (4.101) | S | $\pm \pi$ | rad | 0.52 | 0.52 |
| PAYLOAD_YAW | EF to body yaw Euler angle | V95L3888CB | GN&C/SM-PL IF (4.111) | S | $\pm \pi/2$ | rad | 0.52 | 0.52 |
| PAYLOAD_ROLL | EF to body roll Euler angle | V95L3889CB | GN&C/SM-PL IF (4.111) | S | $\pm \pi$ | rad | 0.52 | 0.52 |

Table 4.3-2. ATT_PROC_ORBIT Interface Requirements

| Name | Description | MSID | Source/ Destination | Type | Range | Unit | Sample Rate (Hz) | User Rate (Hz) |
|-----------------|---|--------------------------------|------------------------|----------------|--------|------|---------------------|-------------------|
| Q_ROLL_SM(K) | Roll wrt stable member quaternion, IMU K, K = 1, 2, 3 | V90U2337CA to V90U2348CA | TLM | Struc: S, V | ± 1 | – | 6.25 | 1.04 |
| PHI_TOPO | Body roll attitude Euler angle | V90H2202CA | GPS SOP (4.17) | S | ±180 | deg | 6.25 | 6.25 |
| PSI_TOPO | Body yaw attitude Euler angle | V90H2230CA | GPS SOP (4.17) | S | ±180 | deg | 6.25 | 6.25 |
| THETA_TOPO | Body pitch attitude Euler angle | V90H2217CA | GPS SOP (4.17) | S | ±90 | deg | 6.25 | 6.25 |
| EULER_GPS_Avail | Topodetic Euler angles availability flag | V90X2610XA | GPS SOP (4.17) | BD | ON/OFF | – | 6.25 | 6.25 |

* Only the AFT ADI Euler angle sines and cosines are output to TLM.

Table 4.3-3. ATT_PROC_ORBIT Initialization

| Module | Name | Description | Source/ Destination | Type | Value | Units |
|--------|--|--|------------------------|-------------|--|--------|
| | <u>Initialize on Transition to OPS-2</u> | | | | | |
| _LOOP | CTR | Inner/outer loop counter | | I | 0 | – |
| | Q_B_M50 | Body wrt M50 quaternion | | Struc: S, V | (1, 0, 0, 0) | – |
| | FIRST_PASS | First pass flag | | B | 1 | – |
| | Q_LVLH_BIASLVLH | LVLH wrt BIASLVLH quaternion | K-LOAD | Struc: S, V | Q_LVLH_ BIASLVLH_ORB | – |
| | \overline{GA}_K | Half-gimbal angles for each IMU _K , K = 1, 2, 3 | | V | 0 | – |
| | EULER_GPS_Avail | Topodetic Euler angles availability flag | | BD | OFF | – |
| _DISP | DVB_ \overline{SEC} | Body $\Delta\overline{V}$ over 0.96 s | | V | 0 | ft/sec |
| | V_IMU_PREV | Previous value, $\overline{V}_{IMU_CURRENT}$ | | V | $\overline{V}_{IMU_CURRENT}$ | ft/sec |
| | Q_M50_REF | M50 wrt reference quaternion | K-LOAD | Struc: S, V | Q_M50_REF_ ORB | – |
| | Q_M50_INRTL | M50 wrt inertial quaternion | K-LOAD | Struc: S, V | Q_M50_INRTL_ ORB (1.0,0.0,0.0,0.0) | – |

| Table 4.3-4. ATT_PROC_ORBIT Carryover Values | | | | | | |
|--|--|-------------|-------|------|------------------------------|---------------------|
| Name | Description | Type | Range | Unit | Principal Function Module(s) | |
| | | | | | Source | Used by |
| SDP(K) | Sine (1/2 DP _K), IMU K, K = 1, 2, 3 | A(3) S | ± 1 | – | A/E ATT PROC (4.226) | ATT_PROC_ORBIT_LOOP |
| CDP(K) | Cosine (1/2 DP _K), IMU K, K = 1, 2, 3 | A(3) S | ± 1 | – | A/E ATT PROC (4.226) | ATT_PROC_ORBIT_LOOP |
| Q_SM_M50(K) | Stable member wrt M50 quaternion, IMU K, K = 1, 2, 3 | Struc(3): S | ± 1 | – | A/E ATT PROC (4.226) | ATT_PROC_ORBIT_LOOP |
| PHI_TOPO | Body roll attitude Euler angle | S | ±180 | deg | A/E ATT PROC (4.226) | ATT_PROC_ORBIT |
| PSI_TOPO | Body yaw attitude Euler angle | S | ±180 | deg | A/E ATT PROC (4.226) | ATT_PROC_ORBIT |
| THETA_TOPO | Body pitch attitude Euler angle | S | ±90 | deg | A/E ATT PROC (4.226) | ATT_PROC_ORBIT |

Note: These variables are passed over to ATT_PROC_ORBIT from A/E ATT PROC (4.226) at OPS-2 transition (from either OPS-1 or OPS-3) and are passed back to A/E ATT PROC at OPS-3 transition (from either OPS-2 or OPS-8).

| Table 4.3-5. ATT_PROC_ORBIT I-Load Variables* | | | | | | |
|---|--|--------|-----------|-----------|-------|---------------------|
| Name | Description | Type | Max Value | Min Value | Units | Modules(s) Used by |
| TNBBODY | Nav base to body frame transformation matrix | M | 1 | –1 | – | ATT_PROC_ORBIT_INIT |
| TNB_CASE(K) | Nav base to IMU Case transformation matrix, IMU K, K = 1, 2, 3 | M | 1 | –1 | – | ATT_PROC_ORBIT_INIT |
| RGAO(K) | Roll gimbal azimuth offset, IMU K, K = 1, 2, 3 | A(3) S | 1 | –1 | rad | ATT_PROC_ORBIT_INIT |
| RGPO(K) | Roll gimbal pitch offset, IMU K, K = 1, 2, 3 | A(3) S | 1 | –1 | rad | ATT_PROC_ORBIT_INIT |

* I-Load values are specific in I-Load CPDS, JSC-19350

| Table 4.3-6. ATT_PROC_ORBIT Input Variable Cross-Reference | |
|--|-----------------|
| Local Name | Source Name |
| IMU_ALIGN_DISP | IMU_ALIGN_DISPL |
| Q_B_M50_CMD_DISPLAY | Q_B_I_CMD_DISPL |
| T_IMUS_GA | T_IMUS |
| V_IMU_CURRENT | SEL_V_M50 |

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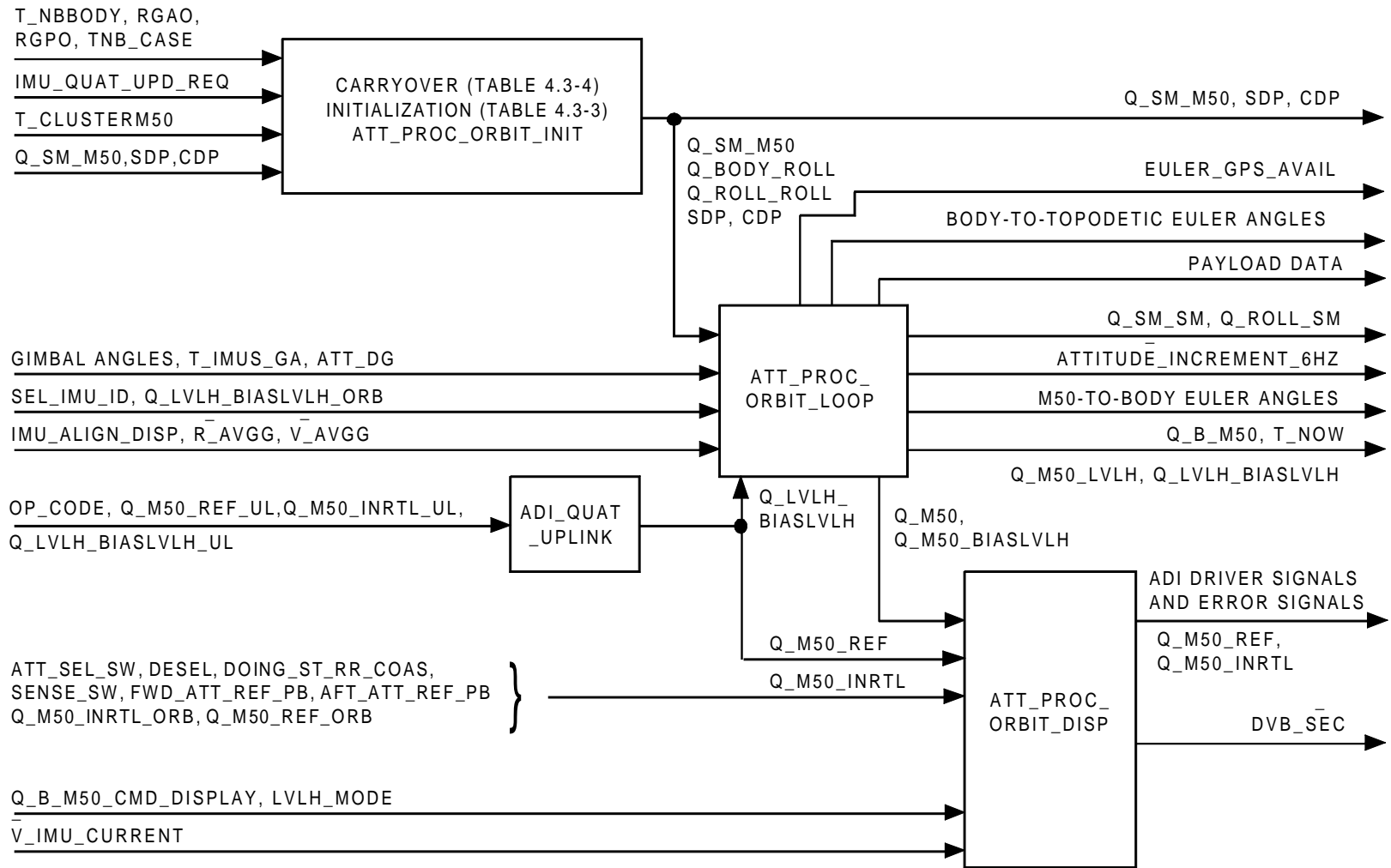


FIGURE 4.3-1. ATT_PROC_ORBIT Software Overview

4.3.1 On-Orbit Attitude Processor Initialization (ATT_PROC_ORBIT_INIT)

ATT_PROC_ORBIT_INIT serves to initialize certain internal constants. It is performed on demand, on or before the first pass through ATT_PROC_ORBIT_LOOP and following IMU on-orbit alignments. An overview block diagram of ATT_PROC_ORBIT_INIT is provided in Figure 4.3.1-1.

A. Function. ATT_PROC_ORBIT_INIT initializes IMU attitude constants and IMU-to-IMU mounting misalignments.

The following constants are initialized for each IMU_K, K = 1, 2, 3. They are a quaternion representing the transformation from the roll gimbal frame to the body frame and a quaternion representing the pairwise IMU gimbal-case mounting misalignments.

First, the navigation base to outer roll gimbal transformation matrix TNB_RL_K is computed. TNB_RL_K is a product of two single-axis rotations (roll gimbal azimuth and pitch offsets) and the navigation base to case transformation.

$$TAZ_K = \begin{bmatrix} \cos(RGAO_K) - \sin(RGAO_K) & 0 & \\ \sin(RGAO_K) & \cos(RGAO_K) & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$TPT_K = \begin{bmatrix} \cos(RGPO_K) & 0 & \sin(RGPO_K) \\ 0 & 1 & 0 \\ -\sin(RGPO_K) & 0 & \cos(RGPO_K) \end{bmatrix}$$

$$TNB_RL_K = TAZ_K TPT_K TNB_CASE_K$$

Then, the matrix M_ROLLBODY_K is formed by

$$M_ROLLBODY_K = T_NBBODY (TNB_RL_K)^T$$

Then the quaternion Q_BODY_ROLL_K is formed from the equivalent matrix M_ROLLBODY_K by use of MAT_TO_QUAT, the matrix to quaternion utility routine. The pairwise IMU gimbal-case mounting misalignments are determined for each IMU pair K (the index K is the number of the excluded IMU)

$$Q_ROLL_ROLL_K = Q_BODY_ROLL_J * Q_BODY_ROLL_I$$

where for

$$\begin{array}{lll} K = 1: & I = 2, & J = 3 \\ K = 2: & I = 1, & J = 3 \\ K = 3: & I = 1, & J = 2 \end{array}$$

When entering MC2, the only initialization required is that associated with the computations of Q_ROLL_ROLL. The values of Q_SM_M50, SDP, and CDP are carried over from either MC1 or MC3.

Whenever an IMU on-orbit alignment is completed (denoted by $IMU_QUAT_UPD_REQ = ON$), $Q_SM_M50_k$ is computed from $(T_CLUSTERM50_k)^T$ by use of MAT_TO_QUAT . Subsequently, the flag $IMU_QUAT_UPD_REQ$ is reset OFF.

B. Processing Requirements. The module $ATT_PROC_ORBIT_INIT$ is performed once to initialize constants in MC2 and following IMU on-orbit alignments.

C. Interface Requirements. The interface requirements for the module $ATT_PROC_ORBIT_INIT$ are shown in Table 4.3.1-1.

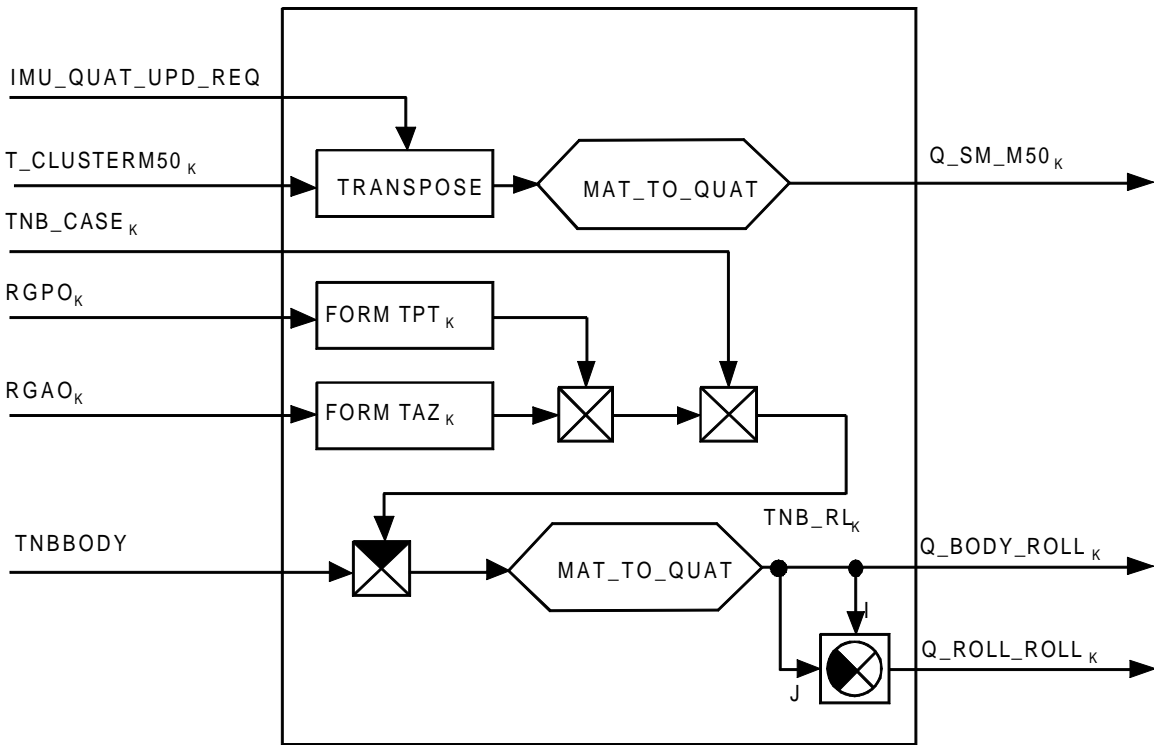


FIGURE 4.3.1-1. ATT_PROC_ORBIT_INIT Block Diagram

| Table 4.3.1-1. ATT_PROC_ORBIT_INIT Interface Requirements | | | | | | | | |
|---|---|------------------------------|--------------------------|-------------------|---------|------|---------------------|-------------------|
| Name | Description | MSID | Source/ Destination | Type | Range | Unit | Sample Rate (Hz) | User Rate (Hz) |
| INPUTS | | | | | | | | |
| IMU_QUAT_UPD_REQ | IMU reference quaternion update request | V95X0532X | IMU ORB A/CAL (4.208) | B | 0, 1 | - | 6.25 | On demand |
| T_CLUSTERM50(K) | M50 wrt cluster matrix IMU K, K = 1, 2, 3 | V99U3450C to V99U3476C | IMU ORB A/CAL (4.208) | A(3) M | ± 1 | - | On demand | On demand |
| OUTPUTS | | | | | | | | |
| | | | | | | | Update Rate (Hz) | User Rate (Hz) |
| Q_SM_M50(K) | Cluster wrt M50 quaternion, IMU K, K = 1, 2, 3 | V90U2664C to V90U2675C | ATT_PROC_ORBIT_LOOP | Struc(3): S, V | ± 1 | - | On demand | 6.25 |
| Q_BODY_ROLL(K) | Body wrt roll gimbal quaternion, IMU K, K = 1, 2, 3 | V90U2652C to V90U2663C | ATT_PROC_ORBIT_LOOP | Struc(3): S, V | ± 1 | - | On demand | 6.25 |
| Q_ROLL_ROLL(K) | Roll gimbal quaternion, IMU pair K, K = 1, 2, 3 | V90U2676C to V90U2687C | ATT_PROC_ORBIT_LOOP | Struc(3): S, V | ± 1 | - | On demand | 6.25 |

4.3.2 On-Orbit Attitude Processor Outer/Inner Loop Processing (ATT_PROC_ORBIT_LOOP)

ATT_PROC_ORBIT_LOOP comprises largely common coding for “outer” and “inner” loop passes. At 1.04 Hz, outer-loop processing establishes exact values for sines and cosines of half-gimbal angles sums and differences. At 6.25 Hz, these functions are propagated using small angle (first-order Taylor series) approximations. Common coding is then used to form platform with respect to platform quaternions for use in IMU selection and the body with respect to M50 quaternion. In outer-loop passes, low-rate CRT display data, payload attitude data and the LVLH frame are derived when required. An internal counter is used to determine whether inner- or outer-loop processing is done.

A. Function. An overview block diagram of ATT_PROC_ORBIT_LOOP is given in Figure 4.3.2-1.

1. The previous values of Q_B_M50 and the half gimbal angle sums are saved:

$$Q_B_M50_PREV = Q_B_M50$$

and

$$\overline{GA_PREV}_K = \overline{GA}_K$$

where K = 1, 2, 3.

2. Gimbal angles are then read from the IMU SOP for each IMU_K

a.

$$\overline{GA}_K = \frac{RAD_PER_DEG}{2} \begin{pmatrix} ORANG_K + IRANG_K \\ ORANG_K - IRANG_K \\ PANG_K \\ AZANG_K \end{pmatrix}$$

- b. Calculate the delta gimbal angle associated with the azimuth gimbal of each IMU, that is,

$$DELGA_{K:4} = GA_{K:4} - GA_PREV_{K:4}$$

where

$$K = 1, 2, 3$$

- c. If the absolute value of DELGA_{K:4} equals or exceeds π/2, it is compensated for π radian discrepancy at gimbal angle = 0 by

$$\text{If } |DELGA_{K:4}| \geq \pi/2$$

then

$$DELGA_{K:4} = DELGA_{K:4} - \pi \text{ SIGN}(DELGA_{K:4})$$

where

$$K = 1, 2, 3$$

- d. Sines and cosines of elements of GA_K are then formed for each IMU_K depending on outer loop status ($CTR=0$) or the potential gimbal repositioning condition ($|DELGA_{K:4}| \geq DELGA_LIMIT$). In other words, if

$$(CTR = 0) \text{ or } (|DELGA_{K:4}| \geq DELGA_LIMIT),$$

then

$$\begin{array}{ll} SRPL_K = \sin(GA_{K:1}) & CRPL_K = \cos(GA_{K:1}) \\ SRMN_K = \sin(GA_{K:2}) & CRMN_K = \cos(GA_{K:2}) \\ SP_K = \sin(GA_{K:3}) & CP_K = \cos(GA_{K:3}) \\ SY_K = \sin(GA_{K:4}) & CY_K = \cos(GA_{K:4}) \end{array}$$

Otherwise, if this is an inner loop pass ($CTR \neq 0$) and a potential gimbal repositioning condition does not exist ($|DELGA_{K:4}| < DELGA_LIMIT$), these functions are propagated with small angle approximations used for each IMU_K . First calculate the delta gimbal angles for each IMU_K .

$$\text{If } (CTR \neq 0) \text{ or } (|DELGA_{K:4}| < DELGA_LIMIT),$$

then

$$\begin{array}{l} DELGA_{K:1} = GA_{K:1} - GA_PREV_{K:1} \\ DELGA_{K:2} = GA_{K:2} - GA_PREV_{K:2} \\ DELGA_{K:3} = GA_{K:3} - GA_PREV_{K:3} \end{array}$$

If the absolute value of $DELGA_{K:3}$ equals or exceeds $\pi/2$, it is compensated for π radian discrepancy at gimbal angle = 0 by

$$\text{If } |DELGA_{K:3}| \geq \pi/2$$

then

$$DELGA_{K:3} = DELGA_{K:3} - \pi \text{ SIGN}(DELGA_{K:3})$$

where

$$K = 1, 2, 3$$

If $DELGA_{K:1}$ or $DELGA_{K:2}$ equals or exceeds $\pi/2$, it is compensated for π or 2π radian discrepancy as follows:

$$\text{If } |DELGA_{K:1}| \geq \pi/2$$

then

$$\text{If } |DELGA_{K:1}| \geq \frac{3\pi}{2}$$

then

$$\text{DELGA}_{K:1} = \text{DELGA}_{K:1} - 2\pi \text{SIGN}(\text{DELGA}_{K:1})$$

otherwise

$$\text{DELGA}_{K:1} = \text{DELGA}_{K:1} - \pi \text{SIGN}(\text{DELGA}_{K:1})$$

where

$$I = 1, 2$$

Then

$$\begin{aligned} \text{OLDSIN} &= \text{SRPL}_K \\ \text{SRPL}_K &= \text{SRPL}_K + \text{DELGA}_{K:1} \text{CRPL}_K \\ \text{CRPL}_K &= \text{CRPL}_K - \text{DELGA}_{K:1} \text{OLDSIN} \\ \text{OLDSIN} &= \text{SRMN}_K \\ \text{SRMN}_K &= \text{SRMN}_K + \text{DELGA}_{K:2} \text{CRMN}_K \\ \text{CRMN}_K &= \text{CRMN}_K - \text{DELGA}_{K:2} \text{OLDSIN} \\ \text{OLDSIN} &= \text{SP}_K \\ \text{SP}_K &= \text{SP}_K + \text{DELGA}_{K:3} \text{CP}_K \\ \text{CP}_K &= \text{CP}_K - \text{DELGA}_{K:3} \text{OLDSIN} \\ \text{OLDSIN} &= \text{SY}_K \\ \text{SY}_K &= \text{SY}_K + \text{DELGA}_{K:4} \text{CY}_K \\ \text{CY}_K &= \text{CY}_K - \text{DELGA}_{K:4} \text{OLDSIN} \end{aligned}$$

3. The quaternion $Q_ROLL_SM_K$ the roll gimbal mounting with respect to stable member, is then formed for each IMU_K , $K = 1, 2, 3$.

$$Q_ROLL_SM_K = (Q_ROLL_SM_S_K, \overline{Q_ROLL_SM_V}_K)$$

This is the product of five single-axis rotation quaternions representing the four gimbal angles and the pitch-outer roll gimbal angle nonorthogonality

where

$$\begin{aligned} Q_ROLL_SM_S_K &= \text{CDP}_K (\text{CP}_K \text{CRPL}_K \text{CY}_K + \text{SP}_K \text{SRMN}_K \text{SY}_K) \\ &\quad - \text{SDP}_K (\text{SP}_K \text{SRPL}_K \text{CY}_K + \text{CP}_K \text{CRMN}_K \text{SY}_K) \\ Q_ROLL_SM_V_{K:1} &= \text{CDP}_K (-\text{CP}_K \text{SRPL}_K \text{CY}_K + \text{SP}_K \text{CRMN}_K \text{SY}_K) \\ &\quad - \text{SDP}_K (\text{SP}_K \text{CRPL}_K \text{CY}_K - \text{CP}_K \text{SRMN}_K \text{SY}_K) \\ Q_ROLL_SM_V_{K:2} &= \text{CDP}_K (-\text{SP}_K \text{CRMN}_K \text{CY}_K - \text{CP}_K \text{SRPL}_K \text{SY}_K) \\ &\quad - \text{SDP}_K (\text{CP}_K \text{SRMN}_K \text{CY}_K + \text{SP}_K \text{CRPL}_K \text{SY}_K) \\ Q_ROLL_SM_V_{K:3} &= \text{CDP}_K (\text{SP}_K \text{SRMN}_K \text{CY}_K - \text{CP}_K \text{CRPL}_K \text{SY}_K) \\ &\quad - \text{SDP}_K (\text{CP}_K \text{CRMN}_K \text{CY}_K - \text{SP}_K \text{SRPL}_K \text{SY}_K) \end{aligned}$$

4. Stable member with respect to stable member quaternions are then formed for each IMU pair, using the pair assignments,

$$\begin{aligned} K = 1: & \quad I = 2, \quad J = 3 \\ K = 2: & \quad I = 1, \quad J = 3 \\ K = 3: & \quad I = 1, \quad J = 2 \end{aligned}$$

$$Q_SM_SM_K = Q_ROLL_SM_J * Q_ROLL_ROLL_K Q_ROLL_SM_I$$

The three quaternions $Q_SM_SM_K$ are sent to IMU RM, which returns a selected IMU number (SEL_IMU_ID).

5. The quaternions $XQ_B_M50_K$ are formed according to these restrictions:
- If the IMU alignment spec is active (IMU_ALIGN_DISP = ON) and this is an outer-loop pass (CTR = 0), $XQ_B_M50_K$ is formed for each IMU K. Processing then continues with Step 6.
 - Otherwise (IMU_ALIGN_DISP = OFF or CTR ≠ 0), only $XQ_B_M50_{SEL_IMU_ID}$ is formed. Processing continues with Step 7.

$$XQ_B_M50_K = Q_BODY_ROLL_K Q_ROLL_SM_K Q_SM_M50_K$$

The attitude quaternion time tag is set to the gimbal angle time tag:

$$T_NOW = T_IMUS_GA$$

6. If (IMU_ALIGN_DISP = ON and CTR = 0), Euler angles of body with respect to M50 are extracted from $XQ_B_M50_K$ for each IMU. The utility function QUAT_TO_EULER is called with each $XQ_B_M50_K$, and PSI_K , $THETA_K$, PHI_K , $TEMP_1$, $TEMP_2$, $TEMP_3$, $TEMP_4$ are returned. The angles are constrained to the range 0–360 degrees by adding 360 degrees to negative angles.
7. Select the output Q_B_M50 :

$$Q_B_M50 = XQ_B_M50_{SEL_IMU_ID}$$

(Note: Q_B_M50 quaternions calculated during inner loop executions may be unnormalized during periods of high IMU gimbal rates.)

- 7a. On the first pass (FIRST_PASS = ON) after transition into this OPS, save the attitude quaternion and reset the first pass flag, that is,

$$Q_B_M50_PREV = Q_B_M50$$

$$FIRST_PASS = OFF$$

8. On every other pass of the outer loop (0.52Hz),

Q_M50_TD is computed as follows:

M_EF_M50 = EARTH_FIXED_TO_M50_COORD(T_IMUS_GA)

$\bar{R} = (M_EF_M50)^T \bar{R}_AVGG$

CALL EF_TO_GEODETTIC(\bar{R}) ASSIGN(LAT,LON,ALT)

M_EFTD = EF_TO_TOPDET (LAT,LON)

M_TDM50 = M_EF_M50 (M_EFTD)^T

The equivalent topodetic to M50 quaternion is then extracted from M_TDM50 using the MAT_TO_QUAT utility routine.

Q_M50_TD = MAT_TO_QUAT (M_TDM50)

9. The body pitch, yaw, roll with respect to the topodetic coordinate frame is computed as follows on every pass of the inner loop (6.25 HZ):

Q_BODY_TD = Q_B_M50 Q_M50_TD

Q_BODY_TD is then used as the argument in a call to QUAT_TO_EULER.

QUAT_TO_EULER returns PSI_TOPO, THETA_TOPO, PHI_TOPO. The angles are in degrees.

The topodetic Euler angles availability flag for the GPS SOP, EULER_GPS_AVAIL, is set equal to the attitude data good flag.

10. Also on every other pass of the outer loop (0.52 Hz), compute a set of Euler angles of body with respect to an earth-fixed true of date frame (EF) in the order pitch about Y, yaw about displaced Z, and roll about doubly displaced X.

The equivalent Q_M50_EF is extracted from the matrix using the M_EF_M50 from step 8 and the MAT_TO_QUAT utility function. The product

Q_BODY_EF = Q_B_M50 Q_M50_EF

is then used as the argument in a call to QUAT_TO_ADI_ANG. QUAT_TO_ADI_ANG returns XPTCHSINE, XPTCHCOS, XYAWSINE, XYAWCOS, XROLLSINE, XROLLCOS, XFLAG.

If XFLAG = OFF, PTCH and ROLL functions were not updated in QUAT_TO_ADI_ANG due to the singularity at YAW = ±90 degrees, and PAYLOAD functions are not updated. If XFLAG = ON,

PAYLOAD_YAW = ARCSIN(XYAWSINE)

PAYLOAD_PITCH = ARCTAN2(XPTCHSINE, XPTCHCOS)

PAYLOAD_ROLL = ARCTAN2(XROLLSINE, XROLLCOS)

11. The body attitude increment over the preceding 160 ms is formed:

$$Q_UPDATE = Q_B_M50 Q_B_M50_PREV^*$$

$$\overline{ATTITUDE_INCREMENT_6HZ} = -2 \text{ DEG_PER_RAD SIGN}(Q_UPDATE_S) \\ \overline{Q_UPDATE_V}$$

12. On every other pass of outer loop (0.52 Hz), a quaternion of M50 with respect to BIASLVLH is constructed for use in ATT_PROC_ORBIT_DISP. First, the M50 with respect to LVLH quaternion is formed using the RV_TO_QLVLH utility function. The latter quaternion, which will also be used by Guidance and the Orbit DAP for manual LVLH maneuvers, is then multiplied by the constant LVLH offset quaternion to yield Q_M50_BIASLVLH.

$$\text{CALL RV_TO_QLVLH}(\overline{R_AVGG}, \overline{V_AVGG}) \text{ ASSIGN}(Q_M50_LVLH)$$

$$Q_M50_BIASLVLH = Q_M50_LVLH Q_LVLH_BIASLVLH$$

13. The pass counter is incremented, and, if necessary, reset to zero.

$$CTR = CTR + 1$$

If

$$CTR \geq 6, CTR = 0$$

B. Processing Requirements. ATT_PROC_ORBIT_LOOP is processed at 6.25 Hz.

C. Interface Requirements. Interface requirements for ATT_PROC_ORBIT_LOOP are shown in Table 4.3.2-1.

D. Supplemental Information. Requirements for the EARTH_FIXED_TO_M50_COORD routine are located in STS83-0006 On-Orbit Navigation FSSR, Section 4.10.2. Requirements for the EF_TO_GEODETIC routine are located in STS83-0006 On-Orbit Navigation FSSR, Section 4.10.9. Requirements for EF_TO_TOPDET can be found in STS83-0006 On-Orbit Navigation FSSR, Section 4.10.4.

| Table 4.3.2-1. ATT_PROC_ORBIT_LOOP Interface Requirements | | | | | | | | |
|---|--|---|--|-------------------|----------------------|--------|---------------------|-------------------|
| Name | Description | MSID | Source/ Destination | Type | Range | Unit | Sample Rate (Hz) | User Rate (Hz) |
| INPUTS | | | | | | | | |
| SEL_IMU_ID | Selected IMU number | V90J2560C | IMU RM (4.72) | I | 1 - 3 | – | 6.25 | 6.25 |
| ORANG(K) | Compensated outer roll gimbal angle, IMU K, K = 1, 2, 3 | V95H0054C V95H1054C V95H2054C | IMU INT PROC (4.38) | A(3) S | 0 - 360 | deg | 6.25 | 6.25 |
| PANG(K) | Compensated pitch gimbal angle. IMU K, K = 1, 2, 3 | V95H0050C V95H1050C V95H2050C | IMU INT PROC (4.38) | A(3) S | 0 - 360 | deg | 6.25 | 6.25 |
| IRANG(K) | Compensated inner roll gimbal angle, IMU K, K = 1, 2, 3 | V95H0053C V95H1053C V95H2053C | IMU INT PROC (4.38) | A(3) S | 0 - 15, 345 - 360 | deg | 6.25 | 6.25 |
| AZANG(K) | Compensated azimuth gimbal angle, IMU K, K = 1, 2, 3 | V95H0051C V95H1051C V95H2051C | IMU INT PROC (4.38) | A(3) S | 0 - 360 | deg | 6.25 | 6.25 |
| ATT_DG | Attitude data good flag | V90X2555X | IMU RM (4.72) | B | 0, 1 | – | 6.25 | 6.25 |
| T_IMUS_GA | IMU gimbal angles data time tag | V95W0002C | IMU INT PROC (4.38) | S | TBD | sec | 6.25 | 6.25 |
| IMU_ALIGN_DISP SDP(K) | IMU align data active flag Sine (1/2 DP _K), IMU K, K = 1, 2, 3 | V95X8020X V90U2645C to V90U2647C | MSC Table 3.3 Table 4.3-4 | B A(3) S | 0, 1 ± 1 | – | 1.04 6.25 | On demand – |
| CDP(K) | Cosine (1/2 DP _K), IMU K, K = 1, 2, 3 | V90U2648C to V90U2650C | Table 4.3-4 | A(3) S | ± 1 | – | 6.25 | – |
| Q_BODY_ ROLL(K) | Body wrt roll gimbal quat, IMU K, K = 1, 2, 3 | V90U2652C to V90U2663C | ATT_PROC_ ORBIT_INIT | Struc(3): S, V | ± 1 | – | 6.25 | On demand |
| Q_ROLL_ ROLL(K) | Roll gimbal wrt roll gimbal quat, IMU pair K, K = 1, 2, 3 | V90U2676C to V90U2687C | ATT_PROC_ ORBIT_INIT | Struc(3): S, V | ± 1 | – | 6.25 | On demand |
| Q_SM_M50(K) | Stable member wrt M50 quaternion, IMU K, K = 1, 2, 3 | V90U2664C to V90U2675C | Table 4.3-4 ATT_PROC_ ORBIT_INIT | Struc(3): S, V | ± 1 | – | 6.25 | On demand |
| \bar{R} _AVGG | Shuttle position vector M50 | V95H0185C to V95H0187C | ORB UPP (4.22) | V | TBD | ft | 0.52 | 0.52 |
| \bar{V} _AVGG | Shuttle velocity vector M50 | V95L0190C to V95L0192C | ORB UPP (4.22) | V | ± 30K | ft/sec | 0.52 | 0.52 |
| Q_LVLH_ BIASLVLH | LVLH wrt BIASLVLH quaternion | V97U2210C to V97U2213C | Table 4.3-3 ADI_QUAT_ UPLINK | Struc: S, V | ± 1 | – | 0.52 | On demand |
| OUTPUTS | | | | | | | | |
| Q_SM_SM(K) | Stable member wrt stable member quat, IMU pair K, K = 1, 2, 3 | V90U2255C to V90U2266C | IMU RM (4.27) | Struc(3): S, V | ± 1 | – | 6.25 | 6.25 |
| Q_M50_LVLH | M50 wrt LVLH quat | V90U2641C to V90U2644C | TLM, ORBIT DAP (4.35), ORB MNVR DIP (4.158) | Struc: S, V | ± 1 | – | 0.52 | 1.04 |
| Q_LVLH_ BIASLVLH | LVLH wrt BIASLVLH quat | V97U2210C to V97U2213C | TLM | Struc: S, V | ± 1 | – | 0.52 | 1.04 |

Table 4.3.2-1. ATT_PROC_ORBIT_LOOP Interface Requirements

| Name | Description | MSID | Source/ Destination | Type | Range | Unit | Sample Rate (Hz) | User Rate (Hz) |
|----------------------------|---|-------------------------------------|---|----------------|----------------------|------|---------------------|----------------------|
| T_NOW | Time tag of Q_B_M50 | V90W2310C | ORB DAP (4.35), TLM GN&C/SM-PL IF (4.111) UNIV POINT PROC (4.213) | S | > 0 | sec | 6.25 | 6.25 |
| Q_B_M50 | Body wrt M50 quaternion | V90U2240C to V90U2243C | GN&C/SM-PL IF (4.111) ORB DAP (4.35), TLM ORB/RND NAV (4.126) REL NAV SPEC (5.24) UNIV POINT PROC (4.213) ORB GUID (4.7), ATT_ PROC_ORBIT _DISP, RR SOP (4.229) IMU RM (4.72) | Struc: S, V | ± 1 | – | 6.25 | 1.04 6.25 12.5 |
| EULER_GPS_ AVAIL | Topodetic Euler angles availability flag | V90X2610XA | GPS SOP (4.17) | BD | ON/OFF | — | 6.25 | 6.25 |
| PSI(K) | First Euler angle, M50 to body, IMU K, K = 1, 2, 3 | V90H2311C to V90H2313C | IMU ALIGN (6.26) | A(3) S | 0 - 360 | deg | 1.04 | 1.04 |
| THETA(K) | Second Euler angle, M50 to body, IMU K, K = 1, 2, 3 | V90H2314C to V90H2316C | IMU ALIGN (6.26) | A(3) S | 0 - 90, 270 - 360 | deg | 1.04 | 1.04 |
| PHI(K) | Third Euler angle, M50 to body, IMU K, K = 1, 2, 3 | V90H2317C to V90H2319C | IMU ALIGN (6.26) | A(3) S | 0 - 360 | deg | 1.04 | 1.04 |
| PAYLOAD_PITCH | Pitch Euler angle, EF to body | V95L3887C | GN&C/SM-PL IF (4.111) | S | $\pm \pi$ | rad | 0.52 | 0.52 |
| PAYLOAD_YAW | Yaw Euler angle, EF to body | V95L3888C | GN&C/SM-PL IF (4.111) | S | $\pm \pi/2$ | rad | 0.52 | 0.52 |
| PAYLOAD_ROLL | Roll Euler angle, EF to body | V95L3889C | GN&C/SM-PL IF (4.111) | S | $\pm \pi$ | rad | 0.52 | 0.52 |
| Q_M50_ BIASLVLH | M50 wrt BIASLVLH quaternion | – | ATT_PROC_ ORBIT_DISP | Struc: S, V | ± 1 | – | 0.52 | 3.125 |
| Q_ROLL_SM(K) | Roll wrt stable member quaternion, IMU K, K = 1, 2, 3 | V90U2237C to V90U2348C | TLM | Struc: S, V | ± 1 | – | 6.25 | 1.04 |
| ATTITUDE_ INCREMENT_6HZ | Attitude increment | V90H2285C V90H2213C V90H2214C | ORB DAP (4.35) | V | ± 10 | deg | 6.25 | 6.25 |
| PHI_TOPO | Body roll attitude Euler angle | V90H2202CA | GPS SOP (4.17) | S | ± 180 | deg | 6.25 | 6.25 |
| PSI_TOPO | Body yaw attitude Euler angle | V90H2230CA | GPS SOP (4.17) | S | ± 180 | deg | 6.25 | 6.25 |
| THETA_TOPO | Body pitch attitude Euler angle | V90H2217CA | GPS SOP (4.17) | S | ± 90 | deg | 6.25 | 6.25 |

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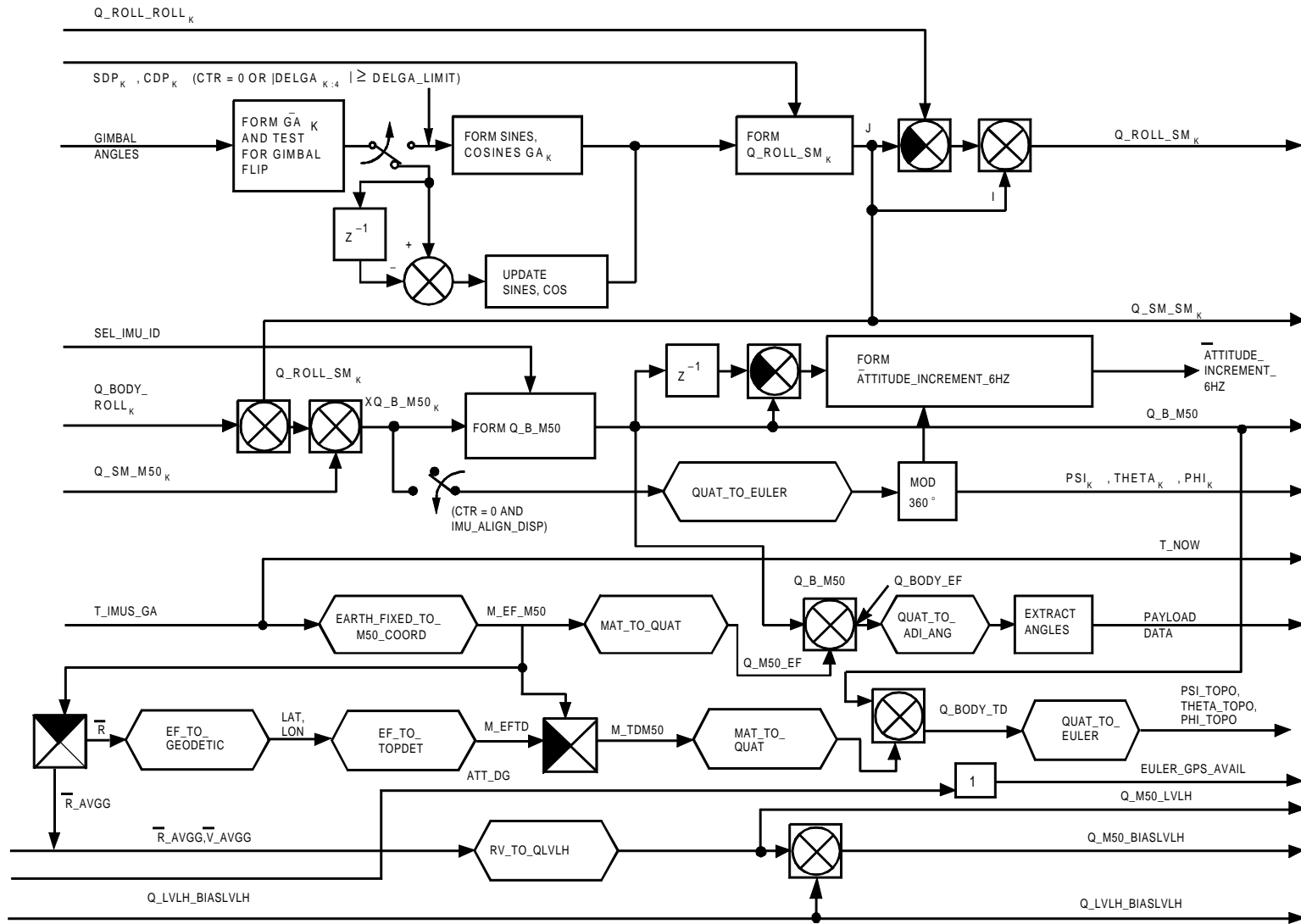
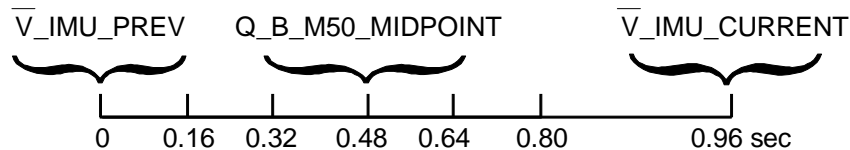


FIGURE 4.3.2-1. ATT_PROC_ORBIT_LOOP Block Diagram

4.3.3 On-Orbit Attitude Processor Display Processing (ATT_PROC_ORBIT_DISP)

ATT_PROC_ORBIT_DISP computes delta velocity in the body frame, body attitude error angles, and ADI ball driver functions.

