Inertial Upper Stage (IUS) Flight Procedures Handbook

SECTION 1
INTRODUCTION

1.1 PURPOSE

This handbook presents inertial upper stage (IUS) systems descriptions as well as procedures rationale for the IUS Deploy Checklist. The 51-E IUS Deploy Checklist was used in conjunction with the procedure rationale.

This book is intended for use by Mission Operations Directorate (MOD) and Flight Crew Operations Directorate (FCOD) personnel as a source of information on deploy procedures rationale.

1.2 BACKGROUND

The IUS is a self-navigating, two-stage, solid-fueled boost vehicle designed and manufactured by Boeing Aerospace Corporation (BAC). It provides the capability to carry as many as four spacecraft per mission into high Earth orbits.

1.3 REFERENCES

51-E IUS Deploy Checklist, Final, Jan. 7, 1985
IUS Payload Systems Procedures Workbook, March 25, 1982
IUS Systems Handbook, Basic, Rev B-1, Dec. 21, 1984, JSC-17077

1.4 ACRONYMS/ABBREVIATIONS

A/G air to ground
ACN Ascension Island Tracking Station (STDN)
ADI attitude director indicator
AFSCF Air Force Satellite Control Facility
AFTA aft frame tilt actuator
AGO Santiago, Chile, Tracking Station (STDN)
ALT alternate
AMP amplifier
ANT antenna
AOS acquisition of signal
ASE airborne support equipment
ATT attitude
AUX auxiliary
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
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<tbody>
<tr>
<td>BAC</td>
<td>Boeing Aerospace Corporation</td>
</tr>
<tr>
<td>C/L</td>
<td>checklist</td>
</tr>
<tr>
<td>C/O</td>
<td>checkout</td>
</tr>
<tr>
<td>CAP</td>
<td>Crew Activity Plan</td>
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<tr>
<td>cb</td>
<td>circuit breaker</td>
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<tr>
<td>CCTV</td>
<td>closed-circuit television</td>
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<tr>
<td>CDC</td>
<td>confined detonating cord</td>
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<tr>
<td>CDR</td>
<td>commander</td>
</tr>
<tr>
<td>CIU</td>
<td>communications interface unit</td>
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<tr>
<td>CMD</td>
<td>command</td>
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<tr>
<td>comm</td>
<td>communications</td>
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<tr>
<td>CRT</td>
<td>cathode ray tube</td>
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<tr>
<td>CRU</td>
<td>converter regulator unit</td>
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<tr>
<td>DAP</td>
<td>digital autopilot</td>
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<tr>
<td>DB</td>
<td>decibel</td>
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<tr>
<td>DMS</td>
<td>data management system</td>
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<tr>
<td>DPLY</td>
<td>deploy</td>
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<tr>
<td>DS</td>
<td>deep space</td>
</tr>
<tr>
<td>DSBL</td>
<td>disable</td>
</tr>
<tr>
<td>EDU</td>
<td>environmental data unit</td>
</tr>
<tr>
<td>EEC</td>
<td>extendable exit cone (SRM)</td>
</tr>
<tr>
<td>EED</td>
<td>electro-explosive device</td>
</tr>
<tr>
<td>EMI</td>
<td>electro-magnetic interference</td>
</tr>
<tr>
<td>EMU</td>
<td>environmental measurement unit</td>
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<tr>
<td>ENA</td>
<td>enable</td>
</tr>
<tr>
<td>EPS</td>
<td>electrical power system</td>
</tr>
<tr>
<td>ESS</td>
<td>equipment support section</td>
</tr>
<tr>
<td>ETA</td>
<td>explosive transfer assembly</td>
</tr>
<tr>
<td>EVA</td>
<td>extravehicular activity</td>
</tr>
<tr>
<td>FLT</td>
<td>flight</td>
</tr>
<tr>
<td>FOV</td>
<td>field of view</td>
</tr>
<tr>
<td>FPS</td>
<td>feet per second</td>
</tr>
<tr>
<td>FWD</td>
<td>forward</td>
</tr>
<tr>
<td>G</td>
<td>gravity</td>
</tr>
<tr>
<td>G&amp;N</td>
<td>guidance and navigation</td>
</tr>
<tr>
<td>GN&amp;C</td>
<td>guidance, navigation, and control</td>
</tr>
<tr>
<td>GDS</td>
<td>Goldstone, California, Tracking Station (STDN)</td>
</tr>
<tr>
<td>GEO</td>
<td>geosynchronous Earth orbit</td>
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<tr>
<td>GET</td>
<td>ground elapsed time</td>
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<tr>
<td>GMT</td>
<td>Greenwich mean time</td>
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<tr>
<td>GPC</td>
<td>general purpose computer</td>
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<td>GSE</td>
<td>ground support equipment</td>
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<tr>
<td>GSFC</td>
<td>Goddard Space Flight Center</td>
</tr>
<tr>
<td>GSTDN</td>
<td>Ground Satellite Tracking Data Network (NASA)</td>
</tr>
<tr>
<td>GTS</td>
<td>Guam Tracking Station (RTS)</td>
</tr>
<tr>
<td>GWN</td>
<td>Guam Tracking Station (STDN) - Guam Island, U.S.</td>
</tr>
<tr>
<td>HAW</td>
<td>Hawaii, Kauai, Tracking Station (STDN)</td>
</tr>
<tr>
<td>HTPB</td>
<td>hydroxy terminated polybutadiene binder</td>
</tr>
<tr>
<td>HTS</td>
<td>Hawaii Tracking Station (RTS) - Kaene Point, Oahu</td>
</tr>
<tr>
<td>I/F</td>
<td>interface</td>
</tr>
<tr>
<td>I/O</td>
<td>input/output</td>
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<tr>
<td>IMU</td>
<td>inertial measurement unit</td>
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<tr>
<td>IOS</td>
<td>Indian Ocean Tracking Station (STDN) - Mahe Island, Seychelles Tracking Station Indian Ocean Station (SGLS, RTS)</td>
</tr>
<tr>
<td>IUS</td>
<td>Inertial Upper Stage</td>
</tr>
<tr>
<td>JSC</td>
<td>Johnson Space Center</td>
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<tr>
<td>kbps</td>
<td>kilobits per second</td>
</tr>
<tr>
<td>KSC</td>
<td>Kennedy Space Center</td>
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<tr>
<td>LOS</td>
<td>loss of signal</td>
</tr>
<tr>
<td>MALF</td>
<td>malfunction</td>
</tr>
<tr>
<td>MCC</td>
<td>Mission Control Center (Houston)</td>
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<tr>
<td>MCDS</td>
<td>multifunction CRT display system</td>
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<tr>
<td>MDL</td>
<td>mission data load</td>
</tr>
<tr>
<td>MDM</td>
<td>multiplexer/demultiplexer</td>
</tr>
<tr>
<td>MET</td>
<td>mission elapsed time</td>
</tr>
<tr>
<td>MGA</td>
<td>medium gain antenna</td>
</tr>
<tr>
<td>MIL</td>
<td>Merritt Island Tracking Station (STDN)</td>
</tr>
<tr>
<td>MILA</td>
<td>Merritt Island Launch Area</td>
</tr>
<tr>
<td>MOD</td>
<td>Mission Operations Directorate</td>
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<tr>
<td>MS</td>
<td>mission specialist</td>
</tr>
<tr>
<td>ms</td>
<td>millisecond</td>
</tr>
<tr>
<td>MSFC</td>
<td>Marshall Space Flight Center</td>
</tr>
<tr>
<td>MUX</td>
<td>multiplex(ing)</td>
</tr>
<tr>
<td>NASA</td>
<td>National Aeronautics and Space Administration</td>
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<tr>
<td>NAV</td>
<td>navigation</td>
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<tr>
<td>NIS</td>
<td>navigation initialization status</td>
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<tr>
<td>NSP</td>
<td>network signal processor</td>
</tr>
<tr>
<td>OMS</td>
<td>orbital maneuvering system</td>
</tr>
<tr>
<td>ops</td>
<td>operations</td>
</tr>
<tr>
<td>ORD</td>
<td>ordnance</td>
</tr>
<tr>
<td>pbI</td>
<td>pushbutton indicator</td>
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<tr>
<td>PCP</td>
<td>power control panel</td>
</tr>
<tr>
<td>PCU</td>
<td>power control unit</td>
</tr>
<tr>
<td>PDI</td>
<td>payload data interleaver</td>
</tr>
<tr>
<td>PDU</td>
<td>power distribution unit</td>
</tr>
<tr>
<td>PET</td>
<td>phase elapsed time</td>
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PI payload interrogator (RF)
P/L or PL payload
PLB payload bay
PLBD payload bay door
PRCS primary reaction control system
PRI primary
PRLA payload retention latch actuator
PSP payload signal processor
PSU pyro switching unit
PTU power transfer unit
PNR power
pyro pyrotechnic
RCS reaction control system
RCVR receiver
REA rocket engine assembly
REM rocket engine module
RF radio frequency
RFI radio frequency interference
RHC rotation hand controller
RIMU redundant inertial measurement unit
RM redundancy management
RTS Remote Tracking Station (USAF)
S&A safe and arm (device)
S/C spacecraft
SCF Satellite Control Facility
SCU signal conditioner unit
SEP separation
SGLS space ground link system/station
SIU signal interface unit
SM systems management
SMAB Solid Motor Assembly Building
SMDC shielded mild detonating cord
SPEC specification
SRM solid rocket motor
SSP standard switch panel
STBD starboard
STC Satellite Test Center
STDN Spaceflight Tracking and Data Network (includes the USB ground station, TDRSS, and TDRSS ground station)
STS Space Transportation System
SV state vector
sw switch
SYNC synchronous
T-0 time minus zero
tb talkback
TCS thermal control subsystem
TDRS Tracking and Data Relay Satellite
TDRSS Tracking and Data Relay Satellite System
TEMP temperature
The following sections are intended to give an overview of the IUS and its systems. For detailed system description, Boeing documentation should be referenced.

2.1 PHYSICAL DESCRIPTION

The IUS vehicle is cylindrical in shape and consists primarily of an aft skirt, interstage structure, first stage solid rocket motor (SRM-1), second stage solid rocket motor (SRM-2), equipment support section (ESS), and airborne support equipment (ASE), (figs. 2-1, 2-2, and 2-3).

The IUS first stage consists of the interstage structure and the SRM-1, which contains up to 21,400 pounds of propellant, and is attached to the ESS by pyrotechnic separation bolts used for staging.

The IUS second stage consists of SRM-2, which contains up to 6,000 pounds of propellant, and the ESS. The ESS is also attached to the spacecraft by pyrotechnic separation bolts used for staging. Contained within the ESS are the avionics needed for guidance and navigation (G&N); a data management system (DMS) to perform computations; signal conditioning; data processing and formatting associated with navigation (NAV), tracking, guidance control and data management functions, the reaction control system (RCS), the electrical power system (EPS), and the telemetry, tracking, and command (TT&C) system.

In addition to the IUS vehicle, the ASE is required to provide the mechanical (fig. 2-4) and electrical interfaces between the IUS and the Orbiter.

2.1.1 Aft Skirt

The aft skirt is a short cylindrical section which provides the structural interface and separation joint between the aft ring on the first stage motor and the aft ASE frame. It also contains the super-zip, a circumferential linear charge. Super-zip is detonated by the crew via the power control panel (PCP) to structurally separate the IUS from the Orbiter (figs. 2-5 and 2-6).