A. Function. An overview block diagram of ATT_PROC_ORBIT_DISP is given in Figure 4.3.3-1. Delta velocity in the body frame is extracted at 1.04 Hz using the attitude at the midpoint of the 0.96-sec interval, i.e.,



First, save the attitude quaternion at the midpoint (0.48 sec) of the IMU RM velocity processing interval,

$$Q_B_M50_MIDPOINT = Q_B_M50$$

Then at 1.04 Hz, compute the delta velocity in the body frame, that is,

$$\bar{D}VM50 = \bar{V}_IMU_CURRENT - \bar{V}_IMU_PREV$$

$$\bar{V}_IMU_PREV = \bar{V}_IMU_CURRENT$$

$$\bar{D}VB_SEC = Q_B_M50_MIDPOINT \bar{D}VM50 Q_B_M50_MIDPOINT^*$$

If LVLH_MODE is OFF, attitude error angles, in degrees, are derived from a quaternion of the commanded body frame with respect to the measured body frame. This is not equivalent to the Euler angles that would define the precise rotation angles from the present to desired attitude. It should be expected, therefore, that for a 3-axis attitude maneuver on the order of 5 degrees or larger, the crew would have to repeat the maneuver sequence at least once.

$$Q_CMDB_B = Q_B_M50_CMD_DISPLAY Q_B_M50^*$$

And, for each axis $i = 1, 2, 3$

$$\bar{B}ODY_ERR_ANG_i = 2 \text{ DEG_PER_RAD SIGN}(Q_CMDB_B_S) (\bar{Q}_CMDB_B_V_i)$$

The positive sign is used in this equation to be compatible with the “fly to” error needles on the ADI.

If LVLH_MODE is ON, the attitude error angles are set to zero.

The remainder of ATT_PROC_ORBIT_DISP is processed at 3.125 Hz. ADI ball driver functions are derived for each of the three crew station ADI's. Each ADI has a three-position ATT_SEL_SW, which defines its reference frame. The two forward ADI's function only as +X ADI's. The aft ADI has a two-position SENSE_SW for which

SENSE_SW = ON RHC orient aft (or -X ADI)

SENSE_SW = OFF RHC orient up (or -Z ADI)

Each ADI has an ATT_REF_PB, which is used to define an inertial reference frame (REF) coincident with the instantaneous ADI installation frame when a non-zero ATT_REF_PB and COAS deselection (DESEL) and DOING_ST_RR_COAS \neq 3 are sensed. Definition of REF depends on which ADI station's button was selected.

The ADI's are numbered as follows:

ADI = 1 Left fore
= 2 Right fore
= 3 Aft

The three ATT_SEL_SW positions indicate reference frames defined by quaternions:

ATT_SEL_SW_{ADI} = -1 (= INRTL) INRTL is an arbitrary inertial reference frame defined by Q_M50_INRTL.

ATT_SEL_SW_{ADI} = 0
(= BIASLVLH) BIASLVLH is a non-inertial frame defined by Q_M50_BIASLVLH. BIASLVLH is a constant rotation away from LVLH given by Q_LVLH_BIASLVLH. LVLH is the local orbital frame.

ATT_SEL_SW_{ADI} = +1 (= REF) REF is an arbitrary inertial reference frame defined by Q_M50_REF. It is redefined as an inertial frame coincident with an instantaneous ADI installation frame whenever an ADI attitude reference switch is sensed and the COAS mode is not selected.

First, if FWD_ATT_REF_PB = ON or AFT_ATT_REF_PB = ON and DESEL = 1 and DOING_ST_RR_COAS \neq 3, Q_M50_REF is updated.

$$Q_M50_REF = Q_B_M50^*$$

If the aft station's PB switch is selected (AFT_ATT_REF_PB = ON) and SENSE_SW is ON,

$$Q_M50_REF = Q_B_M50^* Q_B_XADI$$

Q_B_XADI is a constant quaternion representing 180 degrees about pitch, 0 degree about yaw, and 180 degrees about roll and corrects for the mounting of the -X ADI.

If the aft station's PB switch is selected (AFT_ATT_REF_PB = ON) and SENSE_SW is OFF,

$$Q_M50_REF = Q_B_M50 * Q_B_ZADI$$

Q_B_ZADI is a constant quaternion representing 90 degrees about pitch, 0 degree about yaw, and 180 degrees about roll and corrects for the mounting of the -Z ADI.

Next, for each ADI, ADI = 1, 2, 3, Q_BODY_ADIREF is formed as a function of ATT_SEL_SW_{ADI}. (If any two or more ADI's have the same select switch setting, then the calculation of Q_BODY_ADIREF need be performed only once for those ADI's.)

$$ATT_SEL_SW_{ADI} = -1: Q_BODY_ADIREF = Q_B_M50 Q_M50_INRTL$$

$$ATT_SEL_SW_{ADI} = 0: Q_BODY_ADIREF = Q_B_M50 Q_M50_BIASLVLH$$

$$ATT_SEL_SW_{ADI} = +1: Q_BODY_ADIREF = Q_B_M50 Q_M50_REF$$

If ADI = 3 (aft ADI), Q_BODY_ADIREF is modified according to SENSE_SW. SENSE_SW = ON implies -X ADI, SENSE_SW = OFF implies -Z ADI. The update equations are:

$$\text{If } SENSE_SW = \text{ON } (-X \text{ ADI}), Q_BODY_ADIREF = Q_B_XADI * Q_BODY_ADIREF$$

$$\text{If } SENSE_SW = \text{OFF } (-Z \text{ ADI}), Q_BODY_ADIREF = Q_B_ZADI * Q_BODY_ADIREF$$

Q_BODY_ADIREF is then passed to QUAT_TO_ADI_ANG, which returns XPTCHSINE, XPTCHCOS, XYAWSINE, XYAWCOS, XROLLSINE, XROLLCOS, XFLAG. If XFLAG = OFF, the quaternion represents an attitude with YAW = ± 90 degrees, and the PTCH, ROLL functions have not been updated. That is, they contain data from a previous call. Thus, if XFLAG = OFF, the yaw functions are updated but the pitch and roll driver functions are not updated. If XFLAG = ON:

$$PTCHSINE_{ADI} = XPTCHSINE$$

$$PTCHCOS_{ADI} = XPTCHCOS$$

$$YAWSINE_{ADI} = XYAWSINE$$

$$YAWCOS_{ADI} = XYAWCOS$$

$$ROLLSINE_{ADI} = XROLLSINE$$

$$ROLLCOS_{ADI} = XROLLCOS$$

If the two forward ADI's have the same select switch setting, then the call to QUAT_TO_ADI_ANG need be made only once for those ADI's.

B. Processing Requirements. ATT_PROC_ORBIT_DISP is processed at 6.25 Hz after ATT_PROC_ORBIT_LOOP, except that ADI driver functions are processed at 3.125 Hz.

C. Interface Requirements. The interface requirements for ATT_PROC_ORBIT_DISP are shown in Table 4.3.3-1.

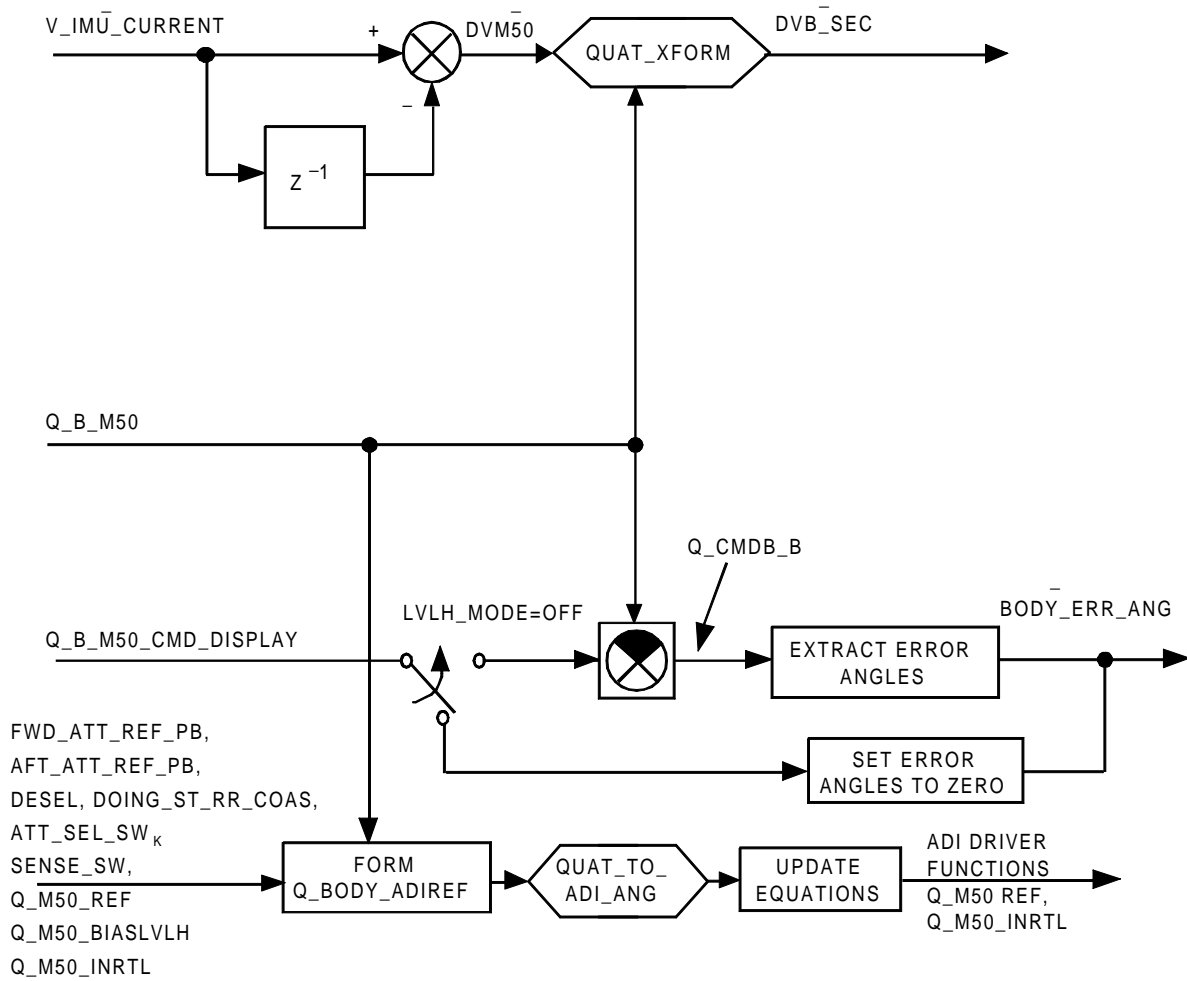


FIGURE 4.3.3-1. ATT_PROC_ORBIT_DISP Block Diagram

| Table 4.3.3-1. ATT_PROC_ORBIT_DISP Interface Requirements | | | | | | | | |
|---|--|-------------------------------------|--------------------------------|----------------|------------|--------|------------------------|------------------------|
| Name | Description | MSID | Source/ Destination | Type | Range | Unit | Sample Rate (Hz) | Update Rate (Hz) |
| INPUTS | | | | | | | | |
| V_IMU_CURRENT | Selected total accumulated sensed velocity | V90L2557C to V90L2559C | IMU RM (4.72) | V | $\pm 10^6$ | ft/sec | 1.04 | 1.04 |
| Q_B_M50 | Body wrt M50 quaternion | V90U2240C to V90U2243C | ATT_PROC_ORBIT_LOOP | Struc: S, V | ± 1 | — | 6.25 | 6.25 |
| Q_B_M50_CMD_DISPLAY | Commanded body attitude for error needle calculations | V90H2721C to V90H2724C | ORB DAP (4.35) | Struc: S, V | ± 1 | — | 6.25 | 6.25 |
| ATT_SEL_SW(K) | ADI mode switch, ADI K, K = left forward (1), right forward (2), aft (3) | V90J7503C V90J7504C V90X7744X | GN&C SW RM (4.180) | A(3) I | -1, 0, +1 | — | 3.125 | 3.125 |
| DESEL | COAS deselect command | V93X6647X | S TRK/COAS CNTL (6.44) | I | 0, 1 | — | 3.125 | On demand |
| SENSE_SW | Aft ADI sense switch | V90X7700X | GN&C SW RM (4.180) | B | 0, 1 | — | 3.125 | 3.125 |
| Q_M50_BIASLVLH | M50 wrt BIASLVLH quaternion | — | ATT_PROC_ORBIT_LOOP | Struc: S, V | ± 1 | — | 3.125 | 0.52 |
| Q_M50_REF | M50 wrt reference quaternion | V97U2218C to V97U2221C | Table 4.3-3 ADI_QUAT_UPLINK | Struc: S, V | ± 1 | — | 3.125 | On demand |
| Q_M50_INRTL | M50 wrt inertial quaternion | V97U2214C to V97U2217C | Table 4.3-3 ADI_QUAT_UPLINK | Struc: S, V | ± 1 | — | 3.125 | On demand |
| LVLH_MODE | LVLH manual mode flag | V90X2174X | ORB DAP (4.35) | B | 0, 1 | — | 6.25 | 6.25 |
| FWD_ATT_REF_PB | Attitude reference PB (LH or RH) | V90X7897X | GN&C SW RM (4.180) | B | 0, 1 | — | 3.125 | 3.125 |
| AFT_ATT_REF_PB | Attitude reference PB (aft) | V90X7701X | GN&C SW RM (4.180) | B | 0, 1 | — | 3.125 | 3.125 |
| DOING_ST_RR_COAS | Angles selected – ST TRK/RR/COAS (1–ST TRK Angles, 2–RR Angles, 3–COAS Angles) | V90J4872C | ORB/RND NAV (4.126) | I | 1, 2, 3 | — | 3.125 | On demand |

Table 4.3.3-1. ATT_PROC_ORBIT_DISP Interface Requirements

| Name | Description | MSID | Source/ Destination | Type | Range | Unit | Update Rate (Hz) | User Rate (Hz) |
|---|---|-------------------------------------|--|----------------|-----------|--------|------------------------|----------------------|
| OUTPUTS | | | | | | | | |
| $\overline{DVB_SEC}$ | Body $\Delta \overline{V}$ over last 0. 96s | V90L2696C to V90L2698C | OMS RM (4.92) ORB DAP (4.35) TLM | V | ± 10 | ft/sec | 1.04 | 1.04 |
| $\overline{BODY_ERR_ANG}$ | Error angles of commanded body wrt body attitude | V90U2233C to V90U2235C | ORB ADI PROC (4.169) | V | ± 180 | deg | 6.25 | 6.25 |
| PTCHSINE(K) | ADI pitch sine, ADI K, K = 1, 2, 3 | V90H2221C V90H2220C V90H2291C | ORB ADI PROC (4.169) TLM* | A(3) S | ± 1 | — | 3.125 | 3.125 |
| Q_M50_REF | M50 wrt reference quaternion | V97U2218C to V97U2221C | TLM | Struc: S, V | ± 1 | — | 3.125 | 3.125 |
| Q_M50_INRTL | M50 wrt inertial quaternion | V97U2214C to V97U2217C | TLM | Struc: S, V | ± 1 | — | 3.125 | 3.125 |
| PITCHCOS(K) | ADI pitch cosine, ADI K, K = 1, 2, 3 | V90H2222C V90H2218C V90H2292C | ORB ADI PROC (4.169) TLM* | A(3) S | ± 1 | — | 3.125 | 3.125 |
| YAWSINE(K) | ADI yaw sine, ADI K, K = 1, 2, 3 | V90H2231C V90H2293C V90H2295C | ORB ADI PROC (4.169), TLM* | A(3) S | ± 1 | — | 3.125 | 3.125 |
| YAWCOS(K) | ADI yaw cosine, ADI K, K = 1, 2, 3 | V90H2232C V90H2294C V90H2296C | ORB ADI PROC (4.169), TLM* | A(3) S | 0–1 | — | 3.125 | 3.125 |
| ROLLSINE(K) | ADI roll sine, ADI K, K = 1, 2, 3 | V90H2208C V90H2206C V90H2289C | ORB ADI PROC (4.169) TLM* | A(3) S | ± 1 | — | 3.125 | 3.125 |
| ROLLCOS(K) | ADI roll cosine, ADI K, K = 1, 2, 3 | V90H2209C V90H2207C V90H2290C | ORB ADI PROC (4.169) TLM* | A(3) S | ± 1 | — | 3.125 | 3.125 |
| * Only the AFT ADI Euler angle sines and cosines are output to TLM. | | | | | | | | |

4.3.4 RV_TO_QLVLH

RV_TO_QLVLH is a procedure which, given a position vector (\overline{R}) and velocity vector (\overline{V}), both coordinated in M50, returns a quaternion $XQ_M50_LVLH = (XQ_M50_LVLH_S, \overline{XQ_M50_LVLH_V})$ from the local orbital frame to the M50 frame. The call to RV_TO_QLVLH is

CALL RV_TO_QLVLH(\overline{XR} , \overline{XV}) ASSIGN(XQ_M50_LVLH)

A. Function. A block diagram of RV_TO_QLVLH is given in Figure 4.3.4-1. The detailed requirements are:

$$\overline{XZ} = \text{UNIT}(-\overline{XR})$$

$$\overline{XY} = \text{UNIT}(\overline{XV} * \overline{XR})$$

$$\overline{XX} = \text{UNIT}(\overline{XY} * \overline{XZ})$$

$$XM = (\text{MATRIX}(\overline{XX}, \overline{XY}, \overline{XZ}))^T$$

and XQ_M50_LVLH is formed from XM using the utility function MAT_TO_QUAT:

CALL MAT_TO_QUAT(XM) ASSIGN(XQ_M50_LVLH_S, $\overline{XQ_M50_LVLH_V}$)

B. Processing Requirements. RV_TO_QLVLH is performed once on call.

C. Interface Requirements. The interface requirements for RV_TO_QLVLH are shown in Table 4.3.4-1.

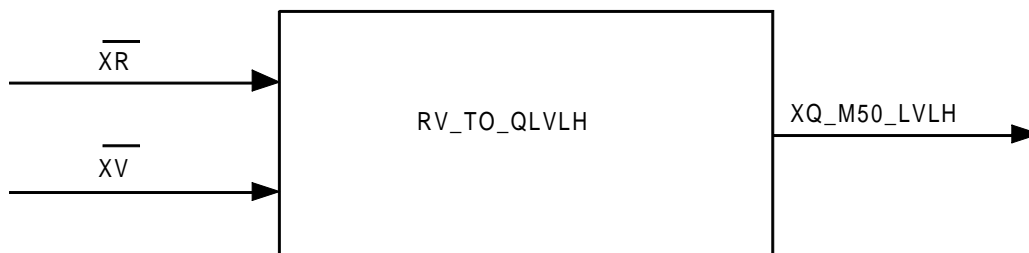


FIGURE 4.3.4-1. RV_TO_QLVLH Block Diagram

| Table 4.3.4-1.RV_TO_QLVLH Interface Requirements | | | | | | | |
|--|-------------------------|------------------------|----------------|-----------|--------|---------------------|---------------------|
| Name | Description | Source/ Destination | Type | Range | Unit | Sample Rate (Hz) | Update Rate (Hz) |
| INPUTS | | | | | | | |
| \overline{XR} | Vehicle position in M50 | Calling prog | V | TBD | ft | On demand | On demand |
| \overline{XV} | Vehicle velocity in M50 | Calling prog | V | $\pm 30K$ | ft/sec | On demand | On demand |
| OUTPUT | | | | | | | |
| Name | Description | Source/ Destination | Type | Range | Unit | Update Rate (Hz) | User Rate (Hz) |
| XQ_M50_LVLH | LVLH to M50 quaternion | Calling prog | Struc: S, V | ± 1 | — | On demand | On demand |

4.3.5 QUAT_TO_EULER

QUAT_TO_EULER is a procedure that extracts Euler angles from a quaternion assuming a yaw, pitch, roll rotation sequence. The resultant angles (in degrees), XPSI, XTHETA, XPHI, with $|XTHETA| < 90$ degrees, represent the same transformation as the arbitrary quaternion. $\sin(XPHI)$, $\cos(XPHI)$, $\sin(XTHETA)$ and $\cos(XTHETA)$ are also returned. For $XTHETA = \pm 90$ degrees, XPHI is arbitrarily chosen to be 0 degrees, and XPSI is extracted so that (XPSI, XTHETA, 0) represents the same attitude as the input quaternion. The call to QUAT_TO_EULER is

```
CALL QUAT_TO_EULER(XQ) ASSIGN(XPSI, XTHETA, XPHI, XSINTH, XCOSTH,
                           XSINPHI, XCOSPHI)
```

A. Function. A block diagram of QUAT_TO_EULER is given in Figure 4.3.5-1. The detailed requirements are:

$$XSINTH = -2 (XQ_V_1 XQ_V_3 + XQ_S XQ_V_2)$$

If $|XSINTH| > 1$ then $XSINTH = \text{sign}(XSINTH)$

(Note: sign is a function which returns -1 for negative values and 1 otherwise)

$$XCOSTH = \text{SQRT}(1 - XSINTH^2)$$

$$XTHETA = \text{DEG_PER_RAD ARCSIN}(XSINTH)$$

If $XCOSTH \geq 2^{-11}$, then the following steps are performed:

$$\text{DUMMY1} = 2 (XQ_V_2 XQ_V_3 - XQ_S XQ_V_1)$$

$$\text{DUMMY2} = 1 - 2 (XQ_V_1^2 + XQ_V_2^2)$$

$$\text{XPSI} = \text{DEG_PER_RAD ARCTAN2}[2 (XQ_V_1 XQ_V_2 - XQ_S XQ_V_3), (1 - 2 (XQ_V_2^2 + XQ_V_3^2))]$$

$$\text{XPHI} = \text{DEG_PER_RAD ARCTAN2}(\text{DUMMY1}, \text{DUMMY2})$$

$$\text{XSINPHI} = \text{DUMMY1}/\text{XCOSTH}$$

$$\text{XCOSPHI} = \text{DUMMY2}/\text{XCOSTH}$$

If $|\text{XCOSPHI}| < 2^{-16}$, $\text{XCOSPHI} = 2^{-16} \text{SIGN}(\text{XCOSPHI})$

If $|\text{XCOSTH}| < 2^{-11}$, then the following steps are performed:

$$\text{XPHI}, \text{XSINPHI} = 0$$

$$\text{XCOSPHI} = 1$$

$$\text{XPSI} = \text{DEG_PER_RAD ARCTAN2}[-2 (XQ_V_1 XQ_V_2 + XQ_S XQ_V_3), (1 - 2 (XQ_V_1^2 + XQ_V_3^2))]$$

B. Processing Requirements. QUAT_TO_EULER is performed once on call.

C. Interface Requirements. The interface requirements for QUAT_TO_EULER are shown in Table 4.3.5-1.

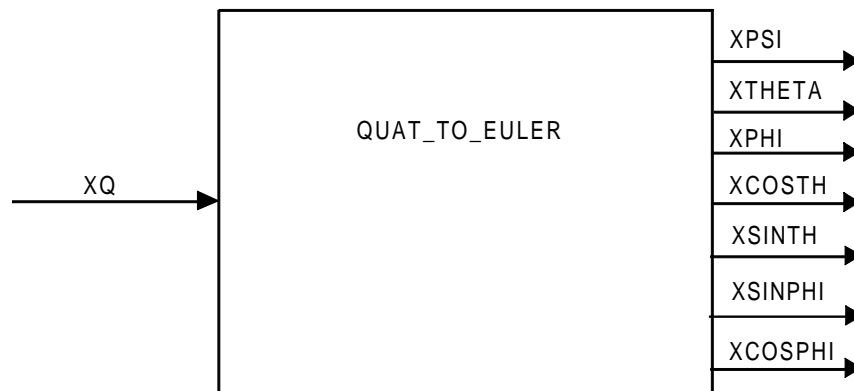


FIGURE 4.3.5-1. QUAT_TO_EULER Block Diagram

| Table 4.3.5-1. QUAT_TO_EULER Interface Requirements | | | | | | | |
|---|-----------------------------|------------------------|----------------|-----------|------|---------------------|---------------------|
| Name | Description | Source/ Destination | Type | Range | Unit | Sample Rate (Hz) | Update Rate (Hz) |
| INPUTS | | | | | | | |
| XQ | Quaternion to be decomposed | Calling prog | Struc: S, V | ± 1 | — | On demand | On demand |
| OUTPUTS | | | | | | | |
| Name | Description | Source/ Destination | Type | Range | Unit | Update Rate (Hz) | User Rate (Hz) |
| XPSI | First Euler angle | Calling prog | S | ± 180 | deg | On demand | On demand |
| XTHETA | Second Euler angle | Calling prog | S | ± 90 | deg | On demand | On demand |
| XPHI | Third Euler angle | Calling prog | S | ± 180 | deg | On demand | On demand |
| XCOSTH | Cosine (XTHETA) | Calling prog | S | 0–1 | — | On demand | On demand |
| XSINTH | Sine (XTHETA) | Calling prog | S | ± 1 | — | On demand | On demand |
| XCOSPHI | Cosine (XPHI) | Calling prog | S | ± 1 | — | On demand | On demand |
| XSINPHI | Sine (XPHI) | Calling prog | S | ± 1 | — | On demand | On demand |

4.3.6 QUAT_TO_ADI_ANG

QUAT_TO_ADI_ANG is a procedure that extracts sines and cosines of ADI sequence angles from an arbitrary quaternion. A flag is returned indicating whether or not pitch and roll functions have been updated. That quaternion represents a rotation from a reference frame to the body frame. The sines and cosines represent the ordered set of angles PTCH, YAW, ROLL, with $|\text{YAW}| < \pi/2$. The call to QUAT_TO_ADI_ANG is

```
CALL QUAT_TO_ADI_ANG(XQ) ASSIGN(XPTCHSINE, XPTCHCOS,
                                XYAWSINE, XYAWCOS, XROLLSINE, XROLLCOS, XFLAG)
```

where XQ is a structure of a scalar and a vector, $XQ = (XQS, \overline{XQV})$. It is assumed that XQ is normalized. A block diagram of QUAT_TO_ADI_ANG is given in Figure 4.3.6-1.

A. Function.

$$\begin{aligned} XFLAG &= \text{ON} \\ XYAWSINE &= 2 (XQV_1 XQV_2 - XQS XQV_3) \\ XYAWCOS &= \text{SQRT}(1 - XYAWSINE^2) \end{aligned}$$

If XYAWCOS < EPSILON, the PTCH and ROLL functions are not updated on this pass, and XFLAG = OFF. If XYAWCOS \geq EPSILON, the update equations are:

$$\begin{aligned} XYAWSEC &= 1/XYAWCOS \\ XROLLSINE &= -2 XYAWSEC (XQV_2 XQV_3 + XQS XQV_1) \\ XROLLCOS &= XYAWSEC (1 - 2 (XQV_1^2 + XQV_3^2)) \\ XPTCHSINE &= -2 XYAWSEC (XQV_1 XQV_3 + XQS XQV_2) \\ XPTCHCOS &= XYAWSEC (1 - 2 (XQV_2^2 + XQV_3^2)) \end{aligned}$$

B. Processing Requirements. QUAT_TO_ADI_ANG is performed once on call.

C. Interface Requirements. The interface requirements for the module QUAT_TO_ADI_ANG are given in Table 4.3.6-1.

D. Constants. Only the constants DEG_PER_RAD = $180/\pi$ deg/rad and EPSILON = 0.03 are used. EPSILON is the lowest value of YAWCOS for which PTCH and ROLL functions are updated.

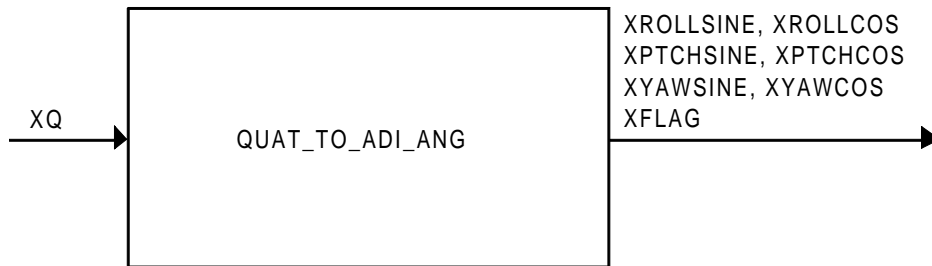


FIGURE 4.3.6-1. QUAT_TO_ADI_ANG Block Diagram

| Table 4.3.6-1. QUAT_TO_ADI_ANG Interface Requirements | | | | | | | |
|---|--------------------------------|------------------------|----------------|---------|------|---------------------|---------------------|
| Name | Description | Source/ Destination | Type | Range | Unit | Sample Rate (Hz) | Update Rate (Hz) |
| INPUT | | | | | | | |
| XQ | Quaternion to be Decomposed | Calling prog | Struc: S, V | ± 1 | — | On demand | On demand |
| OUTPUTS | | | | | | | |
| | | | | | | Update Rate (Hz) | User Rate (Hz) |
| XPTCHSINE | Sin(PTCH) | Calling prog | S | ± 1 | — | On demand | On demand |
| XPTCHCOS | Cos(PTCH) | Calling prog | S | ± 1 | — | On demand | On demand |
| XYAWSINE | Sin(YAW) | Calling prog | S | ± 1 | — | On demand | On demand |
| XYAWCOS | Cos(YAW) | Calling prog | S | 0-1 | — | On demand | On demand |
| XROLLSINE | Sin(ROLL) | Calling prog | S | ± 1 | — | On demand | On demand |
| XROLLCOS | Cos(ROLL) | Calling prog | S | ± 1 | — | On demand | On demand |
| XFLAG | PTCH, ROLL, update flag | Calling prog | S | 0, 1 | — | On demand | On demand |

4.3.7 QUAT_XFORM

The detailed block diagram for the module QUAT_XFORM is presented in Figure 4.3.7-1. This utility routine performs a coordinate transformation on a vector, using quaternions. The input includes a quaternion representing the coordinate transformation and the vector to be transformed. The output is the transformed vector. It is assumed that the input quaternion is normal. QUAT_XFORM shall be reentrant.

A. Function.

$$\overline{VT} = \overline{QBAV} * \overline{W}_A$$

$$\overline{W}_B = \overline{W}_A + 2 (QBAS \overline{VT} + \overline{QBAV} * \overline{VT})$$

These equations may be expanded in scalar form to minimize CPU usage.

$$VT_1 = QBAV_2 W_{A3} - QBAV_3 W_{A2}$$

$$VT_2 = QBAV_3 W_{A1} - QBAV_1 W_{A3}$$

$$VT_3 = QBAV_1 W_{A2} - QBAV_2 W_{A1}$$

$$W_{B1} = W_{A1} + 2 (QBAS VT_1 + QBAV_2 VT_3 - QBAV_3 VT_2)$$

$$W_{B2} = W_{A2} + 2 (QBAS VT_2 + QBAV_3 VT_1 - QBAV_1 VT_3)$$

$$W_{B3} = W_{A3} + 2 (QBAS VT_3 + QBAV_1 VT_2 - QBAV_2 VT_1)$$

B. Processing Requirements. The module QUAT_XFORM is processed when invoked by a user.

C. Interface Requirements. The interface requirements for the module QUAT_XFORM are shown in Table 4.3.7-1.

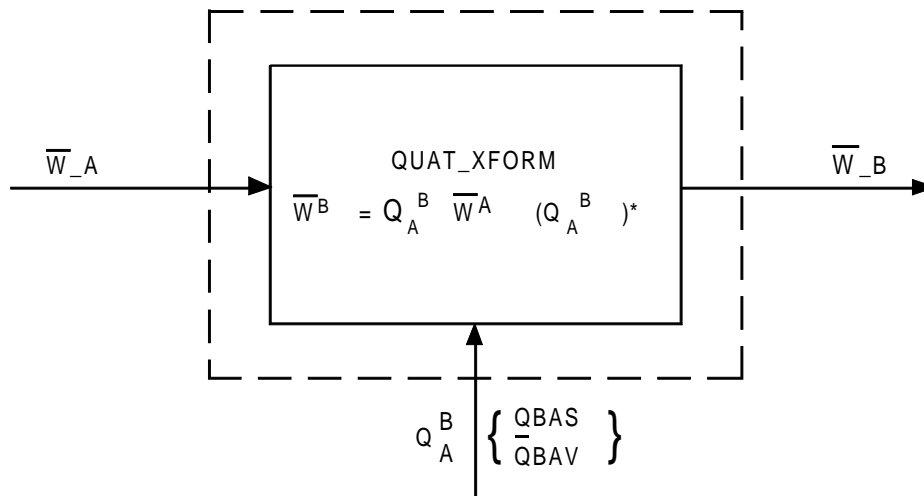


FIGURE 4.3.7-1. QUAT_XFORM Block Diagram

| Table 4.3.7-1. QUAT_XFORM Interface Requirements | | | | | | |
|--|---------------------------------|------------------------|------|-------|---------------------|---------------------|
| Name | Description | Source/ Destination | Type | Units | Sample Rate (Hz) | Update Rate (Hz) |
| INPUTS | | | | | | |
| \bar{W}_A | Input vector in frame A | Calling prog | V | — | On demand | On demand |
| Q_B_A | Quaternion, frame B wrt frame A | Calling prog | Q | — | On demand | On demand |
| Name | Description | Source/ Destination | Type | Units | Update Rate (Hz) | User Rate (Hz) |
| OUTPUTS | | | | | | |
| \bar{W}_B | Output vector in frame B | Calling prog | V | — | On demand | On demand |

4.3.8 MAT_TO_QUAT

The detailed block diagram for the module MAT_TO_QUAT presented in Figure 4.3.8–1 extracts a quaternion from its direction cosine matrix. The extraction process avoids singularities. A positive scalar part is arbitrarily chosen for the resulting quaternion. It is assumed that the input matrix is unitary. MAT_TO_QUAT shall be reentrant.

CAUTION: Quaternions and direction cosine matrices are used to represent transformations of coordinates. The notation used for both methods is briefly described.

Given two coordinate frames A and B, with common origin, and vector whose coordinates in each frame are \bar{V}_A and \bar{V}_B respectively, the notation Q_{B_A} denotes the quaternion which represents the transformation from frame A to frame B:

$$\bar{V}_B = Q_{B_A} \bar{V}_A (Q_{B_A})^*$$

This equation is valid if (i) \bar{V}_A and \bar{V}_B are viewed as quaternions with zero scalar part and (ii) $Q_{B_A} = (QBAS, \bar{QBAV})$ is normalized; the conjugate of Q_{B_A} is defined by $(Q_{B_A})^* = (QBAS, -\bar{QBAV})$. Transformation of coordinates from frame A to frame B may also be viewed as the result of a rotation through an angle θ about an oriented axis ω ; the connection with Q_{B_A} is as follows:

$$QBAS = \cos\left(\frac{\theta}{2}\right), \bar{QBAV} = -\text{UNIT}(\omega) \sin\left(\frac{\theta}{2}\right)$$

With this convention, transformations from frames A and B, each to a third frame C, are related as follows:

$$Q_{C_A} = Q_{C_B} Q_{B_A}$$

Block diagram symbology for quaternion multiplication is described in Section 4.3.10 (QUAT_MULT) of this document.

Notation for direction cosine matrices is slightly different and is briefly described. Given two coordinate frames A and B, with common origin, and a vector whose coordinates in each frame are \bar{V}_A and \bar{V}_B , respectively, the rotation M_{AB} denotes the direction cosine matrix that represents the transformation from frame A to frame B:

$$\bar{V}_B = M_{AB} \bar{V}_A;$$

With this convention, transformations from frames A and B, each to a third frame C, are related as follows:

$$M_{AC} = M_{BC} M_{AB}$$

- A. Function. The detailed technical descriptions appear in the diagram presented in Figure 4.3.8–2.
- B. Processing Requirements. The module MAT_TO_QUAT is processed when invoked by a user.
- C. Interface Requirements. The interface requirements for the module MAT_TO_QUAT are shown in Table 4.3.8–1.

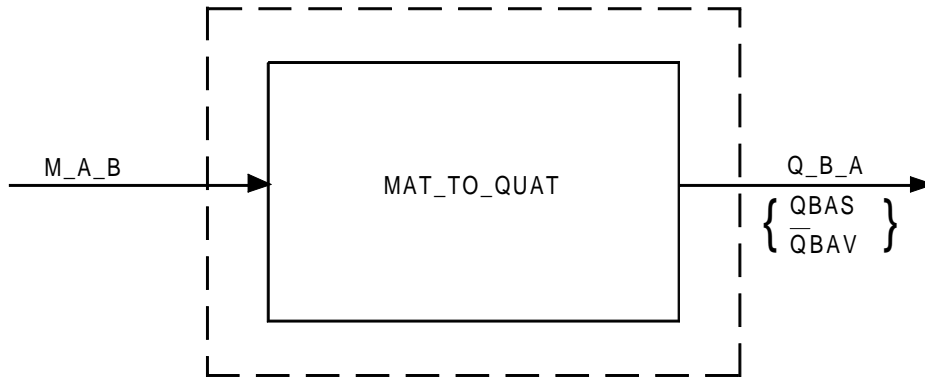


FIGURE 4.3.8-1. MAT_TO_QUAT Block Diagram

| Table 4.3.8-1.MAT_TO_QUAT Interface Requirements | | | | | | |
|--|--|------------------------|----------------|-------|---------------------|---------------------|
| Name | Description | Source/ Destination | Type | Units | Sample Rate (Hz) | Update Rate (Hz) |
| INPUT | | | | | | |
| M_A_B | Direction cosine matrix, B frame wrt A frame | Calling prog | M | — | On demand | On demand |
| OUTPUT | | | | | | |
| Name | Description | Source/ Destination | Type | Units | Update Rate (Hz) | User Rate (Hz) |
| Q_B_A | Quarternion, B frame wrt A frame | Calling prog | Structure S, V | — | On demand | On demand |

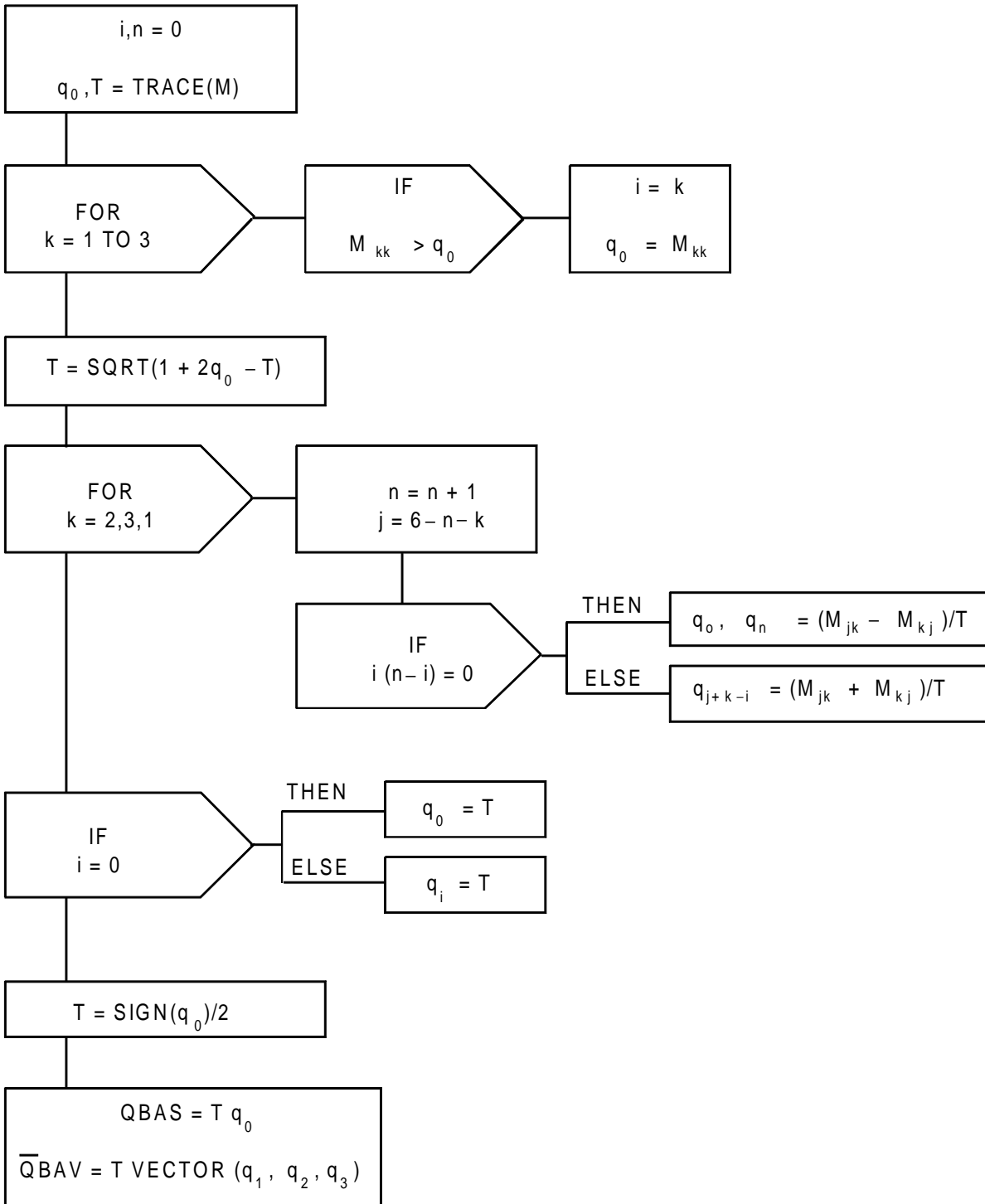


FIGURE 4.3.8-2. MAT_TO_QUAT Logic Diagram

4.3.9 ADI_QUAT_UPLINK

ADI_QUAT_UPLINK, shown in Figure 4.3.9–1, is a procedure that performs the following functions:

1. Determine whether new ADI quaternion loads have been uplinked and made available.
2. Move the new data from the uplink buffers into appropriate compool storage locations.

A. Function. The following set of equations and sequences is used to perform the ADI_QUAT_UPLINK function.

1. If the uplink OP code is for the ADI INERTIAL QUATERNION LOAD (0011000), then transfer the values of the quaternion elements from the uplink buffer into the storage locations used by ATT_PROC_ORBIT_DISP for the ADI inertial quaternion.
2. If the uplink OP code is for the ADI REFERENCE QUATERNION LOAD (0011101), then transfer the values of the quaternion elements from the uplink buffer into the storage locations used by the ATT_PROC_ORBIT_DISP for the ADI reference quaternion.
3. If the uplink OP code is for the ADI BIASLVLH QUATERNION LOAD (0011110), then transfer the values of the quaternion elements from the uplink buffer into the storage locations used by ATT_PROC_ORBIT_LOOP for the ADI bias LVLH quaternion.

B. Processing Requirements. ADI_QUAT_UPLINK is performed on call.

C. Interface Requirements. The interface requirements for ADI_QUAT_UPLINK are given in Table 4.3.9–1.

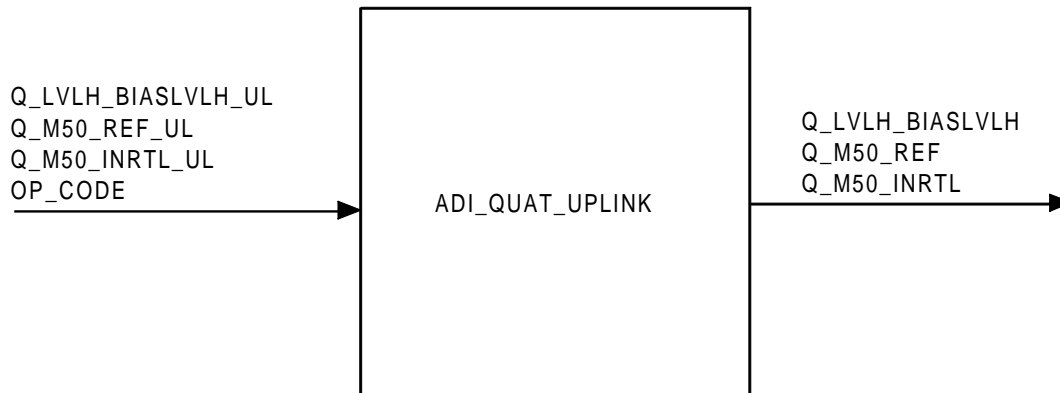


FIGURE 4.3.9-1. ADI_QUAT_UPLINK Block Diagram

| Table 4.3.9-1.ADI_QUAT_UPLINK Interface Requirements | | | | | | | | |
|--|--|------------------------------|-------------------------|-----------------|-------------------------------|------|------------------------|------------------------|
| Name | Description | MSID | Source/ Destination | Type | Range | Unit | Sample Rate (Hz) | Update Rate (Hz) |
| INPUTS | | | | | | | | |
| Q_LVLH_ BIASLVLH_ UL | Uplinked LVLH wrt BIASLVLH | V97U2210C to V97U2213C | Uplink buffer | Struct: S, V | ± 1 | — | On demand | On demand |
| OP_CODE | OP code to define CMD load | V96J3524C | Uplink buffer | BI | 0011000 0011101 0011110 | — | On demand | On demand |
| Q_M50_REF_ UL | Uplinked M50 wrt reference ADI quarternion | V97U2218C to V97U2221C | Uplink buffer | Struct: S, V | ± 1 | — | On demand | On demand |
| Q_M50_INRT_ UL | Uplinked M50 wrt inertial ADI quarternion | V97U2214C to V97U2217C | Uplink buffer | Struct: S, V | ± 1 | — | On demand | On demand |
| OUTPUTS | | | | | | | | |
| Name | Description | MSID | Source/ Destination | Type | Range | Unit | Update Rate (Hz) | User Rate (Hz) |
| Q_LVLH_ BIASLVLH | Uplinked LVLH wrt BIASLVLH quarternion | V97U2210C to V97U2213C | ATT_PROC_ ORBIT_LOOP | Struct: S, V | ± 1 | — | On demand | 0.52 |
| Q_M50_REF | Uplinked M50 wrt reference ADI quarternion | V97U2218C to V97U2221C | ATT_PROC_ ORBIT_DISP | Struct: S, V | ± 1 | — | On demand | 3.125 |
| Q_M50_ INRTL | Uplinked M50 wrt INRTL ADI quarternion | V97U2214C to V97U2217C | ATT_PROC_ ORBIT_DISP | Struct: S, V | ± 1 | — | On demand | 3.125 |

4.3.10 QUAT_MULT

This module obtains the product of two quaternions. The scalar and vector parts of the input quaternions are isolated so the conjugate of either or both inputs may be supplied (by inversion of the vector part) if desired.

- A. Function. The detailed block diagram for the module QUAT_MULT is presented in Figure 4.3.10-1.
- B. Processing Requirements. As called.
- C. Interface Requirements. The interface requirements for the module QUAT_MULT are shown in Table 4.3.10-1.

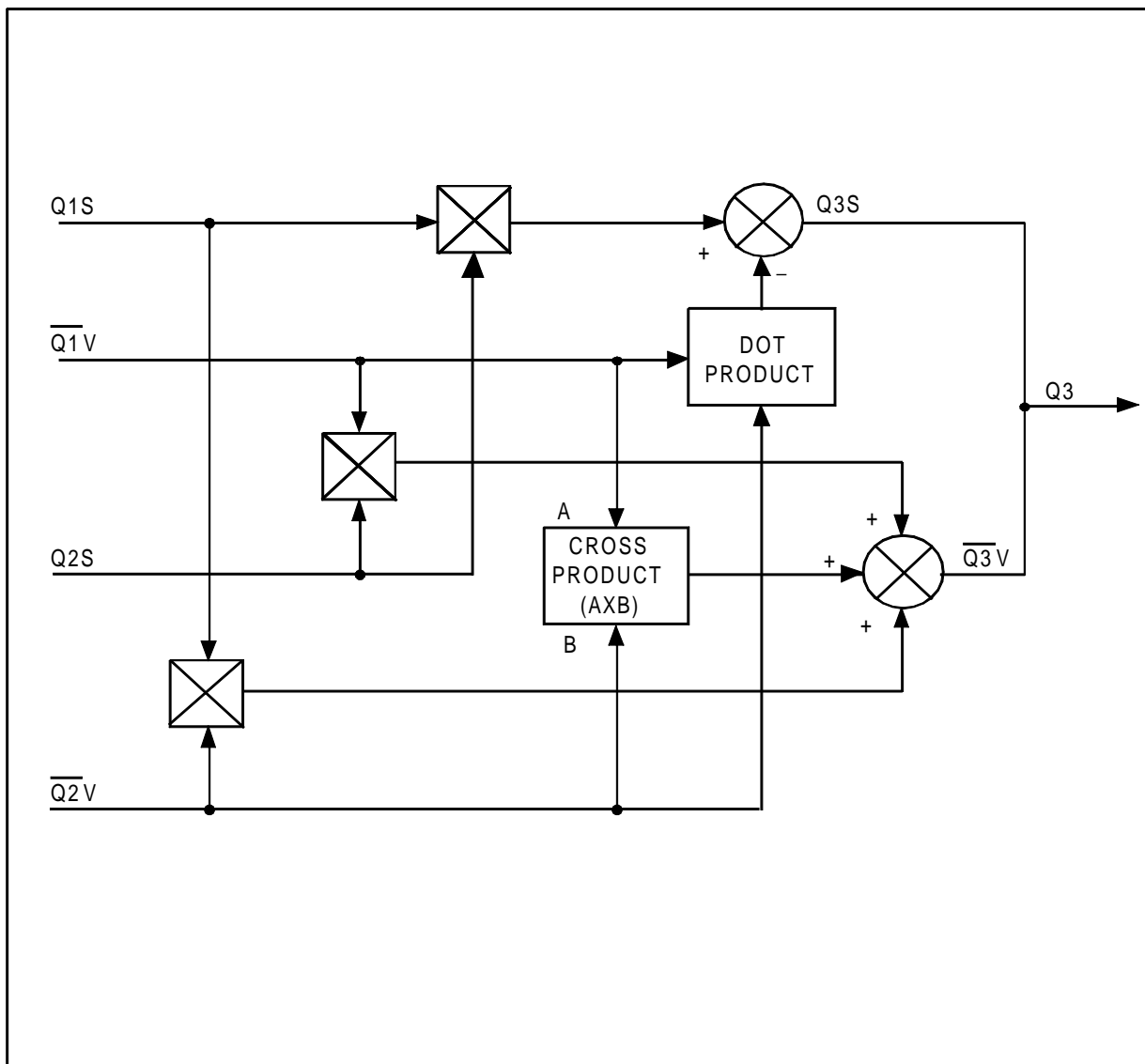


FIGURE 4.3.10-1. QUAT_MULT Block Diagram

| Table 4.3.10-1. QUAT_MULT Interface Requirements | | | | | | | |
|---|--|------------------------|--------------------|---------------------|------|------------------------|------------------------|
| Name | Description | Source/ Destination | Type | Range | Unit | Sample Rate (Hz) | Update Rate (Hz) |
| INPUTS | | | | | | | |
| Q1S (Note 1) | Scalar part of first (lefthand) quaternion | Calling routine | S | -1 to 1 | none | On demand | On demand |
| $\overline{Q1V}$ (Note 1) | Vector part of first (lefthand) quaternion | Calling routine | V(3) | -1 to 1 | none | On demand | On demand |
| Q2S (Note 1) | Scalar part of second (righthand) quaternion | Calling routine | S | -1 to 1 | none | On demand | On demand |
| $\overline{Q2V}$ (Note 1) | Vector part of second (righthand) quaternion | Calling routine | V(3) | -1 to 1 | none | On demand | On demand |
| OUTPUTS | | | | | | | |
| Name | Description | Source/ Destination | Type | Range | Unit | Update Rate (Hz) | User Rate (Hz) |
| Q3 (Note 2) | Quaternion point of Q1 and Q2 | Calling routine | Struct: S; V(3) | -1 to 1; -1 to 1 | none | On demand | On demand |
| Note 1. Input parameter name. Calling routine may use any legal name. Note 2. Assign parameter name. Calling routine may use any legal name. | | | | | | | |

4.3.11 Parameter Tables for ON-ORBIT ATT PROC Interface Support Functions

The IDD inputs and outputs are listed in Tables 4.3.11-1 and 4.3.11-2. Values for the I-loads are contained in the I-loads requirements document (JSC-19350); however, I-load definitions applicable to this principal function are listed in Table 4.3.11-3. K-loads are listed in Table 4.3.11-4. Constants are listed in Table 4.3.11-5.

TABLE 4.3.11-1. INPUT FUNCTIONAL PARAMETERS FOR ONORBIT ATTITUDE PROCESSING (G4.97)

| FSSR NAME | M/S ID | NOMENCLATURE | SOURCE | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-------------------------|------------|-----------------------------------|---------------------|---------|-----------|---------|---------|-------|
| AFT_ATT_REF_PB | V90X7701X | SEL AFT ADI ATT REF PB | GN&C SW RM | | BD | | 93017G | * |
| ATT_DG | V90X2555X | ATTITUDE DATA GOOD FLAG | IMU RM | | | | 93017G | * |
| ATT_SEL_SW(1) | V90J7503C | LH ADI ATTITUDE SELECT SW | GN&C SW RM | | HXS | | 93017G | * |
| ATT_SEL_SW(2) | V90J7504C | RH ADI ATTITUDE SELECT SW | GN&C SW RM | | HXS | | 93017G | * |
| ATT_SEL_SW(3) | V90J7744C | AFT ADI ATTITUDE SELECT SW | GN&C SW RM | | HXS | | 93017G | * |
| 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 | * |
| CDP(1) | V90U2648CB | COS OF 1/2 IMU 1 R/P NONORTHOGON | A/E ATT PROC | | | | | |
| CDP(2) | V90U2649CB | COS OF 1/2 IMU 2 R/P NONORTHOGON | A/E ATT PROC | | | | | |
| CDP(3) | V90U2650CB | COS OF 1/2 IMU 3 R/P NONORTHOGON | A/E ATT PROC | | | | | |
| DESEL | V93X6647X | COAS DES CMD | STAR TRKR/COAS DISP | | BD | | | |
| DOING_ST_RR_COAS | V90J4872C | ANGLES SELECTED-ST TRK/RR/COAS | ORB/RND NAV | SPECIAL | HXS | | 93017G | * |
| FWD_ATT_REF_PB | V90X7897X | STA SEL FWD ADI ATT REF PB | GN&C SW RM | | | | | |
| IMU_ALIGN_DISP | V90X8020X | IMU ALIGN DISP ON FLAG | MSC | | | | 89599C | |
| IMU_QUAT_UPD_REQ | V95X0532X | IMU REFERENCE QUAT UPDATE REQUEST | IMU ORB A/CAL | | | | 89986H | |
| 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 | * |
| LVLH_MODE | V90X2174X | LVLH MODE INDICATOR | ORB DAP | | | | | |
| M_M50TOEF_AT_EPOCH(1,1) | V97U5738C | M50 TO EF TRANS MATRIX ELEM 1,1 | RNP MAT COMP | ND | DPL | | 93090E | |
| M_M50TOEF_AT_EPOCH(1,2) | V97U5739C | M50 TO EF TRANS MATRIX ELEM 1,2 | RNP MAT COMP | ND | DPL | | 93090E | |
| M_M50TOEF_AT_EPOCH(1,3) | V97U5740C | M50 TO EF TRANS MATRIX ELEM 1,3 | RNP MAT COMP | ND | DPL | | 93090E | |
| M_M50TOEF_AT_EPOCH(2,1) | V97U5741C | M50 TO EF TRANS MATRIX ELEM 2,1 | RNP MAT COMP | ND | DPL | | 93090E | |
| M_M50TOEF_AT_EPOCH(2,2) | V97U5742C | M50 TO EF TRANS MATRIX ELEM 2,2 | RNP MAT COMP | ND | DPL | | 93090E | |
| M_M50TOEF_AT_EPOCH(2,3) | V97U5743C | M50 TO EF TRANS MATRIX ELEM 2,3 | RNP MAT COMP | ND | DPL | | 93090E | |
| M_M50TOEF_AT_EPOCH(3,1) | V97U5744C | M50 TO EF TRANS MATRIX ELEM 3,1 | RNP MAT COMP | ND | DPL | | 93090E | |
| M_M50TOEF_AT_EPOCH(3,2) | V97U5745C | M50 TO EF TRANS MATRIX ELEM 3,2 | RNP MAT COMP | ND | DPL | | 93090E | |
| M_M50TOEF_AT_EPOCH(3,3) | V97U5746C | M50 TO EF TRANS MATRIX ELEM 3,3 | RNP MAT COMP | ND | DPL | | 93090E | |
| OP_CODE | V96J3524C | OP CODE TO DEFINE CMD LOAD | UL | | | | 89590B | |
| 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 | * |
| Q_B_I_CMD_DISPLAY(1) | V90H2721CB | CMD BODY WRT M50 QUAT ELEM 1 | ORB DAP | | | | | |
| Q_B_I_CMD_DISPLAY(2) | V90H2722CB | CMD BODY WRT M50 QUAT ELEM 2 | ORB DAP | | | | | |
| Q_B_I_CMD_DISPLAY(3) | V90H2723CB | CMD BODY WRT M50 QUAT ELEM 3 | ORB DAP | | | | | |
| Q_B_I_CMD_DISPLAY(4) | V90H2724CB | CMD BODY WRT M50 QUAT ELEM 4 | ORB DAP | | | | | |
| Q_LVLH_BIASLVLH_UL(1) | V97U2210CC | ADI TO LVLH QUAT ELEM 1 | UL | | | | | |
| Q_LVLH_BIASLVLH_UL(2) | V97U2211CC | ADI TO LVLH QUAT ELEM 2 | UL | | | | | |
| Q_LVLH_BIASLVLH_UL(3) | V97U2212CC | ADI TO LVLH QUAT ELEM 3 | UL | | | | | |
| Q_LVLH_BIASLVLH_UL(4) | V97U2213CC | ADI TO LVLH QUAT ELEM 4 | UL | | | | | |
| Q_M50_INRTL_UL(1) | V97U2214CC | ADI INERT QUAT ELEM 1 | UL | | | | | |
| Q_M50_INRTL_UL(2) | V97U2215CC | ADI INERT QUAT ELEM 2 | UL | | | | | |

TABLE 4.3.11-1. INPUT FUNCTIONAL PARAMETERS FOR ONORBIT ATTITUDE PROCESSING (G4.97)

| FSSR NAME | M/S ID | NOMENCLATURE | SOURCE | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|----------------------|------------|------------------------------------|---------------|-------|-----------|---------|---------|-------|
| Q_M50_INRTL_UL(3) | V97U2216CC | ADI INERT QUAT ELEM 3 | UL | | | | | |
| Q_M50_INRTL_UL(4) | V97U2217CC | ADI INERT QUAT ELEM 4 | UL | | | | | |
| Q_M50_REF_UL(1) | V97U2218CC | ADI REF QUAT ELEM 1 | UL | | | | | |
| Q_M50_REF_UL(2) | V97U2219CC | ADI REF QUAT ELEM 2 | UL | | | | | |
| Q_M50_REF_UL(3) | V97U2220CC | ADI REF QUAT ELEM 3 | UL | | | | | |
| Q_M50_REF_UL(4) | V97U2221CC | ADI REF QUAT ELEM 4 | UL | | | | | |
| Q_SM_M50(1,1) | V90U2664CB | IMU 1 REFERENCE QUATERNION 1 | A/E ATT PROC | | | | | |
| Q_SM_M50(1,2) | V90U2665CB | IMU 1 REFERENCE QUATERNION 2 | A/E ATT PROC | | | | | |
| Q_SM_M50(1,3) | V90U2666CB | IMU 1 REFERENCE QUATERNION 3 | A/E ATT PROC | | | | | |
| Q_SM_M50(1,4) | V90U2667CB | IMU 1 REFERENCE QUATERNION 4 | A/E ATT PROC | | | | | |
| Q_SM_M50(2,1) | V90U2668CB | IMU 2 REFERENCE QUATERNION 1 | A/E ATT PROC | | | | | |
| Q_SM_M50(2,2) | V90U2669CB | IMU 2 REFERENCE QUATERNION 2 | A/E ATT PROC | | | | | |
| Q_SM_M50(2,3) | V90U2670CB | IMU 2 REFERENCE QUATERNION 3 | A/E ATT PROC | | | | | |
| Q_SM_M50(2,4) | V90U2671CB | IMU 2 REFERENCE QUATERNION 4 | A/E ATT PROC | | | | | |
| Q_SM_M50(3,1) | V90U2672CB | IMU 3 REFERENCE QUATERNION 1 | A/E ATT PROC | | | | | |
| Q_SM_M50(3,2) | V90U2673CB | IMU 3 REFERENCE QUATERNION 2 | A/E ATT PROC | | | | | |
| Q_SM_M50(3,3) | V90U2674CB | IMU 3 REFERENCE QUATERNION 3 | A/E ATT PROC | | | | | |
| Q_SM_M50(3,4) | V90U2675CB | IMU 3 REFERENCE QUATERNION 4 | A/E ATT PROC | | | | | |
| R_AVGG(1) | V95H0185CF | X-COMP OF CUR SHUTTLE POS VCTR M50 | ORB UPP | FT | DPL | | 93017G | * |
| R_AVGG(2) | V95H0186CF | Y-COMP OF CUR SHUTTLE POS VCTR M50 | ORB UPP | FT | DPL | | 93017G | * |
| R_AVGG(3) | V95H0187CF | Z-COMP OF CUR SHUTTLE POS VCTR M50 | ORB UPP | FT | DPL | | 93017G | * |
| SDP(1) | V90U2645CB | SIN OF 1/2 IMU 1 R/P NONORTHOGON | A/E ATT PROC | | | | | |
| SDP(2) | V90U2646CB | SIN OF 1/2 IMU 2 R/P NONORTHOGON | A/E ATT PROC | | | | | |
| SDP(3) | V90U2647CB | SIN OF 1/2 IMU 3 R/P NONORTHOGON | A/E ATT PROC | | | | | |
| SEL_IMU_ID | V90J2560C | SELECTED IMU ID | IMU RM | | HXS | | 93017G | * |
| SEL_V_M50(1) | V90L2557C | SEL TOTAL X VEL M50 | IMU RM | FT/S | DPL | | 93017G | * |
| SEL_V_M50(2) | V90L2558C | SEL TOTAL Y VEL M50 | IMU RM | FT/S | DPL | | 93017G | * |
| SEL_V_M50(3) | V90L2559C | SEL TOTAL Z VEL M50 | IMU RM | FT/S | DPL | | 93017G | * |
| SENSE_SW | V90X7700X | SEL SENSE -X | GN&C SW RM | | 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(1,1,2) | V99U3453CA | CLUSTER TO M50/IMU-1 COMPONENT 1,2 | IMU ORB A/CAL | | | | 93017G | * |
| T_CLUSTER_M50(1,1,3) | V99U3456CA | CLUSTER TO M50/IMU-1 COMPONENT 1,3 | IMU ORB A/CAL | | | | 93017G | * |
| T_CLUSTER_M50(1,2,1) | V99U3459CA | CLUSTER TO M50/IMU 1 COMPONENT 2,1 | IMU ORB A/CAL | | | | 93017G | * |
| T_CLUSTER_M50(1,2,2) | V99U3462CA | CLUSTER TO M50/IMU-1 COMPONENT 2,2 | IMU ORB A/CAL | | | | 93017G | * |
| T_CLUSTER_M50(1,2,3) | V99U3465CA | CLUSTER TO M50/IMU-1 COMPONENT 2,3 | IMU ORB A/CAL | | | | 93017G | * |
| T_CLUSTER_M50(1,3,1) | V99U3468CA | CLUSTER TO M50/IMU-1 COMPONENT 3,1 | IMU ORB A/CAL | | | | 93017G | * |
| T_CLUSTER_M50(1,3,2) | V99U3471CA | CLUSTER TO M50/IMU-1 COMPONENT 3,2 | IMU ORB A/CAL | | | | 93017G | * |
| T_CLUSTER_M50(1,3,3) | V99U3474CA | CLUSTER TO M50/IMU-1 COMPONENT 3,3 | IMU ORB A/CAL | | | | 93017G | * |
| T_CLUSTER_M50(2,1,1) | V99U3451CA | CLUSTER TO M50/IMU-2 COMPONENT 1,1 | IMU ORB A/CAL | | | | 93017G | * |
| T_CLUSTER_M50(2,1,2) | V99U3454CA | CLUSTER TO M50/IMU-2 COMPONENT 1,2 | IMU ORB A/CAL | | | | 93017G | * |
| T_CLUSTER_M50(2,1,3) | V99U3457CA | CLUSTER TO M50/IMU-2 COMPONENT 1,3 | IMU ORB A/CAL | | | | 93017G | * |
| T_CLUSTER_M50(2,2,1) | V99U3460CA | CLUSTER TO M50/IMU-2 COMPONENT 2,1 | IMU ORB A/CAL | | | | 93017G | * |
| T_CLUSTER_M50(2,2,2) | V99U3463CA | CLUSTER TO M50/IMU-2 COMPONENT 2,2 | IMU ORB A/CAL | | | | 93017G | * |
| T_CLUSTER_M50(2,2,3) | V99U3466CA | CLUSTER TO M50/IMU-2 COMPONENT 2,3 | IMU ORB A/CAL | | | | 93017G | * |
| T_CLUSTER_M50(2,3,1) | V99U3469CA | CLUSTER TO M50/IMU-2 COMPONENT 3,1 | IMU ORB A/CAL | | | | 93017G | * |
| T_CLUSTER_M50(2,3,2) | V99U3472CA | CLUSTER TO M50/IMU-2 COMPONENT 3,2 | IMU ORB A/CAL | | | | 93017G | * |

TABLE 4.3.11-1. INPUT FUNCTIONAL PARAMETERS FOR ONORBIT ATTITUDE PROCESSING (G4.97)

| FSSR NAME | M/S ID | NOMENCLATURE | SOURCE | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|----------------------|------------|------------------------------------|---------------|-------|-----------|---------|---------|-------|
| T_CLUSTER_M50(2,3,3) | V99U3475CA | CLUSTER TO M50/IMU-2 COMPONENT 3,3 | IMU ORB A/CAL | | | | 93017G | * |
| T_CLUSTER_M50(3,1,1) | V99U3452CA | CLUSTER TO M50/IMU-3 COMPONENT 1,1 | IMU ORB A/CAL | | | | 93017G | * |
| T_CLUSTER_M50(3,1,2) | V99U3455CA | CLUSTER TO M50/IMU-3 COMPONENT 1,2 | IMU ORB A/CAL | | | | 93017G | * |
| T_CLUSTER_M50(3,1,3) | V99U3458CA | CLUSTER TO M50/IMU-3 COMPONENT 1,3 | IMU ORB A/CAL | | | | 93017G | * |
| T_CLUSTER_M50(3,2,1) | V99U3461CA | CLUSTER TO M50/IMU-3 COMPONENT 2,1 | IMU ORB A/CAL | | | | 93017G | * |
| T_CLUSTER_M50(3,2,2) | V99U3464CA | CLUSTER TO M50/IMU-3 COMPONENT 2,2 | IMU ORB A/CAL | | | | 93017G | * |
| T_CLUSTER_M50(3,2,3) | V99U3467CA | CLUSTER TO M50/IMU-3 COMPONENT 2,3 | IMU ORB A/CAL | | | | 93017G | * |
| T_CLUSTER_M50(3,3,1) | V99U3470CA | CLUSTER TO M50/IMU-3 COMPONENT 3,1 | IMU ORB A/CAL | | | | 93017G | * |
| T_CLUSTER_M50(3,3,2) | V99U3473CA | CLUSTER TO M50/IMU-3 COMPONENT 3,2 | IMU ORB A/CAL | | | | 93017G | * |
| T_CLUSTER_M50(3,3,3) | V99U3476CA | CLUSTER TO M50/IMU-3 COMPONENT 3,3 | IMU ORB A/CAL | | | | 93017G | * |
| T_EPOCH | V97W5528C | TIME TAG FOR M_M50TOEF_AT_EPOCH | RNP MAT COMP | S | DPL | | 93090E | |
| T_IMUS | V95W0002C | IMU INPUT TRANS TIME TAG | IMU INT PROC | S | DPL | | 93017G | * |
| V_AVGG(1) | V95L0190CF | X-COMP OF CUR SHUTTLE VEL VCTR M50 | ORB UPP | FT/S | SPL | | 93017G | * |
| V_AVGG(2) | V95L0191CF | Y-COMP OF CUR SHUTTLE VEL VCTR M50 | ORB UPP | FT/S | SPL | | 93017G | * |
| V_AVGG(3) | V95L0192CF | Z-COMP OF CUR SHUTTLE VEL VCTR M50 | ORB UPP | FT/S | SPL | | 93017G | * |

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

TABLE 4.3.11-2. OUTPUT FUNCTIONAL PARAMETERS FROM ONORBIT ATTITUDE PROCESSING (G4.97)

| FSSR NAME | M/S ID | NOMENCLATURE | DESTINATION | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-------------------------------|--------------------------|---|--|-------|-----------|---------|------------------|-------|
| ATT_INC_6HZ(1) | V90H2285CA | ATTITUDE INCREMENT-LO RATE ROLL | ORB DAP | DEG | | | | |
| ATT_INC_6HZ(2) | V90H2213C | ATTITUDE INCREMENT-LO RATE PITCH | ORB DAP | DEG | | | | |
| ATT_INC_6HZ(3) | V90H2214C | ATTITUDE INCREMENT-LO RATE YAW | ORB DAP | DEG | | | | |
| BODY_ERR_ANG(1) | V90H2234CB | BODY ROLL ATTITUDE ERROR | ORB ADI PROC | DEG | | | 89366 | |
| BODY_ERR_ANG(2) | V90H2233CB | BODY PITCH ATTITUDE ERROR | ORB ADI PROC | DEG | | | 89366 | |
| BODY_ERR_ANG(3) | V90H2235CB | BODY YAW ATTITUDE ERROR | ORB ADI PROC | DEG | | | | |
| CDP(1) | V90U2648CA | COS OF 1/2 IMU 1 R/P NONORTHOGON | A/E ATT PROC | | | | | |
| CDP(2) | V90U2649CA | COS OF 1/2 IMU 2 R/P NONORTHOGON | A/E ATT PROC | | | | | |
| CDP(3) | V90U2650CA | COS OF 1/2 IMU 3 R/P NONORTHOGON | A/E ATT PROC | | | | | |
| DVB_SEC(1) | V90L2696C | 1 SEC VEL INC-X | DL FMT 22/1 OMS RM ORB DAP | FT/S | SPL | | 93017G | * |
| DVB_SEC(2) | V90L2697C | 1 SEC VEL INC-Y | DL FMT 22/1 OMS RM ORB DAP | FT/S | SPL | | 93017G | * |
| DVB_SEC(3) | V90L2698C | 1 SEC VEL INC-Z | DL FMT 22/1 OMS RM ORB DAP | FT/S | SPL | | 93017G | * |
| EULER_GPS_AVAIL GMTC/T_NOW | V90X2610XA V90W2310CB | TOPODETTIC EULER ANGLES AVAIL FLAG M50 TO BODY QUAT TIME | GPS SOP DL FMT 22/1 DL FMT 32/1 GN&C/SM-PL IF ORB DAP UNIV POINT PROC | | BD | | 92144C 93017G | * |
| PAYLOAD_PITCH | V95L3887CB | EF TO BODY EULER ANGLE PITCH | GN&C/SM-PL IF | RAD | | | | |
| PAYLOAD_ROLL | V95L3889CB | EF TO BODY EULER ANGLE ROLL | GN&C/SM-PL IF | RAD | | | | |
| PAYLOAD_YAW | V95L3888CB | EF TO BODY EULER ANGLE YAW | GN&C/SM-PL IF | RAD | | | | |
| PHI/PHI_TOPO | V90H2202CA | BODY ROLL ATTITUDE EULER ANGLE | GPS SOP TLM | DEG | SPL | | 92144C | |
| PHI_IMU(1) | V90H2317CA | M50 TO BODY EULER ANGLE 1 PHI | IMU ALIGN DISP | DEG | | | 89490B | |
| PHI_IMU(2) | V90H2318CA | M50 TO BODY EULER ANGLE 2 PHI | IMU ALIGN DISP | DEG | | | 89490B | |
| PHI_IMU(3) | V90H2319CA | M50 TO BODY EULER ANGLE 3 PHI | IMU ALIGN DISP | DEG | | | 89490B | |
| PSI/PSI_TOPO | V90H2230CA | BODY YAW ATTITUDE EULER ANGLE | GPS SOP TLM | DEG | SPL | | 92144C | |
| PSI_IMU(1) | V90H2311CA | M50 TO BODY EULER ANGLE 1 PSI | IMU ALIGN DISP | DEG | | | 89490B | |
| PSI_IMU(2) | V90H2312CA | M50 TO BODY EULER ANGLE 2 PSI | IMU ALIGN DISP | DEG | | | 89490B | |
| PSI_IMU(3) | V90H2313CA | M50 TO BODY EULER ANGLE 3 PSI | IMU ALIGN DISP | DEG | | | 89490B | |
| PTCHCOS(1) | V90H2222CB | LH ADI SEL EULER ANG PITCH COSINE | ORB ADI PROC | | | | | |
| PTCHCOS(2) | V90H2218CB | RH ADI SEL EULER ANG PITCH COSINE | ORB ADI PROC | | | | | |
| PTCHCOS(3) | V90H2292C | AFT ADI SEL EULER ANG PITCH COSINE | ORB ADI PROC TLM | | SPL | | | |
| PTCHSINE(1) | V90H2221CB | LH ADI SEL EULER ANG PITCH SINE | ORB ADI PROC | | | | | |
| PTCHSINE(2) | V90H2220CB | RH ADI SEL EULER ANG PITCH SINE | ORB ADI PROC | | | | | |
| PTCHSINE(3) | V90H2291C | AFT ADI SEL EULER ANG PITCH SINE | ORB ADI PROC TLM | | SPL | | | |

TABLE 4.3.11-2. OUTPUT FUNCTIONAL PARAMETERS FROM ONORBIT ATTITUDE PROCESSING (G4.97)

| FSSR NAME | M/S ID | NOMENCLATURE | DESTINATION | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|-------------------------|------------|----------------------------------|--|-------|-----------|---------|---------|-------|
| Q_BOD_M50(1)/Q_B_M50(1) | V90U2240CB | M50 TO BODY QUAT MEASURED ELEM 1 | A/E ATT PROC DL FMT 22/A DL FMT 32/1 GN&C/SM-PL IF IMU RM ORB DAP ORB GUID ORB/RND NAV REL NAV SPEC RR SOP | | SPL | | 93017G | * |
| Q_BOD_M50(2)/Q_B_M50(2) | V90U2241CB | M50 TO BODY QUAT MEASURED ELEM 2 | UNIV POINT PROC A/E ATT PROC DL FMT 22/A DL FMT 32/1 GN&C/SM-PL IF IMU RM ORB DAP ORB GUID ORB/RND NAV REL NAV SPEC RR SOP | | SPL | | 93017G | * |
| Q_BOD_M50(3)/Q_B_M50(3) | V90U2242CB | M50 TO BODY QUAT MEASURED ELEM 3 | UNIV POINT PROC A/E ATT PROC DL FMT 22/A DL FMT 32/1 GN&C/SM-PL IF IMU RM ORB DAP ORB GUID ORB/RND NAV REL NAV SPEC RR SOP | | SPL | | 93017G | * |
| Q_BOD_M50(4)/Q_B_M50(4) | V90U2243CB | M50 TO BODY QUAT MEASURED ELEM 4 | UNIV POINT PROC A/E ATT PROC DL FMT 22/A DL FMT 32/1 GN&C/SM-PL IF IMU RM ORB DAP ORB GUID ORB/RND NAV REL NAV SPEC RR SOP | | SPL | | 93017G | * |
| Q_LVLH_BIASLVLH(1) | V97U2210CA | ADI TO LVLH QUAT ELEM 1 | UNIV POINT PROC TLM | | | | | |
| Q_LVLH_BIASLVLH(2) | V97U2211CA | ADI TO LVLH QUAT ELEM 2 | TLM | | | | | |

TABLE 4.3.11-2. OUTPUT FUNCTIONAL PARAMETERS FROM ONORBIT ATTITUDE PROCESSING (G4.97)

| FSSR NAME | M/S ID | NOMENCLATURE | DESTINATION | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|--------------------|------------|----------------------------------|---|-------|-----------|---------|---------|-------|
| Q_LVLH_BIASLVLH(3) | V97U2212CA | ADI TO LVLH QUAT ELEM 3 | TLM | | | | | |
| Q_LVLH_BIASLVLH(4) | V97U2213CA | ADI TO LVLH QUAT ELEM 4 | TLM | | | | | |
| Q_M50_INRTL(1) | V97U2214CA | ADI INERT QUAT ELEM 1 | TLM | | | | | |
| Q_M50_INRTL(2) | V97U2215CA | ADI INERT QUAT ELEM 2 | TLM | | | | | |
| Q_M50_INRTL(3) | V97U2216CA | ADI INERT QUAT ELEM 3 | TLM | | | | | |
| Q_M50_INRTL(4) | V97U2217CA | ADI INERT QUAT ELEM 4 | TLM | | | | | |
| Q_M50_LVLH(1) | V90U2641CA | M50 WRT LVLH QUAT 1 | DL FMT 22/A DL FMT 32/A ORB DAP ORB MNVR DIP | | | | 93017G | * |
| Q_M50_LVLH(2) | V90U2642CA | M50 WRT LVLH QUAT 2 | DL FMT 22/A DL FMT 32/A ORB DAP ORB MNVR DIP | | | | 93017G | * |
| Q_M50_LVLH(3) | V90U2643CA | M50 WRT LVLH QUAT 3 | DL FMT 22/A DL FMT 32/A ORB DAP ORB MNVR DIP | | | | 93017G | * |
| Q_M50_LVLH(4) | V90U2644CA | M50 WRT LVLH QUAT 4 | DL FMT 22/A DL FMT 32/A ORB DAP ORB MNVR DIP | | | | 93017G | * |
| Q_M50_REF(1) | V97U2218CA | ADI REF QUAT ELEM 1 | DL FMT 22/A DL FMT 32/A | | | | 93017G | * |
| Q_M50_REF(2) | V97U2219CA | ADI REF QUAT ELEM 2 | DL FMT 22/A DL FMT 32/A | | | | 93017G | * |
| Q_M50_REF(3) | V97U2220CA | ADI REF QUAT ELEM 3 | DL FMT 22/A DL FMT 32/A | | | | 93017G | * |
| Q_M50_REF(4) | V97U2221CA | ADI REF QUAT ELEM 4 | DL FMT 22/A DL FMT 32/A | | | | 93017G | * |
| Q_ROLL_SM(1,1) | V90U2337CA | ROLL GMBL WRT STBL MEM QUAT 1(1) | DL FMT 22/A DL FMT 32/A | | SPL | | 93017G | * |
| Q_ROLL_SM(1,2) | V90U2338CA | ROLL GMBL WRT STBL MEM QUAT 1(2) | DL FMT 22/A DL FMT 32/A | | SPL | | 93017G | * |
| Q_ROLL_SM(1,3) | V90U2339CA | ROLL GMBL WRT STBL MEM QUAT 1(3) | DL FMT 22/A DL FMT 32/A | | SPL | | 93017G | * |
| Q_ROLL_SM(1,4) | V90U2340CA | ROLL GMBL WRT STBL MEM QUAT 1(4) | DL FMT 22/A DL FMT 32/A | | SPL | | 93017G | * |
| Q_ROLL_SM(2,1) | V90U2341CA | ROLL GMBL WRT STBL MEM QUAT 2(1) | DL FMT 22/A DL FMT 32/A | | SPL | | 93017G | * |
| Q_ROLL_SM(2,2) | V90U2342CA | ROLL GMBL WRT STBL MEM QUAT 2(2) | DL FMT 22/A DL FMT 32/A | | SPL | | 93017G | * |
| Q_ROLL_SM(2,3) | V90U2343CA | ROLL GMBL WRT STBL MEM QUAT 2(3) | DL FMT 22/A DL FMT 32/A | | SPL | | 93017G | * |
| Q_ROLL_SM(2,4) | V90U2344CA | ROLL GMBL WRT STBL MEM QUAT 2(4) | DL FMT 22/A DL FMT 32/A | | SPL | | 93017G | * |