2.1.2 Interstage Structure

The interstage and SRM-1 form the IUS stage 1. The forward end of the interstage is connected to the ESS and SRM-1 by pyrotechnic separation bolts. The first stage batteries and the SRM-1 safe and arm (S&A) devices are mounted on the outside of the interstage. Once the IUS vehicle has been assembled in the Solid Motor Assembly Building (SMAB), there can be no access within the interstage.

2.1.3 Solid Rocket Motor

The propulsion system (fig. 2-3), consists of two solid rocket motors (SRM's) and their ignition devices. The stage 1 SRM is the larger motor, with an average thrust of 41,611 pounds; the stage 2 motor with the extendable exit cone (EEC) has an average thrust of 17,629 pounds. Each stage has a vectorable nozzle which is used to adjust the transfer trajectory of the IUS. Additional vernier velocity adjustments are made by the RCS system. The SRM propellant can be off-loaded to meet specific requirements.

2.1.4 Equipment Support Section

The ESS interfaces with the spacecraft and contains the following command and control systems:

- Propulsion system
- RCS
- Thrust vector control (TVC) system
- EPS
- TT&C system
- Thermal control system (TCS)
- Avionics for G&N system
- DMS

2.1.4.1 Propulsion System

The propulsion system provides the primary IUS vehicle propulsion and consists of two SRM's, each with a vectorable nozzle and an independent redundant motor ignition system. The propellant in both SRM's is cast in a tubular grain and is composed of 18 percent aluminum, 68 percent ammonium perchlorate, and 14 percent hydroxy terminated polybutadrene binder (HTPB). Following IUS deployment by the crew, the two first-stage S&A devices are armed and SRM-1 is ignited (~00:55 or 00:67 phase elapsed time (PET)). At burn completion, the IUS performs a vernier velocity correction maneuver with its RCS to compensate for SRM total impulse dispersion. After coasting for ~5 hours, the IUS approaches geosynchronous Earth orbit (GEO) altitude where staging occurs. The two second-stage S&A devices are then armed and SRM-2 is ignited to circularize the orbit at GEO altitude. At burn completion, the IUS again performs a vernier velocity correction maneuver and spacecraft separation is performed.

2.1.4.2 Reaction Control System

The RCS performs the thrust functions required for coast attitude control, SRM powered flight roll control, vehicle maneuvers, velocity vernier for SRM impulse uncertainty, and spacecraft separation maneuvers. The RCS is a monopropellant blowdown pressurized system and consists of two hydrazine fuel tanks (third tank is optional), a fuel manifold, and six rocket engine
modules (REM's). The REM's are installed on the outer second stage structure and provide three-axis attitude control throughout the flight. Thrust- ing is controlled by the DMS and associated software.

Each REM contains a redundant heater assembly to maintain the propellant passages above the freezing temperature of hydrazine and to keep the catalyst beds and control valves above their minimum operating temperatures.

2.1.4.3 Thrust Vector Control System

The TVC system provides the equipment to control the pitch and yaw position of each SRM nozzle. The equipment includes two thrust vector controllers located in the ESS and a set of two actuators and two potentiometers attached to each stage SRM nozzle. The system is electrically redundant with independent channels A and B. Control of the system is by the DMS and the associated software.

2.1.4.4 Electrical Power System

The EPS provides and distributes power to the IUS vehicle and the spacecraft. Power sources include ASE power and IUS stage 1 and 2 batteries.

There are seven buses for the IUS and a separate isolated bus for the spacecraft as follows:
- Avionics A and B (supplied by ASE and avionics batteries)
- Utility batteries A and B
- Utility A and B (supplied by utility batteries)
- Powerdown (supplied by ASE power)
- Spacecraft

The avionics bus provides power to the majority of IUS components, whereas the utility battery bus and utility bus are used for high-current short-duration switching loads; i.e., ordnance devices, motor driven switches, solenoids, actuators, etc. The powerdown bus (also known as the standby bus) is powered by the ASE and required to keep temperature-critical components warm. The system is redundant to ensure that a single failure cannot disable both avionics channels A and B. The power is distributed on several buses with separate buses for the IUS and spacecraft. The EPS also provides switching for ordnance events and other control and measurement functions for the DMS. The majority of the switching functions are controlled by the DMS. However, while the IUS is still in the Orbiter bay, power functions are controlled by the ASE.

2.1.4.5 Telemetry, Tracking, and Command System

The TT&C system provides for the transmission of telemetry (TLM), turnaround of ranging data, and reception of space/ground link system/station (SGLS) compatible commands. The TT&C system is configured into two individual receive/transmit channels to provide operational redundancy; however, the redundant channel (B-string) is optional, and may not be installed for a particular mission. The TT&C system consists of S-band transponders, power amplifiers, diplexers, switches, and antennas. Encryption and decryption devices are installed for classified missions.

2.1.4.6 Thermal Control System

The TCS is comprised of both active and passive elements. Heaters are used on RCS components, batteries, and the redundant inertial measurement unit (RIMU). Passive thermal control is achieved by selective application of exterior coatings, blanket insulation, and thermal isolators. The computers, power amplifiers, and dc-dc converter regulator units (CRU's) are mounted in cutouts in the exterior ESS wall to expose their baseplates to space for thermal control purposes.

2.1.4.7 Guidance and Navigation System

The G&N system consists of the RIMU, star scanner, and associated software. The RIMU is a strap-down system using five gyroscopes and five accelerometers to obtain vehicle inertial attitude rate and acceleration measurements. These data are provided to the flight computers for guidance, navigation, and control (GN&C) computations. The star scanner is used with certain payloads to provide attitude initialization prior to deployment to compensate for accumulated drift errors.

The IUS vehicle uses an explicit guidance algorithm to generate SRM thrust steering commands, SRM ignition time, and RCS vernier thrust cutoff time. Prior to each SRM ignition and each RCS vernier, the vehicle is oriented to a thrust attitude based on nominal performance of the remaining propulsion stages. During SRM burn, the current state vector determined from the navigation function is compared to the desired state vector. The commanded attitude is adjusted to compensate for the buildup of position and velocity errors due to off-nominal SRM performance. The primary purpose of the vernier thrust is to compensate for velocity errors resulting from SRM impulse and cutoff-time dispersions. However, residual position errors remaining from the SRM burn and position errors introduced by impulse and cutoff-time dispersions are also removed by the RCS.

Attitude control in response to guidance commands is provided by TVC during powered flight and by RCS thrusters during coast. Measured attitude from the NAV subsystem is compared with guidance commands to generate error signals. During solid motor burn, these error signals drive the motor nozzle actuators and the resulting nozzle deflections produce the desired attitude control torques in pitch and yaw. Roll control is maintained by the RCS roll-axis thrusters. During coast flight, the error signals are processed in the computer to generate RCS thrust commands to maintain vehicle attitude or to maneuver the vehicle.
2.2.2 Communications Interface Unit (LI1)

The CIU (LI1) provides the interface and control of the communication interfaces between the IUS and Orbiter.

S-band and GN&C command data validity are verified by the CIU checking for proper format, length, and parity. Invalid commands are rejected and the CMD REJECT error light will be illuminated.

The CIU can store up to 64 IUS formatted uplink commands, which can be sent via the front panel COMMAND section. TLM data (command text and execution feedback) are displayed after the associated uplink command is received by the IUS.

CIU software is unable to determine if IUS TLM is in 16 or 64 kbps. Thus the CIU will not lock onto the TLM stream if the PAYLOAD LINK switch is not in the corresponding position; i.e., for 64 kbps, the switch should be in HARDLINE 64 KBPS.

A select group of TLM data (16/64 kbps) is extracted by the CIU, decrypted (if classified mission), and displayed in the VERIFICATION windows on the front panel:

- Variable command count (VCC)
- Predeployment checkout status
- Spacecraft (S/C) discrete commands
- IUS mission status
- Safety status
- Navigation initialization status (NIS) bits
- REM heaters status

2.2.3 Standard Switch Panel (LI2)

On the SSP (LI2), there are three cb's, five switches, and three talkbacks that concern the IUS:

- SW PWR cb
- IUS ANT TB PWR cb
- PL TIMING BUFFER cb
- ACT ORD ARM switch and talkback
- ACT 1 DISENG switch
- IUS RF ANT E/D switch
- IUS RF ANT ENA talkback
- IUS RF ANT DSBL talkback
- ACT 2 DISENG switch
- ACT ORD PREARM switch

2.2.4 SPEC 200

After the Orbiter general purpose computers (GPC's) are configured for on-orbit operations, SPEC 200 IUS/TDRS (fig. 2-11) will be available to the crew to monitor both safety and mission success information. There is only one item entry on this display and it is a toggle command. ITEM 1 EXEC will turn off and on the cyclic transfer of time-tagged Orbiter M50 attitude and state vector data from the Orbiter GPC to a buffer in the CIU. The display is initialized with the transfer OFF. When ON, an asterisk will appear.

This display provides monitor and control capabilities of key events prior to and during IUS deployment for integrated Orbiter/IUS/tracking and data relay satellite (TDRS) operations for nonsecure missions only.

The parameter status field for all parameters will be blank for normal operation or will display an M for missing data. For analog parameters, this field will also display an H or L for off-scale data. Some parameters displayed will be limit-sensed for systems management (SM) alerts or caution and warning alarms. For discretes that are limit-sensed, an overbright + will be displayed in this field when the parameter is out of limits. For analogs that are limit-sensed, an overbright + or + will be displayed when the parameter exceeds either an upper or lower limit. The symbols driven in the parameter status field have the following display priority from highest to lowest: M, H, L, +, −.
Figure 2-1. IUS vehicle structure.

- SRM-1 Attach Ring
- SRM-2 Attach Ring
- Interstage Trunnion Ring
- Forward Trunnion Ring
- Stage 1/2 Separation Joint
- Access Panel
- Equipment Support Section
- Keel Pin Recess
- Interstage
- Aft Skirt (Part of ASE)
Figure 2-2.- IUS vehicle assembly.

2-10
Figure 2-3.- IUS propulsion system.
Figure 2-4.- IUS/Orbiter mechanical interface.
Figure 2-5.- Super-zip separation system.
DETONATOR BLOCKS AND STAINLESS STEEL TUBE WITH CONTAINED PRODUCTS OF COMBUSTION REMAIN WITH ASE.

Figure 2-6.- Super-zip separation system operation.
Figure 2-7. Umbilical boom release sequence.
Figure 2-8.- IUS POWER CONTROL panel (L10).
Figure 2-9.- CIU panel (L11).
Figure 2-10.- Standard switch panel (L12).
<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
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</tr>
<tr>
<td>VOLTS</td>
<td>XX, XS</td>
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<tr>
<td>AMPS</td>
<td>XX, XS</td>
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<td>SIG PRES X5</td>
<td></td>
</tr>
<tr>
<td>CMD LOCK X5</td>
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</tr>
<tr>
<td>XMIT ON</td>
<td>XX, XS</td>
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<tr>
<td>RCS ISOL VLV OPEN</td>
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<tr>
<td>BAS ABS AAS BBS</td>
<td></td>
</tr>
<tr>
<td>RCS VDE ON A</td>
<td></td>
</tr>
<tr>
<td>ARRAY ORD ENA X</td>
<td></td>
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<tr>
<td>(XX)</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2-11 - TUS/TDRS display format.
POST-INSERTION OPS

PCP/CIU ACT C/O

1. CIU PANEL CONFIG

   MS1 R1
   - PL AUX - ON
   - PL PRI MNC tb - ON

   L11a
   - MODE - CLEAR
   - PWR - STBY

   L11b
   - PWR - ON
   - DNLK (three) - TLM
   - PL LK - HDLN 64 KBPS
   - CMD SOURCE - PNL
   - PL SEL - 1
   - VCC-OCTAL ind - CL
   - If VCC OCTAL ind, continue;
     - thermal shutdown may have occurred
   - No other ind lit
   - If MDM ERR GPC it - on, then,
     - CMD GEN CLEAR pb - CLEAR
     - Verify it off and continue
   - If MDM ERR GPC it illuminates again,
     - then continue and notify MCC

2. CIU C/O

   L11
   - CMD SEL tw (two) - 00
   - GEN ENTER pb - ENTER (hold)
   - CMD WORD ind - 888888
   - VCC-OCTAL ind - 88
   - All ind lts on CIU & CIU AUX PNL are on
   - CMD GEN CLEAR pb - CLEAR
   - CMD WORD ind - biane
   - VCC-OCTAL ind - CL

   NOTE
   - If IUS had thermal shutdown
     - VCC-OCTAL will indicate mU
   - All ind lts on CIU & CIU AUX PNL are off

3.1.1 PCP/CIU ACT C/O

Overview: This procedure is used to activate and check out the PCP, CIU, and SSP, and to check the IUS safety status.

1. The PL AUX bus supplies Orbiter power to the PCP and CIU; the PRI PL bus supplies Orbiter power to the IUS/S/C systems.

2. This indicates a nonencrypted command path for non-Department of Defense (DOD) payloads. For DOD flights this switch must be in the SECURE position.

3. For DOD flights the PWR switch on the upper CIU panel is in the OPERATE position to supply power to the encrypter. This is not needed for non-DOD flights. The PWR switch on the Tower CIU panel should be in the ON position to supply power to the CIU circuitry. The IUS is launched in 64 kbps; the CIU must be in 64 kbps to command the IUS and to receive IUS TLM.

4. Prior to launch, this rotary switch was in the T-O UMB(A) position to give the launch team control of the CIU. Placing this switch to PANEL gives the crew control of the CIU.

5. This connects the CIU with IUS string A for hardline command and TLM.

6. CIU indicates the CIU is locked onto the IUS TLM signal. Thermal shutdown powers down the IUS computers, resulting in a loss of TLM lock.

7. Nominally, this light illuminates if Orbiter state vector and attitude data fail a validation test by the CIU. However, a known anomaly exists such that this light may come on with the initial CIU activation. The CLEAR PBI may be used to clear this if it occurs.

8. CIU CMD 00 performs a CIU lamp test to verify all CIU lights are functioning.

9. The CLEAR PBI terminates the lamp test.

10. Loss of IUS TLM will occur if the IUS computers have been powered down.

11. All CIU indicator lights should nominally be off. Any illuminated lights could indicate a faulty CIU.
3 DISPLAY IUS SAFETY STATUS

* If VCC OCTAL (hex) SAFETY STAT *
* cannot be displayed, *
* Go to step 4 *  

WARNING
For any other CMD WORD display, IUS is unsafe (ignore leftmost digit). For unsafe status, XMIT MASTER SAFE CMD and notify MCC

4 ACTIVATE PCP

L10 /cb PNL PWR PRI,ALT (two) - op
/All tbs - bp
cb PNL PWR PRI,ALT (two) - cl

Verify PCP configuration as shown on facing page

CAUTION
Do not use panel mode whose MATRIX STATUS ind is gray when no PCP switch actions are being made. Use other side if possible. If both sides gray, contact MCC

* If NORM BUS PWR PRI,ALT (two) tb - bp, *
* AUTO THERMAL SHUTDOWN has occurred. *
* Continue; /MCC *  

(12) IUS safety status cannot be obtained through the CIU without TLM lock.
(13) CMD 01 determines the status of the IUS ordnance bus, RCS isolation valves, and SRM S&A devices. This command is not sent to the IUS but is entered into the CIU, instructing the CIU to check the necessary IUS TLM data for the safety status.
(14) The MASTER SAFE CMD will command the IUS computers to inhibit the RCS system, terminate all mission sequencing functions, and inhibit software ordnance functions for SRM-1 ignition.
(15) This applies PL AUX bus power to the PCP.
(16) The MATRIX STATUS indicator is nominally gray only during PCP switch activity. If this indicator is gray at any other time it could be because of a faulty PCP switch control matrix.
(17) AUTO THERMAL SHUTDOWN powers down the IUS computers and SCU if an overtemperature is detected. These must be powered back up to resume nominal deploy procedures.
* Perform PNL TEST. If status not correct, perform a second time. If not correct, switch PNL MODE to ALT and repeat test.

** Martian STATUS PRI tb - gray (hold)
** all PRI tb - gray - BP (hold)
** TILT TBL POS PRI tb - gray

** PNL MODE - ALT
** TEST ALT - GRAY (hold)
** all ALT tb - gray - BP (hold)
** MATRIX STATUS ALT tb - gray
** TILT TBL POS ALT tb - gray

** PNL MODE - PRI

* If AUTO THERMAL SHUTDN has occurred then,
* (NORM BUS PWR PRI,ALT (two) tb-bp)

* RECOVERY FROM POWERDOWN
* Verify PLBDs - open

* L10 IUS B FEED PRI(ALT) - OFF
* PRI,ALT (two) tb - bp
* NORM BUS PWR PRI(ALT) - ON
* PRI,ALT (two) tb-bp
* B FEED PRI(ALT) - ON
* PRI,ALT (two) tb-gray

* Record MET / 3:
* L11 /VCC-OCTAL ind - ICL
* COARSE ATTITUDE XFER:
* IUS TLM rate HDLN 64 KBPS
* DAP: AI/AUTO/VERN

* If NO-GO for VERMs, use NORMs

---

(18) This verifies that all PCP talkbacks are functioning properly.
(19) The MATRIX STATUS talkback is gray whenever a PCP switch is active. In this instance the PNL TEST switch is active.
(20) The TILT TBL POS talkback does not respond to the panel test and hence will not go barberpole during the test.
(21) The alternate panel mode is nominally used only for a primary mode failure.
(22) Opening the payload bay doors (PLBD's) will cool the IUS to aid in thermal recovery.
(23) The B FEED is turned off so that the IUS computer A will be in control when power is reapplied to the IUS.
(24) After power is reapplied to the IUS avionics string A, the avionics string B may be brought up.
(25) Internal IUS computer batteries supply power to the computer memories when the avionics power is removed. The mission elapsed time (MET) is recorded here to keep track of remaining computer battery life as well as to log the time power was reapplied to the IUS.
(26) IUS attitude reference is lost when the computers are powered down. Thus new attitude data must be transferred from the GPC's to the IUS.
JSC-18392

(27) Attitude hold is necessary to transfer accurate attitude data to the IUS.

(28) The PL TIMING BUFFER supplies the IUS computers with a clock signal in the event of a powerdown.

(29) This transfers Orbiter attitude and state vector data from the GPC to the CIU.

(30) CMD 10 transfers the attitude in the CIU buffer to the IUS computers.

(31) CMD 21 transfers the state vector in the CIU buffer to the IUS computers.

(32) Once attitude and state vector have been successfully transferred to the IUS, the transfer software is no longer needed. ITEM 1 EXEC turns off the state vector transfer.

(33) This is the nominal TLM configuration.

(34) This ensures that the IUS is in a safe configuration after the powerup.

(35) IUS and ASE batteries and both AFTA's must be kept within temperature limits to function properly.

---

JSC-18392

---
Verify SSP configuration as shown:

JSC-18392

7 SSP C/O

MSI L12U

- cb IUS SW PWR - cl
- cb IUS ANT TB PWR - cl

Verify SSP configuration as shown:

JSC-18392

8 IUS/TDRS SPEC 200 C/O

CRT

- SM 200 IUS/TDRS
- IUS COMP STAT A B
- IN CNTL
- IUS SAFETY UP SEL - (*)
- RF PWR - (-7.3)
- MSN PHASE - 3
- TDRS S/C BUS VOLTS - 26.8 to 28.8
- VAMPS - 7.0 to 16.0

* All other parameters should be * blank. If not, notify MCC *

9 DISABLE IUS AUTO SHUTDOWN

L10 Verify PLBDs - open
- IUS AUTO SHUTDN PRI(ALT) - OFF
- PRI,ALT (two) tb - bp

10 IUS RF ANTENNA ENABLE

L12 IUS RF ANT E/D - ENA
- ENA tb - gray
- DSBL tb - bp

3-12

(36) This allows the IUS antennas to be enabled or disabled as necessary.
(37) The SSP is configured such that the actuator ordnance is safe and the IUS antennas are disabled.
(38) Computer A is nominally in control of the IUS.
(39) This field will be negative when the IUS antennas are disabled. Only the upper IUS antenna should be selected to prevent radio frequency (RF) irradiation of the payload bay.
(40) MSN PHASE 3 indicates the postlaunch/predeploy phase.
(41) This would indicate an anomalous or possibly hazardous condition.
(42) With IUS TLM available, it is no longer necessary to have the IUS automatically power down.
(43) With the IUS RF ANT E/D switch in ENA, IUS transmitter output is routed to the IUS antenna. With the switch in DSBL, the IUS transmitter output is routed to a dummy load. This switch should be placed in DSBL if the IUS lower omni antenna is selected to prevent RF irradiation of the payload bay (PLB).
3.2.1  IUS C/O (EARLY)

Overview: This procedure is used to check out the IUS subsystems and the ability of the ground to command the IUS.

(1) This is because of TORS thermal constraints.

(2) PLB lighting and video tape recorder (VTR) are set up to record the IUS SRM nozzle gimbal check during the predeploy checkout.

(3) Only the upper omni antenna should be selected to prevent RF irradiation of the PLB.