TABLE 4.3.11-2. OUTPUT FUNCTIONAL PARAMETERS FROM ONORBIT ATTITUDE PROCESSING (G4.97)

| FSSR NAME | M/S ID | NOMENCLATURE | DESTINATION | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|----------------|------------|-----------------------------------|----------------------------|-------|-----------|---------|---------|-------|
| Q_ROLL_SM(3,1) | V90U2345CA | ROLL GMBL WRT STBL MEM QUAT 3(1) | DL FMT 22/A DL FMT 32/A | | SPL | | 93017G | * |
| Q_ROLL_SM(3,2) | V90U2346CA | ROLL GMBL WRT STBL MEM QUAT 3(2) | DL FMT 22/A DL FMT 32/A | | SPL | | 93017G | * |
| Q_ROLL_SM(3,3) | V90U2347CA | ROLL GMBL WRT STBL MEM QUAT 3(3) | DL FMT 22/A DL FMT 32/A | | SPL | | 93017G | * |
| Q_ROLL_SM(3,4) | V90U2348CA | ROLL GMBL WRT STBL MEM QUAT 3(4) | DL FMT 22/A DL FMT 32/A | | SPL | | 93017G | * |
| Q_SM_M50(1,1) | V90U2664CA | IMU 1 REFERENCE QUATERNION 1 | A/E ATT PROC | | | | | |
| Q_SM_M50(1,2) | V90U2665CA | IMU 1 REFERENCE QUATERNION 2 | A/E ATT PROC | | | | | |
| Q_SM_M50(1,3) | V90U2666CA | IMU 1 REFERENCE QUATERNION 3 | A/E ATT PROC | | | | | |
| Q_SM_M50(1,4) | V90U2667CA | IMU 1 REFERENCE QUATERNION 4 | A/E ATT PROC | | | | | |
| Q_SM_M50(2,1) | V90U2668CA | IMU 2 REFERENCE QUATERNION 1 | A/E ATT PROC | | | | | |
| Q_SM_M50(2,2) | V90U2669CA | IMU 2 REFERENCE QUATERNION 2 | A/E ATT PROC | | | | | |
| Q_SM_M50(2,3) | V90U2670CA | IMU 2 REFERENCE QUATERNION 3 | A/E ATT PROC | | | | | |
| Q_SM_M50(2,4) | V90U2671CA | IMU 2 REFERENCE QUATERNION 4 | A/E ATT PROC | | | | | |
| Q_SM_M50(3,1) | V90U2672CA | IMU 3 REFERENCE QUATERNION 1 | A/E ATT PROC | | | | | |
| Q_SM_M50(3,2) | V90U2673CA | IMU 3 REFERENCE QUATERNION 2 | A/E ATT PROC | | | | | |
| Q_SM_M50(3,3) | V90U2674CA | IMU 3 REFERENCE QUATERNION 3 | A/E ATT PROC | | | | | |
| Q_SM_M50(3,4) | V90U2675CA | IMU 3 REFERENCE QUATERNION 4 | A/E ATT PROC | | | | | |
| Q_SM_SM(1,1) | V90U2263CB | SM2 TO SM3 TRANS QUAT ELEMENT 1 | IMU RM | | | | | |
| Q_SM_SM(1,2) | V90U2264CB | SM2 TO SM3 TRANS QUAT ELEMENT 2 | IMU RM | | | | | |
| Q_SM_SM(1,3) | V90U2265CB | SM2 TO SM3 TRANS QUAT ELEMENT 3 | IMU RM | | | | | |
| Q_SM_SM(1,4) | V90U2266CB | SM2 TO SM3 TRANS QUAT ELEMENT 4 | IMU RM | | | | | |
| Q_SM_SM(2,1) | V90U2259CB | SM1 TO SM3 TRANS QUAT ELEMENT 1 | IMU RM | | | | | |
| Q_SM_SM(2,2) | V90U2260CB | SM1 TO SM3 TRANS QUAT ELEMENT 2 | IMU RM | | | | | |
| Q_SM_SM(2,3) | V90U2261CB | SM1 TO SM3 TRANS QUAT ELEMENT 3 | IMU RM | | | | | |
| Q_SM_SM(2,4) | V90U2262CB | SM1 TO SM3 TRANS QUAT ELEMENT 4 | IMU RM | | | | | |
| Q_SM_SM(3,1) | V90U2255CB | SM1 TO SM2 TRANS QUAT ELEMENT 1 | IMU RM | | | | | |
| Q_SM_SM(3,2) | V90U2256CB | SM1 TO SM2 TRANS QUAT ELEMENT 2 | IMU RM | | | | | |
| Q_SM_SM(3,3) | V90U2257CB | SM1 TO SM2 TRANS QUAT ELEMENT 3 | IMU RM | | | | | |
| Q_SM_SM(3,4) | V90U2258CB | SM1 TO SM2 TRANS QUAT ELEMENT 4 | IMU RM | | | | | |
| ROLLCOS(1) | V90H2209CB | LH ADI SEL EULER ANG ROLL COSINE | ORB ADI PROC | | | | 89490B | |
| ROLLCOS(2) | V90H2207CB | RH ADI SEL EULER ANG ROLL COSINE | ORB ADI PROC | | | | 89490B | |
| ROLLCOS(3) | V90H2290C | AFT ADI SEL EULER ANG ROLL COSINE | ORB ADI PROC TLM | | SPL | | 89490B | |
| ROLLSINE(1) | V90H2208CB | LH ADI SEL EULER ANG ROLL SINE | ORB ADI PROC | | | | 89490B | |
| ROLLSINE(2) | V90H2206CB | RH ADI SEL EULER ANG ROLL SINE | ORB ADI PROC | | | | 89490B | |
| ROLLSINE(3) | V90H2289C | AFT ADI SEL EULER ANG ROLL SINE | ORB ADI PROC TLM | | SPL | | 89490B | |
| SDP(1) | V90U2645CA | SIN OF 1/2 IMU 1 R/P NONORTHOGON | A/E ATT PROC | | | | | |
| SDP(2) | V90U2646CA | SIN OF 1/2 IMU 2 R/P NONORTHOGON | A/E ATT PROC | | | | | |
| SDP(3) | V90U2647CA | SIN OF 1/2 IMU 3 R/P NONORTHOGON | A/E ATT PROC | | | | | |
| THETA(1) | V90H2314CA | M50 TO BODY EULER ANGLE 1 THETA | IMU ALIGN DISP | DEG | | | | |
| THETA(2) | V90H2315CA | M50 TO BODY EULER ANGLE 2 THETA | IMU ALIGN DISP | DEG | | | | |
| THETA(3) | V90H2316CA | M50 TO BODY EULER ANGLE 3 THETA | IMU ALIGN DISP | DEG | | | | |

TABLE 4.3.11-2. OUTPUT FUNCTIONAL PARAMETERS FROM ONORBIT ATTITUDE PROCESSING (G4.97)

| FSSR NAME | M/S ID | NOMENCLATURE | DESTINATION | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|------------------|------------|----------------------------------|---------------------|-------|-----------|------------------|---------|-------------|
| THETA/THETA_TOPO | V90H2217CA | BODY PITCH ATTITUDE EULER ANGLE | GPS SOP TLM | DEG | SPL | | 92144C | |
| YAWCOS(1) | V90H2232CB | LH ADI SEL EULER ANG YAW COSINE | ORB ADI PROC | | | | | |
| YAWCOS(2) | V90H2294CB | RH ADI SEL EULER ANG YAW COSINE | ORB ADI PROC | | | | | |
| YAWCOS(3) | V90H2296C | AFT ADI SEL EULER ANG YAW COSINE | ORB ADI PROC TLM | | SPL | | | |
| YAWSINE(1) | V90H2231CB | LH ADI SEL EULER ANG YAW SINE | ORB ADI PROC | | | | | |
| YAWSINE(2) | V90H2293CB | RH ADI SEL EULER ANG YAW SINE | ORB ADI PROC | | | | | |
| YAWSINE(3) | V90H2295C | AFT ADI SEL EULER ANG YAW SINE | ORB ADI PROC TLM | | SPL | | | |

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 4.3.11-3. ONORBIT ATTITUDE PROCESSING (G4.97) I-LOADS

| FSSR NAME | MSID | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R E V |
|--------------|-----------|-----------|----|----|---|---|-----------------------------------|----|-----|---------|-------------|
| RGAO(1) | V99U9559C | RAD | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IH1 | DC0599 | |
| RGAO(2) | V99U9560C | RAD | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IH2 | DC0599 | |
| RGAO(3) | V99U9561C | RAD | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IH3 | DC0738 | |
| RGPO(1) | V99U9562C | RAD | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IH1 | DC0599 | |
| RGPO(2) | V99U9563C | RAD | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IH2 | DC0599 | |
| RGPO(3) | V99U9564C | RAD | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IH3 | DC0738 | |
| TNBBODY(1,1) | V96U7096C | ND | F | S | L | P | G4.226 G4.66 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNBBODY(1,2) | V96U7097C | ND | F | S | L | P | G4.226 G4.66 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNBBODY(1,3) | V96U7098C | ND | F | S | L | P | G4.226 G4.66 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNBBODY(2,1) | V96U7099C | ND | F | S | L | P | G4.226 G4.66 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNBBODY(2,2) | V96U7100C | ND | F | S | L | P | G4.226 G4.66 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNBBODY(2,3) | V96U7101C | ND | F | S | L | P | G4.226 G4.66 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNBBODY(3,1) | V96U7102C | ND | F | S | L | P | G4.226 G4.66 G4.97 V4.9A | 00 | IPR | DC0599 | |

TABLE 4.3.11-3. ONORBIT ATTITUDE PROCESSING (G4.97) I-LOADS

| FSSR NAME | MSID | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R E V |
|----------------|-----------|-----------|----|----|---|---|-----------------------------------|----|-----|---------|-------------|
| TNBBODY(3,2) | V96U7103C | ND | F | S | L | P | G4.226 G4.66 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNBBODY(3,3) | V96U7104C | ND | F | S | L | P | G4.226 G4.66 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNB_CASE1(1,1) | V96U7132C | ND | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNB_CASE1(1,2) | V96U7135C | ND | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNB_CASE1(1,3) | V96U7138C | ND | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNB_CASE1(2,1) | V96U7141C | ND | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNB_CASE1(2,2) | V96U7144C | ND | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNB_CASE1(2,3) | V96U7147C | ND | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNB_CASE1(3,1) | V96U7150C | ND | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNB_CASE1(3,2) | V96U7153C | ND | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNB_CASE1(3,3) | V96U7156C | ND | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNB_CASE2(1,1) | V96U7133C | ND | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNB_CASE2(1,2) | V96U7136C | ND | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNB_CASE2(1,3) | V96U7139C | ND | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNB_CASE2(2,1) | V96U7142C | ND | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IPR | DC0599 | |

TABLE 4.3.11-3. ONORBIT ATTITUDE PROCESSING (G4.97) I-LOADS

| FSSR NAME | MSID | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R E V |
|----------------|-----------|-----------|----|----|---|---|--------------------------|----|-----|---------|-------------|
| TNB_CASE2(2,2) | V96U7145C | ND | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNB_CASE2(2,3) | V96U7148C | ND | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNB_CASE2(3,1) | V96U7151C | ND | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNB_CASE2(3,2) | V96U7154C | ND | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNB_CASE2(3,3) | V96U7157C | ND | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNB_CASE3(1,1) | V96U7134C | ND | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNB_CASE3(1,2) | V96U7137C | ND | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNB_CASE3(1,3) | V96U7140C | ND | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNB_CASE3(2,1) | V96U7143C | ND | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNB_CASE3(2,2) | V96U7146C | ND | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNB_CASE3(2,3) | V96U7149C | ND | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNB_CASE3(3,1) | V96U7152C | ND | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNB_CASE3(3,2) | V96U7155C | ND | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IPR | DC0599 | |
| TNB_CASE3(3,3) | V96U7158C | ND | F | S | L | P | G4.226 G4.97 V4.9A | 00 | IPR | DC0599 | |

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

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TABLE 4.3.11-4. ONORBIT ATTITUDE PROCESSING (G4.97) K-LOADS

| FSSR NAME DESCRIPTION | MSID | MC | KLOAD VALUE | ENG UNITS | DT | P R | S | PR FCTN | LAST CR | R E V |
|---|------------|----|-------------|-----------|----|--------|---|-----------------------------------|---------|-------------|
| Q_LVLH_BIASLVLH_ORB(1) ADI TO LVLH QUAT ELEM 1 | V97U2210CC | 00 | +1.00 | E+00 ND | F | S | P | G4.97 | 89901A | |
| Q_LVLH_BIASLVLH_ORB(2) ADI TO LVLH QUAT ELEM 2 | V97U2211CC | 00 | +0.00 | E+00 ND | F | S | P | G4.97 | 89901A | |
| Q_LVLH_BIASLVLH_ORB(3) ADI TO LVLH QUAT ELEM 3 | V97U2212CC | 00 | +0.00 | E+00 ND | F | S | P | G4.97 | 89901A | |
| Q_LVLH_BIASLVLH_ORB(4) ADI TO LVLH QUAT ELEM 4 | V97U2213CC | 00 | +0.00 | E+00 ND | F | S | P | G4.97 | 89901A | |
| Q_M50_INRTL_ORB(1) M50 WRT INERT QUAT ELEM 1 | V97U2214CC | 00 | +1.0 | E+00 ND | F | S | P | G4.158 G4.213 G4.7 G4.97 | 89590B | |
| Q_M50_INRTL_ORB(2) M50 WRT INERT QUAT ELEM 2 | V97U2215CC | 00 | +0.0 | E+00 ND | F | S | P | G4.158 G4.213 G4.7 G4.97 | 89590B | |
| Q_M50_INRTL_ORB(3) M50 WRT INERT QUAT ELEM 3 | V97U2216CC | 00 | +0.0 | E+00 ND | F | S | P | G4.158 G4.213 G4.7 G4.97 | 89590B | |
| Q_M50_INRTL_ORB(4) M50 WRT INERT QUAT ELEM 4 | V97U2217CC | 00 | +0.0 | E+00 ND | F | S | P | G4.158 G4.213 G4.7 G4.97 | 89590B | |
| Q_M50_REF_ORB(1) ADI REF QUAT ELEM 1 | V97U2218CC | 00 | +7.0710678 | E-01 ND | F | S | P | G4.97 | 89901A | |
| Q_M50_REF_ORB(2) ADI REF QUAT ELEM 2 | V97U2219CC | 00 | +7.0710678 | E-01 ND | F | S | P | G4.97 | 89901A | |
| Q_M50_REF_ORB(3) ADI REF QUAT ELEM 3 | V97U2220CC | 00 | +0.0 | E+00 ND | F | S | P | G4.97 | 89901A | |
| Q_M50_REF_ORB(4) ADI REF QUAT ELEM 4 | V97U2221CC | 00 | +0.0 | E+00 ND | F | S | P | G4.97 | 89901A | |

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

TABLE 4.3.11-5. ONORBIT ATTITUDE PROCESSING (G4.97) CONSTANTS

| FSSR NAME DESCRIPTION | MSID | MC | CONSTANT VALUE | ENG UNITS | DT | P R | S | PR FCTN | LAST CR | R E V |
|---|-----------|----|--------------------|-----------|-----|--------|---|---|---------|-------------|
| 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 | |
| DELGA_LIMIT LIMIT ON AZIMUTH DELGA EPSILON | V97U6120C | 00 | +5.6 | E-03 | RAD | F | S | P G4.97 | 92544B | |
| LOWEST VALUE YAWCOS PITCH ROLL FUNCTIONS ARE UPDATED | V97U6121C | 00 | +3.0 | E-02 | ND | F | S | C G4.97 | 90374C | |

TABLE 4.3.11-5. ONORBIT ATTITUDE PROCESSING (G4.97) CONSTANTS

| FSSR NAME DESCRIPTION | MSID | MC | CONSTANT VALUE | ENG UNITS | DT | P R | S | PR FCTN | LAST CR | R E V |
|---|-----------|----|--------------------|-----------|----|--------|-----|--|---------|-------------|
| PI RATIO OF CIRCUMFERENCE TO DIAMETER | V98U8725C | 00 | +3.14159265358E+00 | ND | F | | D C | A6.9 G4.126 G4.127 G4.13 G4.144 G4.15 G4.158 G4.16 G4.19 G4.2 G4.20 G4.205 G4.209 G4.210 G4.213 G4.220 G4.236 G4.237 G4.3 G4.4 G4.5 G4.97 G5.10 G5.24 G5.26 G5.27 | 93090E | |
| Q_B_XADI(1) BODY WRT MOUNTING | V97U6124C | 00 | +0.0 | E+00 | ND | F | S P | G4.97 | 90374C | |
| Q_B_XADI(2) BODY WRT MOUNTING | V97U6125C | 00 | +0.0 | E+00 | ND | F | S P | G4.97 | 90374C | |
| Q_B_XADI(3) BODY WRT MOUNTING | V97U6126C | 00 | +0.0 | E+00 | ND | F | S P | G4.97 | 90374C | |
| Q_B_XADI(4) BODY WRT MOUNTING | V97U6127C | 00 | +1.0 | E+00 | ND | F | S P | G4.97 | 90374C | |
| Q_B_ZADI(1) BODY WRT Z_ADI MOUNTING QUATERNION | V97U6128C | 00 | +0.0 | E+00 | ND | F | S P | G4.97 | 90374C | |
| Q_B_ZADI(2) BODY WRT Z_ADI MOUNTING QUATERNION | V97U6129C | 00 | -7.071068 | E-01 | ND | F | S P | G4.97 | 90374C | |
| Q_B_ZADI(3) BODY WRT Z_ADI MOUNTING QUATERNION | V97U6130C | 00 | +0.0 | E+00 | ND | F | S P | G4.97 | 90374C | |
| Q_B_ZADI(4) BODY WRT Z_ADI MOUNTING QUATERNION | V97U6131C | 00 | +7.071068 | E-01 | ND | F | S P | G4.97 | 90374C | |

TABLE 4.3.11-5. ONORBIT ATTITUDE PROCESSING (G4.97) CONSTANTS

| FSSR NAME DESCRIPTION | MSID | MC | CONSTANT VALUE | ENG UNITS | DT | P R | S | PR FCTN | LAST CR | R E V |
|---|-----------|----|----------------|-----------|---------|--------|---|---|---------|-------------|
| RAD_PER_DEG DEGREE TO RADIAN CONVERSION FACTOR | V97U0383C | 00 | +1.7453293 | E-02 | RAD/DEG | F | S | C A6.9 G4.1 G4.126 G4.127 G4.128 G4.144 G4.15 G4.158 G4.175 G4.20 G4.201 G4.204 G4.205 G4.209 G4.210 G4.211 G4.213 G4.220 G4.223 G4.226 G4.227 G4.236 G4.237 G4.3 G4.35 G4.36 G4.7 G4.72 G4.9 G4.97 G5.27 | 93090E | |

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

4.4 ORBIT DAP CONFIGURATION SPECIALIST FUNCTION (5.8)

- A. Function. This function contains three modules whose purposes are to calculate vehicle inertia-dependent control parameters (INERTIA_CALC), to store and manage the DAP load parameters (DAP_LOAD_PROC), and to downlist the On-Orbit DAP configurations (DAP_DOWNLIST).
- B. Flow Diagram. The flow diagram for the Orbit DAP Configuration Spec Function is shown in Figure 4.4-1.
- C. Processing Rate. The processing rate for the Orbit DAP Configuration Spec is 12.5 Hz. The processing rate of DAP_DOWNLIST is 0.52 Hz. Additionally the DAP_LOAD_PROC module contained within the Orbit DAP Configuration Spec can be called on demand from the Orbit DAP (4.35).
- D. Interface Requirements. The interface requirements for the Orbit DAP Configuration Spec are shown in Tables 4.4-1 and 4.4-2.
- E. I-Loads. The I-loads for the Orbit DAP Configuration Spec are given in Table 4.4-3 and Table 4.4-4.
- F. Initialization Requirements. The initialization requirements for the Orbit DAP Configuration Spec are given in Table 4.4-5.
- G. Carryover Requirements. The carryover requirements for the Orbit DAP Configuration Spec are given in Table 4.4-6.

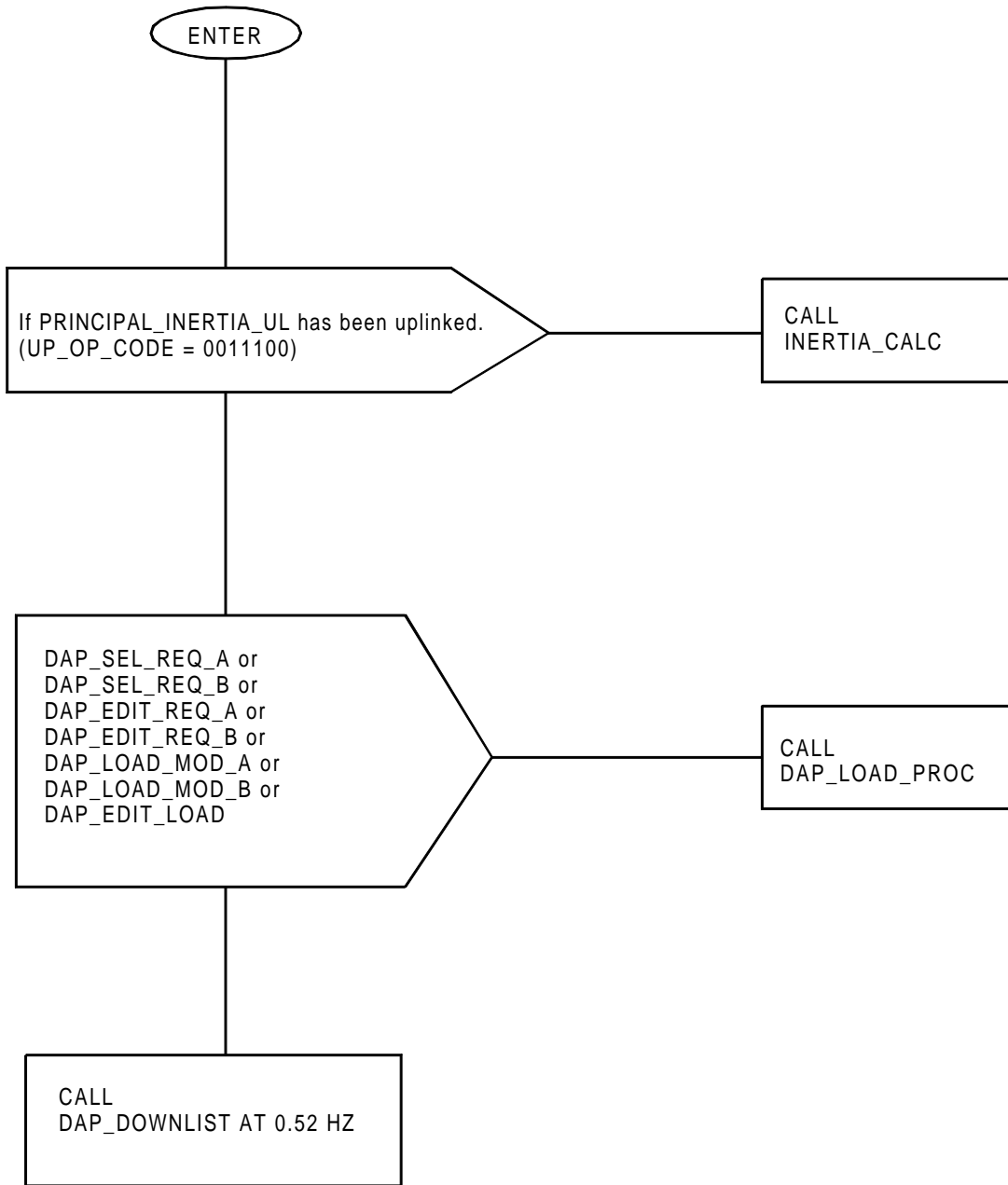


FIGURE 4.4-1. Orbit DAP Configuration Spec Flow Diagram

Table 4.4-1. Input Parameters for the Orbit DAP Configuration Principal Function (5.8)

| Name | Description | MSID | Source/ Destination | Type | Range | Unit | Sample Rate (Hz) | User Rate (Hz) |
|---------------------|--|------------------------|---|-------|-------------|-------|------------------------|----------------------|
| DAP_EDIT_LOAD | Flag indicating parameter modification to edit DAP | V93X3658X | ORB DAP CONFIG (6.1) | B | 0,1 | none | | |
| DAP_EDIT_REQ_A | Flag requesting DAP A load for edit | V93X5787X | ORB DAP CONFIG (6.1) | B | 0,1 | none | | |
| DAP_EDIT_REQ_B | Flag requesting DAP B load for edit | V93X5788X | ORB DAP CONFIG (6.1) | B | 0,1 | none | | |
| DAP_LOAD_EDIT_A | ID of display requested edit DAP A | V93J5781C | ORB DAP CONFIG (6.1) | I | 0– 15 | none | | |
| DAP_LOAD_EDIT_B | ID of display requested edit DAP B | V93J5782C | ORB DAP CONFIG (6.1) | I | 0– 15 | none | | |
| DAP_LOAD_MOD_A | Flag indicating DAP A load mod | V93X5783X | ORB DAP CONFIG (6.1) | B | 0,1 | none | | |
| DAP_LOAD_MOD_B | Flag indicating DAP B load mod | V93X5784X | ORB DAP CONFIG (6.1) | B | 0,1 | none | | |
| DAP_LOAD_SEL_A | ID of display requested select DAP A | V93J5779C | ORB DAP CONFIG (6.1), ON-ORBIT DAP (4.35) | I | 0– 15 | none | | |
| DAP_LOAD_SEL_B | ID of display requested select DAP B | V93J5780C | ORB DAP CONFIG (6.1), ON-ORBIT DAP (4.35) | I | 0– 15 | none | | |
| DAP_SEL_REQ_A | Flag requesting DAP A load selection | V93X5785X | ORB DAP CONFIG (6.1), ON-ORBIT DAP (4.35) | B | 0,1 | none | | |
| DAP_SEL_REQ_B | Flag requesting DAP B load selection | V93X5786X | ORB DAP CONFIG (6.1), ON-ORBIT DAP (4.35) | B | 0,1 | none | | |
| EDIT_ALT_RATE_LIMIT | Edit disp of requested rate limit in ALT mode | V93R5698C | ORB DAP CONFIG (6.1) | S | 0.05 – 5 | deg/s | On demand | On demand |
| EDIT_ALT_JET_OPTION | Edit disp of ALT mode jet options (1 = FWD & AFT, 3 = Aft only) | V93U5699C | ORB DAP CONFIG (6.1) | I | 1, 3 | none | On demand | On demand |
| EDIT_ALT_MAX_JETS | Edit disp of max number of jets to be commanded ON in ALT mode | V93U5734C | ORB DAP CONFIG (6.1) | I | 1 – 3 | none | On demand | On demand |
| EDIT_ALT_ON_TIME | Edit disp of requested max firing duration in ALT mode | V93W5740C | ORB DAP CONFIG (6.1) | S | 0.08 – 9.99 | S | On demand | On demand |
| EDIT_ALT_DELAY_TIME | Edit disp of requested min time between firings in ALT mode | V93W5737C | ORB DAP CONFIG (6.1) | S | 0 – 99.9 | S | On demand | On demand |
| EDIT_COMP_THRESHOLD | Edit disp of magnitudes of rotation compensation thresholds (0 = disable compensation) | V93H5743C V93H5747C | ORB DAP CONFIG (6.1) | A(2)S | ≥ 0 | deg/s | On demand | On demand |

| Table 4.4-1. Input Parameters for the Orbit DAP Configuration Principal Function (5.8) | | | | | | | | |
|--|--|------------------------------|-------------------------|-------|-----------------------------|------------|------------------------|----------------------|
| Name | Description | MSID | Source/ Destination | Type | Range | Unit | Sample Rate (Hz) | User Rate (Hz) |
| EDIT_DB | Edit disp of magnitudes of phase plane attitude deadband requests | V93H5775C V93H5777C | ORB DAP CONFIG (6.1) | A(2)S | > 0 | deg | On demand | On demand |
| EDIT_MNVR_RATE | Edit disp of magnitudes of discrete maneuver rates (about body axes for manual disc rate submode; about eigenaxis for auto mode) | V93R5707C V93R5711C | ORB DAP CONFIG (6.1) | A(2)S | > 0 | deg/s | On demand | On demand |
| EDIT_NOM_NOSE_TAIL_PITCH | Edit disp of pitch acceleration options (1 = nominal, 2 = low nose, 3 = low tail) | V93J5752C | ORB DAP CONFIG (6.1) | I | 1,2,3 | none | On demand | On demand |
| EDIT_NOM_NOSE_TAIL_YAW | Edit disp of yaw acceleration options (1 = nominal, 2 = low nose, 3 = low tail) | V93J5756C | ORB DAP CONFIG (6.1) | I | 1,2,3 | none | On demand | On demand |
| EDIT_PAYLOAD_EXTENDED | Edit disp of payload extended flags (0 = payload not extended, 1 through 9 = selected payloads) | V93J5762C | ORB DAP CONFIG (6.1) | I | 0,1,2, 3,4,5, 6,7,8,9 | none | On demand | On demand |
| EDIT_RATE_LIMIT | Edit disp of magnitudes of phase plane rate error limit requests | V93R5728C V93R5732C | ORB DAP CONFIG (6.1) | A(2)S | > 0 | deg/s | On demand | On demand |
| EDIT_ROT_PULSE | Edit disp of magnitudes of rotation pulses | V93R5716C V93R5704C | ORB DAP CONFIG (6.1) | A(2)S | > 0 | deg/s | On demand | On demand |
| EDIT_TRANS_PULSE | Edit disp of magnitudes of translation pulses | V93R5702C | ORB DAP CONFIG (6.1) | S | > 0 | ft/s | On demand | On demand |
| PRINCIPAL_INERTIA_UL | Diagonals of vehicle inertia matrix (body-axis moments of inertia) | V96H1320C to V96H1322C | UPLINK | A(3)S | | slug ft-ft | As required | — |
| UP_OP_CODE | Uplink operation code | V96J3521C | UPLINK | B(7) | | none | As required | — |

Table 4.4-2. Output Parameters for the Orbit DAP Configuration Principal Function (5.8)

| Name | Description | MSID | Source/ Destination | Type | Range | Unit | Sample Rate (Hz) | User Rate (Hz) |
|-------------------------------|--|---------------------------------------|--|---------|-----------------------------|-----------------|---------------------|-------------------|
| KP2 | Pitch filter gain for OMS TVC (two engines) | V97U2354C | ON-ORBIT DAP (4.35) | S | ≥ 0 | deg/ (deg/s) | As required | 1/ maneuver |
| KR | Roll filter gain for OMS TVC (two engines) | V97U2355C | ON-ORBIT DAP (4.35) | S | ≥ 0 | deg/ (deg/s) | As required | 12.5 |
| KY2 | Yaw filter gain for OMS TVC (two engines) | V97U2356C | ON-ORBIT DAP (4.35) | S | ≥ 0 | deg/ (deg/s) | As required | 1/ maneuver |
| ARRAY_COMP_ THRESHOLD | Array of magnitudes of rotation compensation thresholds (0 = disable compensation) | See Table 4.1-3A | ON-ORBIT DAP (4.35), ORB DAP CONFIG (6.1) | A(2,2)S | ≥ 0 | deg/s | On demand | On demand |
| ARRAY_DB | Array of magnitudes of phase plane attitude deadband requests | See Table 4.1-3B | ON-ORBIT DAP (4.35), ORB DAP CONFIG (6.1) | A(2,2)S | > 0 | deg | On demand | On demand |
| ARRAY_MNVR_RATE | Array of magnitudes of discrete maneuver rates (about body axes for manual disc rate submode; about eigenaxis for auto mode) | See Table 4.1-3C | ON-ORBIT DAP (4.35), ORB DAP CONFIG (6.1) | A(2,2)S | > 0 | deg/s | On demand | On demand |
| ARRAY_NOM_NOSE_ TAIL_PITCH | Array of pitch acceleration options (1 = nominal, 2 = low nose, 3 = low tail) | V93J5750C V93J5751C (DAPs A, B) | ON-ORBIT DAP (4.35), ORB DAP CONFIG (6.1) | A(2)I | 1,2,3 | none | On demand | On demand |
| ARRAY_NOM_NOSE_ TAIL_YAW | Array of yaw acceleration options (1 = nominal, 2 = low nose, 3 = low tail) | V93J5754C V93J5755C (DAPs A, B) | ON-ORBIT DAP (4.35), ORB DAP CONFIG (6.1) | A(2)I | 1,2,3 | none | On demand | On demand |
| ARRAY_PAYLOAD_ EXTENDED | Array of payload extended flags (0 = payload not extended, 1 through 9 = selected payloads) | V93J5758C V93J5759C (DAPs A, B) | ON-ORBIT DAP (4.35), ORB DAP CONFIG (6.1) | A(2)I | 0,1,2,3, 4,5,6,7, 8,9 | none | On demand | On demand |
| ARRAY_RATE_LIMIT | Array of magnitudes of phase plane rate error limit requests | See Table 4.1-3D | ON-ORBIT DAP (4.35), ORB DAP CONFIG (6.1) | A(2,2)S | > 0 | deg/s | On demand | On demand |
| ARRAY_ROT_PULSE | Array of magnitudes of rotation pulses | See Table 4.1-3E | ON-ORBIT DAP (4.35), ORB DAP CONFIG (6.1) | A(2,2)S | > 0 | deg/s | On demand | On demand |
| ARRAY_TRANS_ PULSE | Array of magnitudes of translation pulses | V93R5700C V93R5701C (DAPs A, B) | ON-ORBIT DAP (4.35), ORB DAP CONFIG (6.1) | A(2)S | > 0 | ft/s | On demand | On demand |
| ARRAY_ALT_RATE_ LIMIT | Array of requested rate limit in ALT mode | V93R1951C V93R1956C (DAPs A, B) | ON-ORBIT DAP (4.35), ORB DAP CONFIG (6.1) | A(2)S | 0.05 - 5 | deg/s | On demand | On demand |
| ARRAY_ALT_JET_ OPTION | Array of ALT mode jet options (1 = FWD & AFT, 3 = Aft only) | V93U1952C V93U1957C (DAPs A, B) | ON-ORBIT DAP (4.35), ORB DAP CONFIG (6.1) | A(2)I | 1, 3 | none | On demand | On demand |
| ARRAY_ALT_MAX_ JETS | Array of max number of jets to be commanded ON in ALT mode | V93U1953C V93U1958C (DAPs A, B) | ON-ORBIT DAP (4.35), ORB DAP CONFIG (6.1) | A(2)I | 1 - 3 | none | On demand | On demand |

| Table 4.4-2. Output Parameters for the Orbit DAP Configuration Principal Function (5.8) | | | | | | | | |
|---|--|---------------------------------------|--|-------|-----------------------------|-------|---------------------|-------------------|
| Name | Description | MSID | Source/ Destination | Type | Range | Unit | Sample Rate (Hz) | User Rate (Hz) |
| ARRAY_ALT_ON_TIME | Array of requested max firing duration in ALT mode | V93W1954C V93W1959C (DAPs A, B) | ON-ORBIT DAP (4.35), ORB DAP CONFIG (6.1) | A(2)S | 0.08 - 9.99 | S | On demand | On demand |
| ARRAY_ALT_DELAY_TIME | Array of requested min time between firings in ALT mode | V93W1955C V93W1960C (DAPs A, B) | ON-ORBIT DAP (4.35), ORB DAP CONFIG (6.1) | A(2)S | 0 - 99.9 | S | On demand | On demand |
| EDIT_COMP_THRESHOLD | Edit disp of magnitudes of rotation compensation thresholds (0 = disable compensation) | V93H5743C V93H5747C | ORB DAP CONFIG (6.1) | A(2)S | ≥ 0 | deg/s | On demand | On demand |
| EDIT_DB | Edit disp of magnitudes of phase plane attitude deadband requests | V93H5775C V93H5777C | ORB DAP CONFIG (6.1) | A(2)S | > 0 | deg | On demand | On demand |
| EDIT_MNVR_RATE | Edit disp of magnitudes of discrete maneuver rates (about body axes for manual disc rate submode; about eigenaxis for auto mode) | V93R5707C V93R5711C | ORB DAP CONFIG (6.1) | A(2)S | > 0 | deg/s | On demand | On demand |
| EDIT_NOM_NOSE_TAIL_PITCH | Edit disp of pitch acceleration options (1 = nominal, 2 = low nose, 3 = low tail) | V93J5752C | ORB DAP CONFIG (6.1) | I | 1,2,3 | none | On demand | On demand |
| EDIT_NOM_NOSE_TAIL_YAW | Edit disp of yaw acceleration options (1 = nominal, 2 = low nose, 3 = low tail) | V93J5756C | ORB DAP CONFIG (6.1) | I | 1,2,3 | none | On demand | On demand |
| EDIT_PAYLOAD_EXTENDED | Edit disp of payload extended flags (0 = payload not extended, 1 through 9 = selected payloads) | V93J5762C | ORB DAP CONFIG (6.1) | I | 0,1,2,3, 4,5,6,7, 8,9 | none | On demand | On demand |
| EDIT_RATE_LIMIT | Edit disp of magnitudes of phase plane rate error limit requests | V93R5728C V93R5732C | ORB DAP CONFIG (6.1) | A(2)S | > 0 | deg/s | On demand | On demand |
| EDIT_ROT_PULSE | Edit disp of magnitudes of rotation pulses | V93R5716C V93R5704C | ORB DAP CONFIG (6.1) | A(2)S | > 0 | deg/s | On demand | On demand |
| EDIT_TRANS_PULSE | Edit disp of magnitudes of translation pulses | V93R5702C | ORB DAP CONFIG (6.1) | S | > 0 | ft/s | On demand | On demand |
| EDIT_ALT_RATE_LIMIT | Edit disp of requested rate limit in ALT mode | V93R5698C | ORB DAP CONFIG (6.1) | S | > 0 | deg/s | On demand | On demand |
| EDIT_ALT_JET_OPTION | Edit disp of ALT mode jet options (1 = FWD & AFT, 3 = Aft only) | V93U5699C | ORB DAP CONFIG (6.1) | I | 1, 3 | none | On demand | On demand |
| EDIT_ALT_MAX_JETS | Edit disp of max number of jets to be commanded ON in ALT mode | V93U5734C | ORB DAP CONFIG (6.1) | I | 1 - 3 | none | On demand | On demand |
| EDIT_ALT_ON_TIME | Edit disp of requested max firing duration in ALT mode | V93W5740C | ORB DAP CONFIG (6.1) | S | > 0 | S | On demand | On demand |
| EDIT_ALT_DELAY_TIME | Edit disp of requested min time between firings in ALT mode | V93W5737C | ORB DAP CONFIG (6.1) | S | ≥ 0 | S | On demand | On demand |
| DAP_SEL_REQ_A | Flag requesting DAP A load selection | V93X5785X | ORB DAP CONFIG (6.1) | B | 0, 1 | none | | |
| DAP_SEL_REQ_B | Flag requesting DAP B load selection | V93X5786X | ORB DAP CONFIG (6.1) | B | 0, 1 | none | | |

Table 4.4-2. Output Parameters for the Orbit DAP Configuration Principal Function (5.8)

| Name | Description | MSID | Source/ Destination | Type | Range | Unit | Sample Rate (Hz) | User Rate (Hz) |
|-----------------|--|--|---------------------------|--------|--------|------|---------------------|-------------------|
| DAP_EDIT_REQ_A | Flag requesting DAP A load for edit | V93X5787X | ORB DAP CONFIG (6.1) | B | 0, 1 | none | | |
| DAP_EDIT_REQ_B | Flag requesting DAP B load for edit | V93X5788X | ORB DAP CONFIG (6.1) | B | 0, 1 | none | | |
| DAP_LOAD_MOD_A | Flag indicating DAP A load mod | V93X5783X | ORB DAP CONFIG (6.1) | B | 0, 1 | none | | |
| DAP_LOAD_MOD_B | Flag indicating DAP B load mod | V93X5784X | ORB DAP CONFIG (6.1) | B | 0, 1 | none | | |
| DAP_LOAD_SEL_A | ID of display requested select DAP A | V93J5779C | ORB DAP CONFIG (6.1), TLM | I | 0 - 15 | none | | |
| DAP_LOAD_SEL_B | ID of display requested select DAP B | V93J5780C | ORB DAP CONFIG (6.1), TLM | I | 0 - 15 | none | | |
| DAPLOAD_CHANGE | Flag signifying change in one or both dapload selection parameters (bit 1 ON = dapload has changed; bit 2 ON = PRIM_VERN sw has changed) | V93X3656X | ON-ORBIT DAP (4.35) | B(2) | 0, 1 | none | | |
| DAP_EDIT_LOAD | Flag indicating parameter modification to edit DAP | V93X3658X | ORB DAP CONFIG (6.1) | B | 0, 1 | none | | |
| DAP_DATA_CHANGE | Flag indicating change in DAP load parameters | V93X5774X | ON-ORBIT DAP (4.35) | B | 0, 1 | none | | |
| DAPPAR_INT | On-Orbit DAP integer downlist array | V93J1535C through V93J1538C V93U1962C V93U1963C | TLM | A(6)I | | | | |
| DAPPAR_SCAL | On-Orbit DAP decimal downlist array | V93R1539C V93H1540C V93R1541C V93R1542C V93H1543C V93R1544C V93R1545C V93H1546C V93R1547C V93R1548C V93H1549C V93R1961C V93W1964C V93W1965C | TLM | A(14)S | | | | |

| Table 4.4-3. Orbit DAP Configuration I-Loads | | | | |
|--|--|-------|-------------------------------------|------------|
| Name | Description | Type | MSID | Units |
| PRINCIPAL_INERTIA_REF | Diagonals of nominal vehicle inertia matrix (body-axis moments of inertia) | A(3)S | V98U9938C V98U9939C V98U9940C | slug ft-ft |

| Table 4.4-4. Orbit DAP Configuration I-Load/K-Load | | | | | |
|--|--|------------|--|-------|---------------------|
| Name | Description | Type | MSID/Value | Unit | Module Used by |
| TABLE_COMP_THRESHOLD | Array of magnitudes of rotation compensation thresholds (0 = disable compensation) | A(15,2,2)S | V98U7435C through V98U7494C | deg/s | ORB DAP CONFIG SPEC |
| TABLE_DB | Array of magnitudes of phase plane attitude deadband requests | A(15,2,2)S | V98U7495C through V98U7554C | deg | ORB DAP CONFIG SPEC |
| TABLE_MNVR_RATE | Array of magnitudes of discrete maneuver rates (about body axes for manual disc rate submode; about eigenaxis for auto mode) | A(15,2,2)S | V98U7555C through V98U7614C | deg/s | ORB DAP CONFIG SPEC |
| TABLE_NOM_NOSE_TAIL_PITCH | Array of pitch acceleration options (1 = nominal, 2 = low nose, 3 = low tail) | A(15,2)I | V98U7670C through V98U7699C | none | ORB DAP CONFIG SPEC |
| TABLE_NOM_NOSE_TAIL_YAW | Array of yaw acceleration options (1 = nominal, 2 = low nose, 3 = low tail) | A(15,2)I | V98U7700C through V98U7729C | none | ORB DAP CONFIG SPEC |
| TABLE_PAYLOAD_EXTENDED | Array of payload extended flags (0 = payload not extended, 1 through 9 = selected payloads) | A(15,2)I | V98U7730C through V98U7759C | none | ORB DAP CONFIG SPEC |
| TABLE_RATE_LIMIT | Array of magnitudes of phase plane rate error limit requests | A(15,2,2)S | V98U7760C through V98U7819C | deg/s | ORB DAP CONFIG SPEC |
| TABLE_ROT_PULSE | Array of magnitudes of rotation pulses | A(15,2,2)S | V98U7820C through V98U7879C | deg/s | ORB DAP CONFIG SPEC |
| TABLE_TRANS_PULSE | Array of magnitudes of translation pulses | A(15,2)S | V98U7880C through V98U7909C | ft/s | ORB DAP CONFIG SPEC |
| TABLE_ALT_RATE_LIMIT | Array of requested rate limit in ALT mode | A(15,2)S | V98U7418C through V98U7432C, and V98U7615C through V98U7629C | deg/s | ORB DAP CONFIG SPEC |
| TABLE_ALT_JET_OPTION | Array of ALT mode jet options (1 = FWD & AFT, 3 = Aft only) | A(15,2)I | V98U7305C through V98U7334C | none | ORB DAP CONFIG SPEC |
| TABLE_ALT_MAX_JETS | Array of max number of jets to be commanded ON in ALT mode | A(15,2)I | V98U7335C through V98U7364C | none | ORB DAP CONFIG SPEC |
| TABLE_ALT_ON_TIME | Array of requested max firing duration in ALT mode | A(15,2)S | V98U7388C through V98U7417C | S | ORB DAP CONFIG SPEC |

Table 4.4-4. Orbit DAP Configuration I-Load/K-Load

| Name | Description | Type | MSID/Value | Unit | Module Used by |
|----------------------|---|----------|-----------------------------|------|---------------------|
| TABLE_ALT_DELAY_TIME | Array of requested min time between firings in ALT mode | A(15,2)S | V98U7275C through V98U7304C | S | ORB DAP CONFIG SPEC |
| KP_REF | Pitch filter gain for OMS TVC (two engines) for nominal vehicle inertia | S | V97U2756C/0.258 | sec | ORB DAP CONFIG |
| KR_REF | Roll filter gain for OMS TVC (two engines) for nominal vehicle inertia | S | V97U2757C/0.290 | sec | ORB DAP CONFIG |
| KY_REF | Yaw filter gain for OMS TVC (two engines) for nominal vehicle inertia | S | V97U2758C/0.266 | sec | ORB DAP CONFIG |

Table 4.4-5. Orbit DAP Configuration Initialization Requirements

| Initialize on Transition | | Variable | Initial Value |
|--------------------------|-------|-----------------|---------------|
| From | To | | |
| OPS 0*, 1, 3 | OPS 2 | DAP_SEL_REQ_A | 1 |
| | | DAP_SEL_REQ_B | 1 |
| | | DAP_EDIT_REQ_A | 0 |
| | | DAP_EDIT_REQ_B | 0 |
| | | DAP_LOAD_MOD_A | 0 |
| | | DAP_LOAD_MOD_B | 0 |
| | | DAP_LOAD_SEL_A | 1 |
| | | DAP_LOAD_SEL_B | 1 |
| | | DAP_LOAD_EDIT_A | 0 |
| | | DAP_LOAD_EDIT_B | 0 |
| | | DAP_EDIT_LOAD | 0 |
| OPS 8, 2 | OPS 2 | DAP_SEL_REQ_A | 0 |
| | | DAP_SEL_REQ_B | 0 |
| | | DAP_EDIT_REQ_A | 0 |
| | | DAP_EDIT_REQ_B | 0 |
| | | DAP_LOAD_MOD_A | 0 |
| | | DAP_LOAD_MOD_B | 0 |
| | | DAP_LOAD_EDIT_A | 0 |
| | | DAP_LOAD_EDIT_B | 0 |
| DAP_EDIT_LOAD | 0 | | |

* Only if a Mass Memory read is employed to overlay the flight computer major function base memory.