(4) 64 kbps allows the ground to monitor the IUS during its checkout over the Hawaii Tracking Station, Kaene Point (HTS) ground site.
2 TRANSFER TO INTERNAL PWR

At MCC go:

- \( \sqrt{\text{ASE BATT PRI,ALT (two) tb - gray}} \quad 5 \)
- \( \sqrt{\text{IUS CONV PWR PRI(ALT) - OFF (mom)}} \)
- \( \sqrt{\text{PRI,ALT (two) tb - bp}} \)
- \( \sqrt{\text{IUS BUS A BATT PRI(ALT) - STAGE I ON (mom)}} \)
- \( \sqrt{\text{PRI,ALT (two) tb - gray}} \)

Record MET:__ / :__ : ______ 6

- \( \sqrt{\text{IUS A FEED PRI,ALT (two) tb - bp}} \)
- \( \sqrt{\text{BUS B BATT PRI(ALT) - STAGE I ON (mom)}} \)
- \( \sqrt{\text{PRI,ALT (two) tb - gray}} \)
- \( \sqrt{\text{B FEED PRI,ALT (two) tb - bp}} \)

(60 sec) 7

3 PREDEPLOYMENT CHECK

- \( \sqrt{\text{MS2 R11 VTR pb = - PLAY, RCD (simo)}} \)
- \( \sqrt{\text{STBY = RUN}} \)

MS1 L11 Send CIU CMD 35, OM729

\( \sqrt{\text{CMD WORD ind - __13 within 5 sec}} \)

- If not __13 within 5 sec, *
- If same results, *
- Go to PL SYS, PL MAL, 1.31 *

\( \sqrt{\text{CMD WORD ind - ___00 Comp A & B \ OK < 1:40 sec}} \)

- Other indications *
- XX *
- 0 Both comp OK *
- 1 Comp A failed *
- 2 Comp B failed *
- 3 Both comp failed *
- 1 Test in progress *
- 0 Test complete *

Record CMD WORD ind __ __ __ __ __ __ __ __ 8
CAUTION
Do not send any CIU CMDs for at least 60 sec after check complete

MS1 CRT
✓ IUS COMP STAT A B
  IN CNTL *
  A FAILED (blank)
  B FAILED (blank)
✓ IUS SAFETY RF PWR - 25.0 ± 5.0

* If one or both computers *
  * failed, contact MCC *

MS2 RII
VTR pb - STOP
Perform VTR, TV deact, TV/VTR (Cue Card)

A7
PL BAY FLOODS - OFF

4 TRANSFER TO ORBITER PWR

MS1 L10
IUS CONV PWR PRI(ALT) - ON (mom)
✓ PRI,ALT (two) tb - gray

IUS A FEED PRI(ALT) - ON (mom)
✓ PRI,ALT (two) tb - gray
  BUS A BATT PRI(ALT) - STAGE I&II OFF (mom)
  ✓ PRI,ALT (two) tb - bp

B FEED PRI(ALT) - ON (mom)
✓ PRI,ALT (two) tb - gray
  BUS B BATT PRI(ALT) - STAGE I&II OFF (mom)
  ✓ PRI,ALT (two) tb - bp

Record MET / : : | :

//MCC checkout complete

************************************************************************
 HTS LOS
************************************************************************
************************************************************************
 VTS AOS
************************************************************************
************************************************************************
 GDS AOS
************************************************************************

(9) If the checkout was nominal it will take about 1 minute to reconfigure control of all systems to computer A.

(10) PLB floods and VTR are not needed until later.

(11) This routes regulated Orbiter power to the IUS.

(12) IUS batteries are turned off to conserve their useful life once Orbiter power is applied to the IUS avionics buses.

(13) The MET is recorded to keep track of remaining IUS battery life.
JSC-18392

5 IUS (DIRECT) ___________________________________________________________ 14

MSL L10

CMD PATH ENA - RF (/MCC)

AFSCF sends cmds:
IUS RF to coho
1.7 MHz off
64 + 16 KBPS
MCC reports AFSCF cmdg complete

* If no ground call received by VTS LOS, then:
* * If IUS in 16 KBPS, assume AFSCF commanding complete,
* * Go to Step 6
* * If IUS in 64 KBPS,
* * CMD PATH ENA - HOLN.
* * Perform XFER 64 + 16,
* * REF DATA
* * Leave IUS transmitter on.
* * Go to step 1, TDRS (PI) SETUP
* * RF LINK CHECKS (EARLY)
* * _____________________________ 15

6 IUS (PI) LOCK

L11 IUS TLM rate 16 KBPS ____________________________________________________ 17

PSP/POI SETUP:

CRT
ISM 62 PCOMM/PL COMM
170 RESET PSP 1 - ITEM 6 EXEC (*)

Verify configuration of POI

PDI DECOM 'INPUT FMT
✓ 1 2 16
✓ 2 5 15
✓ 3 5 16
✓ 4 0
✓ 5-FPM 1 16

(14) The IUS direct check is performed by the Air Force Satellite Control Facility (AFSCF) over the Vandenberg Tracking Station (VTS) site.

(15) Taking the RF to coherent mode allows the ground to obtain range rate data from the IUS. The 1.7 MHz subcarrier contains IUS environmental data and is turned off. The TLM rate is taken back to 16 kbps in preparation for the upcoming IUS payload interrogator (PI) check.

(16) The remaining IUS RF checks are performed if there is enough time before loss of signal (LOS). Otherwise, the PI is set up for the TDRS checks. The IUS PI check will be performed during the late RF check if necessary.

(17) 16 kbps is the only RF TLM rate available for IUS/PI link.

(18) This is the nominal payload data interleaver (PDI) setup for IUS/TDRS ops on 51-E.
(19) Channel 906 is used to communicate with the IUS.
(20) This is the nominal PI setup for IUS/PI lock. The various PI switch settings do not take effect until the S-BD PL CNTL is taken to PNL.
(21) This indicates that the PI is receiving the IUS transmitter signal.
(22) This indicates that the IUS receiver is locked onto the PI signal.
(23) This will tune the PI command signal to the proper IUS receiver frequency.
(24) CMD 34 turns the IUS transmitter and power amplifier off. This also verifies the ability of the crew to command the IUS through the PI.
(25) Once the IUS/PI link checkout is complete and the PL link is back in HOLN, the PI is turned off as it is no longer needed.

MS1 CRT IUS SAFETY RF PWR - (-7.3)
L10 CMD PATH ENA - HDLN
L11 PL LK - HDLN 16 KBPS

Advise MCC IUS PI check complete
and DNLK is off

At MCC GO or LOS:

ALL S-BD PL CNTL - CMD
PWR SEL - PSP
CNTL-PNL, then CMD

***************** GDS LOS *****************

***************** VTS AOS *****************
3.2.2 RF LINK CHECKS (EARLY)

Overview: These checks verify the ability of the ground to command the TDRS payload.

(1) This is the nominal PDI setup for IUS/TDRS ops on 51-E. When Mission Control Center (MCC) transmits the payload signal processor (PSP) CMD load, it configures the PSP for TDRS command.

(2) 089 is the channel used by the PI to communicate with the TDRS.

(3) This is the nominal PI setup for TDRS/PI lock.

(4) This causes the above PI switch settings to take effect.

(5) This tunes the PI frequency to the TDRS receivers to allow communication between the two.

(6) Turning the modulation on places command data on the PI transmitted output allowing command of TDRS.
NOTE
Up to 32 sec may be required for an indication of CMD LOCK. TDRS/PI Ops require at least one SIG PRES and one CMD LOCK indication.

2 TDRS (PI) LINK C/O

CRT TDRS RCVR SIG PRES A (*), B (*)

TDRS LOCK A (*), B (*)

Advise MCC of TDRS lock status.

NOTE
MCC sends test cmd (2 min)

At MCC GO:

MSI ALL S-BD PL CNTL - CMD

MCC cmds PI

* If LOS, and PI not turned off by MCC then:
* S-BD PL CNTL - CMD
* PWR SEL - PSP
* CNTL - PNL, then CMD

*************** ACN AOS ***************

NOTE
During TDRS (DIRECT) Check, A/G COMM is UHF SPLX. Crew xmit will inhibit UHF RCV

3 TDRS (DIRECT)

NOTE
WSGT sends test cmd (2 min)

*************** ACN LOS ***************
ACTUATOR ENGAGEMENT

1 PRI(ALT) ACT ENGAGE

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>MID lights may be on no longer than 15 min</td>
</tr>
</tbody>
</table>

**MS2 A7**
- PL BAY FLOOD MID,AFT (four) - ON
- FWD BHD - ON
- Perform TV, VTR activation, TV/VTR (Cue Card)
- VTR RCD - C
- MON 2 - C (PRI ACT)

**R11**
- VTR pb - PLAY, RCD (sim)
- STBY - RUN

**MS1 L10**
- TILT TBL DR ENA PRI(ALT) - INTERM
- TILT TBL MOTION PRI(ALT) - RAISE (mom)
- (hold until MOTION PRI(ALT) tb - gray, start watch)

* If MOTION tb stays bp, *
* Go to PL SYS, PL MAL, 1.3a *

* TILT TBL POS PRI(ALT) tb - bp *

When
- TILT TBL PRI DR ENAGED tb - gray (Approx 1:40 sec, record time ), then
- TILT TBL MOTION PRI(ALT) tb - bp

* If PRI DR ENAGED tb still bp *
* after 3:20 sec, TILT TBL *
* DR ENA - OFF, then *
* Go to PL SYS, PL MAL, 1.3b *

**MS2 R11**
- VTR pb - STOP
- Perform VTR, TV deact, TV/VTR (Cue Card)

**A7**
- PL BAY FLOODS - OFF

3.2.3 ACTUATOR ENGAGEMENT

Overview: This procedure is used to engage the AFTA to the tilt table slip ring. The actuator was disengaged to prevent possible damage from launch loads.

1 (1) This is because of TDRS thermal constraints.
2 (2) Lighting and VTR are configured to record the engagement of the actuator to the slip ring.
3 (3) The actuator drive motor is unlocked.
4 (4) This could indicate a broken actuator or a problem with the MOTION talkback.
5 (5) This indicates that the actuator has moved from the -13° 65 position.
6 (6) Maximum drive time to actuator engagement is 3:20.
7 (7) Taking the TILT TBL DR ENA to OFF locks up the actuator drive motor.
late checks

IUS C/O (LATE)

1 PRECHECKS

**MS2 A7**
- VTR RCD - B or C
- MON 1 - C (IUS SRM nozzle)
- MON 2 - B (IUS SRM nozzle)

**MS1 L12**
- IUS RF ANT ENA tb - gray
- VDSL tb - bp

**CRT**
- IUS SAFETY - ANT STAT
  - MG SEL - blank
  - LWR SEL - blank
  - UP SEL - (*)
  - RF PWR - {-7.3}

**L10**
- CMD PATH ENA - HDSL
- IUS TLM RATE HOLN 64 KBPS

******************************* HAW AOS *******************************

2 TRANSFER TO INTERNAL PWR

At MCC GO:

**L10**
- ASE BATT PRI,ALT (two) tb - gray
- IUS CONV PWR PRI(ALT) - OFF (mom)
  - PRI,ALT (two) tb - bp

- IUS BUS A BATT PRI(ALT) - STAGE I ON
  - PRI,ALT (two) tb - gray

- Record MET __/___:___:___

- IUS A FEED PRI,ALT (two) tb - gray
  - (after 40 sec)

- BUS B BATT PRI(ALT) - STAGE I ON
  - PRI,ALT (two) tb - gray
  - B FEED PRI,ALT (two) tb - gray
    - (after 40 sec)

3.3.1 IUS C/O (LATE)

Overview: The IUS is given a final health check before deployment.

1. The VTR is set up to record the IUS SRM nozzle gimbal check during the predeploy checkout.

2. Only the upper omni antenna should be selected to prevent RF irradiation of the PLB.

3. 64 kbps is used over ground sites for IUS TLM.

4. ASE batteries provide power to the IUS while switching from Orbiter to IUS internal battery power. The ASE batteries also provide backup power in the event of IUS battery failure.

5. When the IUS internal batteries are first turned on, the MET is recorded to keep track of battery lifetime.

6. The SRM gimbal check during the predeploy checkout cannot be done on external power.
3 PREDEPLOYMENT CHECK

| MS2 R11 | VTR pb - PLAY, RCD (simO)                  |
|         | /STBY - RUN                                |
| MS1 L11 | Send CIU CMD 35, [OH720]                   |
|         | /CMD WORD ind - 1-13 (within 5 sec)        |
|         | * if not 1-13 within 5 sec, *             |
|         | * resend cmd. if same results, *          |
|         | * Go to PL SYS, PL MAL, 1.37 *            |
|         | /CMD WORD ind - 000 Comp A & B            |
|         | OK < 1:40 sec                             |
|         | * other indications                      |
|         | *                                        |
|         | * 0 Both comp OK                         |
|         | * 1 Comp A failed                        |
|         | * 2 Comp B failed                        |
|         | * 3 Both comp failed                     |
|         | * 1 Test in progress                     |
|         | * 0 Test complete                        |

CAUTION

Do not send any CIU CMD for at least 60 sec after check complete

CRT

/IUS COMP STAT A 8
IN CNTL *
/A FAILED (blank)
/B FAILED (blank)
/IUS SAFETY RF PWR - 25.0 ± 5.0

* If one or both computers *
* failed, contact MCC *

(7) CMD 35 initiates the IUS predeploy checkout which activates the IUS power amplifier and transmitter, performs SRM gimbal checks to assure operation of the TVC, and tests the SCU relay drivers.

(8) If the checkout was nominal, it will take about 1 minute to reconfigure control of all systems to computer A.
PLB floods and VTR are not needed until later.

This routes regulated Orbiter power to the IUS.

IUS batteries are turned off to conserve their useful life once Orbiter power is applied to the IUS avionics buses.

The MET is recorded to keep track of remaining IUS battery life.
3.3.2 MNVR TO TORS CHECK ATTITUDE

Overview: This attitude will point the TORS S/C directly at the ground site for the upcoming RF checks at Hawaii, Kauai, Tracking Station (HAW).

(1) DAP A8 is the nominal digital autopilot (DAP) for the IUS deploy; it keeps Orbiter attitude rates low. DAP B1 is used to maneuver to subsequent attitudes.

(2) Several IUS deploy steps are time tagged.

(3) Low Z is used to reduce plume impingement on the TORS S/C when it is elevated.
3.3.3 **TILT TABLE ELEVATION TO 29°**

Overview: The IUS/TDRS is elevated to 29° to perform the final RF downlink checks.

1. The VTR is set up to record the IUS elevation to 29°.
2. Raising the tilt table in primary RCS (PRCS) could result in structural damage to the table.
3. This releases the locks on the actuator drive motor.
4. This applies power to the PRLA's so that the IUS may be released from the forward ASE.
5. Power is removed to prevent inadvertent PRLA closing and to reduce Orbiter electrical loads.
6. When the PRLA's have opened, the IUS is pushed up by a keel spring to overcome any static friction that may have existed between the IUS and forward ASE.

---

**NOTE**

IUS pushed up by keel pin springs when PRLAs opened. Normally sufficient to open keel pin switches.
RAISE TO 29°

MS2 W9
When tilting starts,
16mm Camr - on

R11 VTR pb - PLAY, RCD (simo)
STBY - RUN

MS1 L10
TILT TBL MOTION PRI(ALT) - RAISE
(start watch)
* If POS ALT(PRI) tb - gray, hold *
* motion sw until POS ALT(PRI) *
* tb - bp *
* *
* If MOTION PRI(ALT) tb - bp, hold *
* motion sw 5 sec max *

At 29°, (~3:45)
* If MOTION PRI(ALT) tb - bp *
* before POS tb - gray and no *
* payload motion is observed,*
* Go to PL SYS, PL MAL, 1.3c *

\[ √ \] TILT TBL POS PRI(ALT) tb - gray
(Record Time __ / __ :__ :__)

\[ √ \] TILT TBL MOTION PRI(ALT) tb - bp
DR ENA PRI(ALT) - OFF

MS2 CCTV
Visually inspect raised assembly

R11 VTR pb - STOP
16mm Camr - off

A7 PL BAY FLOOD MID,AFT (four) - ON
FWD BHD - ON

CAUTION
At 29° if VERN failure,
use NORMs (LOW Z)

(7) The IUS/TDRS is elevated to the 29° position to allow the TDRS transmitter to be used for the final RF checks.

(8) These talkbacks indicate whether or not the IUS has begun elevation to 29°.

(9) This could result from a jammed tilt table, bad AFTA, or inadequate electrical drive.

(10) This locks the actuator drive motor to hold the IUS at 29°.

(11) Low Z reduces PRCS plume contamination of the elevated IUS/TDRS.
3.3.4 TRANSFER SV

Overview: An updated state vector is needed by the IUS navigation system to propagate the transfer trajectory to GEO.

(1) This transfers Orbiter attitude and state vector data from the GPC to the CIU.

(2) The MDM ERR GPC light will illuminate if the Orbiter state vector fails a data validation test by the CIU. If this occurs, it is necessary to resend the state vector from GPC to CIU.

(3) CMD 21 transfers the state vector from the CIU buffer to the IUS computers. 64 kbps is required to view the NIS BIT feedback on the CIU.

(4) This field will display an * if the transfer was successful.

(5) An accurate state vector is needed onboard the IUS for proper transfer trajectory computation.

(6) After a successful state vector transfer to the IUS, the state vector transfer from GPC to CIU is disabled.
3.3.5 RF CHECKS (LATE) PART I

Overview: The TDRS transmitter is turned on by ground control via the Orbiter PI.

(1) 089 is the channel used by the PI to communicate with the TDRS.
(2) This is the nominal PI setup for TDRS/PI lock.
(3) This causes the above PI switch settings to take effect.
(4) This tunes the PI frequency to the TDRS receivers to allow communication between the two.
(5) This indicates the TDRS receiver is locked onto the PI signal.
(6) At least one TDRS receiver must be locked onto the PI signal to permit commanding.
(7) The ground will command the TDRS via the Orbiter over the Indian Ocean tracking station (IOS) ground site.
(8) The ground commands the TORS transmitter on and enables the coherent mode for the upcoming direct check.

1 TORS (PI) SETUP

MSI

7 AN 7 POLAR - R CIRC
/ XMT PWR - MED
/ CH SEL INTRG 1,2 tw (six)-089,089
/ MOD - OFF
/ PWR SYS - 1
/ SEL - BOTH
/ PSP CMD OUTPUT - INTRG

S-BD PL CNTL - CMD

CRT

7 AN 7 POLAR - R CIRC
/ XMT PWR - MED
/ CH SEL INTRG 1,2 tw (six)-089,089
/ MOD - OFF
/ PWR SYS - 1
/ SEL - BOTH
/ PSP CMD OUTPUT - INTRG

S-BD PL CNTL - CMD

CRT

/* TORS RCVR SIG PRES A (*), B (*)
* IF TORS RCVR SIG PRES A (blank) or *
* B (blank), then PI FREQ SWEEP - ON *
* for up to 90 sec until both TORS *
* RCVR SIG PRES, then release *

NOTE
Up to 32 sec may be reqd for an indication of CMD LOCK. TDRS/PI Ops require at least one SIG PRES and one CMD LOCK indication.

2 TORS (PI) LINK C/O

/* TORS RCVR SIG PRES A (*), B (*)
/* CMD LOCK A (*), B (*)

Advertise MCC of TORS lock status

NOTE
MCC sends TORS PA - ON and coho drive - ENA kms.

CRT

/* TORS XMIT on A (*) *
/* SIGNAL STRENGTH change
Expect SM ALERT (200 TORS XMIT)

A1

/ MCC GO or LOS:
/ S-BD PL CNTL - CMD
/ MCC cnms PI

NOTE

******************************************************************************* IOS AOS *******************************************************************************

******************************************************************************* IOS LOS *******************************************************************************
3.3.6 REM HEATER ACTIVATION

Overview: The REM heaters are activated prior to deploy to keep the IUS RCS valves and catalyst bed warm.

(1) HDLN is the preferred command path.

(2) CMD 22 turns on the REM heaters. A CMD WORD feedback of 3 indicates the heaters on both avionics strings have been activated.

(3) The MET is recorded to keep track of how long the heaters have been on in the event of a delayed deployment. If both avionics string heaters are active, they must be cycled off and on to prevent overheating IUS equipment.
RF CHECKS (LATE) PART II

Overview: The ability of the TDRS to transmit to the ground is verified. Afterwards the PI is locked onto the IUS to allow for postdeploy TLM and commanding.

(1) The direct check must be done over a ground site.
(2) The S-band antennas at HAW are used for the TDRS direct check.
(3) The S-band antennas at Santiago Tracking Station (AGO) are used as an alternate site for the TDRS direct check. AGO has no UHF station.
(4) If there is no go for deploy by HAW LOS, the deploy will be waved off.

**NOTE:**

During TDRS (DIRECT) Check, A/G COMM is UHF SPLX. Crew xmit will inhibit RCV.

NOTE: WGST sends test cmd (2 min)

MCC updates Deploy Pad & Sep Burn Pad
MCC gives TDRS Direct Check status

* IF HAW TDRS Direct Check not success-
* ful or if no comm at HAW, then mnvr
* per TORS DIRECT CHECK ATTITUDE (pad)
* to 90 AGO attitude and repeat TORS
* Direct Check. (The earliest deploy
* will be 9D.) There can be no uplink
* voice at AGO until TDRS Direct Check
* is completed. The attitude at AGO is
* sun protected. If not successful a
* AGO, then, mnvr to the 9D GWM
* attitude per the TORS DIRECT CHECK
* ATTITUDE (pad)
* *
* MNVR OPTION:
* R
* P
* Y
* *
* DAP: AB/AUTO/VERN
* Initiate MNVR

MCC gives GO for DEPLOY

***************HAW LOS***************
2 IUS (PI) LOCK

MSI L11

IUS TLM rate HDLN 16 KBPS

PI SETUP:

AIL

S-BD PL CNTL - CMD
ANT POLAR - R CIRC
XMTR PWR - MED
CH SEL INTRG 1,2 tw (six)-906,906
MOD - ON
PWR SYS - 1
SEL - BOTH
PS P CMD OUTPUT - INTRG
CNTL - PNL

ALU

SIG STRENGTH sel - S-BD PL
S/S > 1.43 volts

CRT

PL INTRG PHASE LOCK - YES
SM 200 IUS/TDRS
IUS RCVR CMD LOCK (*)

NOTE
Crew may receive ERR MSG - 'S62
PDI DECOM FAIL' as result of this
switch action. Ignore message

CRT

Crew advises MCC of IUS/PI lock status
IUS RCVR cmd lock (*)

(5) IUS TLM rate should be 16 kbps in preparation for switching to the RF mode.
(6) 906 is the channel used by the PI to communicate with the IUS.
(7) This is the nominal PI setup for IUS/PI lock.
(8) This causes the above PI switch settings to take effect.
(9) This indicates that the PI is receiving the IUS transmitter signal.
(10) This indicates that the IUS receiver is locked onto the PI signal.
(11) This tunes the PI frequency to ensure IUS command lock.
(12) The IUS link is taken to RF to allow commanding and TLM through the PI
     after the umbilicals have been released.
3.4.1 MNVR TO DEPLOY ATTITUDE

Overview: This procedure points the Orbiter in the proper attitude for IUS deploy.

1. The Orbiter is set up to track the Sun with its belly to keep the IUS/TDRS shaded.

2. DAP A8 is the nominal DAP configuration for IUS deploy; it keeps Orbiter attitude rates low for the deploy.

3. Low Z reduces PRCS contamination of the elevated IUS/TDRS.

4. This prevents inadvertent maneuvering by removing power from the rotation hand controller (RHC) and translation hand controller (THC).
DEPLOY COUNTDOWN

Overview: The final steps prior to IUS deploy are performed.