Table 4.4-6. On-Orbit DAP Configuration Spec Carryover Parameters

| Name | Description | Type | Range | Unit | P.F. Carried-over From | Module Used By |
|---------------------------|--|------------|------------------------------|-------|------------------------|----------------|
| TABLE_COMP_THRESHOLD | Array of magnitudes of rotation compensation thresholds (0 = disable compensation) | A(15,2,2)S | ≥ 0 | deg/s | 5.8 | DAP_LOAD_PROC |
| TABLE_DB | Array of magnitudes of phase plane attitude deadband requests | A(15,2,2)S | > 0 | deg | 5.8 | DAP_LOAD_PROC |
| TABLE_MNVR_RATE | Array of magnitudes of discrete maneuver rates (about body axes for manual disc rate submode; about eigenaxis for auto mode) | A(15,2,2)S | > 0 | deg/s | 5.8 | DAP_LOAD_PROC |
| TABLE_NOM_NOSE_TAIL_PITCH | Array of pitch acceleration options (1 = nominal, 2 = low nose, 3 = low tail) | A(15,2)I | 1, 2, 3 | none | 5.8 | DAP_LOAD_PROC |
| TABLE_NOM_NOSE_TAIL_YAW | Array of yaw acceleration options (1 = nominal, 2 = low nose, 3 = low tail) | A(15,2)I | 1, 2, 3 | none | 5.8 | DAP_LOAD_PROC |
| TABLE_PAYLOAD_EXTENDED | Array of payload extended flags (0 = payload not extended, 1 through 9 = selected payloads) | A(15,2)I | 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 | none | 5.8 | DAP_LOAD_PROC |
| TABLE_RATE_LIMIT | Array of magnitudes of phase plane rate error limit requests | A(15,2,2)S | > 0 | deg/s | 5.8 | DAP_LOAD_PROC |
| TABLE_ROT_PULSE | Array of magnitudes of rotation pulses | A(15,2,2)S | > 0 | deg/s | 5.8 | DAP_LOAD_PROC |
| TABLE_TRANS_PULSE | Array of magnitudes of translation pulses | A(15,2)S | > 0 | ft/s | 5.8 | DAP_LOAD_PROC |
| TABLE_ALT_RATE_LIMIT | Array of requested rate limit in ALT mode | A(15,2)S | > 0 | deg/s | 5.8 | DAP_LOAD_PROC |
| TABLE_ALT_JET_OPTION | Array of ALT mode jet options (1 = FWD & AFT, 3 = Aft only) | A(15,2)I | 1, 3 | none | 5.8 | DAP_LOAD_PROC |
| TABLE_ALT_MAX_JETS | Array of max number of jets to be commanded ON in ALT mode | A(15,2)I | 1 - 3 | none | 5.8 | DAP_LOAD_PROC |
| TABLE_ALT_ON_TIME | Array of requested max firing duration in ALT mode | A(15,2)S | > 0 | S | 5.8 | DAP_LOAD_PROC |
| TABLE_ALT_DELAY_TIME | Array of requested min time between firings in ALT mode | A(15,2)S | ≥ 0 | S | 5.8 | DAP_LOAD_PROC |
| DAP_LOAD_SEL_A | ID of display requested select DAP A | I | 0 - 15 | none | 5.8 | DAP_LOAD_PROC |
| DAP_LOAD_SEL_B | ID of display requested select DAP B | I | 0 - 15 | none | 5.8 | DAP_LOAD_PROC |

4.4.1 Inertia Calculation Module (INERTIA_CALC)

A. Function. This module calculates vehicle inertia-dependent control parameters for the on-orbit DAP (OFC), based on uplinked values of vehicle moments of inertia.

The interface requirements for INERTIA_CALC are given in Tables 4.4.1-1 (inputs) and 4.4.1-2 (outputs). In both these tables, the Mnemonic column gives an identifying alphanumeric code. Three codes are listed for variables that are three-element arrays. The order of listing for these is roll, pitch, and yaw.

The outputs KP2, KR, and KY2 should be initialized via K-load because these outputs will be referenced prior to the first execution of this module in OPS 2.

B. Block Diagram. The detailed block diagram for INERTIA_CALC is presented in Figure 4.4.1-1.

C. Processing Rate. INERTIA_CALC is processed as required.

D. Interface Requirements. The interface requirements for INERTIA_CALC are shown in Tables 4.4.1-1 and 4.4.1-2.

E. I-Loads/K-Loads. The I-loads for INERTIA_CALC are given in Table 4.4.1-3. K-Loads are given in Table 4.4.1-3A.

| Name | Description | MSID | Source | Type | Range | Unit | Sample Rate (Hz) | User Rate (Hz) |
|----------------------|--|-----------------------------|--------|-------|-------|------------|------------------|----------------|
| PRINCIPAL_INERTIA_UL | Diagonals of vehicle inertia matrix (body-axis moments of inertia) | V96H1320C through V96H1322C | UPLINK | A(3)S | | slug/ft-ft | As required | — |
| UP_OP_CODE | Uplink operation code | V96J3521C | UPLINK | B(7) | | none | As required | — |

| Name | Description | MSID | Destination | Type | Range | Unit | Sample Rate (Hz) | User Rate (Hz) |
|------|---|-----------|---------------------|------|----------|--------------|------------------|----------------|
| KP2 | Pitch filter gain for OMS TVC (two engines) | V95U8847C | ON-ORBIT DAP (4.35) | S | ≥ 0 | deg/ (deg/s) | As required | 1/ maneuver |
| KR | Roll filter gain for OMS TVC (two engines) | V95U8848C | ON-ORBIT DAP (4.35) | S | ≥ 0 | deg/ (deg/s) | As required | 12.5 |
| KY2 | Yaw filter gain for OMS TVC (two engines) | V95U8849C | ON-ORBIT DAP (4.35) | S | ≥ 0 | deg/ (deg/s) | As required | 1/ maneuver |

| Table 4.4.1-3.INERTIA_CALC I-Loads | | | | |
|------------------------------------|--|-------|-------------------------------------|----------------------|
| Name | Description | Type | MSID | Units |
| PRINCIPAL_INERTIA_REF | Diagonals of nominal vehicle inertia matrix (body-axis moments of inertia) | A(3)S | V98U9938C V98U9939C V98U9940C | slug ft ² |

| Table 4.4.1-3A INERTIA_CALC K-Loads | | | | | |
|-------------------------------------|--|------|------------------------|---------------|----------------|
| Name | Description | Type | MSID/ Value | Units | Module used by |
| KP_REF | Pitch filter gains for OMS TVC (two engines) for nominal vehicle inertia | S | V97U2756C/ 2.58 E-1 | deg/(deg/sec) | ORB DAP CONFIG |
| KR_REF | Roll filter gains for OMS TVC (two engines) for nominal vehicle inertia | S | V97U2757C/ 2.90 E-1 | deg/(deg/sec) | ORB DAP CONFIG |
| KY_REF | Yaw filter gains for OMS TVC (two engines) for nominal vehicle inertia | S | V97U2758C/ 2.66 E-1 | deg/(deg/sec) | ORB DAP CONFIG |

| Table 4.4.1-5.INERTIA_CALC Carryover Values | | | | | | |
|---|--|-------|-------|----------------------|---|-------------------|
| Name | Description | Type | Range | Unit | Principal Function Carried Over From | Module(s) Used By |
| INERTIA_CHANGE | Flag indicating vehicle inertia and inertia dependent parameters have changed (1 = changed) | B | 0, 1 | none | ORBIT DAP (4.35), ORBIT DAP CONFIG (5.8) | DAPLOAD_SELECT |
| KP2 | Pitch filter gain for OMS TVC (two engines) | S | ≥ 0 | deg/ (deg/sec) | ORBIT DAP (4.35), ORBIT DAP CONFIG (5.8) | TVC_LAW_PITCH_YAW |
| KR | Roll filter gain for OMS TVC (two engines) | S | ≥ 0 | deg/ (deg/sec) | ORBIT DAP (4.35), ORBIT DAP CONFIG (5.8) | TVC_LAW_ROLL |
| KY2 | Yaw filter gain for OMS TVC (two engines) | S | ≥ 0 | deg/ (deg/sec) | ORBIT DAP (4.35), ORBIT DAP CONFIG (5.8) | TVC_LAW_PITCH_YAW |
| MAG_CONTROL_ACCEL_PRIM_NOM | Magnitude of average control acceleration available for each axis, assuming nominal vehicle mass properties, payload not extended, using primary RCS jets. | A(3)S | ≥ 0 | deg/sec ² | ORBIT DAP (4.35), ORBIT DAP CONFIG (5.8) | DAPLOAD_SELECT |
| MAG_CONTROL_ACCEL_VERN_NOM | Magnitude of average control acceleration available for each axis, assuming nominal vehicle mass properties, payload not extended, using vernier RCS jets. | A(3)S | ≥ 0 | deg/sec ² | ORBIT DAP (4.35), ORBIT DAP CONFIG (5.8) | DAPLOAD_SELECT |

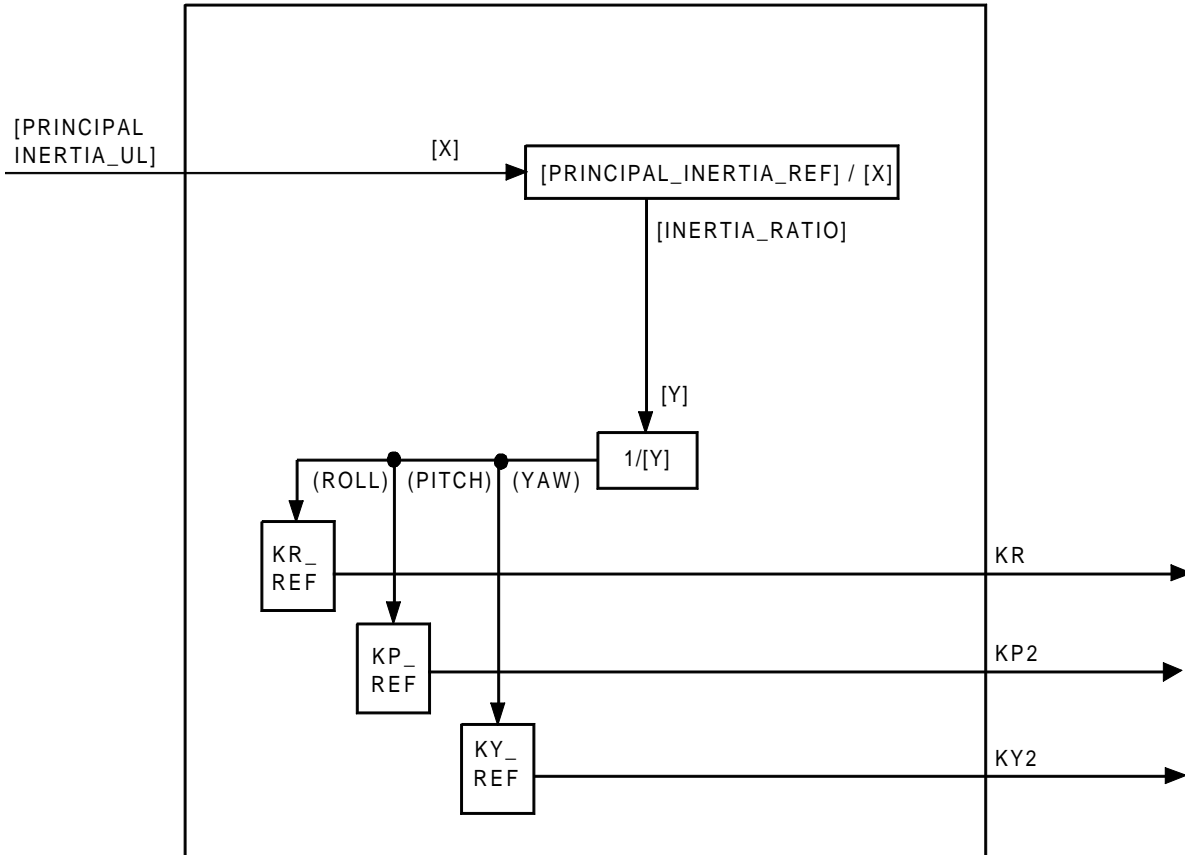


FIGURE 4.4.1-1. INERTIA_CALC Block Diagram

4.4.2 DAP LOAD Processor (DAP_LOAD_PROC)

A. Function. The DAP_LOAD_PROC module manages the DAP A and B load tables and controls the transfer of parameter values between the selected DAP loads, the DAP CONFIG displays, and the table DAP loads.

B. Block Diagram. None.

C. Processing Rate. The DAP_LOAD_PROC module is processed as required.

D. Interface Requirements. The interface requirements for DAP_LOAD_PROC are given in Tables 4.4.2-2 and 4.4.2-3.

E. I-Loads. The I-loads for DAP_LOAD_PROC are given in Table 4.4.2-4.

F. Flag Reset Requirements. The DAP_LOAD_PROC flag reset requirements are shown in Table 4.4.2-5.

G. Detailed Technical Description. Each DAP load consists of the nineteen parameter values needed by the Orbit DAP to configure its translational and rotational control options. Table 4.4.2-1 shows the different nomenclatures used for these parameters, since individual user functions employ different terminology for equivalent DAP load parameters.

Table 4.4.2-1.DAP_LOAD_PROC Nomenclature

| | |
|---------------------------------|-------------------------------|
| TABLE_COMP_THRESHOLD (X,Y,Z) | ARRAY_COMP_THRESHOLD (Y,Z) |
| TABLE_DB (X,Y,Z) | ARRAY_DB (Y,Z) |
| TABLE_MNVR_RATE (X,Y,Z) | ARRAY_MNVR_RATE (Y,Z) |
| TABLE_NOM_NOSE_TAIL_PITCH (X,Y) | ARRAY_NOM_NOSE_TAIL_PITCH (Y) |
| TABLE_NOM_NOSE_TAIL_YAW (X,Y) | ARRAY_NOM_NOSE_TAIL_YAW (Y) |
| TABLE_PAYLOAD_EXTENDED (X,Y) | ARRAY_PAYLOAD_EXTENDED (Y) |
| TABLE_RATE_LIMIT (X,Y,Z) | ARRAY_RATE_LIMIT (Y,Z) |
| TABLE_ROT_PULSE (X,Y,Z) | ARRAY_ROT_PULSE (Y,Z) |
| TABLE_TRANS_PULSE (X,Y) | ARRAY_TRANS_PULSE (Y) |
| TABLE_ALT_RATE_LIMIT (X,Y) | ARRAY_ALT_RATE_LIMIT (Y) |
| TABLE_ALT_JET_OPTION (X,Y) | ARRAY_ALT_JET_OPTION (Y) |
| TABLE_ALT_MAX_JETS (X,Y) | ARRAY_ALT_MAX_JETS (Y) |
| TABLE_ALT_ON_TIME (X,Y) | ARRAY_ALT_ON_TIME (Y) |
| TABLE_ALT_DELAY_TIME (X,Y) | ARRAY_ALT_DELAY_TIME (Y) |

EDIT_COMP_THRESHOLD (Z)
 EDIT_DB (Z)
 EDIT_MNVR_RATE (Z)
 EDIT_NOM_NOSE_TAIL_PITCH
 EDIT_NOM_NOSE_TAIL_YAW
 EDIT_PAYLOAD_EXTENDED
 EDIT_RATE_LIMIT (Z)
 EDIT_ROT_PULSE (Z)
 EDIT_TRANS_PULSE
 EDIT_ALT_RATE_LIMIT
 EDIT_ALT_JET_OPTION
 EDIT_ALT_MAX_JETS
 EDIT_ALT_ON_TIME
 EDIT_ALT_DELAY_TIME

Where: X = 1 through 15 for the DAP A1 through A15 or DAP B1 through B15
 Y = 1 for DAP A, = 2 for DAP B
 Z = 1 for NORM jets, = 2 for VERN jets

The following short-hand notation may also be used throughout DAP_LOAD_PROC for the sets of parameters above.

TABLE_PARAM (X,Y)
 ARRAY_PARAM (Y)
 EDIT_PARAM

DAPLOAD Proc Detailed Requirements

- 1) IF DAP_SEL_REQ_A = 1
 THEN DAP_LOAD_MOD_A = 0
 DAPLOAD_CHANGE(BIT 1) = 1
 ARRAY_PARAM(1) = TABLE_PARAM(DAP_LOAD_SEL_A, 1)
- 2) IF DAP_SEL_REQ_B = 1
 THEN DAP_LOAD_MOD_B = 0
 DAPLOAD_CHANGE(BIT 1) = 1
 ARRAY_PARAM(2) = TABLE_PARAM(DAP_LOAD_SEL_B, 2)
- 3) IF DAP_EDIT_REQ_A = 1
 THEN EDIT_PARAM = TABLE_PARAM(DAP_LOAD_EDIT_A, 1)
- 4) IF DAP_EDIT_REQ_B = 1
 THEN EDIT_PARAM = TABLE_PARAM(DAP_LOAD_EDIT_B, 2)
- 5) IF DAP_LOAD_MOD_A = 1
 THEN DAP_LOAD_SEL_A = 0
 DAP_DATA_CHANGE = 1
- 6) IF DAP_LOAD_MOD_B = 1
 THEN DAP_LOAD_SEL_B = 0
 DAP_DATA_CHANGE = 1
- 7) IF DAP_EDIT_LOAD = 1
 THEN IF DAP_LOAD_EDIT_B = 0
 THEN TABLE_PARAM(DAP_LOAD_EDIT_A, 1) = EDIT_PARAM
 IF DAP_LOAD_EDIT_A = DAP_LOAD_SEL_A
 THEN DAP_LOAD_MOD_A = 0
 DAPLOAD_CHANGE(BIT 1) = 1
 ARRAY_PARAM(1) = TABLE_PARAM(DAP_LOAD_SEL_A, 1)
 ELSE TABLE_PARAM(DAP_LOAD_EDIT_B, 2) = EDIT_PARAM
 IF DAP_LOAD_EDIT_B = DAP_LOAD_SEL_B
 THEN DAP_LOAD_MOD_B = 0
 DAPLOAD_CHANGE(BIT 1) = 1
 ARRAY_PARAM(2) = TABLE_PARAM(DAP_LOAD_SEL_B, 2)

Table 4.4.2-2. Input Parameters for DAP_LOAD_PROC

| Name | Description | MSID | Source | Type | Range | Unit | Sample Rate (Hz) | User Rate (Hz) |
|--------------------------|--|------------------------|---|-------|---------------------|-------|------------------|----------------|
| EDIT_COMP_THRESHOLD | Edit disp of magnitudes of rotation compensation thresholds (0 = disable compensation) | V93H5743C V93H5747C | ORB DAP CONFIG (6.1) | A(2)S | ≥ 0 | deg/s | On demand | On demand |
| EDIT_DB | Edit disp of magnitudes of phase plane attitude deadband requests | V93H5775C V93H5777C | ORB DAP CONFIG (6.1) | A(2)S | > 0 | deg | On demand | On demand |
| EDIT_MNVR_RATE | Edit disp of magnitudes of discrete maneuver rates (about body axes for manual disc rate submode; about eigenaxis for auto mode) | V93R5707C V93R5711C | ORB DAP CONFIG (6.1) | A(2)S | > 0 | deg/s | On demand | On demand |
| EDIT_NOM_NOSE_TAIL_PITCH | Edit disp of pitch acceleration options (1 = nominal, 2 = low nose, 3 = low tail) | V93J5752C | ORB DAP CONFIG (6.1) | I | 1,2,3 | none | On demand | On demand |
| EDIT_NOM_NOSE_TAIL_YAW | Edit disp of yaw acceleration options (1 = nominal, 2 = low nose, 3 = low tail) | V93J5756C | ORB DAP CONFIG (6.1) | I | 1,2,3 | none | On demand | On demand |
| EDIT_PAYLOAD_EXTENDED | Edit disp of payload extended flags (0 = payload not extended, 1 through 9 = selected payloads) | V93J5762C | ORB DAP CONFIG (6.1) | I | 0,1,2,3,4,5,6,7,8,9 | none | On demand | On demand |
| EDIT_RATE_LIMIT | Edit disp of magnitudes of phase plane rate error limit requests | V93R5728C V93R5732C | ORB DAP CONFIG (6.1) | A(2)S | > 0 | deg/s | On demand | On demand |
| EDIT_ROT_PULSE | Edit disp of magnitudes of rotation pulses | V93R5716C V93R5704C | ORB DAP CONFIG (6.1) | A(2)S | > 0 | deg/s | On demand | On demand |
| EDIT_TRANS_PULSE | Edit disp of magnitudes of translation pulses | V93R5702C | ORB DAP CONFIG (6.1) | S | > 0 | ft/s | On demand | On demand |
| EDIT_ALT_RATE_LIMIT | Edit disp of requested rate limit in ALT mode | V93R5698C | ORB DAP CONFIG (6.1) | S | 0.05 – 5 | deg/s | On demand | On demand |
| EDIT_ALT_JET_OPTION | Edit disp of ALT mode jet options (1 = FWD & AFT, 3 = Aft only) | V93U5699C | ORB DAP CONFIG (6.1) | I | 1, 3 | none | On demand | On demand |
| EDIT_ALT_MAX_JETS | Edit disp of max number of jets to be commanded ON in ALT mode | V93U5734C | ORB DAP CONFIG (6.1) | I | 1 – 3 | none | On demand | On demand |
| EDIT_ALT_ON_TIME | Edit disp of requested max firing duration in ALT mode | V93W5740C | ORB DAP CONFIG (6.1) | S | 0.08 – 9.99 | S | On demand | On demand |
| EDIT_ALT_DELAY_TIME | Edit disp of requested min time between firings in ALT mode | V93W5737C | ORB DAP CONFIG (6.1) | S | 0 – 99.9 | S | On demand | On demand |
| DAP_SEL_REQ_A | Flag requesting DAP A load selection | V93X5785X | ORB DAP CONFIG (6.1), ON-ORBIT DAP (4.35) | B | 0, 1 | none | | |
| DAP_SEL_REQ_B | Flag requesting DAP B load selection | V93X5786X | ORB DAP CONFIG (6.1), ON-ORBIT DAP (4.35) | B | 0, 1 | none | | |
| DAP_EDIT_REQ_A | Flag requesting DAP A load for edit | V93X5787X | ORB DAP CONFIG (6.1) | B | 0, 1 | none | | |
| DAP_EDIT_REQ_B | Flag requesting DAP B load for edit | V93X5788X | ORB DAP CONFIG (6.1) | B | 0, 1 | none | | |

Table 4.4.2-2. Input Parameters for DAP_LOAD_PROC

| Name | Description | MSID | Source | Type | Range | Unit | Sample Rate (Hz) | User Rate (Hz) |
|-----------------|--|-----------|---|------|--------|------|------------------|----------------|
| DAP_LOAD_MOD_A | Flag indicating DAP A load mod | V93X5783X | ORB DAP CONFIG (6.1) | B | 0, 1 | none | | |
| DAP_LOAD_MOD_B | Flag indicating DAP B load mod | V93X5784X | ORB DAP CONFIG (6.1) | B | 0, 1 | none | | |
| DAP_LOAD_SEL_A | ID of display requested select DAP A | V93J5779C | ORB DAP CONFIG (6.1), ON-ORBIT DAP (4.35) | I | 0 – 15 | none | | |
| DAP_LOAD_SEL_B | ID of display requested select DAP B | V93J5780C | ORB DAP CONFIG (6.1), ON-ORBIT DAP (4.35) | I | 0 – 15 | none | | |
| DAP_LOAD_EDIT_A | ID of display requested edit DAP A | V93J5781C | ORB DAP CONFIG (6.1) | I | 0 – 15 | none | | |
| DAP_LOAD_EDIT_B | ID of display requested edit DAP B | V93J5782C | ORB DAP CONFIG (6.1) | I | 0 – 15 | none | | |
| DAP_EDIT_LOAD | Flag indicating parameter modification to edit DAP | V93X3658X | ORB DAP CONFIG (6.1) | B | 0, 1 | none | | |

Table 4.4.2-3. Output Parameters for DAP_LOAD_PROC

| Name | Description | MSID | Destination | Type | Range | Unit | Sample Rate (Hz) | User Rate (Hz) |
|---------------------------|--|---------------------------------------|---|---------|---------------------|-------|------------------|----------------|
| ARRAY_COMP_THRESHOLD | Array of magnitudes of rotation compensation thresholds (0 = disable compensation) | See Table 4.1-3A | ON-ORBIT DAP (4.35), ORB DAP CONFIG (6.1) | A(2,2)S | ≥ 0 | deg/s | On demand | On demand |
| ARRAY_DB | Array of magnitudes of phase plane attitude deadband requests | See Table 4.1-3B | ON-ORBIT DAP (4.35), ORB DAP CONFIG (6.1) | A(2,2)S | > 0 | deg | On demand | On demand |
| ARRAY_MNVR_RATE | Array of magnitudes of discrete maneuver rates (about body axes for manual disc rate submode; about eigenaxis for auto mode) | See Table 4.1-3C | ON-ORBIT DAP (4.35), ORB DAP CONFIG (6.1) | A(2,2)S | > 0 | deg/s | On demand | On demand |
| ARRAY_NOM_NOSE_TAIL_PITCH | Array of pitch acceleration options (1 = nominal, 2 = low nose, 3 = low tail) | V93J5750C V93J5751C (DAPs A, B) | ON-ORBIT DAP (4.35), ORB DAP CONFIG (6.1) | A(2)I | 1,2,3 | none | On demand | On demand |
| ARRAY_NOM_NOSE_TAIL_YAW | Array of yaw acceleration options (1 = nominal, 2 = low nose, 3 = low tail) | V93J5754C V93J5755C (DAPs A, B) | ON-ORBIT DAP (4.35), ORB DAP CONFIG (6.1) | A(2)I | 1,2,3 | none | On demand | On demand |
| ARRAY_PAYLOAD_EXTENDED | Array of payload extended flags (0 = payload not extended, 1 through 9 = selected payloads) | V93J5758C V93J5759C (DAPs A, B) | ON-ORBIT DAP (4.35), ORB DAP CONFIG (6.1) | A(2)I | 0,1,2,3,4,5,6,7,8,9 | none | On demand | On demand |
| ARRAY_RATE_LIMIT | Array of magnitudes of phase plane rate error limit requests | See Table 4.1-3D | ON-ORBIT DAP (4.35), ORB DAP CONFIG (6.1) | A(2,2)S | > 0 | deg/s | On demand | On demand |
| ARRAY_ROT_PULSE | Array of magnitudes of rotation pulses | See Table 4.1-3E | ON-ORBIT DAP (4.35), ORB DAP CONFIG (6.1) | A(2,2)S | > 0 | deg/s | On demand | On demand |
| ARRAY_TRANS_PULSE | Array of magnitudes of translation pulses | V93R5700C V93R5701C (DAPs A, B) | ON-ORBIT DAP (4.35), ORB DAP CONFIG (6.1) | A(2)S | > 0 | ft/s | On demand | On demand |
| ARRAY_ALT_RATE_LIMIT | Array of requested rate limit in ALT mode | V93R1951C V93R1956C (DAPs A, B) | ON-ORBIT DAP (4.35), ORB DAP CONFIG (6.1) | A(2)S | > 0 | deg/s | On demand | On demand |
| ARRAY_ALT_JET_OPTION | Array of ALT mode jet options (1 = FWD & AFT, 3 = Aft only) | V93U1952C V93U1957 (DAPs A, B) | ON-ORBIT DAP (4.35), ORB DAP CONFIG (6.1) | A(2)I | 1, 3 | none | On demand | On demand |
| ARRAY_ALT_MAX_JETS | Array of max number of jets to be commanded ON in ALT mode | V93U1953C V93U1958C (DAPs A, B) | ON-ORBIT DAP (4.35), ORB DAP CONFIG (6.1) | A(2)I | 1 - 3 | none | On demand | On demand |
| ARRAY_ALT_ON_TIME | Array of requested max firing duration in ALT mode | V93W1954C V93W1959C (DAPs A, B) | ON-ORBIT DAP (4.35), ORB DAP CONFIG (6.1) | A(2)S | > 0 | S | On demand | On demand |
| ARRAY_ALT_DELAY_TIME | Array of requested min time between firings in ALT mode | V93W1955C V93W1960C (DAPs A, B) | ON-ORBIT DAP (4.35), ORB DAP CONFIG (6.1) | A(2)S | ≥ 0 | S | On demand | On demand |

Table 4.4.2-3. Output Parameters for DAP_LOAD_PROC

| Name | Description | MSID | Destination | Type | Range | Unit | Sample Rate (Hz) | User Rate (Hz) |
|--------------------------|--|------------------------|----------------------|-------|---------------------|-------|------------------|----------------|
| EDIT_COMP_THRESHOLD | Edit disp of magnitudes of rotation compensation thresholds (0 = disable compensation) | V93H5743C V93H5747C | ORB DAP CONFIG (6.1) | A(2)S | ≥ 0 | deg/s | On demand | On demand |
| EDIT_DB | Edit disp of magnitudes of phase plane attitude deadband requests | V93H5775C V93H5777C | ORB DAP CONFIG (6.1) | A(2)S | > 0 | deg | On demand | On demand |
| EDIT_MNVR_RATE | Edit disp of magnitudes of discrete maneuver rates (about body axes for manual disc rate submode; about eigenaxis for auto mode) | V93R5707C V93R5711C | ORB DAP CONFIG (6.1) | A(2)S | > 0 | deg/s | On demand | On demand |
| EDIT_NOM_NOSE_TAIL_PITCH | Edit disp of pitch acceleration options (1 = nominal, 2 = low nose, 3 = low tail) | V93J5752C | ORB DAP CONFIG (6.1) | I | 1,2,3 | none | On demand | On demand |
| EDIT_NOM_NOSE_TAIL_YAW | Edit disp of yaw acceleration options (1 = nominal, 2 = low nose, 3 = low tail) | V93J5756C | ORB DAP CONFIG (6.1) | I | 1,2,3 | none | On demand | On demand |
| EDIT_PAYLOAD_EXTENDED | Edit disp of payload extended flags (0 = payload not extended, 1 through 9 = selected payloads) | V93J5762C | ORB DAP CONFIG (6.1) | I | 0,1,2,3,4,5,6,7,8,9 | none | On demand | On demand |
| EDIT_RATE_LIMIT | Edit disp of magnitudes of phase plane rate error limit requests | V93R5728C V93R5732C | ORB DAP CONFIG (6.1) | A(2)S | > 0 | deg/s | On demand | On demand |
| EDIT_ROT_PULSE | Edit disp of magnitudes of rotation pulses | V93R5716C V93R5704C | ORB DAP CONFIG (6.1) | A(2)S | > 0 | deg/s | On demand | On demand |
| EDIT_TRANS_PULSE | Edit disp of magnitudes of translation pulses | V93R5702C | ORB DAP CONFIG (6.1) | S | > 0 | ft/s | On demand | On demand |
| EDIT_ALT_RATE_LIMIT | Edit disp of requested rate limit in ALT mode | V93R5698C | ORB DAP CONFIG (6.1) | S | > 0 | deg/s | On demand | On demand |
| EDIT_ALT_JET_OPTION | Edit disp of ALT mode jet options (1 = FWD & AFT, 3 = Aft only) | V93U5699C | ORB DAP CONFIG (6.1) | I | 1, 3 | none | On demand | On demand |
| EDIT_ALT_MAX_JETS | Edit disp of max number of jets to be commanded ON in ALT mode | V93U5734C | ORB DAP CONFIG (6.1) | I | 1 - 3 | none | On demand | On demand |
| EDIT_ALT_ON_TIME | Edit disp of requested max firing duration in ALT mode | V93W5740C | ORB DAP CONFIG (6.1) | S | > 0 | S | On demand | On demand |
| EDIT_ALT_DELAY_TIME | Edit disp of requested min time between firings in ALT mode | V93W5737C | ORB DAP CONFIG (6.1) | S | ≥ 0 | S | On demand | On demand |
| DAP_SEL_REQ_A | Flag requesting DAP A load selection | V93X5785X | ORB DAP CONFIG (6.1) | B | 0, 1 | none | | |
| DAP_SEL_REQ_B | Flag requesting DAP B load selection | V93X5786X | ORB DAP CONFIG (6.1) | B | 0, 1 | none | | |
| DAP_EDIT_REQ_A | Flag requesting DAP A load for edit | V93X5787X | ORB DAP CONFIG (6.1) | B | 0, 1 | none | | |
| DAP_EDIT_REQ_B | Flag requesting DAP B load for edit | V93X5788X | ORB DAP CONFIG (6.1) | B | 0, 1 | none | | |
| DAP_LOAD_MOD_A | Flag requesting DAP A load mod | V93X5783X | ORB DAP CONFIG (6.1) | B | 0, 1 | none | | |
| DAP_LOAD_MOD_B | Flag requesting DAP B load mod | V93X5784X | ORB DAP CONFIG (6.1) | B | 0, 1 | none | | |

Table 4.4.2-3. Output Parameters for DAP_LOAD_PROC

| Name | Description | MSID | Destination | Type | Range | Unit | Sample Rate (Hz) | User Rate (Hz) |
|-----------------|--|-----------|---------------------------|------|--------|------|------------------|----------------|
| DAP_LOAD_SEL_A | ID of display requested select DAP A | V93J5779C | ORB DAP CONFIG (6.1), TLM | I | 0 - 15 | none | | |
| DAP_LOAD_SEL_B | ID of display requested select DAP B | V93J5780C | ORB DAP CONFIG (6.1), TLM | I | 0 - 15 | none | | |
| DAPLOAD_CHANGE | Flag signifying change in one or both dapload selection parameters (bit 1 ON = dapload has changed; bit 2 ON = PRIM_VERN sw has changed) | V93X3656X | ON-ORBIT DAP (4.35) | B(2) | 0, 1 | none | | |
| DAP_EDIT_LOAD | Flag indicating parameter modification to edit DAP | V93X3658X | ORB DAP CONFIG (6.1) | B | 0, 1 | none | | |
| DAP_DATA_CHANGE | Flag indicating change in DAP load parameters | V93X5774X | ON-ORBIT DAP (4.35) | B | 0, 1 | none | | |

| Table 4.4.2-4.DAP_LOAD_PROC I-Loads | | | | |
|-------------------------------------|--|------------|--|-------|
| Name | Description | Type | MSID | Units |
| TABLE_COMP_THRESHOLD | Array of magnitudes of rotation compensation thresholds (0 = disable compensation) | A(15,2,2)S | V98U7435C through V98U7494C | deg/s |
| TABLE_DB | Array of magnitudes of phase plane attitude deadband requests | A(15,2,2)S | V98U7495C through V98U7554C | deg |
| TABLE_MNVR_RATE | Array of magnitudes of discrete maneuver rates (about body axes for manual disc rate submode; about eigenaxis for auto mode) | A(15,2,2)S | V98U7555C through V98U7614C | deg/s |
| TABLE_NOM_NOSE_TAIL_PITCH | Array of pitch acceleration options (1 = nominal, 2 = low nose, 3 = low tail) | A(15,2)I | V98U7670C through V98U7699C | none |
| TABLE_NOM_NOSE_TAIL_YAW | Array of yaw acceleration options (1 = nominal, 2 = low nose, 3 = low tail) | A(15,2)I | V98U7700C through V98U7729C | none |
| TABLE_PAYLOAD_EXTENDED | Array of payload extended flags (0 = payload not extended, 1 through 9 = selected payloads) | A(15,2)I | V98U7730C through V98U7759C | none |
| TABLE_RATE_LIMIT | Array of magnitudes of phase plane rate error limit requests | A(15,2,2)S | V98U7760C through V98U7819C | deg/s |
| TABLE_ROT_PULSE | Array of magnitudes of rotation pulses | A(15,2,2)S | V98U7820C through V98U7879C | deg/s |
| TABLE_TRANS_PULSE | Array of magnitudes of translation pulses | A(15,2)S | V98U7880C through V98U7909C | ft/s |
| TABLE_ALT_RATE_LIMIT | Array of requested rate limit in ALT mode | A(15,2)S | V98U7418C through V98U7432C, and V98U7615C through V98U7629C | deg/s |
| TABLE_ALT_JET_OPTION | Array of ALT mode jet options (1 = FWD & AFT, 3 = Aft only) | A(15,2)I | V98U7305C through V98U7334C | none |
| TABLE_ALT_MAX_JETS | Array of max number of jets to be commanded ON in ALT mode | A(15,2)I | V98U7335C through V98U7364C | none |
| TABLE_ALT_ON_TIME | Array of requested max firing duration in ALT mode | A(15,2)S | V98U7388C through V98U7417C | S |
| TABLE_ALT_DELAY_TIME | Array of requested min time between firings in ALT mode | A(15,2)S | V98U7275C through V98U7304C | S |

| Table 4.4.2-5. Flags Reset by DAP_LOAD_PROC After Use | |
|---|--------|
| Flag | Set to |
| DAP_SEL_REQ_A | 0 |
| DAP_SEL_REQ_B | 0 |
| DAP_EDIT_REQ_A | 0 |
| DAP_EDIT_REQ_B | 0 |
| DAP_LOAD_MOD_A | 0 |
| DAP_LOAD_MOD_B | 0 |
| DAP_EDIT_LOAD | 0 |

4.4.3 On-Orbit DAP Downlist Module

- A. Function. The On-Orbit DAP downlist module shall allow one of the 30 stored DAP loads to be downlisted every 2 seconds. This module loads one of the 30 DAP loads (19 DAP parameters plus a DAP Load ID) from the DAP Table to two downlist arrays which need to be preserved as a homogeneous set for downlist. These arrays are then downlisted. The module shall repeatedly cycle through all 30 DAP loads for downlist while in OPS 2.
- B. Block Diagram. The detailed block diagram for On-Orbit DAP Downlist Module is shown in Figure 4.4.3-1.
- C. Processing Rate. The On-Orbit DAP Downlist Module is processed at 0.52 Hz while in OPS 2.
- D. Interface Requirements. The On-Orbit DAP Downlist Module interface requirements are shown in Table 4.4.3-1 and 4.4.3-2.
- E. Constants. None.
- F. Initialization Requirements. The downlisted DAP load shall be initialized to zeros.