1. The IUS transmitter/receiver must be locked onto the PI to allow commanding following umbilical release and to obtain IUS TLM.
2. This transfers attitude and state vector data from the GPC to the CIU.
3. The MDM ERR light will illuminate if the Orbiter state vector fails a data validation test by the CIU.
4. This allows RF commanding of the IUS through the CIU/PI.
**CAUTION**

*MC of other indications.
Do not deploy IUS until it is determined a healthy avionics string exists*

1. **ENABLE RNDZ NAV**
2. **RNDZ NAV ENA - ITEM 1 EXEC (*)**
3. **CDR Move to MS station**
4. **XFER IUS TO INT PWR**
5. **ASE BATT PRI,ALT (two) tb - gray**
6. **IUS BUS A BATT PRI(ALT)-STAGE I ON (mom)**
7. **IUS A FEED PRI,ALT (two) tb - bp (after 40 sec)**
8. **BUS B BATT PRI(ALT)-STAGE I ON (mom)**
9. **BUS B FEED PRI,ALT (two) tb - gray (after 40 sec)**
10. **XFER TDRS TO IUS PWR**
11. **IUS S/C BATT PRI(ALT)- STAGE I ON (mom)**
12. **S/C PWR PRI,ALT (two) - bp (after 40 sec)**

---

(5) Without at least one healthy avionics string the IUS will not function properly.

(6) This enables rendezvous navigation software for use in pointing the PI at the IUS postdeploy.

(7) The commander (CDR) moves to assist the mission specialist (MS) in the deploy and to take evasive maneuvers if necessary.

(8) ASE batteries provide the IUS with power during the switching between Orbiter power and IUS batteries.

(9) When the IUS batteries are first brought on line the MET is recorded to keep track of remaining battery life.

(10) The IUS must be on internal power prior to umbilical release.

(11) The TDRS is transferred to IUS S/C batteries prior to umbilical release.

(12) The MET is recorded to keep track of remaining IUS S/C battery life.
VERIFICATION

**Verifier:**

**Action:**

- Verify TDRS battery off (TDRS BATT ON 1, 2, 3 (blank))
  - If SPEC 200 shows
  - TORS BATT ON 1 (+) or 2 (+)
  - or 3 (+), then MCC.
  - Continue with deployment

**Deadface Umbilicals**

**MSI L10**

- IUS HTRS BATT PRI(ALT) - OFF (mom)
  - PRI,ALT (two) tb - bp
- PWR PRI(ALT) - OFF (mom)
  - PRI,ALT (two) tb - bp
- S/C REG PWR PRI(ALT) - OFF(GSE) (mom)
  - PRI,ALT (two) tb - bp

### CAUTION

Prior to umbilical rel.,
- For change in IUS COMP STAT since given GO for DEPLOY
- IUS RCVR CMD LOCK (*)
- TORS XMIT ON A (*) or B (*)

**L10**

- IUS BUS A,B BATT PRI,ALT (four) tb - gray
- IUS S/C BATT PRI,ALT (two) tb - gray
- CMD PATH ENA - RF

**L12**

- IUS RF ANT ENA tb - gray

If change in IUS COMP STATUS and/or above indications cannot be confirmed, refer to 'IUS GO/NO GO CHART'

**Cue Card**

- cb IUS SW PWR - op
- cb IUS ANT TB PWR - op

---

13. The TDRS batteries should remain off to preserve their power for IUS separation at GEO.
14. All IUS/TORS systems still powered by the Orbiter/ASE are powered down to prevent electrical arcing or power spikes when the umbilicals are released.
15. The IUS RF ANT E/O must be ENA prior to umbilical release or there will be no IUS RF commanding or TLM available after umbilical release.
16. Prior to umbilical release, the IUS/TORS must be on internal power, the IUS locked onto the PI signal, and the TORS transmitter turned on.
17. This prevents the IUS antennas from being disabled prior to umbilical release.
7 RELEASE UMBILICALS

MS1 L10 UMB ENA PRI(ALT) - ENA
  /PRI,ALT (two) tb - gray
  REL PRI(ALT) - REL
  /PRI,ALT (two) tb - gray
  IUS BATTs PRI, ALT (six) tbs - bp

NOTE
Crew should receive SM ALERT - 'S62, PDI DECOM FAIL', as a result of loss of TDRS HDLN data. Ignore msg.

WARNING
If Cable Tray does not release, or UMB REL tb still bp, complete step 7. Then repeat step 7 in ALT. Regardless of Cable Tray release and UMB plug release status, attempt to raise to 59°.

18 All HDLN commanding and TLM are lost once the umbilicals are released.

19 The umbilical tray will mechanically release as the IUS is rotated through 35°.

20 This reduces the electrical load on the ASE batteries.

21 IUS batteries are used for tilt table elevation/lowering and must be kept within operating temperatures.

22 The postdeploy separation burn data is loaded into the GPCs to reduce the number of critical crew activities surrounding the deploy timeframe.

L10 UMB ENA PRI(ALT) - OFF (mom)
  /PRI,ALT (two) tb - bp
  IUS CONV PWR PRI (ALT) - ON
  /PRI,ALT (two) tb - gray
  HTRS BATT PRI(ALT) - ON (mom)
  /PRI,ALT (two) tb - gray

8 OMS SEP BURN PREP

PLT CRT GNC, OPS 202 PRO
  GNC ORBIT MNVR EXEC
  Load SEP BURN TGT DATA per Burn Pad LOAD - ITEM 22 EXEC
  /Soluton per burn pad
  Do not mnvr
  GNC, OPS 201 PRO
  GNC UNIV PTD

3-68

3-69
RAISE TO 59°

16mm Camr - Install ASA 100 (DAYLIGHT) film mag and orange filter
When tilting starts, 16mm Camr - on
Take 70mm photos during tilting

A7
MON 1 - D (above PAM SS)
MON 2 - C (STBD tilt indicator)
VTR RCD - C

NOTE
Alternate between Camr C & D to record elevation

CAUTION
If VERN failure, raise tilt table in free drift

MS1 L10
TILT TBL DR ENA PRI(ALT) - MAX
TILT TBL MOTION PRI(ALT) - RAISE (hold until MOTION PRI(ALT) tb - gray, start watch)
√TILT TBL POS PRI(ALT) tb - bp
At 59° (~3:30),
√TILT TBL POS PRI(ALT) tb - gray
(Record MET __/____:____:____)
* If MOTION PRI(ALT) tb - bp *
* before POS tb - gray and no *
* payload motion is observed, *
* Go to PL SYS, PL MAL, 1.3c *
√TILT TBL MOTION PRI(ALT) tb - bp
DR ENA PRI(ALT) - OFF

CDR
Verify from CCTV IUS at 59°

(23) CCTV and VTR are set up to view IUS elevation to 59°.
(24) Raising the tilt table in PRCS could result in structural damage to the aft ASE.
(25) This releases the locks on the tilt table actuator drive motor.
(26) The IUS is elevated to 59° in preparation for deploy.
(27) These talkbacks indicate IUS position and motion.
(28) This could result from a jammed tilt table, bad AFTA, or inadequate electrical drive.
(29) This applies the locks to the tilt table actuator drive motor.
MS2 R11
VTR pb - STOP
16mm Camr - off
Install ASA 320 film mag and remove orange filter

A7
MON 1 - B (IUS/TDRS)
MON 2 - C (tilt table/IUS sep plane)
VTR RCD - C

CAUTION
If IUS elevation < 45°, DO NOT DEPLOY. Go to PL SYS, PL MAL, 1.3f

CAUTION
If VERN failure, use NORMs (LOW Z)

MS2 R11
VTR pb - PLAY, RCD (simo)
STBY - RUN
Record Camr C until SRM nozzle clears
ASE, then alternate recording between Camr B & O

CDR A6
ADI ATT - REF
ATT REF pb - PUSH
ADI - 0,0,0
SENSE - (-X)
FLT CNTLR PWR - OFF

CDR A6
IGNC 33 REL NAV
ORB TO TGT - ITEM 10 EXEC
NAV GNG, R, Y, Y approx 0

CDR A6
/DAP TRANS: NORM/NORM/NORM,LOW Z
/DAP ROT: PULSE/PULSE/PULSE
DAP: A8/MAN/NORM

MS2 16mm Camr - on

(30) Minimum deploy angle is 40°.
(31) Low Z reduces PRCS contamination of the IUS/TDRS.
(32) The aft attitude director indicator is configured for the separation maneuver following the deploy.
(33) The Orbiter state vector is transferred to the IUS slot in REL NAV prior to deploy to provide an accurate target state vector for GPC processing. This will allow the universal pointing software to point the PI at the IUS postdeploy.
(34) The IUS is deployed in free drift.
(35) Power is applied to the aft THC and RHC for postdeploy separation maneuvers.
3.4.3 DEPLOY IUS/TDRS

Overview: The IUS is deployed from the Orbiter PLB.

1. This reduces by one the number of pyro inhibits.

2. This enables the super-zip firing mechanism.

3. The deploy window closes 2 minutes past the nominal deploy time.

4. This fires the super-zip to release the IUS from the aft ASE.

5. Alternate panel power provides a backup means to deploy the IUS.

6. The pyro bus is powered off to preserve ASE batteries for tilt table towering.

- CAUTION: Do not DEPLOY any later than nominal time +2 min

Record MET / : : (actual deploy time)

Visually verify deployment

* If failure to deploy after 2nd *
* attempt with PCP in PRI MODE, *
* continue procedure through *
* PYRO BUS - OFF, then PNL *
* MODE - ALT and repeat DEPLOY *
* IUS/TDRS procedure (* * *)
* If SM ALERT '62 PDI DECOM FAIL' * * msg received at deploy, verify * * IUS/PI link by SPEC 62 and CIU * * display * * * If no lock after 30 seconds, then * * PI FREQ SWEEP - ON for up to 35 * * sec until PHASE LOCK ind and PL * * SIG S/S > 1.43, then release * * THX -X (in), 8 sec (2.2 FPS) * monitor pitch -1°/sec

When P = 70° on REF BALL then, * DAP ROT: DISC/DISC/DISC **__________________________ 8
FLT CNTLR PWR - OFF

MS2
16mm Camr - off

When IUS deploy recording complete,
VTR pb - STOP
Insert new VTR Cassette
Reset VTR Counter

+C0:00 2 CYCLIC XFER SV TO IUS

CDR
SM 200 IUS/TORS

* MS2 SAFETY MSN PHASE 5

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>If not in MSN PHASE 5, do not send CIU CMD 36</td>
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<table>
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<tr>
<th>NOTE</th>
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<tbody>
<tr>
<td>Any CIU, ENTER, SEND, CLEAR pb operation will terminate SV XFER. Reinitiate with CIU CMD 36</td>
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</tbody>
</table>

| +03:00 |
| Possible SM ALERT (200 IUS ANT) - |
| Ignore msg |

(7) There could be a loss of lock between the PI and IUS at deploy due to IUS antenna blockage.
(8) This maintains Orbiter attitude to allow the crew to visually track the IUS through the overhead windows.
(9) MSN PHASE 5 indicates postdeploy.
(10) CMD 36 initiates the cyclic (once/minute) transfer of Orbiter state vector to the IUS. This allows the IUS to point the correct antenna at the Orbiter for comm.
(11) This message may occur when the IUS selects its lower antenna for transmission.
3.5.1 LOWER TILT TABLE TO -6°

Overview: After IUS deploy, the tilt table is lowered to the -6° position and locked to prevent possible ASE damage during entry.

(1) VTR and PLB cameras are configured to view the tilt table lowering.
(2) This releases the locks on the actuator drive motor.
(3) The crew watches the tilt table lowering for any anomalies.
(4) These talkbacks indicate tilt table position and motion.
(5) This could result from a jammed tilt table, bad AFTA, or inadequate electrical drive.
(6) Tilt table drive is disabled to reduce ASE electrical loads.

NOTE
Alternate recording Camrs B & C to cover tilt table stow

VTR pb - PLAY, RCD (simo) /STBY - RUN

TILT TBL DR ENA PRI(ALT) - MAX
TILT TBL MOTION PRI(ALT) - LOWER (hold until MOTION PRI tb-gray, start watch)
TILT TBL POS PRI,ALT (two) tb - bp

At -6° (-8:25, 16:50 max),
TILT TBL POS PRI,ALT (two) tb - gray

* If both POS tb are bp
* when motion stops,
* Go to PL SYS, PL MAL, 1.3d *

(Record MET _____/_____ : ____)

CCTV Verify tilt table at -6°
TILT TBL DR ENA PRI(ALT) - OFF

VTR pb - STOP

JSC-18392

3-80
POSTDEPLOY SEPARATION MNVR

1 OMS BURN PREP
   GNC UNIV PTG

2 POSTDEPLOY SEPARATION MNVR

3.5.2 POSTDEPLOY SEPARATION MNVR

Overview: An orbital maneuvering system (OMS) burn is performed to increase the distance between the IUS and Orbiter prior to SRM-1 ignition. This burn also prevents recontact with the IUS due to the out-of-plane deploy.

1. Once the IUS has cleared the Orbiter, solar tracking is no longer necessary.

2. Low nitrogen pressure may not properly open the fuel/oxidizer lines to the OMS engines.

3. An OMS burn could damage the actuator or drive motor if the drive locks are not applied.

WARNING
If OMS N2 PRESS out of limits on either side, do AV = 40 FPS burn on good engine. Xfeed at 1/2 AV total. If both OMS have N2 PRESS out of limits, do AV = 15 FPS +X RCS burn. Perform ON-ORBIT RCS BURN, ORB OPS, RCS

CAUTION
If tilt table will not be at -6° by OMS TIG, then stop tilt table motion and perform 1 ENG OMS burn. After OMS burn continue tilt table lowering

BURN DATA per Burn Pad
LOAD - ITEM 22 EXEC
TIMER - ITEM 23 EXEC
WARNING

If TIG on time: If unable to burn at least 15 FPS of AV TOTAL (OMS & RCS), XMIT MASTER SAFE CMD. Go to PL SYS, PL_MAL, IUS S8

If TIG slips: 1) Reload TGTS for new TIG
2) If no burn by nominal deploy +23 min (DESC INJ) or +31 min (ASC INJ), XMIT MASTER SAFE CMD, then go to PL SYS, PL_MAL, 1.3n, [6]

C3 DAP TRANS: NORM/NORM/NORM, no LOW Z (TIG-2) Perform OMS 2/ORBIT OMS BURN Cue Card

*************** IOS LOS ***************
6 MNVR TO IUS VIEWING ATTITUDE

CDR CRT

GNC, OPS 201 PRO
GNC UNIV PTG

TRK OPTION:
TGT ID +1
BODY VECTOR +3 (-Z)
OM +0.0

/DAP: B1/AUTO/NORM **
Initiate TRK

When mnvr complete,
DAP: B1/AUTO/VERN ————

NOTE
Final IUS/PI loss of lock
will occur at DEPLOY +32:00

* If lock lost prior to DEPLOY *
* +32:00, then PI FREQ SWEEP - ON *
* for up to 35 sec until IUS RCVR *
* CMD LOCK indicated (SPEC 200), *
* then release *

10

DPLY +33 <
MS1 A1

TURN OFF PI:
S-BD PL CTL - CMD
PWR SEL - PSP
CTL - PNL then, CMD

SV/ATT XFER - ITEM 1 EXEC (no *) ————

7 MNVR TO PROTECT ATTITUDE

CDR CRT

TRK OPTION:
TGT ID +1
BODY VECTOR +5
P +3 0 5.0
Y + - 0.0
OM + - 0.0

WM: SS
+41:00
(+10:30)

DAP: B1/AUTO/NORM **
Initiate TRK
DAP ROT: DISC/DISC/DISC

When MNVR complete,
DAP: B1/AUTO/VERN

SRM-1 IGN

DAP: B1/MAN/VERN

IUS SRM-1 ignition

1 +55:00
(1BA 67:00)
Maintain orbiter attitude for at least
8 1/2 min

3-86

(10) This allows the crew to visually track the IUS through the Orbiter window and also keeps the PI pointed at the IUS.

(11) The final IUS/PI loss of lock occurs when the Orbiter maneuvers to window-protect attitude.

(12) After the final loss of lock, the PI is powered off and the cyclic state vector transfer to the CIU is disabled as it is no longer needed.

(13) This attitude protects the Orbiter windows from IUS SRM plume impingement.
CLOSEOUT

3.5.3 CLOSEOUT

Overview: This procedure disengages the tilt table actuator and removes power from all IUS-related controls.

1. Entry loads could cause structural damage to an unlocked tilt table.

2. VTR and monitors are set up to record the alternate tilt table actuator disengagement.

3. VTR and monitors are set up to record the primary tilt table actuator disengagement.

4. The PCP must be in the ALT mode to nominally disengage the primary actuator.

5. CCTV is used to verify primary actuator disengagement.

---

**WARNING**

To prevent tilt table damage during reentry, the tilt table must be locked at -6° or AFTA must stay connected.

1. **PRI ACT DISENGAGE**

   **MS2 A7**
   - MON 1 - B (PORT Actuator)
   - MON 2 - C (STBD Actuator)

   If using ALT ACT
   - VTR RCD - B
   - VTR pb - PLAY/RCO
   - STBY - RUN
   - Perform DISENGAGE ALT ACT
   - Go to step 2

   If using PRI ACT
   - VTR RCD - C
   - VTR pb - PLAY/RCO
   - STBY - RUN
   - Perform DISENGAGE PRI ACT

2. **Perform DISENGAGE ALT ACT**

3. **Perform DISENGAGE PRI ACT**

4. PNL MODE - ALT

5. TILT TBL ACT 1 - DISENG (mom)
* If not disengaged, use pin pusher: *
* cb IUS SW PWR - cl *
* IUS ACT ORD PREAM - PREAM *
* ARM - ARM *
* (tb-gray) *
* ACT 1 DISENG - DISENG *
* /PRI ACT DISENG on PCP: *
* /TILT TBL PRI ACT 1 ENGAGED *
* tb - bp *
* IUS ACT 1 DISENG - OFF *
* ACT ORD ARM - SAFE *
* PREAM - OFF *
* cb IUS SW PWR - op *

Go to step 3

2 DISENGAGE ALT ACT

L12U cb IUS SW PWR - cl

IUS ACT ORD PREAM - PREAM
ARM - ARM (tb-gray)
ACT 2 DISENG - DISENG

/ALT AFTA tilted up

IUS ACT 2 DISENG - OFF
ACT ORD ARM - SAFE (tb-bp)
PREAM - OFF
cb IU$ SW PWR - op

MS2 R11 VTR pb - STOP
3 REMOVE CIU PWR

MSI L11
CTU PWR - OFF

4 REMOVE PCP PWR

L10
IUS HTRS BATT PRI(ALT) - OFF
  /PRI,ALT (two) tb - bp
WBDI PRI(ALT) - OFF
  /PRI,ALT (two) tb - bp
CONV PWR PRI(ALT) - OFF
  /PRI,ALT (two) tb - bp

ASE BATT PRI(ALT) - OFF (mom)
  /PRI,ALT (two) tb - bp
ORB S/C CONV PWR PRI(ALT) - OFF (mom)
  /PRI,ALT (two) tb - bp

cb PNL PWR PRI,ALT (two) - op
  /ALT PCP tbs - bp

5 Deselect RNDZ NAV

CDR CRT
UNIV PTG
CNCL - ITEM 21 EXEC

GNC 33 REL NAV
RNDZ NAV ENA - ITEM 1 EXEC (no *)

PLT CRT
SM 62 PCM/MU/PL COMM

Load PCM/MU formats 103/161 per ORB OPS
Zero decom inputs for IUS/TDRS (3)

(9) Power is removed from ASE, PCP, and CIU to reduce Orbiter electrical loads.

(10) After SRM-1 ignition and with the PI off, REL NAV is no longer needed to point the PI at the IUS.

(11) The nominal on-orbit telemetry format loads (TFL's) are loaded.
3.6.1 IUS COARSE ATTITUDE ALIGN

Overview: This procedure transfers the Orbiter attitude to the IUS in the event that the IUS has lost its attitude reference, such as after auto thermal shutdown.

1. HDLN is the preferred commanding when available; 64 kbps allows the CIU to display NIS BIT feedback.

2. For a good attitude transfer, the Orbiter should not be maneuvering.

3. This transfers the Orbiter attitude and state vector from the GPC to CIU buffer.

4. This light will illuminate if the attitude data fails a CIU validation test.

5. CMD 10 transfers the attitude from the CIU buffer to the IUS computers.

6. After a successful transfer, the attitude transfer from GPC to CIU is deactivated until it is required again.
MANUAL POWERDOWN

NOTE
Both IUS STDBY buses will remain on.

NOTE
Crew will receive SM ALERT - 'S62 PDI DECOM FAIL' as a result of loss of IUS HDLN data. Ignore message.

If IUS on internal power,
IUS BUS A BATT PRI(ALT) - STAGE I & II OFF
PRI,ALT (two) tb - bp

or

B BATT PRI(ALT) - STAGE I & II OFF
PRI,ALT (two) tb - bp

Record MET __/:__ __ (VMCC)

If IUS on Orbiter power,
IUS NORM BUS PWR PRI(ALT) - OFF
PRI,ALT (two) tb - bp

Record MET __/:__ __ (VMCC)

3.6.2 MANUAL POWERDOWN

Overview: This procedure is used to manually power down the IUS to conserve Orbiter power if the IUS is to be deployed much later than nominal or not at all.

(1) The standby bus supplies power to the RIMU and the RCS tank and line heaters.

(2) This results from powering down the IUS computers and communications hardware.

(3) This removes avionics bus power from the IUS by taking the IUS batteries off line.

(4) The MET is recorded to keep track of when the IUS was powered down as well as remaining IUS battery life.

(5) This sends the powerdown command to the power distribution unit (PDU) which removes avionics power from the IUS.

(6) The MET is recorded to keep track of when the IUS was powered down.
3.6.3 IUS POWER KILL

Overview: The IUS power kill quickly removes all power to the IUS. It should be used only in emergency situations where crew safety is in jeopardy.