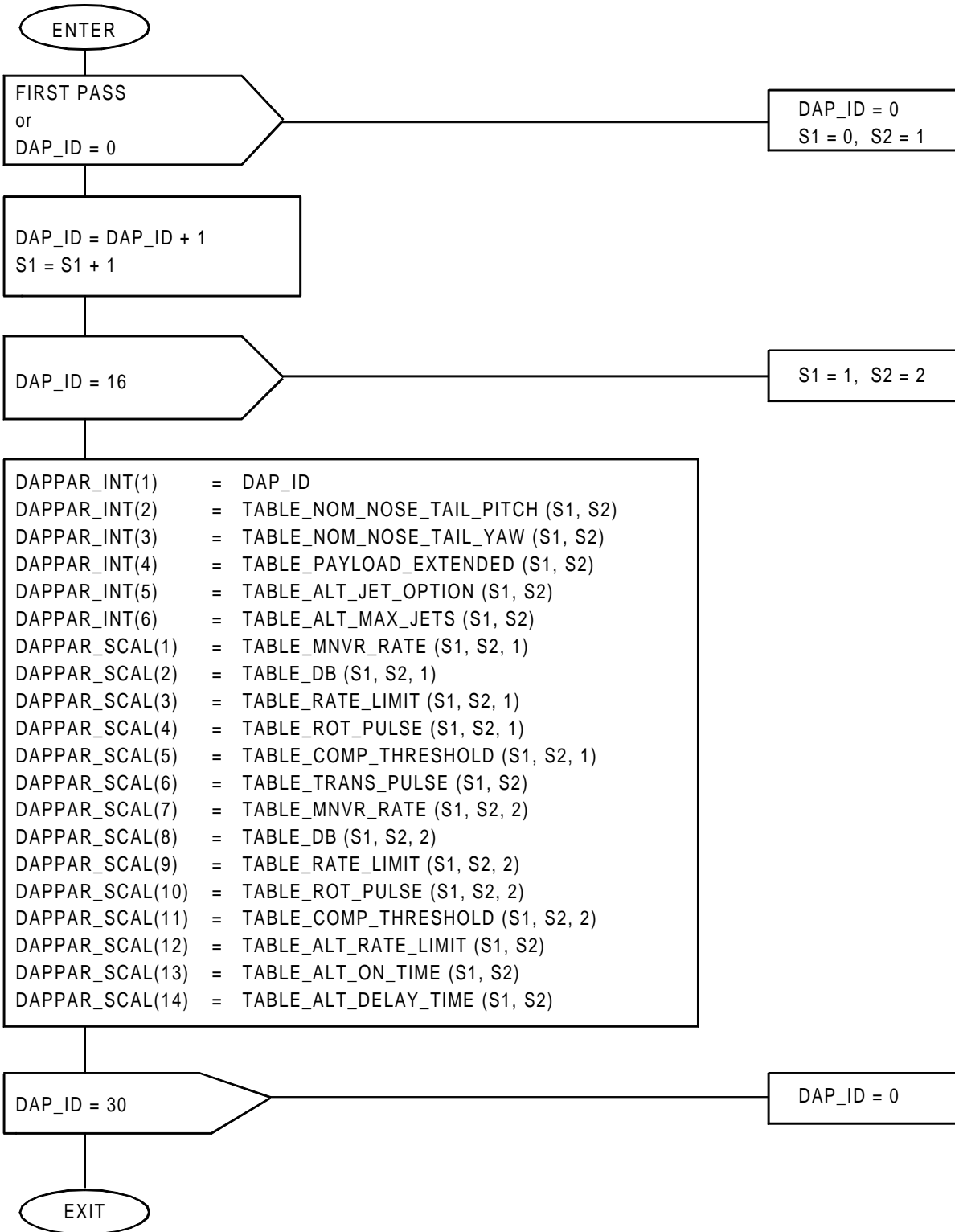


FIGURE 4.4.3-1. On-Orbit DAP Downlist Module

Table 4.4.3-1. Input Parameters for On-Orbit DAP Downlist Module

| Name | Description | MSID | Source | Type | Units |
|---------------------------|--|--|--------|------------|-------|
| TABLE_COMP_THRESHOLD | Array of magnitudes of rotation compensation thresholds (0 = disable compensation) | V98U7435C through V98U7494C | 5.8 | A(15,2,2)S | deg/s |
| TABLE_DB | Array of magnitudes of phase plane attitude deadband requests | V98U7495C through V98U7554C | 5.8 | A(15,2,2)S | deg |
| TABLE_MNVR_RATE | Array of magnitudes of discrete maneuver rates (about body axes for manual disc rate submode; about eigenaxis for auto mode) | V98U7555C through V98U7614C | 5.8 | A(15,2,2)S | deg/s |
| TABLE_NOM_NOSE_TAIL_PITCH | Array of pitch acceleration options (1 = nominal, 2 = low nose, 3 = low tail) | V98U7670C through V98U7699C | 5.8 | A(15,2)I | none |
| TABLE_NOM_NOSE_TAIL_YAW | Array of yaw acceleration options (1 = nominal, 2 = low nose, 3 = low tail) | V98U7700C through V98U7729C | 5.8 | A(15,2)I | none |
| TABLE_PAYLOAD_EXTENDED | Array of payload extended flags (0 = payload not extended, 1 through 9 = selected payloads) | V98U7730C through V98U7759C | 5.8 | A(15,2)I | none |
| TABLE_RATE_LIMIT | Array of magnitudes of phase plane rate error limit requests | V98U7760C through V98U7819C | 5.8 | A(15,2,2)S | deg/s |
| TABLE_ROT_PULSE | Array of magnitudes of rotation pulses | V98U7820C through V98U7879C | 5.8 | A(15,2,2)S | deg/s |
| TABLE_TRANS_PULSE | Array of magnitudes of translation pulses | V98U7880C through V98U7909C | 5.8 | A(15,2)S | ft/s |
| TABLE_ALT_RATE_LIMIT | Array of requested rate limit in ALT mode | V98U7418C through V98U7432C, and V98U7615C through V98U7629C | 5.8 | A(15,2)S | deg/s |
| TABLE_ALT_JET_OPTION | Array of ALT mode jet options (1 = FWD & AFT, 3 = Aft only) | V98U7305C through V98U7334C | 5.8 | A(15,2)I | none |
| TABLE_ALT_MAX_JETS | Array of max number of jets to be commanded ON in ALT mode | V98U7335C through V98U7364C | 5.8 | A(15,2)I | none |
| TABLE_ALT_ON_TIME | Array of requested max firing duration in ALT mode | V98U7388C through V98U7417C | 5.8 | A(15,2)S | sec |
| TABLE_ALT_DELAY_TIME | Array of requested min time between firings in ALT mode | V98U7275C through V98U7304C | 5.8 | A(15,2)S | sec |

| Table 4.4.3-2. Output Parameters for On-Orbit DAP Downlist Module | | | | | |
|---|-------------------------------------|--|-------------|--------|-------|
| Name | Description | MSID | Destination | Type | Units |
| DAPPAR_INT | On-Orbit DAP integer downlist array | V93J1535C V93J1536C V93J1537C V93J1538C V93U1962C V93U1963C | TLM | A(6)I | |
| DAPPAR_SCAL | On-Orbit DAP decimal downlist array | V93R1539C V93H1540C V93R1541C V93R1542C V93H1543C V93R1544C V93R1545C V93H1546C V93R1547C V93R1548C V93H1549C V93R1961C V93W1964C V93W1965C | TLM | A(14)S | |

4.4.4 Parameter Tables for ORB DAP Configuration Specialist Interface Support Functions

The IDD inputs and outputs are listed in Tables 4.4.4-1 and 4.4.4-2. Values for the I-loads are contained in the I-loads requirements document (JSC-19350); however, I-load definitions applicable to this principal function are listed in Table 4.4.4-3. K-loads are listed in Table 4.4.4-4. Constants are listed in Table 4.4.4-5.

TABLE 4.4.4-1. INPUT FUNCTIONAL PARAMETERS FOR ORB DAP CONFIG SPEC FUNCTION (REF DISP 6.1) (G5.8)

| FSSR NAME | M/S ID | NOMENCLATURE | SOURCE | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|--------------------------|------------|-----------------------------|---------------------|----------|-----------|---------|---------|-------|
| DAP_EDIT_LOAD | V93X3658X | DAP EDIT LOAD | ORB DAP CONFIG DISP | | BD | | 79862F | |
| DAP_EDIT_REQ_A | V93X5787X | DAP EDIT REQ A | ORB DAP CONFIG DISP | | BD | | 79862F | |
| DAP_EDIT_REQ_B | V93X5788X | DAP EDIT REQ B | ORB DAP CONFIG DISP | | BD | | 79862F | |
| DAP_LOAD_EDIT_A | V93J5781C | DAP LOAD EDIT A | ORB DAP CONFIG DISP | | HXS | | 79862F | |
| DAP_LOAD_EDIT_B | V93J5782C | DAP LOAD EDIT B | ORB DAP CONFIG DISP | | | | 79862F | |
| DAP_LOAD_MOD_A | V93X5783X | DAP LOAD MOD A | ORB DAP CONFIG DISP | | BD | | 79862F | |
| DAP_LOAD_MOD_B | V93X5784X | DAP LOAD MOD B | ORB DAP CONFIG DISP | | BD | | 79862F | |
| DAP_LOAD_SEL_A | V93J5779C | DAP LOAD SEL A | ORB DAP CONFIG DISP | | HXS | | 93017G | * |
| DAP_LOAD_SEL_A | V93J5779CB | DAP LOAD SEL A | ORB DAP | | HXS | | 90837G | |
| DAP_LOAD_SEL_B | V93J5780C | DAP LOAD SEL B | ORB DAP CONFIG DISP | | HXS | | 93017G | * |
| DAP_LOAD_SEL_B | V93J5780CB | DAP LOAD SEL B | ORB DAP | | HXS | | 90837G | |
| DAP_SEL_REQ_A | V93X5785X | DAP SEL REQ A | ORB DAP CONFIG DISP | | BD | | 79862F | |
| DAP_SEL_REQ_A | V93X5785XB | DAP SEL REQ A | ORB DAP | | BD | | 90837G | |
| DAP_SEL_REQ_B | V93X5786X | DAP SEL REQ B | ORB DAP CONFIG DISP | | BD | | 79862F | |
| DAP_SEL_REQ_B | V93X5786XB | DAP SEL REQ B | ORB DAP | | BD | | 90837G | |
| EDIT_ALT_DELAY_TIME | V93W5737C | ALT PRIMARY DELAY TIME EDIT | ORB DAP CONFIG DISP | S | SPL | | 79862F | |
| EDIT_ALT_JET_OPTION | V93U5699C | ALT PRIMARY JET OPTION EDIT | ORB DAP CONFIG DISP | | HXS | | 79862F | |
| EDIT_ALT_MAX_JETS | V93U5734C | ALT PRIMARY MAX JETS EDIT | ORB DAP CONFIG DISP | | HXS | | 79862F | |
| EDIT_ALT_ON_TIME | V93W5740C | ALT PRIMARY ON TIME EDIT | ORB DAP CONFIG DISP | S | SPL | | 79862F | |
| EDIT_ALT_RATE_LIMIT | V93R5698C | ALT PRIMARY RATE LIMIT EDIT | ORB DAP CONFIG DISP | DEG/S | SPL | | 79862F | |
| EDIT_COMP_THRESHOLD(1) | V93H5743C | NORM ROT CMPNT DBD EDIT | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| EDIT_COMP_THRESHOLD(2) | V93H5747C | VERN ROT CMPNT DBD EDIT | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| EDIT_DB(1) | V93H5775C | NORM ATT DEADBAND EDIT | ORB DAP CONFIG DISP | DEG | VAR | | 79862F | |
| EDIT_DB(2) | V93H5777C | VERN ATT DEADBAND EDIT | ORB DAP CONFIG DISP | DEG | VAR | | 79862F | |
| EDIT_MNVR_RATE(1) | V93R5707C | NORM DISCRETE RATE EDIT | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| EDIT_MNVR_RATE(2) | V93R5711C | VERN DISCRETE RATE EDIT | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| EDIT_NOM_NOSE_TAIL_PITCH | V93J5752C | P NOM/NOSE/TAIL JET EDIT | ORB DAP CONFIG DISP | | VAR | | 79862F | |
| EDIT_NOM_NOSE_TAIL_YAW | V93J5756C | Y NOM/NOSE/TAIL JET EDIT | ORB DAP CONFIG DISP | | VAR | | 79862F | |
| EDIT_PAYLOAD_EXTENDED | V93J5762C | CNTL ACCEL EDIT | ORB DAP CONFIG DISP | | VAR | | 90708C | |
| EDIT_RATE_LIMIT(1) | V93R5728C | NORM RATE LIMIT EDIT | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| EDIT_RATE_LIMIT(2) | V93R5732C | VERN RATE LIMIT EDIT | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| EDIT_ROT_PULSE(1) | V93R5716C | NORM ROT PULSE LEVEL EDIT | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| EDIT_ROT_PULSE(2) | V93R5704C | VERN ROT PULSE LEVEL EDIT | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| EDIT_TRANS_PULSE | V93R5702C | TRANS PULSE LEVEL EDIT | ORB DAP CONFIG DISP | FT/S | BSS | | 79862F | |
| PRINCIPAL_INERTIA_UL(X) | V96H1320C | VEHICLE X INERTIA(UPLINK) | UL | SLUG-FT2 | | | 90185A | |
| PRINCIPAL_INERTIA_UL(Y) | V96H1321C | VEHICLE Y INERTIA(UPLINK) | UL | SLUG-FT2 | | | 90185A | |
| PRINCIPAL_INERTIA_UL(Z) | V96H1322C | VEHICLE Z INERTIA(UPLINK) | UL | SLUG-FT2 | | | 90185A | |
| UP_OP_CODE | V96J3521C | OP CODE FOR UPLINK | UL | | HXS | | 92067D | |

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

TABLE 4.4.4-2. OUTPUT FUNCTIONAL PARAMETERS FROM ORB DAP CONFIG SPEC FUNCTION (REF DISP 6.1) (G5.8)

| FSSR NAME | M/S ID | NOMENCLATURE | DESTINATION | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|------------------------------|------------|--------------------------|---------------------|-------|-----------|------------------|---------|-------------|
| ARRAY_ALT_DELAY_TIME(1) | V93W1955CA | ALT PRIMARY DELAY TIME A | ORB DAP | S | BSS | | 79862F | |
| ARRAY_ALT_DELAY_TIME(2) | V93W1960CA | ALT PRIMARY DELAY TIME B | ORB DAP CONFIG DISP | S | BSS | | 79862F | |
| ARRAY_ALT_JET_OPTION(1) | V93U1952CA | ALT PRIMARY JET OPTION A | ORB DAP CONFIG DISP | | VAR | | 79862F | |
| ARRAY_ALT_JET_OPTION(2) | V93U1957CA | ALT PRIMARY JET OPTION B | ORB DAP CONFIG DISP | | VAR | | 79862F | |
| ARRAY_ALT_MAX_JETS(1) | V93U1953CA | ALT PRIMARY MAX JETS A | ORB DAP CONFIG DISP | | VAR | | 79862F | |
| ARRAY_ALT_MAX_JETS(2) | V93U1958CA | ALT PRIMARY MAX JETS B | ORB DAP CONFIG DISP | | VAR | | 79862F | |
| ARRAY_ALT_ON_TIME(1) | V93W1954CA | ALT PRIMARY ON TIME A | ORB DAP | S | BSS | | 79862F | |
| ARRAY_ALT_ON_TIME(2) | V93W1959CA | ALT PRIMARY ON TIME B | ORB DAP CONFIG DISP | S | BSS | | 79862F | |
| ARRAY_ALT_RATE_LIMIT(1) | V93R1951CA | ALT PRIMARY RATE LIMIT A | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_ALT_RATE_LIMIT(2) | V93R1956CA | ALT PRIMARY RATE LIMIT B | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_COMP_THRESHOLD(1,1) | V93H5741CA | NORM ROT CMPNT DBD A | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_COMP_THRESHOLD(1,2) | V93H5745CA | VERN ROT CMPNT DBD A | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_COMP_THRESHOLD(2,1) | V93H5742CA | NORM ROT CMPNT DBD B | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_COMP_THRESHOLD(2,2) | V93H5746CA | VERN ROT CMPNT DBD B | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_DB(1,1) | V93H5766CA | NORM ATT DEADBAND A | ORB DAP CONFIG DISP | DEG | VAR | | 79862F | |
| ARRAY_DB(1,2) | V93H5768CA | VERN ATT DEADBAND A | ORB DAP CONFIG DISP | DEG | VAR | | 79862F | |
| ARRAY_DB(2,1) | V93H5767CA | NORM ATT DEADBAND B | ORB DAP CONFIG DISP | DEG | VAR | | 79862F | |
| ARRAY_DB(2,2) | V93H5769CA | VERN ATT DEADBAND B | ORB DAP CONFIG DISP | DEG | VAR | | 79862F | |
| ARRAY_MNVR_RATE(1,1) | V93R5705CA | NORM DISCRETE RATE A | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_MNVR_RATE(1,2) | V93R5709CA | VERN DISCRETE RATE A | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_MNVR_RATE(2,1) | V93R5706CA | NORM DISCRETE RATE B | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_MNVR_RATE(2,2) | V93R5710CA | VERN DISCRETE RATE B | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_NOM_NOSE_TAIL_PITCH(1) | V93J5750CA | P NOM/NOSE/TAIL JET A | ORB DAP CONFIG DISP | | VAR | | 92789C | |

TABLE 4.4.4-2. OUTPUT FUNCTIONAL PARAMETERS FROM ORB DAP CONFIG SPEC FUNCTION (REF DISP 6.1) (G5.8)

| FSSR NAME | M/S ID | NOMENCLATURE | DESTINATION | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|------------------------------|------------|------------------------|---------------------|-------|-----------|---------|---------|-------|
| ARRAY_NOM_NOSE_TAIL_PITCH(2) | V93J5751CA | P NOM/NOSE/TAIL JET B | ORB DAP | | VAR | | 92789C | |
| ARRAY_NOM_NOSE_TAIL_YAW(1) | V93J5754CA | Y NOM/NOSE/TAIL JET A | ORB DAP CONFIG DISP | | VAR | | 79862F | |
| ARRAY_NOM_NOSE_TAIL_YAW(2) | V93J5755CA | Y NOM/NOSE/TAIL JET B | ORB DAP CONFIG DISP | | VAR | | 79862F | |
| ARRAY_PAYLOAD_EXTENDED(1) | V93J5758CA | CNTL ACCEL A | ORB DAP | | HXS | | 90708C | |
| ARRAY_PAYLOAD_EXTENDED(2) | V93J5759CA | CNTL ACCEL B | ORB DAP CONFIG DISP | | HXS | | 90708C | |
| ARRAY_RATE_LIMIT(1,1) | V93R5726CA | NORM RATE LIMIT A | ORB DAP | DEG/S | BSS | | 79862F | |
| ARRAY_RATE_LIMIT(1,2) | V93R5730CA | VERN RATE LIMIT A | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_RATE_LIMIT(2,1) | V93R5727CA | NORM RATE LIMIT B | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_RATE_LIMIT(2,2) | V93R5731CA | VERN RATE LIMIT B | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_ROT_PULSE(1,1) | V93R5714CA | NORM ROT PULSE LEVEL A | ORB DAP | DEG/S | BSS | | 79862F | |
| ARRAY_ROT_PULSE(1,2) | V93R5718CA | VERN ROT PULSE LEVEL A | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_ROT_PULSE(2,1) | V93R5715CA | NORM ROT PULSE LEVEL B | ORB DAP | DEG/S | BSS | | 79862F | |
| ARRAY_ROT_PULSE(2,2) | V93R5719CA | VERN ROT PULSE LEVEL B | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| ARRAY_TRANS_PULSE(1) | V93R5700CA | TRANS PULSE LEVEL A | ORB DAP | DEG/S | BSS | | 79862F | |
| ARRAY_TRANS_PULSE(2) | V93R5701CA | TRANS PULSE LEVEL B | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| DAPLOAD_CHANGE | V93X3656X | DAPLOAD CHANGE | ORB DAP | | | | 79862F | |
| DAPPAR_INT(1) | V93J1535C | DAPLOAD ID | DL FMT 22/1 | | HXS | | 93017G | * |
| DAPPAR_INT(2) | V93J1536C | P NOM/NOSE/TAIL JET | DL FMT 22/1 | | HXS | | 93017G | * |
| DAPPAR_INT(3) | V93J1537C | Y NOM/NOSE/TAIL JET | DL FMT 22/1 | | HXS | | 93017G | * |
| DAPPAR_INT(4) | V93J1538C | CNTL ACCEL | DL FMT 22/1 | | HXS | | 93017G | * |
| DAPPAR_INT(5) | V93U1962C | ALT JET OPTION | DL FMT 22/1 | | HXS | | 93017G | * |
| DAPPAR_INT(6) | V93U1963C | ALT MAX JETS | DL FMT 22/1 | | HXS | | 93017G | * |
| DAPPAR_SCAL(1) | V93R1539C | NORM DISCRETE RATE | DL FMT 22/1 | DEG/S | SPL | | 93017G | * |
| DAPPAR_SCAL(10) | V93R1548C | VERN PULSE LEVEL | DL FMT 22/1 | DEG/S | SPL | | 93017G | * |
| DAPPAR_SCAL(11) | V93H1549C | VERN ROT CMPNT DBD | DL FMT 22/1 | DEG/S | SPL | | 93017G | * |
| DAPPAR_SCAL(12) | V93R1961C | ALT RATE LIMIT | DL FMT 22/1 | DEG/S | SPL | | 93017G | * |
| DAPPAR_SCAL(13) | V93W1964C | ALT ON TIME | DL FMT 22/1 | S | SPL | | 93017G | * |
| DAPPAR_SCAL(14) | V93W1965C | ALT DELAY TIME | DL FMT 22/1 | S | SPL | | 93017G | * |
| DAPPAR_SCAL(2) | V93H1540C | NORM ATT DEADBAND | DL FMT 22/1 | DEG | SPL | | 93017G | * |
| DAPPAR_SCAL(3) | V93R1541C | NORM RATE LIMIT | DL FMT 22/1 | DEG/S | SPL | | 93017G | * |
| DAPPAR_SCAL(4) | V93R1542C | NORM ROT PULSE LEVEL | DL FMT 22/1 | DEG/S | SPL | | 93017G | * |

TABLE 4.4.4-2. OUTPUT FUNCTIONAL PARAMETERS FROM ORB DAP CONFIG SPEC FUNCTION (REF DISP 6.1) (G5.8)

| FSSR NAME | M/S ID | NOMENCLATURE | DESTINATION | UNITS | DATA TYPE | P R E C | LAST CR | R E V |
|--------------------------|------------|-----------------------------|---------------------|-------|-------------|---------|---------|-------|
| DAPPAR_SCAL(5) | V93H1543C | NORM ROT CMPNT DBD | DL FMT 22/1 | DEG/S | SPL | | 93017G | * |
| DAPPAR_SCAL(6) | V93R1544C | TRANS PULSE LEVEL | DL FMT 22/1 | FT/S | SPL | | 93017G | * |
| DAPPAR_SCAL(7) | V93R1545C | VERN DISCRETE RATE | DL FMT 22/1 | DEG/S | SPL | | 93017G | * |
| DAPPAR_SCAL(8) | V93H1546C | VERN ATT DEADBAND | DL FMT 22/1 | DEG | SPL | | 93017G | * |
| DAPPAR_SCAL(9) | V93R1547C | VERN RATE LIMIT | DL FMT 22/1 | DEG/S | SPL | | 93017G | * |
| DAP_DATA_CHANGE | V93X5774XA | DAP DATA CHANGE FLAG | ORB DAP | | | | 79862F | |
| DAP_EDIT_LOAD | V93X3658XA | DAP EDIT LOAD | ORB DAP CONFIG DISP | | BD | | 79862F | |
| DAP_EDIT_REQ_A | V93X5787XA | DAP EDIT REQ A | ORB DAP CONFIG DISP | | BD | | 79862F | |
| DAP_EDIT_REQ_B | V93X5788XA | DAP EDIT REQ B | ORB DAP CONFIG DISP | | BD | | 79862F | |
| DAP_LOAD_MOD_A | V93X5783XA | DAP LOAD MOD A | ORB DAP CONFIG DISP | | BD | | 79862F | |
| DAP_LOAD_MOD_B | V93X5784XA | DAP LOAD MOD B | ORB DAP CONFIG DISP | | BD | | 79862F | |
| DAP_LOAD_SEL_A | V93J5779CA | DAP LOAD SEL A | ORB DAP CONFIG DISP | | HXS | | 79862F | |
| DAP_LOAD_SEL_B | V93J5780CA | DAP LOAD SEL B | ORB DAP CONFIG DISP | | HXS | | 79862F | |
| DAP_SEL_REQ_A | V93X5785XA | DAP SEL REQ A | ORB DAP CONFIG DISP | | BD | | 79862F | |
| DAP_SEL_REQ_B | V93X5786XA | DAP SEL REQ B | ORB DAP CONFIG DISP | | BD | | 79862F | |
| EDIT_ALT_DELAY_TIME | V93W5737CA | ALT PRIMARY DELAY TIME EDIT | ORB DAP CONFIG DISP | S | SPL | | 79862F | |
| EDIT_ALT_JET_OPTION | V93U5699CA | ALT PRIMARY JET OPTION EDIT | ORB DAP CONFIG DISP | | HXS | | 79862F | |
| EDIT_ALT_MAX_JETS | V93U5734CA | ALT PRIMARY MAX JETS EDIT | ORB DAP CONFIG DISP | | HXS | | 79862F | |
| EDIT_ALT_ON_TIME | V93W5740CA | ALT PRIMARY ON TIME EDIT | ORB DAP CONFIG DISP | S | SPL | | 79862F | |
| EDIT_ALT_RATE_LIMIT | V93R5698CA | ALT PRIMARY RATE LIMIT EDIT | ORB DAP CONFIG DISP | DEG | SPL | | 79862F | |
| EDIT_COMP_THRESHOLD(1) | V93H5743CA | NORM ROT CMPNT DBD EDIT | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| EDIT_COMP_THRESHOLD(2) | V93H5747CA | VERN ROT CMPNT DBD EDIT | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| EDIT_DB(1) | V93H5775CA | NORM ATT DEADBAND EDIT | ORB DAP CONFIG DISP | DEG | VAR | | 79862F | |
| EDIT_DB(2) | V93H5777CA | VERN ATT DEADBAND EDIT | ORB DAP CONFIG DISP | DEG | VAR | | 79862F | |
| EDIT_MNVR_RATE(1) | V93R5707CA | NORM DISCRETE RATE EDIT | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| EDIT_MNVR_RATE(2) | V93R5711CA | VERN DISCRETE RATE EDIT | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| EDIT_NOM_NOSE_TAIL_PITCH | V93J5752CA | P NOM/NOSE/TAIL JET EDIT | ORB DAP CONFIG DISP | | VAR | | 79862F | |
| EDIT_NOM_NOSE_TAIL_YAW | V93J5756CA | Y NOM/NOSE/TAIL JET EDIT | ORB DAP CONFIG DISP | | VAR | | 79862F | |
| EDIT_PAYLOAD_EXTENDED | V93J5762CA | CNTL ACCEL EDIT | ORB DAP CONFIG DISP | | VAR | | 90708C | |
| EDIT_RATE_LIMIT(1) | V93R5728CA | NORM RATE LIMIT EDIT | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| EDIT_RATE_LIMIT(2) | V93R5732CA | VERN RATE LIMIT EDIT | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| EDIT_ROT_PULSE(1) | V93R5716CA | NORM ROT PULSE LEVEL EDIT | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| EDIT_ROT_PULSE(2) | V93R5704CA | VERN ROT PULSE LEVEL EDIT | ORB DAP CONFIG DISP | DEG/S | BSS | | 79862F | |
| EDIT_TRANS_PULSE | V93R5702CA | TRANS PULSE LEVEL EDIT | ORB DAP CONFIG DISP | FT/S | BSS | | 79862F | |
| KP2 | V95U8847C | OMS TVC FILTER GAIN-PITCH | ORB DAP | | DEG/(DEG/S) | | 90185A | |
| KR | V95U8848C | OMS TVC FILTER GAIN-ROLL | ORB DAP | | DEG/(DEG/S) | | 90185A | |
| KY2 | V95U8849C | OMS TVC FILTER GAIN-YAW | ORB DAP | | DEG/(DEG/S) | | 90185A | |

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 4.4.4-3. ORB DAP CONFIG SPEC FUNCTION (REF DISP 6.1) (G5.8) I-LOADS

| FSSR NAME | MSID | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R E V |
|----------------------------|-----------|------------|----|----|---|---|---------------|----|-----|---------|-------------|
| PRINCIPAL_INERTIA_REF(1) | V98U9938C | SLUG*FT**2 | F | S | M | P | G4.35 G5.8 | 00 | OMI | 90708C | |
| PRINCIPAL_INERTIA_REF(2) | V98U9939C | SLUG*FT**2 | F | S | M | P | G4.35 G5.8 | 00 | OMI | 90708C | |
| PRINCIPAL_INERTIA_REF(3) | V98U9940C | SLUG*FT**2 | F | S | M | P | G4.35 G5.8 | 00 | OMI | 90708C | |
| TABLE_ALT_DELAY_TIME(1,1) | V98U7275C | SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_DELAY_TIME(1,2) | V98U7290C | SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_DELAY_TIME(10,1) | V98U7284C | SEC | F | S | D | P | G5.8 | 00 | D10 | 79862F | |
| TABLE_ALT_DELAY_TIME(10,2) | V98U7299C | SEC | F | S | D | P | G5.8 | 00 | B10 | 79862F | |
| TABLE_ALT_DELAY_TIME(11,1) | V98U7285C | SEC | F | S | D | P | G5.8 | 00 | D11 | 79862F | |
| TABLE_ALT_DELAY_TIME(11,2) | V98U7300C | SEC | F | S | D | P | G5.8 | 00 | B11 | 79862F | |
| TABLE_ALT_DELAY_TIME(12,1) | V98U7286C | SEC | F | S | D | P | G5.8 | 00 | D12 | 79862F | |
| TABLE_ALT_DELAY_TIME(12,2) | V98U7301C | SEC | F | S | D | P | G5.8 | 00 | B12 | 79862F | |
| TABLE_ALT_DELAY_TIME(13,1) | V98U7287C | SEC | F | S | D | P | G5.8 | 00 | D13 | 79862F | |
| TABLE_ALT_DELAY_TIME(13,2) | V98U7302C | SEC | F | S | D | P | G5.8 | 00 | B13 | 79862F | |
| TABLE_ALT_DELAY_TIME(14,1) | V98U7288C | SEC | F | S | D | P | G5.8 | 00 | D14 | 79862F | |
| TABLE_ALT_DELAY_TIME(14,2) | V98U7303C | SEC | F | S | D | P | G5.8 | 00 | B14 | 79862F | |
| TABLE_ALT_DELAY_TIME(15,1) | V98U7289C | SEC | F | S | D | P | G5.8 | 00 | D15 | 79862F | |
| TABLE_ALT_DELAY_TIME(15,2) | V98U7304C | SEC | F | S | D | P | G5.8 | 00 | B15 | 79862F | |
| TABLE_ALT_DELAY_TIME(2,1) | V98U7276C | SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_DELAY_TIME(2,2) | V98U7291C | SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_DELAY_TIME(3,1) | V98U7277C | SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_DELAY_TIME(3,2) | V98U7292C | SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_DELAY_TIME(4,1) | V98U7278C | SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_DELAY_TIME(4,2) | V98U7293C | SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_DELAY_TIME(5,1) | V98U7279C | SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_DELAY_TIME(5,2) | V98U7294C | SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_DELAY_TIME(6,1) | V98U7280C | SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_DELAY_TIME(6,2) | V98U7295C | SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_DELAY_TIME(7,1) | V98U7281C | SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_DELAY_TIME(7,2) | V98U7296C | SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_DELAY_TIME(8,1) | V98U7282C | SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_DELAY_TIME(8,2) | V98U7297C | SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_DELAY_TIME(9,1) | V98U7283C | SEC | F | S | D | P | G5.8 | 00 | D09 | 79862F | |
| TABLE_ALT_DELAY_TIME(9,2) | V98U7298C | SEC | F | S | D | P | G5.8 | 00 | B09 | 79862F | |
| TABLE_ALT_JET_OPTION(1,1) | V98U7305C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_JET_OPTION(1,2) | V98U7320C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_JET_OPTION(10,1) | V98U7314C | ND | I | S | D | P | G5.8 | 00 | D10 | 79862F | |
| TABLE_ALT_JET_OPTION(10,2) | V98U7329C | ND | I | S | D | P | G5.8 | 00 | B10 | 79862F | |
| TABLE_ALT_JET_OPTION(11,1) | V98U7315C | ND | I | S | D | P | G5.8 | 00 | D11 | 79862F | |
| TABLE_ALT_JET_OPTION(11,2) | V98U7330C | ND | I | S | D | P | G5.8 | 00 | B11 | 79862F | |
| TABLE_ALT_JET_OPTION(12,1) | V98U7316C | ND | I | S | D | P | G5.8 | 00 | D12 | 79862F | |
| TABLE_ALT_JET_OPTION(12,2) | V98U7331C | ND | I | S | D | P | G5.8 | 00 | B12 | 79862F | |
| TABLE_ALT_JET_OPTION(13,1) | V98U7317C | ND | I | S | D | P | G5.8 | 00 | D13 | 79862F | |
| TABLE_ALT_JET_OPTION(13,2) | V98U7332C | ND | I | S | D | P | G5.8 | 00 | B13 | 79862F | |
| TABLE_ALT_JET_OPTION(14,1) | V98U7318C | ND | I | S | D | P | G5.8 | 00 | D14 | 79862F | |

TABLE 4.4.4-3. ORB DAP CONFIG SPEC FUNCTION (REF DISP 6.1) (G5.8) I-LOADS

| FSSR NAME | MSID | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R E V |
|----------------------------|-----------|-----------|----|----|---|---|---------|----|-----|---------|-------------|
| TABLE_ALT_JET_OPTION(14,2) | V98U7333C | ND | I | S | D | P | G5.8 | 00 | B14 | 79862F | |
| TABLE_ALT_JET_OPTION(15,1) | V98U7319C | ND | I | S | D | P | G5.8 | 00 | D15 | 79862F | |
| TABLE_ALT_JET_OPTION(15,2) | V98U7334C | ND | I | S | D | P | G5.8 | 00 | B15 | 79862F | |
| TABLE_ALT_JET_OPTION(2,1) | V98U7306C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_JET_OPTION(2,2) | V98U7321C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_JET_OPTION(3,1) | V98U7307C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_JET_OPTION(3,2) | V98U7322C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_JET_OPTION(4,1) | V98U7308C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_JET_OPTION(4,2) | V98U7323C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_JET_OPTION(5,1) | V98U7309C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_JET_OPTION(5,2) | V98U7324C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_JET_OPTION(6,1) | V98U7310C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_JET_OPTION(6,2) | V98U7325C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_JET_OPTION(7,1) | V98U7311C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_JET_OPTION(7,2) | V98U7326C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_JET_OPTION(8,1) | V98U7312C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_JET_OPTION(8,2) | V98U7327C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_JET_OPTION(9,1) | V98U7313C | ND | I | S | D | P | G5.8 | 00 | D09 | 79862F | |
| TABLE_ALT_JET_OPTION(9,2) | V98U7328C | ND | I | S | D | P | G5.8 | 00 | B09 | 79862F | |
| TABLE_ALT_MAX_JETS(1,1) | V98U7335C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_MAX_JETS(1,2) | V98U7350C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_MAX_JETS(10,1) | V98U7344C | ND | I | S | D | P | G5.8 | 00 | D10 | 79862F | |
| TABLE_ALT_MAX_JETS(10,2) | V98U7359C | ND | I | S | D | P | G5.8 | 00 | B10 | 79862F | |
| TABLE_ALT_MAX_JETS(11,1) | V98U7345C | ND | I | S | D | P | G5.8 | 00 | D11 | 79862F | |
| TABLE_ALT_MAX_JETS(11,2) | V98U7360C | ND | I | S | D | P | G5.8 | 00 | B11 | 79862F | |
| TABLE_ALT_MAX_JETS(12,1) | V98U7346C | ND | I | S | D | P | G5.8 | 00 | D12 | 79862F | |
| TABLE_ALT_MAX_JETS(12,2) | V98U7361C | ND | I | S | D | P | G5.8 | 00 | B12 | 79862F | |
| TABLE_ALT_MAX_JETS(13,1) | V98U7347C | ND | I | S | D | P | G5.8 | 00 | D13 | 79862F | |
| TABLE_ALT_MAX_JETS(13,2) | V98U7362C | ND | I | S | D | P | G5.8 | 00 | B13 | 79862F | |
| TABLE_ALT_MAX_JETS(14,1) | V98U7348C | ND | I | S | D | P | G5.8 | 00 | D14 | 79862F | |
| TABLE_ALT_MAX_JETS(14,2) | V98U7363C | ND | I | S | D | P | G5.8 | 00 | B14 | 79862F | |
| TABLE_ALT_MAX_JETS(15,1) | V98U7349C | ND | I | S | D | P | G5.8 | 00 | D15 | 79862F | |
| TABLE_ALT_MAX_JETS(15,2) | V98U7364C | ND | I | S | D | P | G5.8 | 00 | B15 | 79862F | |
| TABLE_ALT_MAX_JETS(2,1) | V98U7336C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_MAX_JETS(2,2) | V98U7351C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_MAX_JETS(3,1) | V98U7337C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_MAX_JETS(3,2) | V98U7352C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_MAX_JETS(4,1) | V98U7338C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_MAX_JETS(4,2) | V98U7353C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_MAX_JETS(5,1) | V98U7339C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_MAX_JETS(5,2) | V98U7354C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_MAX_JETS(6,1) | V98U7340C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_MAX_JETS(6,2) | V98U7355C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_MAX_JETS(7,1) | V98U7341C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_MAX_JETS(7,2) | V98U7356C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_MAX_JETS(8,1) | V98U7342C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_MAX_JETS(8,2) | V98U7357C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |

TABLE 4.4.4-3. ORB DAP CONFIG SPEC FUNCTION (REF DISP 6.1) (G5.8) I-LOADS

| FSSR NAME | MSID | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R E V |
|----------------------------|-----------|-----------|----|----|---|---|---------|----|-----|---------|-------------|
| TABLE_ALT_MAX_JETS(9,1) | V98U7343C | ND | I | S | D | P | G5.8 | 00 | D09 | 79862F | |
| TABLE_ALT_MAX_JETS(9,2) | V98U7358C | ND | I | S | D | P | G5.8 | 00 | B09 | 79862F | |
| TABLE_ALT_ON_TIME(1,1) | V98U7388C | SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_ON_TIME(1,2) | V98U7403C | SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_ON_TIME(10,1) | V98U7397C | SEC | F | S | D | P | G5.8 | 00 | D10 | 79862F | |
| TABLE_ALT_ON_TIME(10,2) | V98U7412C | SEC | F | S | D | P | G5.8 | 00 | B10 | 79862F | |
| TABLE_ALT_ON_TIME(11,1) | V98U7398C | SEC | F | S | D | P | G5.8 | 00 | D11 | 79862F | |
| TABLE_ALT_ON_TIME(11,2) | V98U7413C | SEC | F | S | D | P | G5.8 | 00 | B11 | 79862F | |
| TABLE_ALT_ON_TIME(12,1) | V98U7399C | SEC | F | S | D | P | G5.8 | 00 | D12 | 79862F | |
| TABLE_ALT_ON_TIME(12,2) | V98U7414C | SEC | F | S | D | P | G5.8 | 00 | B12 | 79862F | |
| TABLE_ALT_ON_TIME(13,1) | V98U7400C | SEC | F | S | D | P | G5.8 | 00 | D13 | 79862F | |
| TABLE_ALT_ON_TIME(13,2) | V98U7415C | SEC | F | S | D | P | G5.8 | 00 | B13 | 79862F | |
| TABLE_ALT_ON_TIME(14,1) | V98U7401C | SEC | F | S | D | P | G5.8 | 00 | D14 | 79862F | |
| TABLE_ALT_ON_TIME(14,2) | V98U7416C | SEC | F | S | D | P | G5.8 | 00 | B14 | 79862F | |
| TABLE_ALT_ON_TIME(15,1) | V98U7402C | SEC | F | S | D | P | G5.8 | 00 | D15 | 79862F | |
| TABLE_ALT_ON_TIME(15,2) | V98U7417C | SEC | F | S | D | P | G5.8 | 00 | B15 | 79862F | |
| TABLE_ALT_ON_TIME(2,1) | V98U7389C | SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_ON_TIME(2,2) | V98U7404C | SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_ON_TIME(3,1) | V98U7390C | SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_ON_TIME(3,2) | V98U7405C | SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_ON_TIME(4,1) | V98U7391C | SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_ON_TIME(4,2) | V98U7406C | SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_ON_TIME(5,1) | V98U7392C | SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_ON_TIME(5,2) | V98U7407C | SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_ON_TIME(6,1) | V98U7393C | SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_ON_TIME(6,2) | V98U7408C | SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_ON_TIME(7,1) | V98U7394C | SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_ON_TIME(7,2) | V98U7409C | SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_ON_TIME(8,1) | V98U7395C | SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_ON_TIME(8,2) | V98U7410C | SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_ON_TIME(9,1) | V98U7396C | SEC | F | S | D | P | G5.8 | 00 | D09 | 79862F | |
| TABLE_ALT_ON_TIME(9,2) | V98U7411C | SEC | F | S | D | P | G5.8 | 00 | B09 | 79862F | |
| TABLE_ALT_RATE_LIMIT(1,1) | V98U7418C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_RATE_LIMIT(1,2) | V98U7615C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_RATE_LIMIT(10,1) | V98U7427C | DEG/SEC | F | S | D | P | G5.8 | 00 | D10 | 79862F | |
| TABLE_ALT_RATE_LIMIT(10,2) | V98U7624C | DEG/SEC | F | S | D | P | G5.8 | 00 | B10 | 79862F | |
| TABLE_ALT_RATE_LIMIT(11,1) | V98U7428C | DEG/SEC | F | S | D | P | G5.8 | 00 | D11 | 79862F | |
| TABLE_ALT_RATE_LIMIT(11,2) | V98U7625C | DEG/SEC | F | S | D | P | G5.8 | 00 | B11 | 79862F | |
| TABLE_ALT_RATE_LIMIT(12,1) | V98U7429C | DEG/SEC | F | S | D | P | G5.8 | 00 | D12 | 79862F | |
| TABLE_ALT_RATE_LIMIT(12,2) | V98U7626C | DEG/SEC | F | S | D | P | G5.8 | 00 | B12 | 79862F | |
| TABLE_ALT_RATE_LIMIT(13,1) | V98U7430C | DEG/SEC | F | S | D | P | G5.8 | 00 | D13 | 79862F | |
| TABLE_ALT_RATE_LIMIT(13,2) | V98U7627C | DEG/SEC | F | S | D | P | G5.8 | 00 | B13 | 79862F | |
| TABLE_ALT_RATE_LIMIT(14,1) | V98U7431C | DEG/SEC | F | S | D | P | G5.8 | 00 | D14 | 79862F | |
| TABLE_ALT_RATE_LIMIT(14,2) | V98U7628C | DEG/SEC | F | S | D | P | G5.8 | 00 | B14 | 79862F | |
| TABLE_ALT_RATE_LIMIT(15,1) | V98U7432C | DEG/SEC | F | S | D | P | G5.8 | 00 | D15 | 79862F | |
| TABLE_ALT_RATE_LIMIT(15,2) | V98U7629C | DEG/SEC | F | S | D | P | G5.8 | 00 | B15 | 79862F | |
| TABLE_ALT_RATE_LIMIT(2,1) | V98U7419C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |

TABLE 4.4.4-3. ORB DAP CONFIG SPEC FUNCTION (REF DISP 6.1) (G5.8) I-LOADS

| FSSR NAME | MSID | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R E V |
|------------------------------|-----------|-----------|----|----|---|---|---------|----|-----|---------|-------------|
| TABLE_ALT_RATE_LIMIT(2,2) | V98U7616C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_RATE_LIMIT(3,1) | V98U7420C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_RATE_LIMIT(3,2) | V98U7617C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_RATE_LIMIT(4,1) | V98U7421C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_RATE_LIMIT(4,2) | V98U7618C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_RATE_LIMIT(5,1) | V98U7422C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_RATE_LIMIT(5,2) | V98U7619C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_RATE_LIMIT(6,1) | V98U7423C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_RATE_LIMIT(6,2) | V98U7620C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_RATE_LIMIT(7,1) | V98U7424C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_RATE_LIMIT(7,2) | V98U7621C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_RATE_LIMIT(8,1) | V98U7425C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ALT_RATE_LIMIT(8,2) | V98U7622C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ALT_RATE_LIMIT(9,1) | V98U7426C | DEG/SEC | F | S | D | P | G5.8 | 00 | D09 | 79862F | |
| TABLE_ALT_RATE_LIMIT(9,2) | V98U7623C | DEG/SEC | F | S | D | P | G5.8 | 00 | B09 | 79862F | |
| TABLE_COMP_THRESHOLD(1,1,1) | V98U7435C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_COMP_THRESHOLD(1,1,2) | V98U7450C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_COMP_THRESHOLD(1,2,1) | V98U7465C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_COMP_THRESHOLD(1,2,2) | V98U7480C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_COMP_THRESHOLD(10,1,1) | V98U7444C | DEG/SEC | F | S | D | P | G5.8 | 00 | D10 | 79862F | |
| TABLE_COMP_THRESHOLD(10,1,2) | V98U7459C | DEG/SEC | F | S | D | P | G5.8 | 00 | D10 | 79862F | |
| TABLE_COMP_THRESHOLD(10,2,1) | V98U7474C | DEG/SEC | F | S | D | P | G5.8 | 00 | B10 | 79862F | |
| TABLE_COMP_THRESHOLD(10,2,2) | V98U7489C | DEG/SEC | F | S | D | P | G5.8 | 00 | B10 | 79862F | |
| TABLE_COMP_THRESHOLD(11,1,1) | V98U7445C | DEG/SEC | F | S | D | P | G5.8 | 00 | D11 | 79862F | |
| TABLE_COMP_THRESHOLD(11,1,2) | V98U7460C | DEG/SEC | F | S | D | P | G5.8 | 00 | D11 | 79862F | |
| TABLE_COMP_THRESHOLD(11,2,1) | V98U7475C | DEG/SEC | F | S | D | P | G5.8 | 00 | B11 | 79862F | |
| TABLE_COMP_THRESHOLD(11,2,2) | V98U7490C | DEG/SEC | F | S | D | P | G5.8 | 00 | B11 | 79862F | |
| TABLE_COMP_THRESHOLD(12,1,1) | V98U7446C | DEG/SEC | F | S | D | P | G5.8 | 00 | D12 | 79862F | |
| TABLE_COMP_THRESHOLD(12,1,2) | V98U7461C | DEG/SEC | F | S | D | P | G5.8 | 00 | D12 | 79862F | |
| TABLE_COMP_THRESHOLD(12,2,1) | V98U7476C | DEG/SEC | F | S | D | P | G5.8 | 00 | B12 | 79862F | |
| TABLE_COMP_THRESHOLD(12,2,2) | V98U7491C | DEG/SEC | F | S | D | P | G5.8 | 00 | B12 | 79862F | |
| TABLE_COMP_THRESHOLD(13,1,1) | V98U7447C | DEG/SEC | F | S | D | P | G5.8 | 00 | D13 | 79862F | |
| TABLE_COMP_THRESHOLD(13,1,2) | V98U7462C | DEG/SEC | F | S | D | P | G5.8 | 00 | D13 | 79862F | |
| TABLE_COMP_THRESHOLD(13,2,1) | V98U7477C | DEG/SEC | F | S | D | P | G5.8 | 00 | B13 | 79862F | |
| TABLE_COMP_THRESHOLD(13,2,2) | V98U7492C | DEG/SEC | F | S | D | P | G5.8 | 00 | B13 | 79862F | |
| TABLE_COMP_THRESHOLD(14,1,1) | V98U7448C | DEG/SEC | F | S | D | P | G5.8 | 00 | D14 | 79862F | |
| TABLE_COMP_THRESHOLD(14,1,2) | V98U7463C | DEG/SEC | F | S | D | P | G5.8 | 00 | D14 | 79862F | |
| TABLE_COMP_THRESHOLD(14,2,1) | V98U7478C | DEG/SEC | F | S | D | P | G5.8 | 00 | B14 | 79862F | |
| TABLE_COMP_THRESHOLD(14,2,2) | V98U7493C | DEG/SEC | F | S | D | P | G5.8 | 00 | B14 | 79862F | |
| TABLE_COMP_THRESHOLD(15,1,1) | V98U7449C | DEG/SEC | F | S | D | P | G5.8 | 00 | D15 | 79862F | |
| TABLE_COMP_THRESHOLD(15,1,2) | V98U7464C | DEG/SEC | F | S | D | P | G5.8 | 00 | D15 | 79862F | |
| TABLE_COMP_THRESHOLD(15,2,1) | V98U7479C | DEG/SEC | F | S | D | P | G5.8 | 00 | B15 | 79862F | |
| TABLE_COMP_THRESHOLD(15,2,2) | V98U7494C | DEG/SEC | F | S | D | P | G5.8 | 00 | B15 | 79862F | |
| TABLE_COMP_THRESHOLD(2,1,1) | V98U7436C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_COMP_THRESHOLD(2,1,2) | V98U7451C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_COMP_THRESHOLD(2,2,1) | V98U7466C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_COMP_THRESHOLD(2,2,2) | V98U7481C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |

TABLE 4.4.4-3. ORB DAP CONFIG SPEC FUNCTION (REF DISP 6.1) (G5.8) I-LOADS

| FSSR NAME | MSID | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R E V |
|-----------------------------|-----------|-----------|----|----|---|---|---------|----|-----|---------|-------------|
| TABLE_COMP_THRESHOLD(3,1,1) | V98U7437C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_COMP_THRESHOLD(3,1,2) | V98U7452C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_COMP_THRESHOLD(3,2,1) | V98U7467C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_COMP_THRESHOLD(3,2,2) | V98U7482C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_COMP_THRESHOLD(4,1,1) | V98U7438C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_COMP_THRESHOLD(4,1,2) | V98U7453C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_COMP_THRESHOLD(4,2,1) | V98U7468C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_COMP_THRESHOLD(4,2,2) | V98U7483C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_COMP_THRESHOLD(5,1,1) | V98U7439C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_COMP_THRESHOLD(5,1,2) | V98U7454C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_COMP_THRESHOLD(5,2,1) | V98U7469C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_COMP_THRESHOLD(5,2,2) | V98U7484C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_COMP_THRESHOLD(6,1,1) | V98U7440C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_COMP_THRESHOLD(6,1,2) | V98U7455C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_COMP_THRESHOLD(6,2,1) | V98U7470C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_COMP_THRESHOLD(6,2,2) | V98U7485C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_COMP_THRESHOLD(7,1,1) | V98U7441C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_COMP_THRESHOLD(7,1,2) | V98U7456C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_COMP_THRESHOLD(7,2,1) | V98U7471C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_COMP_THRESHOLD(7,2,2) | V98U7486C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_COMP_THRESHOLD(8,1,1) | V98U7442C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_COMP_THRESHOLD(8,1,2) | V98U7457C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_COMP_THRESHOLD(8,2,1) | V98U7472C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_COMP_THRESHOLD(8,2,2) | V98U7487C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_COMP_THRESHOLD(9,1,1) | V98U7443C | DEG/SEC | F | S | D | P | G5.8 | 00 | D09 | 79862F | |
| TABLE_COMP_THRESHOLD(9,1,2) | V98U7458C | DEG/SEC | F | S | D | P | G5.8 | 00 | D09 | 79862F | |
| TABLE_COMP_THRESHOLD(9,2,1) | V98U7473C | DEG/SEC | F | S | D | P | G5.8 | 00 | B09 | 79862F | |
| TABLE_COMP_THRESHOLD(9,2,2) | V98U7488C | DEG/SEC | F | S | D | P | G5.8 | 00 | B09 | 79862F | |
| TABLE_DB(1,1,1) | V98U7495C | DEG | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_DB(1,1,2) | V98U7510C | DEG | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_DB(1,2,1) | V98U7525C | DEG | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_DB(1,2,2) | V98U7540C | DEG | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_DB(10,1,1) | V98U7504C | DEG | F | S | D | P | G5.8 | 00 | D10 | 79862F | |
| TABLE_DB(10,1,2) | V98U7519C | DEG | F | S | D | P | G5.8 | 00 | D10 | 79862F | |
| TABLE_DB(10,2,1) | V98U7534C | DEG | F | S | D | P | G5.8 | 00 | B10 | 79862F | |
| TABLE_DB(10,2,2) | V98U7549C | DEG | F | S | D | P | G5.8 | 00 | B10 | 79862F | |
| TABLE_DB(11,1,1) | V98U7505C | DEG | F | S | D | P | G5.8 | 00 | D11 | 79862F | |
| TABLE_DB(11,1,2) | V98U7520C | DEG | F | S | D | P | G5.8 | 00 | D11 | 79862F | |
| TABLE_DB(11,2,1) | V98U7535C | DEG | F | S | D | P | G5.8 | 00 | B11 | 79862F | |
| TABLE_DB(11,2,2) | V98U7550C | DEG | F | S | D | P | G5.8 | 00 | B11 | 79862F | |
| TABLE_DB(12,1,1) | V98U7506C | DEG | F | S | D | P | G5.8 | 00 | D12 | 79862F | |
| TABLE_DB(12,1,2) | V98U7521C | DEG | F | S | D | P | G5.8 | 00 | D12 | 79862F | |
| TABLE_DB(12,2,1) | V98U7536C | DEG | F | S | D | P | G5.8 | 00 | B12 | 79862F | |
| TABLE_DB(12,2,2) | V98U7551C | DEG | F | S | D | P | G5.8 | 00 | B12 | 79862F | |
| TABLE_DB(13,1,1) | V98U7507C | DEG | F | S | D | P | G5.8 | 00 | D13 | 79862F | |
| TABLE_DB(13,1,2) | V98U7522C | DEG | F | S | D | P | G5.8 | 00 | D13 | 79862F | |
| TABLE_DB(13,2,1) | V98U7537C | DEG | F | S | D | P | G5.8 | 00 | B13 | 79862F | |

TABLE 4.4.4-3. ORB DAP CONFIG SPEC FUNCTION (REF DISP 6.1) (G5.8) I-LOADS

| FSSR NAME | MSID | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R E V |
|-------------------------|-----------|-----------|----|----|---|---|---------|----|-----|---------|-------------|
| TABLE_DB(13,2,2) | V98U7552C | DEG | F | S | D | P | G5.8 | 00 | B13 | 79862F | |
| TABLE_DB(14,1,1) | V98U7508C | DEG | F | S | D | P | G5.8 | 00 | D14 | 79862F | |
| TABLE_DB(14,1,2) | V98U7523C | DEG | F | S | D | P | G5.8 | 00 | D14 | 79862F | |
| TABLE_DB(14,2,1) | V98U7538C | DEG | F | S | D | P | G5.8 | 00 | B14 | 79862F | |
| TABLE_DB(14,2,2) | V98U7553C | DEG | F | S | D | P | G5.8 | 00 | B14 | 79862F | |
| TABLE_DB(15,1,1) | V98U7509C | DEG | F | S | D | P | G5.8 | 00 | D15 | 79862F | |
| TABLE_DB(15,1,2) | V98U7524C | DEG | F | S | D | P | G5.8 | 00 | D15 | 79862F | |
| TABLE_DB(15,2,1) | V98U7539C | DEG | F | S | D | P | G5.8 | 00 | B15 | 79862F | |
| TABLE_DB(15,2,2) | V98U7554C | DEG | F | S | D | P | G5.8 | 00 | B15 | 79862F | |
| TABLE_DB(2,1,1) | V98U7496C | DEG | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_DB(2,1,2) | V98U7511C | DEG | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_DB(2,2,1) | V98U7526C | DEG | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_DB(2,2,2) | V98U7541C | DEG | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_DB(3,1,1) | V98U7497C | DEG | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_DB(3,1,2) | V98U7512C | DEG | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_DB(3,2,1) | V98U7527C | DEG | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_DB(3,2,2) | V98U7542C | DEG | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_DB(4,1,1) | V98U7498C | DEG | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_DB(4,1,2) | V98U7513C | DEG | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_DB(4,2,1) | V98U7528C | DEG | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_DB(4,2,2) | V98U7543C | DEG | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_DB(5,1,1) | V98U7499C | DEG | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_DB(5,1,2) | V98U7514C | DEG | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_DB(5,2,1) | V98U7529C | DEG | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_DB(5,2,2) | V98U7544C | DEG | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_DB(6,1,1) | V98U7500C | DEG | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_DB(6,1,2) | V98U7515C | DEG | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_DB(6,2,1) | V98U7530C | DEG | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_DB(6,2,2) | V98U7545C | DEG | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_DB(7,1,1) | V98U7501C | DEG | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_DB(7,1,2) | V98U7516C | DEG | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_DB(7,2,1) | V98U7531C | DEG | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_DB(7,2,2) | V98U7546C | DEG | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_DB(8,1,1) | V98U7502C | DEG | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_DB(8,1,2) | V98U7517C | DEG | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_DB(8,2,1) | V98U7532C | DEG | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_DB(8,2,2) | V98U7547C | DEG | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_DB(9,1,1) | V98U7503C | DEG | F | S | D | P | G5.8 | 00 | D09 | 79862F | |
| TABLE_DB(9,1,2) | V98U7518C | DEG | F | S | D | P | G5.8 | 00 | D09 | 79862F | |
| TABLE_DB(9,2,1) | V98U7533C | DEG | F | S | D | P | G5.8 | 00 | B09 | 79862F | |
| TABLE_DB(9,2,2) | V98U7548C | DEG | F | S | D | P | G5.8 | 00 | B09 | 79862F | |
| TABLE_MNVR_RATE(1,1,1) | V98U7555C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_MNVR_RATE(1,1,2) | V98U7570C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_MNVR_RATE(1,2,1) | V98U7585C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_MNVR_RATE(1,2,2) | V98U7600C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_MNVR_RATE(10,1,1) | V98U7564C | DEG/SEC | F | S | D | P | G5.8 | 00 | D10 | 79862F | |
| TABLE_MNVR_RATE(10,1,2) | V98U7579C | DEG/SEC | F | S | D | P | G5.8 | 00 | D10 | 79862F | |

TABLE 4.4.4-3. ORB DAP CONFIG SPEC FUNCTION (REF DISP 6.1) (G5.8) I-LOADS

| FSSR NAME | MSID | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R E V |
|-------------------------|-----------|-----------|----|----|---|---|---------|----|-----|---------|-------------|
| TABLE_MNVR_RATE(10,2,1) | V98U7594C | DEG/SEC | F | S | D | P | G5.8 | 00 | B10 | 79862F | |
| TABLE_MNVR_RATE(10,2,2) | V98U7609C | DEG/SEC | F | S | D | P | G5.8 | 00 | B10 | 79862F | |
| TABLE_MNVR_RATE(11,1,1) | V98U7565C | DEG/SEC | F | S | D | P | G5.8 | 00 | D11 | 79862F | |
| TABLE_MNVR_RATE(11,1,2) | V98U7580C | DEG/SEC | F | S | D | P | G5.8 | 00 | D11 | 79862F | |
| TABLE_MNVR_RATE(11,2,1) | V98U7595C | DEG/SEC | F | S | D | P | G5.8 | 00 | B11 | 79862F | |
| TABLE_MNVR_RATE(11,2,2) | V98U7610C | DEG/SEC | F | S | D | P | G5.8 | 00 | B11 | 79862F | |
| TABLE_MNVR_RATE(12,1,1) | V98U7566C | DEG/SEC | F | S | D | P | G5.8 | 00 | D12 | 79862F | |
| TABLE_MNVR_RATE(12,1,2) | V98U7581C | DEG/SEC | F | S | D | P | G5.8 | 00 | D12 | 79862F | |
| TABLE_MNVR_RATE(12,2,1) | V98U7596C | DEG/SEC | F | S | D | P | G5.8 | 00 | B12 | 79862F | |
| TABLE_MNVR_RATE(12,2,2) | V98U7611C | DEG/SEC | F | S | D | P | G5.8 | 00 | B12 | 79862F | |
| TABLE_MNVR_RATE(13,1,1) | V98U7567C | DEG/SEC | F | S | D | P | G5.8 | 00 | D13 | 79862F | |
| TABLE_MNVR_RATE(13,1,2) | V98U7582C | DEG/SEC | F | S | D | P | G5.8 | 00 | D13 | 79862F | |
| TABLE_MNVR_RATE(13,2,1) | V98U7597C | DEG/SEC | F | S | D | P | G5.8 | 00 | B13 | 79862F | |
| TABLE_MNVR_RATE(13,2,2) | V98U7612C | DEG/SEC | F | S | D | P | G5.8 | 00 | B13 | 79862F | |
| TABLE_MNVR_RATE(14,1,1) | V98U7568C | DEG/SEC | F | S | D | P | G5.8 | 00 | D14 | 79862F | |
| TABLE_MNVR_RATE(14,1,2) | V98U7583C | DEG/SEC | F | S | D | P | G5.8 | 00 | D14 | 79862F | |
| TABLE_MNVR_RATE(14,2,1) | V98U7598C | DEG/SEC | F | S | D | P | G5.8 | 00 | B14 | 79862F | |
| TABLE_MNVR_RATE(14,2,2) | V98U7613C | DEG/SEC | F | S | D | P | G5.8 | 00 | B14 | 79862F | |
| TABLE_MNVR_RATE(15,1,1) | V98U7569C | DEG/SEC | F | S | D | P | G5.8 | 00 | D15 | 79862F | |
| TABLE_MNVR_RATE(15,1,2) | V98U7584C | DEG/SEC | F | S | D | P | G5.8 | 00 | D15 | 79862F | |
| TABLE_MNVR_RATE(15,2,1) | V98U7599C | DEG/SEC | F | S | D | P | G5.8 | 00 | B15 | 79862F | |
| TABLE_MNVR_RATE(15,2,2) | V98U7614C | DEG/SEC | F | S | D | P | G5.8 | 00 | B15 | 79862F | |
| TABLE_MNVR_RATE(2,1,1) | V98U7556C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_MNVR_RATE(2,1,2) | V98U7571C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_MNVR_RATE(2,2,1) | V98U7586C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_MNVR_RATE(2,2,2) | V98U7601C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_MNVR_RATE(3,1,1) | V98U7557C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_MNVR_RATE(3,1,2) | V98U7572C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_MNVR_RATE(3,2,1) | V98U7587C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_MNVR_RATE(3,2,2) | V98U7602C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_MNVR_RATE(4,1,1) | V98U7558C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_MNVR_RATE(4,1,2) | V98U7573C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_MNVR_RATE(4,2,1) | V98U7588C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_MNVR_RATE(4,2,2) | V98U7603C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_MNVR_RATE(5,1,1) | V98U7559C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_MNVR_RATE(5,1,2) | V98U7574C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_MNVR_RATE(5,2,1) | V98U7589C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_MNVR_RATE(5,2,2) | V98U7604C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_MNVR_RATE(6,1,1) | V98U7560C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_MNVR_RATE(6,1,2) | V98U7575C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_MNVR_RATE(6,2,1) | V98U7590C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_MNVR_RATE(6,2,2) | V98U7605C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_MNVR_RATE(7,1,1) | V98U7561C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_MNVR_RATE(7,1,2) | V98U7576C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_MNVR_RATE(7,2,1) | V98U7591C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_MNVR_RATE(7,2,2) | V98U7606C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_MNVR_RATE(8,1,1) | V98U7562C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |

TABLE 4.4.4-3. ORB DAP CONFIG SPEC FUNCTION (REF DISP 6.1) (G5.8) I-LOADS

| FSSR NAME | MSID | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R E V |
|---------------------------------|-----------|-----------|----|----|---|---|---------|----|-----|---------|-------------|
| TABLE_MNVR_RATE(8,1,2) | V98U7577C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_MNVR_RATE(8,2,1) | V98U7592C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_MNVR_RATE(8,2,2) | V98U7607C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_MNVR_RATE(9,1,1) | V98U7563C | DEG/SEC | F | S | D | P | G5.8 | 00 | D09 | 79862F | |
| TABLE_MNVR_RATE(9,1,2) | V98U7578C | DEG/SEC | F | S | D | P | G5.8 | 00 | D09 | 79862F | |
| TABLE_MNVR_RATE(9,2,1) | V98U7593C | DEG/SEC | F | S | D | P | G5.8 | 00 | B09 | 79862F | |
| TABLE_MNVR_RATE(9,2,2) | V98U7608C | DEG/SEC | F | S | D | P | G5.8 | 00 | B09 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(1,1) | V98U7670C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(1,2) | V98U7685C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(10,1) | V98U7679C | ND | I | S | D | P | G5.8 | 00 | D10 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(10,2) | V98U7694C | ND | I | S | D | P | G5.8 | 00 | B10 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(11,1) | V98U7680C | ND | I | S | D | P | G5.8 | 00 | D11 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(11,2) | V98U7695C | ND | I | S | D | P | G5.8 | 00 | B11 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(12,1) | V98U7681C | ND | I | S | D | P | G5.8 | 00 | D12 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(12,2) | V98U7696C | ND | I | S | D | P | G5.8 | 00 | B12 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(13,1) | V98U7682C | ND | I | S | D | P | G5.8 | 00 | D13 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(13,2) | V98U7697C | ND | I | S | D | P | G5.8 | 00 | B13 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(14,1) | V98U7683C | ND | I | S | D | P | G5.8 | 00 | D14 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(14,2) | V98U7698C | ND | I | S | D | P | G5.8 | 00 | B14 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(15,1) | V98U7684C | ND | I | S | D | P | G5.8 | 00 | D15 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(15,2) | V98U7699C | ND | I | S | D | P | G5.8 | 00 | B15 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(2,1) | V98U7671C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(2,2) | V98U7686C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(3,1) | V98U7672C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(3,2) | V98U7687C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(4,1) | V98U7673C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(4,2) | V98U7688C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(5,1) | V98U7674C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(5,2) | V98U7689C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(6,1) | V98U7675C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(6,2) | V98U7690C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(7,1) | V98U7676C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(7,2) | V98U7691C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(8,1) | V98U7677C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(8,2) | V98U7692C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(9,1) | V98U7678C | ND | I | S | D | P | G5.8 | 00 | D09 | 79862F | |
| TABLE_NOM_NOSE_TAIL_PITCH(9,2) | V98U7693C | ND | I | S | D | P | G5.8 | 00 | B09 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(1,1) | V98U7700C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(1,2) | V98U7715C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(10,1) | V98U7709C | ND | I | S | D | P | G5.8 | 00 | D10 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(10,2) | V98U7724C | ND | I | S | D | P | G5.8 | 00 | B10 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(11,1) | V98U7710C | ND | I | S | D | P | G5.8 | 00 | D11 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(11,2) | V98U7725C | ND | I | S | D | P | G5.8 | 00 | B11 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(12,1) | V98U7711C | ND | I | S | D | P | G5.8 | 00 | D12 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(12,2) | V98U7726C | ND | I | S | D | P | G5.8 | 00 | B12 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(13,1) | V98U7712C | ND | I | S | D | P | G5.8 | 00 | D13 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(13,2) | V98U7727C | ND | I | S | D | P | G5.8 | 00 | B13 | 79862F | |

TABLE 4.4.4-3. ORB DAP CONFIG SPEC FUNCTION (REF DISP 6.1) (G5.8) I-LOADS

| FSSR NAME | MSID | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R E V |
|-------------------------------|-----------|-----------|----|----|---|---|---------|----|-----|---------|-------------|
| TABLE_NOM_NOSE_TAIL_YAW(14,1) | V98U7713C | ND | I | S | D | P | G5.8 | 00 | D14 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(14,2) | V98U7728C | ND | I | S | D | P | G5.8 | 00 | B14 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(15,1) | V98U7714C | ND | I | S | D | P | G5.8 | 00 | D15 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(15,2) | V98U7729C | ND | I | S | D | P | G5.8 | 00 | B15 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(2,1) | V98U7701C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(2,2) | V98U7716C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(3,1) | V98U7702C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(3,2) | V98U7717C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(4,1) | V98U7703C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(4,2) | V98U7718C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(5,1) | V98U7704C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(5,2) | V98U7719C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(6,1) | V98U7705C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(6,2) | V98U7720C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(7,1) | V98U7706C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(7,2) | V98U7721C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(8,1) | V98U7707C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(8,2) | V98U7722C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(9,1) | V98U7708C | ND | I | S | D | P | G5.8 | 00 | D09 | 79862F | |
| TABLE_NOM_NOSE_TAIL_YAW(9,2) | V98U7723C | ND | I | S | D | P | G5.8 | 00 | B09 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(1,1) | V98U7730C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(1,2) | V98U7745C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(10,1) | V98U7739C | ND | I | S | D | P | G5.8 | 00 | D10 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(10,2) | V98U7754C | ND | I | S | D | P | G5.8 | 00 | B10 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(11,1) | V98U7740C | ND | I | S | D | P | G5.8 | 00 | D11 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(11,2) | V98U7755C | ND | I | S | D | P | G5.8 | 00 | B11 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(12,1) | V98U7741C | ND | I | S | D | P | G5.8 | 00 | D12 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(12,2) | V98U7756C | ND | I | S | D | P | G5.8 | 00 | B12 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(13,1) | V98U7742C | ND | I | S | D | P | G5.8 | 00 | D13 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(13,2) | V98U7757C | ND | I | S | D | P | G5.8 | 00 | B13 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(14,1) | V98U7743C | ND | I | S | D | P | G5.8 | 00 | D14 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(14,2) | V98U7758C | ND | I | S | D | P | G5.8 | 00 | B14 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(15,1) | V98U7744C | ND | I | S | D | P | G5.8 | 00 | D15 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(15,2) | V98U7759C | ND | I | S | D | P | G5.8 | 00 | B15 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(2,1) | V98U7731C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(2,2) | V98U7746C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(3,1) | V98U7732C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(3,2) | V98U7747C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(4,1) | V98U7733C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(4,2) | V98U7748C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(5,1) | V98U7734C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(5,2) | V98U7749C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(6,1) | V98U7735C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(6,2) | V98U7750C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(7,1) | V98U7736C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(7,2) | V98U7751C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(8,1) | V98U7737C | ND | I | S | M | P | G5.8 | 00 | D18 | 79862F | |

TABLE 4.4.4-3. ORB DAP CONFIG SPEC FUNCTION (REF DISP 6.1) (G5.8) I-LOADS

| FSSR NAME | MSID | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R E V |
|-----------------------------|-----------|-----------|----|----|---|---|---------|----|-----|---------|-------------|
| TABLE_PAYLOAD_EXTENDED(8,2) | V98U7752C | ND | I | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(9,1) | V98U7738C | ND | I | S | D | P | G5.8 | 00 | D09 | 79862F | |
| TABLE_PAYLOAD_EXTENDED(9,2) | V98U7753C | ND | I | S | D | P | G5.8 | 00 | B09 | 79862F | |
| TABLE_RATE_LIMIT(1,1,1) | V98U7760C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_RATE_LIMIT(1,1,2) | V98U7775C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_RATE_LIMIT(1,2,1) | V98U7790C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_RATE_LIMIT(1,2,2) | V98U7805C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_RATE_LIMIT(10,1,1) | V98U7769C | DEG/SEC | F | S | D | P | G5.8 | 00 | D10 | 79862F | |
| TABLE_RATE_LIMIT(10,1,2) | V98U7784C | DEG/SEC | F | S | D | P | G5.8 | 00 | D10 | 79862F | |
| TABLE_RATE_LIMIT(10,2,1) | V98U7799C | DEG/SEC | F | S | D | P | G5.8 | 00 | B10 | 79862F | |
| TABLE_RATE_LIMIT(10,2,2) | V98U7814C | DEG/SEC | F | S | D | P | G5.8 | 00 | B10 | 79862F | |
| TABLE_RATE_LIMIT(11,1,1) | V98U7770C | DEG/SEC | F | S | D | P | G5.8 | 00 | D11 | 79862F | |
| TABLE_RATE_LIMIT(11,1,2) | V98U7785C | DEG/SEC | F | S | D | P | G5.8 | 00 | D11 | 79862F | |
| TABLE_RATE_LIMIT(11,2,1) | V98U7800C | DEG/SEC | F | S | D | P | G5.8 | 00 | B11 | 79862F | |
| TABLE_RATE_LIMIT(11,2,2) | V98U7815C | DEG/SEC | F | S | D | P | G5.8 | 00 | B11 | 79862F | |
| TABLE_RATE_LIMIT(12,1,1) | V98U7771C | DEG/SEC | F | S | D | P | G5.8 | 00 | D12 | 79862F | |
| TABLE_RATE_LIMIT(12,1,2) | V98U7786C | DEG/SEC | F | S | D | P | G5.8 | 00 | D12 | 79862F | |
| TABLE_RATE_LIMIT(12,2,1) | V98U7801C | DEG/SEC | F | S | D | P | G5.8 | 00 | B12 | 79862F | |
| TABLE_RATE_LIMIT(12,2,2) | V98U7816C | DEG/SEC | F | S | D | P | G5.8 | 00 | B12 | 79862F | |
| TABLE_RATE_LIMIT(13,1,1) | V98U7772C | DEG/SEC | F | S | D | P | G5.8 | 00 | D13 | 79862F | |
| TABLE_RATE_LIMIT(13,1,2) | V98U7787C | DEG/SEC | F | S | D | P | G5.8 | 00 | D13 | 79862F | |
| TABLE_RATE_LIMIT(13,2,1) | V98U7802C | DEG/SEC | F | S | D | P | G5.8 | 00 | B13 | 79862F | |
| TABLE_RATE_LIMIT(13,2,2) | V98U7817C | DEG/SEC | F | S | D | P | G5.8 | 00 | B13 | 79862F | |
| TABLE_RATE_LIMIT(14,1,1) | V98U7773C | DEG/SEC | F | S | D | P | G5.8 | 00 | D14 | 79862F | |
| TABLE_RATE_LIMIT(14,1,2) | V98U7788C | DEG/SEC | F | S | D | P | G5.8 | 00 | D14 | 79862F | |
| TABLE_RATE_LIMIT(14,2,1) | V98U7803C | DEG/SEC | F | S | D | P | G5.8 | 00 | B14 | 79862F | |
| TABLE_RATE_LIMIT(14,2,2) | V98U7818C | DEG/SEC | F | S | D | P | G5.8 | 00 | B14 | 79862F | |
| TABLE_RATE_LIMIT(15,1,1) | V98U7774C | DEG/SEC | F | S | D | P | G5.8 | 00 | D15 | 79862F | |
| TABLE_RATE_LIMIT(15,1,2) | V98U7789C | DEG/SEC | F | S | D | P | G5.8 | 00 | D15 | 79862F | |
| TABLE_RATE_LIMIT(15,2,1) | V98U7804C | DEG/SEC | F | S | D | P | G5.8 | 00 | B15 | 79862F | |
| TABLE_RATE_LIMIT(15,2,2) | V98U7819C | DEG/SEC | F | S | D | P | G5.8 | 00 | B15 | 79862F | |
| TABLE_RATE_LIMIT(2,1,1) | V98U7761C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_RATE_LIMIT(2,1,2) | V98U7776C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_RATE_LIMIT(2,2,1) | V98U7791C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_RATE_LIMIT(2,2,2) | V98U7806C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_RATE_LIMIT(3,1,1) | V98U7762C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_RATE_LIMIT(3,1,2) | V98U7777C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_RATE_LIMIT(3,2,1) | V98U7792C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_RATE_LIMIT(3,2,2) | V98U7807C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_RATE_LIMIT(4,1,1) | V98U7763C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_RATE_LIMIT(4,1,2) | V98U7778C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_RATE_LIMIT(4,2,1) | V98U7793C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_RATE_LIMIT(4,2,2) | V98U7808C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_RATE_LIMIT(5,1,1) | V98U7764C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_RATE_LIMIT(5,1,2) | V98U7779C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_RATE_LIMIT(5,2,1) | V98U7794C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_RATE_LIMIT(5,2,2) | V98U7809C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |

TABLE 4.4.4-3. ORB DAP CONFIG SPEC FUNCTION (REF DISP 6.1) (G5.8) I-LOADS

| FSSR NAME | MSID | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R E V |
|-------------------------|-----------|-----------|----|----|---|---|---------|----|-----|---------|-------------|
| TABLE_RATE_LIMIT(6,1,1) | V98U7765C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_RATE_LIMIT(6,1,2) | V98U7780C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_RATE_LIMIT(6,2,1) | V98U7795C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_RATE_LIMIT(6,2,2) | V98U7810C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_RATE_LIMIT(7,1,1) | V98U7766C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_RATE_LIMIT(7,1,2) | V98U7781C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_RATE_LIMIT(7,2,1) | V98U7796C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_RATE_LIMIT(7,2,2) | V98U7811C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_RATE_LIMIT(8,1,1) | V98U7767C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_RATE_LIMIT(8,1,2) | V98U7782C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_RATE_LIMIT(8,2,1) | V98U7797C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_RATE_LIMIT(8,2,2) | V98U7812C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_RATE_LIMIT(9,1,1) | V98U7768C | DEG/SEC | F | S | D | P | G5.8 | 00 | D09 | 79862F | |
| TABLE_RATE_LIMIT(9,1,2) | V98U7783C | DEG/SEC | F | S | D | P | G5.8 | 00 | D09 | 79862F | |
| TABLE_RATE_LIMIT(9,2,1) | V98U7798C | DEG/SEC | F | S | D | P | G5.8 | 00 | B09 | 79862F | |
| TABLE_RATE_LIMIT(9,2,2) | V98U7813C | DEG/SEC | F | S | D | P | G5.8 | 00 | B09 | 79862F | |
| TABLE_ROT_PULSE(1,1,1) | V98U7820C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ROT_PULSE(1,1,2) | V98U7835C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ROT_PULSE(1,2,1) | V98U7850C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ROT_PULSE(1,2,2) | V98U7865C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ROT_PULSE(10,1,1) | V98U7829C | DEG/SEC | F | S | D | P | G5.8 | 00 | D10 | 79862F | |
| TABLE_ROT_PULSE(10,1,2) | V98U7844C | DEG/SEC | F | S | D | P | G5.8 | 00 | D10 | 79862F | |
| TABLE_ROT_PULSE(10,2,1) | V98U7859C | DEG/SEC | F | S | D | P | G5.8 | 00 | B10 | 79862F | |
| TABLE_ROT_PULSE(10,2,2) | V98U7874C | DEG/SEC | F | S | D | P | G5.8 | 00 | B10 | 79862F | |
| TABLE_ROT_PULSE(11,1,1) | V98U7830C | DEG/SEC | F | S | D | P | G5.8 | 00 | D11 | 79862F | |
| TABLE_ROT_PULSE(11,1,2) | V98U7845C | DEG/SEC | F | S | D | P | G5.8 | 00 | D11 | 79862F | |
| TABLE_ROT_PULSE(11,2,1) | V98U7860C | DEG/SEC | F | S | D | P | G5.8 | 00 | B11 | 79862F | |
| TABLE_ROT_PULSE(11,2,2) | V98U7875C | DEG/SEC | F | S | D | P | G5.8 | 00 | B11 | 79862F | |
| TABLE_ROT_PULSE(12,1,1) | V98U7831C | DEG/SEC | F | S | D | P | G5.8 | 00 | D12 | 79862F | |
| TABLE_ROT_PULSE(12,1,2) | V98U7846C | DEG/SEC | F | S | D | P | G5.8 | 00 | D12 | 79862F | |
| TABLE_ROT_PULSE(12,2,1) | V98U7861C | DEG/SEC | F | S | D | P | G5.8 | 00 | B12 | 79862F | |
| TABLE_ROT_PULSE(12,2,2) | V98U7876C | DEG/SEC | F | S | D | P | G5.8 | 00 | B12 | 79862F | |
| TABLE_ROT_PULSE(13,1,1) | V98U7832C | DEG/SEC | F | S | D | P | G5.8 | 00 | D13 | 79862F | |
| TABLE_ROT_PULSE(13,1,2) | V98U7847C | DEG/SEC | F | S | D | P | G5.8 | 00 | D13 | 79862F | |
| TABLE_ROT_PULSE(13,2,1) | V98U7862C | DEG/SEC | F | S | D | P | G5.8 | 00 | B13 | 79862F | |
| TABLE_ROT_PULSE(13,2,2) | V98U7877C | DEG/SEC | F | S | D | P | G5.8 | 00 | B13 | 79862F | |
| TABLE_ROT_PULSE(14,1,1) | V98U7833C | DEG/SEC | F | S | D | P | G5.8 | 00 | D14 | 79862F | |
| TABLE_ROT_PULSE(14,1,2) | V98U7848C | DEG/SEC | F | S | D | P | G5.8 | 00 | D14 | 79862F | |
| TABLE_ROT_PULSE(14,2,1) | V98U7863C | DEG/SEC | F | S | D | P | G5.8 | 00 | B14 | 79862F | |
| TABLE_ROT_PULSE(14,2,2) | V98U7878C | DEG/SEC | F | S | D | P | G5.8 | 00 | B14 | 79862F | |
| TABLE_ROT_PULSE(15,1,1) | V98U7834C | DEG/SEC | F | S | D | P | G5.8 | 00 | D15 | 79862F | |
| TABLE_ROT_PULSE(15,1,2) | V98U7849C | DEG/SEC | F | S | D | P | G5.8 | 00 | D15 | 79862F | |
| TABLE_ROT_PULSE(15,2,1) | V98U7864C | DEG/SEC | F | S | D | P | G5.8 | 00 | B15 | 79862F | |
| TABLE_ROT_PULSE(15,2,2) | V98U7879C | DEG/SEC | F | S | D | P | G5.8 | 00 | B15 | 79862F | |
| TABLE_ROT_PULSE(2,1,1) | V98U7821C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ROT_PULSE(2,1,2) | V98U7836C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ROT_PULSE(2,2,1) | V98U7851C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |

TABLE 4.4.4-3. ORB DAP CONFIG SPEC FUNCTION (REF DISP 6.1) (G5.8) I-LOADS

| FSSR NAME | MSID | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R E V |
|-------------------------|-----------|-----------|----|----|---|---|---------|----|-----|---------|-------------|
| TABLE_ROT_PULSE(2,2,2) | V98U7866C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ROT_PULSE(3,1,1) | V98U7822C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ROT_PULSE(3,1,2) | V98U7837C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ROT_PULSE(3,2,1) | V98U7852C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ROT_PULSE(3,2,2) | V98U7867C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ROT_PULSE(4,1,1) | V98U7823C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ROT_PULSE(4,1,2) | V98U7838C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ROT_PULSE(4,2,1) | V98U7853C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ROT_PULSE(4,2,2) | V98U7868C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ROT_PULSE(5,1,1) | V98U7824C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ROT_PULSE(5,1,2) | V98U7839C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ROT_PULSE(5,2,1) | V98U7854C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ROT_PULSE(5,2,2) | V98U7869C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ROT_PULSE(6,1,1) | V98U7825C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ROT_PULSE(6,1,2) | V98U7840C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ROT_PULSE(6,2,1) | V98U7855C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ROT_PULSE(6,2,2) | V98U7870C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ROT_PULSE(7,1,1) | V98U7826C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ROT_PULSE(7,1,2) | V98U7841C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ROT_PULSE(7,2,1) | V98U7856C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ROT_PULSE(7,2,2) | V98U7871C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ROT_PULSE(8,1,1) | V98U7827C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ROT_PULSE(8,1,2) | V98U7842C | DEG/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_ROT_PULSE(8,2,1) | V98U7857C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ROT_PULSE(8,2,2) | V98U7872C | DEG/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_ROT_PULSE(9,1,1) | V98U7828C | DEG/SEC | F | S | D | P | G5.8 | 00 | D09 | 79862F | |
| TABLE_ROT_PULSE(9,1,2) | V98U7843C | DEG/SEC | F | S | D | P | G5.8 | 00 | D09 | 79862F | |
| TABLE_ROT_PULSE(9,2,1) | V98U7858C | DEG/SEC | F | S | D | P | G5.8 | 00 | B09 | 79862F | |
| TABLE_ROT_PULSE(9,2,2) | V98U7873C | DEG/SEC | F | S | D | P | G5.8 | 00 | B09 | 79862F | |
| TABLE_TRANS_PULSE(1,1) | V98U7880C | FT/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_TRANS_PULSE(1,2) | V98U7895C | FT/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_TRANS_PULSE(10,1) | V98U7889C | FT/SEC | F | S | D | P | G5.8 | 00 | D10 | 79862F | |
| TABLE_TRANS_PULSE(10,2) | V98U7904C | FT/SEC | F | S | D | P | G5.8 | 00 | B10 | 79862F | |
| TABLE_TRANS_PULSE(11,1) | V98U7890C | FT/SEC | F | S | D | P | G5.8 | 00 | D11 | 79862F | |
| TABLE_TRANS_PULSE(11,2) | V98U7905C | FT/SEC | F | S | D | P | G5.8 | 00 | B11 | 79862F | |
| TABLE_TRANS_PULSE(12,1) | V98U7891C | FT/SEC | F | S | D | P | G5.8 | 00 | D12 | 79862F | |
| TABLE_TRANS_PULSE(12,2) | V98U7906C | FT/SEC | F | S | D | P | G5.8 | 00 | B12 | 79862F | |
| TABLE_TRANS_PULSE(13,1) | V98U7892C | FT/SEC | F | S | D | P | G5.8 | 00 | D13 | 79862F | |
| TABLE_TRANS_PULSE(13,2) | V98U7907C | FT/SEC | F | S | D | P | G5.8 | 00 | B13 | 79862F | |
| TABLE_TRANS_PULSE(14,1) | V98U7893C | FT/SEC | F | S | D | P | G5.8 | 00 | D14 | 79862F | |
| TABLE_TRANS_PULSE(14,2) | V98U7908C | FT/SEC | F | S | D | P | G5.8 | 00 | B14 | 79862F | |
| TABLE_TRANS_PULSE(15,1) | V98U7894C | FT/SEC | F | S | D | P | G5.8 | 00 | D15 | 79862F | |
| TABLE_TRANS_PULSE(15,2) | V98U7909C | FT/SEC | F | S | D | P | G5.8 | 00 | B15 | 79862F | |
| TABLE_TRANS_PULSE(2,1) | V98U7881C | FT/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_TRANS_PULSE(2,2) | V98U7896C | FT/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_TRANS_PULSE(3,1) | V98U7882C | FT/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_TRANS_PULSE(3,2) | V98U7897C | FT/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |

TABLE 4.4.4-3. ORB DAP CONFIG SPEC FUNCTION (REF DISP 6.1) (G5.8) I-LOADS

| FSSR NAME | MSID | ENG UNITS | DT | PR | D | S | PR FCTN | MC | CAT | LAST CR | R E V |
|------------------------|-----------|-----------|----|----|---|---|---------|----|-----|---------|-------------|
| TABLE_TRANS_PULSE(4,1) | V98U7883C | FT/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_TRANS_PULSE(4,2) | V98U7898C | FT/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_TRANS_PULSE(5,1) | V98U7884C | FT/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_TRANS_PULSE(5,2) | V98U7899C | FT/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_TRANS_PULSE(6,1) | V98U7885C | FT/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_TRANS_PULSE(6,2) | V98U7900C | FT/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_TRANS_PULSE(7,1) | V98U7886C | FT/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_TRANS_PULSE(7,2) | V98U7901C | FT/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_TRANS_PULSE(8,1) | V98U7887C | FT/SEC | F | S | M | P | G5.8 | 00 | D18 | 79862F | |
| TABLE_TRANS_PULSE(8,2) | V98U7902C | FT/SEC | F | S | M | P | G5.8 | 00 | B18 | 79862F | |
| TABLE_TRANS_PULSE(9,1) | V98U7888C | FT/SEC | F | S | D | P | G5.8 | 00 | D09 | 79862F | |
| TABLE_TRANS_PULSE(9,2) | V98U7903C | FT/SEC | F | S | D | P | G5.8 | 00 | B09 | 79862F | |

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

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TABLE 4.4.4-4. ORB DAP CONFIG SPEC FUNCTION (REF DISP 6.1) (G5.8) K-LOADS

| FSSR NAME DESCRIPTION | MSID | MC | KLOAD VALUE | ENG UNITS | DT | P R | S | PR FCTN | LAST CR | R E V |
|-------------------------------------|-----------|----|-------------|-----------|----|--------|---|---------|---------|-------------|
| KP_REF TVC FILTER GAIN NOM-PITCH | V97U2756C | 00 | +2.58 | E-01 SEC | F | S | P | G5.8 | 90353G | |
| KR_REF TVC FILTER GAIN NOM-ROLL | V97U2757C | 00 | +2.90 | E-01 SEC | F | S | P | G5.8 | 90353G | |
| KY_REF TVC FILTER GAIN NOM-YAW | V97U2758C | 00 | +2.66 | E-01 SEC | F | S | P | G5.8 | 90353G | |

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

TABLE 4.4.4-5. ORB DAP CONFIG SPEC FUNCTION (REF DISP 6.1) (G5.8) CONSTANTS

| FSSR NAME DESCRIPTION | MSID | MC | CONSTANT VALUE | ENG UNITS | DT | P R | S | PR FCTN | LAST CR | R E V |
|--------------------------|------|----|----------------|-----------|----|--------|---|---------|---------|-------------|
|--------------------------|------|----|----------------|-----------|----|--------|---|---------|---------|-------------|

NO REQUIREMENTS

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

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 |
| | 92984 | 32 | Reassign Effectivity of SCR 92836D to OI-32 |
| | 92985 | 32 | Reassign Effectivity of SCR 92837A to OI-32 |
| | 92989 | 32 | Reassign Effectivity of SCR 92858D to OI-32 |
| | 92955A | 32 | Expand Effectivity of PASS-only RTF SCRs to Include OI-32 |
| 1.3-1 (T) | 92103A | 26B | FSSR Parameter Table Upgrade |
| 4.1-1 (T) | 91003D | 26 | Addition of \pm X Jets for On-Orbit Rotational Control |
| | 92214A | 27 | Post-CI Three-String GPS Documentation Cleanup |
| | 92187F | 28 | Automatic Reboost |
| | 92320D | 29 | Software Changes for Forward RCS Interconnect System (FICS) |
| 4.1-2 (T) | 92871C | 30/ 32 | RCS Manifold Auto-Close for Failed-On Jet |
| | 92836D | 32 | Notch Filter Performance Improvement |
| | 91003D | 26 | Addition of \pm X Jets for On-Orbit Rotational Control |
| | 91006B | 26 | Increase Orbit DAP Attitude Precision |
| | 92187F | 28 | Automatic Reboost |
| | 92260B | 28 | Six Jet VFAIL |
| | 92340A | 28 | GAX Annunciation Correction for CR 92260B |
| | 92510E | 30 | Modification to Maneuver Execute Display |
| | 92871C | 30/ 32 | RCS Manifold Auto-Close for Failed-On Jet |
| | 92836D | 32 | Notch Filter Performance Improvement |
| 4.1-5 (T) | 90704F | 28 | DAP Hotstick Downmode Alert and Message |
| | 92510E | 30 | Modification to Maneuver Execute Display |
| 4.1-7 (T) | 92187F | 28 | Automatic Reboost |
| | 92323 | 29 | Post Contact Thrusting I-Load Streamlining |
| | 92333B | 29 | Automatic Reboost Upgrade |

| Table R.1-1. CR Reference Summary | | | |
|-----------------------------------|--------|-----------|--|
| Paragraph | CR No. | OI | CR Title |
| 4.1-9 (T) | 92836D | 32 | Notch Filter Performance Improvement |
| | 91003D | 26 | Addition of \pm X Jets for On-Orbit Rotational Control |
| | 92187F | 28 | Automatic Reboost |
| 4.1-10. (T) | 92836D | 32 | Notch Filter Performance Improvement |
| | 92323 | 29 | Post Contact Thrusting I-Load Streamlining |
| | 92323 | 29 | Post Contact Thrusting I-Load Streamlining |
| 4.1-11. (T) | 92323 | 29 | Post Contact Thrusting I-Load Streamlining |
| 4.1-12. (T) | 92323 | 29 | Post Contact Thrusting I-Load Streamlining |
| 4.1-13. (T) | 92323 | 29 | Post Contact Thrusting I-Load Streamlining |
| 4.1.1-1 (F) | 91003D | 26 | Addition of \pm X Jets for On-Orbit Rotational Control |
| 4.2.1.1-1. (T) | 92362A | 29 | Rendezvous Burns In Target Track |
| | 92678C | 30 | Correction CR for CR 92510E - Requirements Cleanup |
| 4.2.1.2.2 | 92187F | 28 | Automatic Reboost |
| | 92260B | 28 | Six Jet VFAIL |
| | 92278A | 28 | Automatic Reboost Cleanup |
| | 92333B | 29 | Automatic Reboost Upgrade |
| | 92741A | 30 | Automatic Reboost Errors-Within-Deadbands Check |
| | 92871C | 30/ 32 | RCS Manifold Auto-Close for Failed-On Jet |
| | 92187F | 28 | Automatic Reboost |
| 4.2.1.2.3 | 92187F | 28 | Automatic Reboost |
| 4.2.1.3 | 92259A | 28 | Z Translation Mode Change Re-Initialization |
| | 92260B | 28 | Six Jet VFAIL |
| 4.2.1.3-1. (T) | 92362A | 29 | Rendezvous Burns In Target Track |
| | 92871C | 30/ 32 | RCS Manifold Auto-Close for Failed-On Jet |
| | 92259A | 28 | Z Translation Mode Change Re-Initialization |
| 4.2.1.3-2 (T) | 92362A | 29 | Rendezvous Burns In Target Track |
| | 92187F | 28 | Automatic Reboost |
| 4.2.1.3-2 (T) | 92278A | 28 | Automatic Reboost Cleanup |
| | 92362A | 29 | Rendezvous Burns In Target Track |
| | 92741A | 30 | Automatic Reboost Errors-Within-Deadbands Check |
| | 92871C | 30/ 32 | RCS Manifold Auto-Close for Failed-On Jet |
| | 92887A | 30/ 32 | RCS Auto Manifold Close Enable/Disable via SPEC 23 |

| Table R.1-1. CR Reference Summary | | | |
|-----------------------------------|---------------|-----------|--|
| Paragraph | CR No. | OI | CR Title |
| 4.2.1.3-3.(T) | 92899A | 30/ 32 | Correction CR to CRs 92871C and 92887A |
| | 92871C | 30/ 32 | RCS Manifold Auto-Close for Failed-On Jet |
| 4.2.1.5-1 (T) | 91003D | 26 | Addition of \pm X Jets for On-Orbit Rotational Control |
| | 92260B | 28 | Automatic Reboost |
| | 92260B | 28 | Six Jet VFAIL |
| | 92510E | 30 | Modification to Maneuver Execute Display |
| | 92741A | 30 | Automatic Reboost Errors-Within-Deadbands Check |
| | 92871C | 30/ 32 | RCS Manifold Auto-Close for Failed-On Jet |
| | 4.2.1.7-1 (T) | 91003D | 26 |
| 92187F | | 28 | Automatic Reboost |
| 4.2.2 | 91006B | 26 | Increase Orbit DAP Attitude Precision |
| 4.2.2-1. (F) | 92187F | 28 | Automatic Reboost |
| 4.2.2-1.(F) | 92510E | 30 | Modification to Maneuver Execute Display |
| | 92741A | 30 | Automatic Reboost Errors-Within-Deadbands Check |
| 4.2.2.1.1 | 91006B | 26 | Increase Orbit DAP Attitude Precision |
| | 92510E | 30 | Modification to Maneuver Execute Display |
| | 92678C | 30 | Correction CR for CR 92510E - Requirements Cleanup |
| 4.2.2.1.1-1.(T) | 92510E | 30 | Modification to Maneuver Execute Display |
| 4.2.2.1.1-1.(2)(F) | 92510E | 30 | Modification to Maneuver Execute Display |
| 4.2.2.1.5 | 91006B | 26 | Increase Orbit DAP Attitude Precision |
| 4.2.2.1.7 | 91006B | 26 | Increase Orbit DAP Attitude Precision |
| 4.2.2.1.7-1.(T) | 92741A | 30 | Automatic Reboost Errors-Within-Deadbands Check |
| 4.2.2.2.1 | 91003D | 26 | Addition of \pm X Jets for On-Orbit Rotational Control |
| | 92187F | 28 | Automatic Reboost |
| | 92260B | 28 | Six Jet VFAIL |
| | 92333B | 29 | Automatic Reboost Upgrade |
| | 91003D | 26 | Addition of \pm X Jets for On-Orbit Rotational Control |
| 4.2.2.2.1-1 (F) | 92187F | 28 | Automatic Reboost |
| | 92278A | 28 | Automatic Reboost Cleanup |
| | 92333B | 29 | Automatic Reboost Upgrade |
| | 92741A | 30 | Automatic Reboost Errors-Within-Deadbands Check |
| | 92278A | 28 | Automatic Reboost Cleanup |
| 4.2.2.2.1-3 (F) | 92278A | 28 | Automatic Reboost Cleanup |

| Table R.1-1. CR Reference Summary | | | |
|-----------------------------------|--------|----|---|
| Paragraph | CR No. | OI | CR Title |
| 4.2.2.2.1-4c (T) | 92837A | 32 | Hot Stick Rate Estimate Improvement |
| | 91003D | 26 | Addition of \pm X Jets for On-Orbit Rotational Control |
| | 91003D | 26 | Addition of \pm X Jets for On-Orbit Rotational Control |
| | 92187F | 28 | Automatic Reboost |
| | 92260B | 28 | Six Jet VFAIL |
| 4.2.2.2.1-5 (T) | 92320D | 29 | Software Changes for Forward RCS Interconnect System (FICS) |
| | 92741A | 30 | Automatic Reboost Errors-Within-Deadbands Check |
| | 91003D | 26 | Addition of \pm X Jets for On-Orbit Rotational Control |
| | 92187F | 28 | Automatic Reboost |
| | 92333B | 29 | Automatic Reboost Upgrade |
| 4.2.2.2.1-6 (T) | 92187F | 28 | Automatic Reboost |
| | 92303 | 28 | Automatic Reboost Cleanup II |
| | 92333B | 29 | Automatic Reboost Upgrade |
| | 92465C | 29 | Automatic Reboost Upgrades Correction |
| | 92725B | 30 | Improve Accuracy of Reboost Time Remaining Calculation |
| 4.2.2.2.1-12. (F) | 92741A | 30 | Automatic Reboost Errors-Within-Deadbands Check |
| | 92187F | 28 | Automatic Reboost |
| | 92333B | 29 | Automatic Reboost Upgrade |
| | 92465C | 29 | Automatic Reboost Upgrades Correction |
| | 92741A | 30 | Automatic Reboost Errors-Within-Deadbands Check |
| 4.2.2.2.1-12a (F) | 92187F | 28 | Automatic Reboost |
| | 92333B | 29 | Automatic Reboost Upgrade |
| | 92465C | 29 | Automatic Reboost Upgrades Correction |
| | 92741A | 30 | Automatic Reboost Errors-Within-Deadbands Check |
| | 92187F | 28 | Automatic Reboost |
| 4.2.2.2.1-12b (F) | 92333B | 29 | Automatic Reboost Upgrade |
| | 92457 | 29 | Automatic Reboost Accel Calc |
| | 92465C | 29 | Automatic Reboost Upgrades Correction |
| | 92187F | 28 | Automatic Reboost |
| | 92333B | 29 | Automatic Reboost Upgrade |
| 4.2.2.2.1-12c (F) | 92187F | 28 | Automatic Reboost |
| | 92333B | 29 | Automatic Reboost Upgrade |
| | 92187F | 28 | Automatic Reboost |
| | 92333B | 29 | Automatic Reboost Upgrade |
| | 92465C | 29 | Automatic Reboost Upgrades Correction |
| 4.2.2.2.1-12d (F) | 92187F | 28 | Automatic Reboost |
| | 92333B | 29 | Automatic Reboost Upgrade |
| | 92465C | 29 | Automatic Reboost Upgrades Correction |
| | 92187F | 28 | Automatic Reboost |
| | 92303 | 28 | Automatic Reboost Cleanup II |
| 4.2.2.2.1-12e (F) | 92333B | 29 | Automatic Reboost Upgrade |
| | 92465C | 29 | Automatic Reboost Upgrades Correction |
| | 92187F | 28 | Automatic Reboost |
| | 92303 | 28 | Automatic Reboost Cleanup II |
| | 92333B | 29 | Automatic Reboost Upgrade |
| 4.2.2.2.1-13 (F) | 92278A | 28 | Automatic Reboost Cleanup |

| Table R.1-1. CR Reference Summary | | | |
|-----------------------------------|--------|----|---|
| Paragraph | CR No. | OI | CR Title |
| 4.2.2.2.1-15 (F) | 91003D | 26 | Addition of $\pm X$ Jets for On-Orbit Rotational Control |
| | 92313A | 28 | Automatic Reboost Correction |
| 4.2.2.2.1-16 (F) | 91003D | 26 | Addition of $\pm X$ Jets for On-Orbit Rotational Control |
| | 92187F | 28 | Automatic Reboost |
| | 92278A | 28 | Automatic Reboost Cleanup |
| 4.2.2.2.1-16b (F) | 92187F | 28 | Automatic Reboost |
| | 92313A | 28 | Automatic Reboost Correction |
| 4.2.2.2.1-17 (F) | 92278A | 28 | Automatic Reboost Cleanup |
| 4.2.2.2.1-18 (F) | 91003D | 26 | Addition of $\pm X$ Jets for On-Orbit Rotational Control |
| | 92278A | 28 | Automatic Reboost Cleanup |
| 4.2.2.2.1-18a (F) | 90708C | 24 | Orbit DAP On-Board I-Load Calculation and Notch Filter Uplink |
| | 91003D | 26 | Addition of $\pm X$ Jets for On-Orbit Rotational Control |
| 4.2.2.2.1-19 (F) | 91003D | 26 | Addition of $\pm X$ Jets for On-Orbit Rotational Control |
| | 92278A | 28 | Automatic Reboost Cleanup |
| 4.2.2.2.1-19a (F) | 91003D | 26 | Addition of $\pm X$ Jets for On-Orbit Rotational Control |
| 4.2.2.2.1-19b (F) | 91003D | 26 | Addition of $\pm X$ Jets for On-Orbit Rotational Control |
| | 92278A | 28 | Automatic Reboost Cleanup |
| 4.2.2.2.1-20 (F) | 92260B | 28 | Six Jet VFAIL |
| 4.2.2.2.2 | 92187F | 28 | Automatic Reboost |
| | 93081A | 32 | Phase Plane Modifications to Reduce VRCS Shelf-pulsing |
| 4.2.2.2.2-1.(T) | 92611B | 29 | Change Drift Channel Constants to I-Loads |
| 4.2.2.2.2-1 (F) | 92187F | 28 | Automatic Reboost |
| | 93081A | 32 | Phase Plane Modifications to Reduce VRCS Shelf-pulsing |
| 4.2.2.2.2-1a (F) | 93081A | 32 | Phase Plane Modifications to Reduce VRCS Shelf-pulsing |
| 4.2.2.2.2-2 (T) | 93081A | 32 | Phase Plane Modifications to Reduce VRCS Shelf-pulsing |
| 4.2.2.2.2-3.(T) | 92611B | 29 | Change Drift Channel Constants to I-Loads |
| 4.2.2.2.2-3 (F) | 92187F | 28 | Automatic Reboost |
| 4.2.2.2.2-4 (T) | 92187F | 28 | Automatic Reboost |
| | 93081A | 32 | Phase Plane Modifications to Reduce VRCS Shelf-pulsing |
| 4.2.2.2.2-5 (T) | 92187F | 28 | Automatic Reboost |
| | 92611B | 29 | Change Drift Channel Constants to I-Loads |
| | 93081A | 32 | Phase Plane Modifications to Reduce VRCS Shelf-pulsing |
| 4.2.2.3-1.(F) | 92836D | 32 | Notch Filter Performance Improvement |
| 4.2.2.3.1 | 91006B | 26 | Increase Orbit DAP Attitude Precision |

| Table R.1-1. CR Reference Summary | | | |
|-----------------------------------|--------|----|--|
| Paragraph | CR No. | OI | CR Title |
| | 92836D | 32 | Notch Filter Performance Improvement |
| 4.2.2.3.1-1.(T) | 92836D | 32 | Notch Filter Performance Improvement |
| 4.2.2.3.1-1.(F) | 92836D | 32 | Notch Filter Performance Improvement |
| 4.2.2.3.1-2.(F) | 92836D | 32 | Notch Filter Performance Improvement |
| 4.2.2.3.1-3.(T) | 92836D | 32 | Notch Filter Performance Improvement |
| 4.2.2.3.1-3 (F) | 92037D | 26 | Orbit DAP Inertia I-Loads Scrub |
| | 92836D | 32 | Notch Filter Performance Improvement |
| 4.2.2.3.2 | 91006B | 26 | Increase Orbit DAP Attitude Precision |
| | 92836D | 32 | Notch Filter Performance Improvement |
| 4.2.2.3.2-1.(T) | 92836D | 32 | Notch Filter Performance Improvement |
| 4.2.2.3.2-1.(F) | 92836D | 32 | Notch Filter Performance Improvement |
| 4.2.3.1 | 92187F | 28 | Automatic Reboost |
| 4.2.3-1 (F) | 92187F | 28 | Automatic Reboost |
| | 92510E | 30 | Modification to Maneuver Execute Display |
| 4.2.3.1-1 (T) | 92187F | 28 | Automatic Reboost |
| 4.2.3.1-1 (F) | 92187F | 28 | Automatic Reboost |
| 4.2.3.2 | 91003D | 26 | Addition of $\pm X$ Jets for On-Orbit Rotational Control |
| 4.2.3.2-1 (F) | 91003D | 26 | Addition of $\pm X$ Jets for On-Orbit Rotational Control |
| 4.2.3.2-5 (F) | 91003D | 26 | Addition of $\pm X$ Jets for On-Orbit Rotational Control |
| 4.2.3.2-1 (T) | 91003D | 26 | Addition of $\pm X$ Jets for On-Orbit Rotational Control |
| | 92836D | 32 | Notch Filter Performance Improvement |
| 4.2.3.2-2 (T) | 91003D | 26 | Addition of $\pm X$ Jets for On-Orbit Rotational Control |
| | 92836D | 32 | Notch Filter Performance Improvement |
| 4.2.3.2-3.(F) | 92836D | 32 | Notch Filter Performance Improvement |
| 4.2.3.3-1 (T) | 90704F | 28 | DAP Hotstlick Downmode Alert and Message |
| 4.2.3.3 | 92509C | 29 | Correction CR for Forward RCS Interconnect System (FICS) |
| 4.2.3.3-1.(T) | 92510E | 30 | Modification to Maneuver Execute Display |
| 4.2.3.4 | 92836D | 32 | Notch Filter Performance Improvement |
| 4.2.3.4-1.(T) | 92836D | 32 | Notch Filter Performance Improvement |
| 4.2.3.4-1.(F) | 92836D | 32 | Notch Filter Performance Improvement |
| 4.2.3.5 | 92323 | 29 | Post Contact Thrusting I-Load Streamlining |
| 4.2.3.5-2. (F) | 92323 | 29 | Post Contact Thrusting I-Load Streamlining |
| 4.2.3.5-2. (T) | 92323 | 29 | Post Contact Thrusting I-Load Streamlining |
| 4.2.3.5-2a. (T) | 92323 | 29 | Post Contact Thrusting I-Load Streamlining |

| Table R.1-1. CR Reference Summary | | | | |
|-----------------------------------|-------------|-----------|---|--|
| Paragraph | CR No. | OI | CR Title | |
| 4.2.3.5-2b. (T) | 92323 | 29 | Post Contact Thrusting I-Load Streamlining | |
| 4.2.3.5-2c. (T) | 92323 | 29 | Post Contact Thrusting I-Load Streamlining | |
| 4.2.3.5-2d. (T) | 92323 | 29 | Post Contact Thrusting I-Load Streamlining | |
| 4.2.4-1 (T) | 91003D | 26 | Addition of \pm X Jets for On-Orbit Rotational Control | |
| | 91051K | 26B | Streamlined Shuttle GPS Capability | |
| | 92067D | 27 | Three String GPS Capability | |
| | 92144C | 27 | Three String GPS Documentation Cleanup | |
| | 92187F | 28 | Automatic Reboost | |
| | 92306A | 28 | Orbiter Window Protection | |
| | 92320D | 29 | Software Changes for Forward RCS Interconnect System (FICS) | |
| | 92340A | 28 | GAX Annunciation Correction for CR 92260B | |
| | 92354 | 27 | Delete Erroneous TLM Destinations | |
| | 92355B | 29 | GPC Major Mode to MEDS | |
| | 92504G | 30 | Alleviate ET Recontact For RTLS 2EO Yellow and Orange Regions | |
| | 92565A | 30 | SE RTLS Increased Pitch Authority Using Forward RCS Jets | |
| | 92871C | 30/ 32 | RCS Manifold Auto-Close for Failed-On Jet | |
| | 4.2.4-2 (T) | 91003D | 26 | Addition of \pm X Jets for On-Orbit Rotational Control |
| | | 91006B | 26 | Increase Orbit DAP Attitude Precision |
| 90704F | | 28 | DAP Hotstick Downmode Alert and Message | |
| 92187F | | 28 | Automatic Reboost | |
| 92340A | | 28 | GAX Annunciation Correction for CR 92260B | |
| 92510E | | 30 | Modification to Maneuver Execute Display | |
| 92871C | | 30/ 32 | RCS Manifold Auto-Close for Failed-On Jet | |
| 4.2.4-3 (T) | 92214A | 27 | Post-CI Three-String GPS Documentation Cleanup | |
| | 92187F | 28 | Automatic Reboost | |
| | 92323 | 29 | Post Contact Thrusting I-Load Streamlining | |
| | 92333B | 29 | Automatic Reboost Upgrade | |
| | 92611B | 29 | Change Drift Channel Constants to I-Loads | |
| | 93081A | 32 | Phase Plane Modifications to Reduce VRCS Shelf-pulsing | |
| 4.2.4-4. (T) | 92322 | 29 | VRCS Down Firing Thruster K-load Force Correction | |
| 4.2.4-5. (T) | 91051K | 26B | Streamlined Shuttle GPS Capability | |

| Table R.1-1. CR Reference Summary | | | |
|-----------------------------------|--------|-----|---|
| Paragraph | CR No. | OI | CR Title |
| 4.3-1 (F) | 92389C | 29 | Spiral HAC in TAEM Area Navigation |
| | 92332D | 30 | Add Theta Limits Bracket to MEDS ADI Displays |
| | 92522D | 30 | Overhaul MEDS Composite Flight Instrument Display |
| | 93090E | 33 | Bearing Displays |
| | 91051K | 26B | Streamlined Shuttle GPS Capability |
| 4.3-2 (T) | 92144C | 27 | Three String GPS Documentation Cleanup |
| | 91051K | 26B | Streamlined Shuttle GPS Capability |
| | 92144C | 27 | Three String GPS Documentation Cleanup |
| 4.3-3 (T) | 92214A | 27 | Post-CI Three-String GPS Documentation Cleanup |
| | 92144C | 27 | Three String GPS Documentation Cleanup |
| 4.3-4 (T) | 91051K | 26B | Streamlined Shuttle GPS Capability |
| | 92144C | 27 | Three String GPS Documentation Cleanup |
| 4.3.2 | 91051K | 26B | Streamlined Shuttle GPS Capability |
| | 92069B | 26B | Single-String GPS Documentation Cleanup |
| | 92144C | 27 | Three String GPS Documentation Cleanup |
| | 92544B | 29 | Reduce Threshold for ATT PROC Outer Loop Execution |
| | 92858D | 32 | Eliminate GPC Error Exposure from QUAT_TO_EULER |
| 4.3.2-1 (T) | 91051K | 26B | Streamlined Shuttle GPS Capability |
| | 92144C | 27 | Three String GPS Documentation Cleanup |
| | 92214A | 27 | Post-CI Three-String GPS Documentation Cleanup |
| 4.3.2-1 (F) | 91051K | 26B | Streamlined Shuttle GPS Capability |
| | 92144C | 27 | Three String GPS Documentation Cleanup |
| | 92214A | 27 | Post-CI Three-String GPS Documentation Cleanup |
| 4.3.5 | 92858D | 32 | Eliminate GPC Error Exposure from QUAT_TO_EULER |
| 4.3.11-1 (T) | 91051K | 26B | Streamlined Shuttle GPS Capability |
| | 92144C | 27 | Three String GPS Documentation Cleanup |
| | 92067D | 27 | Three String GPS Capability |
| | 92329E | 29 | Onboard Calculation of RNP Matrix |
| | 92392C | 29 | Doc-Only Corrections for OI-29 CRs 92329E, 92364D, and 92369B |
| 4.3.11-2 (T) | 92522D | 30 | Overhaul MEDS Composite Flight Instrument Display |
| | 92748B | 30 | Make a Double Precision Copy of V_AVGG for REL NAV |
| | 93090E | 33 | Bearing Displays |
| 4.3.11-5 (T) | 92144C | 27 | Three String GPS Documentation Cleanup |
| | 91051K | 26B | Streamlined Shuttle GPS Capability |

Table R.1-1. CR Reference Summary

| Paragraph | CR No. | OI | CR Title |
|--------------|--------|----|---|
| | 92329E | 29 | Onboard Calculation of RNP Matrix |
| | 92389C | 29 | Spiral HAC in TAEM Area Navigation |
| | 92544B | 29 | Reduce Threshold for ATT PROC Outer Loop Execution |
| | 92332D | 30 | Add Theta Limits Bracket to MEDS ADI Displays |
| | 92522D | 30 | Overhaul MEDS Composite Flight Instrument Display |
| | 92749B | 30 | Universal Pointing Processor Degrees to Radians Documentation Clean-up |
| | 93090E | 33 | Bearing Displays |
| 4.4-1 (F) | 92037D | 26 | Orbit DAP Inertia I-Loads Scrub |
| | 91003D | 26 | Addition of $\pm X$ Jets for On-Orbit Rotational Control |
| 4.4-1 (T) | 91003D | 26 | Addition of $\pm X$ Jets for On-Orbit Rotational Control |
| 4.4-4 (T) | 92037D | 26 | Orbit DAP Inertia I-Loads Scrub |
| 4.4-5 (T) | 92064A | 26 | Orbit DAP Inertia CALC K-Load Correction |
| 4.4.1 | 91003D | 26 | Addition of $\pm X$ Jets for On-Orbit Rotational Control |
| | 92037D | 26 | Orbit DAP Inertia I-Loads Scrub |
| 4.4.1-1 (T) | 91003D | 26 | Addition of $\pm X$ Jets for On-Orbit Rotational Control |
| 4.4.1-3A (T) | 92037D | 26 | Orbit DAP Inertia I-Loads Scrub |
| | 92064A | 26 | Orbit DAP Inertia CALC K-Load Correction |
| 4.4.1-4 (T) | 92037D | 26 | Orbit DAP Inertia I-Loads Scrub |
| 4.4.1-1 (F) | 91003D | 26 | Addition of $\pm X$ Jets for On-Orbit Rotational Control |
| | 92037D | 26 | Orbit DAP Inertia I-Loads Scrub |
| 4.4.4-1 (T) | 91003D | 26 | Addition of $\pm X$ Jets for On-Orbit Rotational Control |
| | 92067D | 27 | Three String GPS Capability |
| 4.4.4-3 (T) | 92037D | 26 | Orbit DAP Inertia I-Loads Scrub |

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 |
| 2550 | | Internal Counter in On-Orbit ATT_PROC |
| 12003 | | Incorporate PL Interface Requirements With On-Orbit DAP via Flight Critical MDM |
| 12019 | | Standardization of FSSR Principal Function I/O Tables |
| 12071A | | Maneuver Execute (6.35 and 6.46) Display Changes |
| 12109 | | On-Orbit 1, I/O Update |
| 12120 | | Update IMU On-Orbit Interface Requirements |
| 12190D | | PFG Mode Team Approved Changes for Ascent/RTLS |
| 12214A | | ST SOP Interface Table Update |
| 12225B | | GN&C Level C Uplink Requirements |
| 12233 | | Transition DAP Rate Change |
| 12243 | | Editorial Corrections to ATT_PROC_ORBIT |
| 12244 | | IMU Angle Sign Convention in ATT_PROC |
| 12245 | | -Z ADI Equations in ATT_PROC |
| 12246 | | Orbit ATT_PROC ADI I-Load Reference Quaternions |
| 12269 | | MSID Correction to IDD Tables |
| 12316 | | GN&C SW RM Processing Rate Reduction |
| 12336 | | I-Load OFT 1 Baseline Mission and LRU Dependent Parameters |
| 12337 | | I-Load OFT 1 Baseline Design Dependent Parameters |
| 12338 | | I-Load OFT 1 Baseline Constants |
| 12339 | | I-Load OFT 1 Baseline Removals |
| 12407B | | Addition of Transport Delay Compensation to Antenna Management |
| 12411B | | OMS Engine FDI Simplification |
| 12442A | | Integrated Entry NAV, Ascent NAV, and Orbital NAV Interface Signal Requirements |
| 12443 | | I-Load for Entry FACI |
| 12474C | | Reduce IMU Velocity Processing Rate |
| 12586 | | Integrated Signals – Interface for 6.35, 6.46, and Associated Maneuver DIPS |
| 12600C | | Integrated MSID Assignments |
| 12624A | | S/W Mod Requirements to Support MCR 4598 (FC SW MOD) |
| 12660C | | Orbit ATT_PROC Update |

Table R.2-1. Historical Change Request Summary

| CR No. | OI | CR Title |
|--------|----|--|
| 12687B | | Total Attitude Errors Required for Orbit Display |
| 12693B | | ADI and IMU Quaternion Availability to TLM |
| 12718C | | GN&C Switch RM Modifications |
| 12781A | | Vehicle OMS Trim Angle Interface Requirements |
| 12843 | | Update On-Orbit (OPS 2) Guidance Software |
| 12981D | | On-Orbit Flight Control |
| 19014A | | On-Orbit Software Requirements Documentation OFT-1 only |
| 19074A | | Orbit DAP Configuration Display Item Entry Limits |
| 19100 | | FSSR Update |
| 19167B | | Rel NAV Display Interface Correction |
| 19409A | | COAS Mark/ADI PB Signal Interface |
| 19441 | | Correct ADI Error Needles to "Fly to" Reference |
| 19499 | | CR 12660A Incorporates Incorrect Indices for Limiting Gimbal Discontinuity |
| 19500 | | FSSR Update III |
| 19556A | | I-Load Corrections for STS-1 |
| 19605 | | Orbit DAP Carry Over of PHASE_PLANE_ACCEL to Trans DAP |
| 19608A | | Orbit ATT_PROC Correction to Attitude Increment Computation and Initialization Clean-Up |
| 19630A | | Orbit DAP Configuration Display Inertia Item Entry Limit Update |
| 19682A | | On-Orbit Attitude Processor Software Protection During a Potential Gimbal Flip Condition |
| 19826 | | I-Load Corrections On-Orbit DAP |
| 19838 | | Override of Translation Options in On-Orbit DAP (STS-2) |
| 19954 | | Errors in ORB ATT PROC (CR 19167B) |
| 29016 | | Orbit DAP Documentation and I-Load Changes to Principal Inertias |
| 29017 | | Universal Pointing Downlist |
| 29018 | | On-Orbit DAP Downlist Parameters (STS-2 and Subs) |
| 29085 | | On-Orbit Flight Control (STS-2) |
| 29087 | | Documentation Clean-Up for On-Orbit Attitude Processor |
| 29149B | | Add Program Interrupt Handling |
| 29152 | | QUAT_TO_ADI Singularity Avoidance |
| 29162A | | I-Load Changes |
| 29164C | | BFS I-Load Cleanup |
| 29191 | | Activation of RCS_JET Activity Lights During OPS 2, OPS 8, and MM 301-302 |
| 29216 | | OMS/RCS Downlist Documentation Requirements |
| 29217B | | Correction to CR 29018A, On-Orbit DAP Downlist Parameters |

| Table R.2-1. Historical Change Request Summary | | |
|--|----|------------------------------------|
| CR No. | OI | CR Title |
| 29407C | | Maneuver Exec Disp PFS 18/BFS 12 |
| 29471B | | HFE Overrun Definition |
| 29490C | | RCS Vernier Leak Detection |
| 29500 | | FSSR Update No. 7 |
| 29512 | | Orbit ATT_PROC Compensation |
| 29560 | | ATT PROC/IMU Quaternion I/L |
| 29566A | | Single Axis Translation Logic |
| 29567A | | Combined – Pitch/Roll Accel |
| 29568A | | –X Translation Aft Pitch Default |
| 29620 | | MOD CR 29560 – Quat I/L |
| 29692B | | A/E and ORB ATT PROC Cold Start |
| 29696A | | I/L for IMU S/N 10 in Pos 1 |
| 29697 | | I/L for IMU S/N 10 in Pos 2 |
| 29698 | | I/L for IMU S/N 10 in Pos 3 |
| 29700 | | Matching I/L for Standard IMU |
| 29762A | | ATT_PROC IDD CLEANUP |
| 29764A | | Orbit 2 DAP Low Z Pulse Mode |
| 29800B | | FSSR Update No. 8 |
| 29886C | | MNVR Exec Disp/Dips Update |
| 29895B | | Update GN&C/SM–PL IF Requirements |
| 29902A | | Cycle 3.2.2 I/L 3/10/81 Launch |
| 39008 | | ORB DAP OMS STATE–I/L MSID |
| 39011 | | ORB DAP JET–MAP UPDATE |
| 39012 | | DAP TVC Filter Gain I–Loads |
| 39013 | | Correct ORB DAP ARRAY–DB I/L |
| 39014 | | Remove Duplicate DAP MSID’s |
| 39074A | | OMS TVC Yaw Limit Changes |
| 39097 | | Cycle 3.3.2 – OMS TGT and REL Quat |
| 39155D | | RCS Jet Priority Control |
| 39166A | | Orbit DAP IMU Fail Proc |
| 39184E | | STS–2 Cycle 1 MPAD I–Loads |
| 39188 | | Quat for IMU 21 in Pos 1 |
| 39189 | | Quat for IMU 21 in Pos 2 |
| 39192A | | Cycle 3.3.3 I–Loads |
| 39276A | | IMU S/N 12 I–L/Pos 1/VAB, Pad |
| 39277A | | IMU S/N 12 I–L/Pos 2/VAB, Pad |

| Table R.2-1. Historical Change Request Summary | | |
|--|----|---|
| CR No. | OI | CR Title |
| 39278A | | IMU S/N 12 I-L/Pos 3/VAB, Pad |
| 39304 | | IMU 12-Pos 1-Quaternions (1) |
| 39305 | | IMU 12-Pos 2-Quaternions (1) |
| 39306 | | IMU 12-Pos 3-Quaternions (1) |
| 39443 | | ORB DAP STATE ESTIMATOR GAIN (1) |
| 39448 | | Improper RCS Prioritization |
| 39467A | | DR CloseOut – Doc Cleanup (1) |
| 39530F | | STS-2 Cycle 2 I/L (2) |
| 39536 | | Delete IMU Quaternion I-Loads (Ref: 29692B) |
| 39581A | | ADD DVB_SEC Parameters - D/L (Ref) |
| 39606A | | Add Destination for DVB_SEC |
| 39619 | | STS-3 Orbit DAP I-Loads (2) |
| 39640 | | FSSR Update |
| 39662A | | ORB DAP VEH Inertia Uplink |
| 39740 | | ORB DAP Inertia Keyboard Limit (IDD only) |
| 39771 | | ROT DISC Initialization |
| 39917D | | ON-ORB CG Offset Correction |
| 39947H | | Orbit DAP Low Bandwidth TVC |
| 59010D | | Universal Pointing Upgrade |
| 59091 | | ORB DAP Rotation Compensation |
| 59245A | | Stable ATT-IMU CF. OPS Change |
| 59778 | | IMU S/N 4 IL, Slot 3, OV-102 (1) |
| 59837 | | VERN downmode during MAN MNVR |
| 59843 | | STS-11 Cycle 1 ONORB QUAT (2) |
| 59963 | | I-Load Scrub: Univ Point |
| 59994 | | Orbit DAP quaternion select |
| 69049 | | STS-11 Cycle 2 and Subs ONORB QUAT (2) |
| 69070 | | FSSR update |
| 69095A | | UNIV PTG Runs Postburn Mnvr |
| 69200A | | PBI Across OPS/IMU Fail Mode |
| 69209C | | Univ Ptg CR 59010D Cleanup |
| 69222 | | ORB DAP I/L for OAST-1 (2) |
| 69279A | | IMU Outer Roll Gimbal Offsets |
| 69304 | | Downmode on Selection of VRCS |
| 69443 | | ORB DAP Response to Preburn Mnvr |
| 69467 | | 41-G Orbit DAP I-Loads OAI (2) |

| Table R.2-1. Historical Change Request Summary | | |
|--|----|---|
| CR No. | OI | CR Title |
| 69468 | | 41-G Orbit DAP I-Loads OA2 (2) |
| 69469 | | 41-G Orbit DAP I-Loads OA3 (2) |
| 69470 | | 41-G Orbit DAP I-Loads OA4 (2) |
| 69519 | | Pre-IMRB RI I/ LOwnership (2) |
| 69599C | | Supplement-CRA-s 59245A/69200A |
| 69646 | | ORB DAP Quat Select-IMU Fail |
| 69719A | | Delete Veh Unique RCS Priority |
| 69814A | | 41-G ORB DAP I/L-s/OA1 CYC 3 (2) |
| 69833A | | LVLH ATT Independent of ADI |
| 69859A | | Vernier Jet Counter Compare |
| 79000 | | IMU S/N 12 I/L Slot 1, 1H10 (2) |
| 79001 | | IMU S/N 12 I/L Slot 2, 1H20 (2) |
| 79002 | | IMU S/N 12 I/L Slot 3, 1H30 (2) |
| 79006 | | 51-D Orbit DAP I-Load (PP-1) (2) |
| 79007 | | 51-D Orbit DAP I-Load (PP-2) (2) |
| 79037 | | 51-F Orbit I/L (PP-1) (2) |
| 79108 | | Supplement CR 69833A |
| 79153 | | IMU NAV Base I-L-s, OV-104 (2) |
| 79166C | | RCS Documentation Priority Corrections |
| 79171 | | IMU S/N 12, I/L SLT 1, OV-104 (2) |
| 79172 | | IMU S/N 12, I/L SLT 2, OV-104 (2) |
| 79173 | | IMU S/N 12, I/L SLT 3, OV-104 (2) |
| 79454 | | Documentation Lash-Up CR 69200A and 69646 |
| 79471 | | Correct FLT CNTL SW PROC Rates |
| 79473 | | I/L-Syncom IV-3 Repair-Redeploy (2) |
| 79801G | | On-Orbit/Rdnz Nav D/L Cleanup |
| 79862F | 23 | Universal Pointing Future MNVR – DAP Part |
| 79880A | | Correct THC Transport Lag, Execution Rate |
| 89111C | | Errata for STS 83-0003A |
| 89141C | | FSSR Errata STS 83-0009A |
| 89366B | | FSSR Errata STS 83-0008A Volume 1 |
| 89429A | | OI-8C Implementation of CR 69689 |
| 89490C | | FSSR STS 83-0009B OI-8B Errata/Baseline |
| 89545A | | STS 83-0013B Errata Baseline |
| 89590B | | FSSR 9 OI-8B PCN-B1 Errata |
| 89599C | | Cleanup to Level B GN&C Document |

| Table R.2-1. Historical Change Request Summary | | |
|--|----|--|
| CR No. | OI | CR Title |
| 89662B | | FSSR STS 83-0003B Errata Update |
| 89685A | | On-Orbit DAP THC Hot Stick Moding to Primary |
| 89686B | | On-Orbit DAP Moding Upgrades |
| 89670 | | Fix Low Z Multiplier |
| 89746 | | On-Orbit RCS Tank Constraint Removal |
| 89795C | | Cleanup to CR 89685A |
| 89805 | | Errata Change CR 89665A Page 3 & IDD |
| 89816 | | Cleanup to CR 89746 |
| 89841 | | STS 83-0009B PCN-B2 Errata (OI-8C) |
| 89921C | | Closed Loop PRCS Pulse Mode |
| 89901A | 21 | Convert ATT/PTG ILDS to KLDS |
| 89921C | | Closed Loop PRCS Pulse Mode |
| 89986H | 22 | OPS-1 IMU Alignment |
| 90114B | 21 | Abort Sequencing Redesign |
| 90185A | | Add CR Field to FSSR I/O Tables |
| 90314H | 23 | State Estimator Upgrades |
| 90353G | 23 | Transition Flight Control I-Load to K-Load Conversion |
| 90374C | | Automated FSSR Constants |
| 90381 | | Clarify PBIs Ignored with RHC and THC Out of Detent |
| 90606E | 23 | PFS/BFS ICD Baseline |
| 90639B | 23 | CR 79862F "Universal Pointing Future MNVR – DAP Part" Corrections |
| 90644A | 23 | State Estimator Upgrades Correction |
| 90690A | 24 | Deletion of EQTN MSID Column from K-Load FSSR Tables |
| 90705H | 25 | 3 Engines Out Auto Contingency |
| 90708C | 24 | Orbit DAP On-Board I-Load Calculation and Notch Filter Uplink |
| 90709B | 24 | Orbit DAP Jet Selection Upgrade |
| 90718 | 23 | State Estimator Upgrades Correction II |
| 90781C | 24 | Define Parametric Data Nomenclature(s) |
| 90790 | 24 | Add Memory Configuration to the FSSR I-Load Tables |
| 90806A | 23 | Notch Filter Desired Attitude Correction |
| 90809A | 24 | Orbit DAP I-Load CALC/Jet Select CR Corrections (Ref: 90708 & 90709) |
| 90814C | 24 | Add Description of Database Generated FSSR Parameter Tables |
| 90837G | 24 | Automatic Post Contact Firing Sequence |
| 90874D | 24 | Orbit DAP I-Load CALC and Notch Filter Uplink Corrections |
| 90882B | 23 | FSSR Doc Only Changes GN&C ON-Orbit/Deorbit |
| 90900D | 24 | FSSR-9 Orbit Flight Control Documentation Changes |

| Table R.2-1. Historical Change Request Summary | | |
|--|----|--|
| CR No. | OI | CR Title |
| 90952B | 24 | CR 90837G Requirements Cleanup/Corrections |
| 90953C | 24 | Candidate Limiting for Orbit DAP Jet Selection Upgrade |
| 90966A | 25 | Deletion of the Qualifier from the FSSR I-Load Tables |
| 91066D | 25 | Standardize the FSSR Correlation Tables |
| 91072D | 24 | OI-24 GN&C Doc Issues Cleanup |
| 92027B | 25 | TDMS-2 Required FSSR Changes |
| (1) = Reference Only | | (2) = I-Load Only |