1. Since all power to the IUS is removed, temperature-critical components could be damaged after long durations.

2. The PWR KILL switch sends the following commands simultaneously to the IUS:
   - S/C stage 1/2 batteries - off
   - S/C power - off
   - IUS bus A stage 1/2 batteries - off
   - IUS support A feed - off
   - IUS bus B stage 1/2 batteries - off
   - IUS support B feed - off

   When ASE power is removed from the S/C, the following five commands are sent simultaneously:
   - ASE batteries - off
   - S/C converter power - off
   - IUS battery heaters - off
   - IUS guard heaters - off
   - IUS converter power - off

3. All power-related talkbacks should now be barberpole.

4. When power is removed, all IUS TLM is lost. In addition, the TDRS batteries will come on line to supply power to the TDRS S/C.

5. This supplies alternate power to the PWR KILL switch if the primary mode is not functioning.
WARNING
Sending CMDs 50 and 51 with the Umbilical released and IUS in MSN PHASE 3 irrevocably disables the IUS. No powerup will be possible. These cmds cannot be sent Post-Deploy (MSN PHASE 5)

Send CIU CMD 50, [O2PP9]
No CIU CMD feedback

Send CIU CMD 51, [O2229]
No CIU CMD feedback

NOTE
Crew will receive SM ALERT - 'S62 PDI DECOM FAIL' as a result of loss of IUS RF data. Ignore message

If responses are not as expected, /MCC

(6) If IUS umbilicals are released, the power kill command must be sent by the CIU through the PI. Once this command is sent, the IUS cannot be powered back up.

(7) This enables the transmission of RF CIU commands to the IUS.

(8) CMD 50 turns the S/C bus stage 1 battery off.

(9) CMD 51 turns the IUS avionics stage 1 battery off.

(10) Once avionics bus power is removed, IUS TLM is no longer available.
3.6.4 RESTOW IUS (UMBILICAL ATTACHED)

Overview: This procedure is used to restow the IUS for a much later than nominal deploy time (greater than two orbits) or mission abort.

1. This is because of TDRS thermal constraints.

2. VIR and monitors are set up to view tilt table lowering.

3. This routes regulated Orbiter power to the IUS.

4. IUS batteries are turned off to conserve their useful life once Orbiter power is applied to the IUS avionics buses.

5. The MET is recorded to keep track of remaining IUS battery life.

6. Orbiter power is applied to the TDRS S/C. IUS S/C batteries are turned off to conserve their useful life.

7. The MET is recorded to keep track of remaining IUS S/C battery life.

---

RESTOW IUS (UMBILICAL ATTACHED)

**CAUTION**

MID lights may be on no longer than 15 min

1. **CAMERA PREP**
   - PL BAY FLOOD MID, AFT (four) - ON
   - FWD BHD - ON
   - VTR RCD - C
   - MON 1 - B (tilt table)
   - MON 2 - C (tilt indicator)
   - Sufficient tape remaining

2. **IUS/TDRS TO ORBITER POWER**
   - If IUS on orbiter power,
     - Go to step 3
   - If IUS on internal power,
     - ASE BATT PRI, ALT (two) tb - gray
     - IUS PWR PRI, ALT (two) tb - gray
     - IUS CONV PWR PRI, ALT - ON
       - PRI, ALT (two) tb - gray
       - PRI, ALT (two) tb - bp
     - BUS A BATT PRI, ALT (two) - STAGE I & II OFF
       - PRI, ALT (two) tb - bp
     - BUS B BATT PRI, ALT (two) - STAGE I & II OFF
       - PRI, ALT (two) tb - bp
     - Rcd MET __/___:____:____ (MCC)
   - S/C REG PWR PRI (ALT) - ON
     - PRI (two) tb - gray
     - PWR PRI (ALT) - ON
       - PRI, ALT (two) tb - bp
     - IUS S/C BATT PRI (ALT) - STAGE I II OFF
       - PRI, ALT (two) tb - bp
     - Rcd MET __/___:____:____ (MCC)
3 REM HEATERS OFF

<table>
<thead>
<tr>
<th>MSI L10</th>
<th>L11</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMD PATH ENA - HDLN</td>
<td>PL LK - HDLN 16(64) KBPS</td>
</tr>
</tbody>
</table>

Send CIU CMD 44 (OPC79)
No CIU CMD feedback

4 IUS XMTR OFF

<table>
<thead>
<tr>
<th>L10</th>
<th>L11</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMD PATH ENA - HDLN</td>
<td>PL LK - HDLN 16(64) KBPS</td>
</tr>
</tbody>
</table>

Send CIU CMD 34 (I2P11)
No CIU CMD feedback

JSC-18392

(8) HDLN commanding is preferred when the umbilicals are attached. Either data rate may be used.

(9) CMD 44 turns the REM heaters off.

(10) CMD 34 turns off the IUS A and B encryptor (if applicable), transmitter, and 20 W power amplifier.

(11) SPEC 200 may be used to verify that IUS RF power is off.

CDR CRT

ISM 200 IUS/TDRS
IUS SAFETY RF PWR - (-7.3)

Advise MCC IUS XMTR is OFF
TORS (PI) SETUP

MS1 ALL

\( \sqrt{S-80 \text{ PL CNTL - CMD}} \)
\( \sqrt{\text{ANT POLAR - R CIRC}} \)
\( \sqrt{\text{XMTR PWR - MED}} \)
\( \sqrt{\text{CH SEL INTRG 1,2 tw (six)-089,089}} \)
\( \text{MOD - OFF} \)
\( \sqrt{\text{PWR SYS - 1}} \)
\( \text{SEL - BOTH} \)
\( \sqrt{\text{PSP CMD OUTPUT - INTRG}} \)
\( \text{CMTL - PNL} \)

CDR CRT

\( \text{SM 200 [US/TDRS]} \)
\( \sqrt{\text{TORS RCVR SIG PRES A (*)}, B (*)} \)

* If TORS RCVR SIG PRES A (blank) or *
* B (blank), then PI FREQ SWEEP - ON *
* For up to 90 sec until TORS RCVR *
* SIG PRES, then release *

MS1 ALL

\( \sqrt{S-80 \text{ PL MOD - ON}} \)

CDR CRT

\( \sqrt{\text{TORS RCVR CMD LOCK A (*)}, B (*)} \)

---

(12) The PI is set up so that the ground can command the TORS transmitter off.

(13) This tunes the PI frequency to the TORS receivers to allow communication between the two.

(14) When the PL modulation is turned on, the TORS receivers will lock onto the PI command signal.
NOTE

Up to 32 sec may be required for indication of CMD LOCK.
TDRS/PI ops require at least one SIG PRES and one CMD LOCK indication.

CAUTION

TDRS XMTR must be OFF before lowering tilt table.

---

MS1 CRT

TDRS RXV SRG PRES A (*), B (*), CMD LOCK A (*), B (*)

Advise MCC of TDRS lock status.

MCC will cmd TDRS XMTR off

On MCC GO or LOS:

S-BD PL CNTL - CMD

MCC will cmd PI

---

(15) The TDRS must be locked onto the PI signal to enable commanding.

(16) This is to prevent RF irradiation of the PLB which could overheat the TDRS electronics.

(17) The ground commands the TDRS transmitter off through the PI over a ground site.
7 LOWER TILT TABLE TO 0°

NOTE
Alternate between recording
Camr C & D to cover lowering
of IUS/TDRS

MS2 R11
VTR pb - PLAY, RCD (simo)
√STBY - RUN

(18) The PRLA's on the forward ASE must be open to allow reberthing of the IUS.
(19) This unlocks the tilt table actuator drive motor.
(20) These talkbacks verify tilt table motion and position.
(21) This could be caused by a stalled tilt table, bad AFTA, or inadequate electrical drive.
(22) Once the tilt table is at 0°, the VTR recording is stopped.

MS1 A6U
√PL RETEN LAT 1,2 tb (two) - REL
TILT TBL DR ENA PRI(ALT) - MAX
MOTION PRI(ALT) - LOWER (hold
until tb - gray, start watch)
√POS PRI(ALT) tb - bp

At 0° (~3:45 (7:30 max) from 29°)
√TILT TBL POS PRI,ALT (two) tb - gray
√MOTION PRI(ALT) tb - bp

(Rcd time ____:____:____)

* If MOTION PRI(ALT) tb - bp prior *
* to 0° or POS tb - bp at 0°, then *
* Go to PL SYS, PL_MAL, 1.3e *

MS2 CCTV
Visually verify tilt table at 0°

R11
VTR pb - STOP

3-112
8 ENGAGE PRLAs

CAUTION
TILT TBL ACT DR ENA must be INTERM or MAX prior to closing PRLAs. If TILT TBL POS tb - bp, hold MOTION - LOWER while latching PRLAs or until TILT TBL POS tb - gray

MS2 A6U
✓ PL RETEN PL SEL - 1
R13L
PL BAY MECH PWR SYS 1,2 (two) - ON
A6U
PL RETEN LAT 1,2 (two) - LAT
LOGIC PWR SYS 1,2 (two) - ON

After approx 30 sec (60 sec max),
✓ PL RETEN LAT 1,2 (two) tb - LAT
✓ RDY 1,2 (two) tb - gray
LOGIC PWR SYS 1,2 (two) - OFF
LAT 1,2 (two) - OFF

PL BAY MECH PWR SYS 1,2 (two) - OFF

R13L
TILT TBL DR ENA PRI(ALT) - OFF

MS1 L10

CAUTION
If there is to be another elevation attempt, do not proceed to disengage AFTA or CLOSEOUT

(23) The actuator drive motor must be unlocked during PRLA capture to allow the IUS to move freely to the latched position.

(24) This firmly latches the IUS to the forward ASE frame.

(25) Once the PRLA's have latched, power is removed to reduce Orbiter electrical loads.

(26) This locks the tilt table actuator drive motor to prevent any further actuator motion.

(27) Disengaging the AFTA would prevent nominal tilt table elevation in the future. Performing closeout removes all power to the IUS, PCP, and CIU.
9 ACT DISENGAGE

MON 1 - B (PORT Actuator)
MON 2 - C (STBD Actuator)

If using ALT ACT,
VTR RCD - B
VTR pb - PLAY, RCD (simo)
STBY - RUN
Go to step 10

If using PRI ACT,
VTR RCD - C
VTR pb - PLAY, RCD (simo)
STBY - RUN

MS2 A7
R11
MS1 L10
MS2 CCTV

VTR and monitors are set up to record the disengagement of the alternate (port) AFTA.
VTR and monitors are set up to record the disengagement of the primary (starboard (STBD)) AFTA.
The PCP must be in the ALT mode to nominally disengage the primary actuator.
When disengaged, the actuator will be tilted up from its nominal position. CCTV is used to verify this.
The pin pusher uses an explosive charge to release the AFTA if the nominal disengagement procedure fails. Using the pin pusher causes the actuator engaged talkback to go barberpole.
PRI is the nominal panel mode for the rest of the PCP operations.

(28)
(29)
(30)
(31)
(32)
(33)
10  ALT ACT DISENGAGE

CB IUS SW PWR - cl
IUS ACT ORD PREARM - PREARM
ARM - ARM (tb-gray)
ACT 2 DISENG - DISENG
Note
Crew will receive SM ALERT
'S62 PDI DECOM FAIL' as a
result of loss of IUS HDLM data,
and SM ALERT - '200 TORS BATT'
as a result of TORS batteries
coming on-line. Ignore messages

34

11  CLOSEOUT

CB IUS SW PWR - op

MSI L10
IUS HT RS BATT PRI(ALT) - OFF
PRI,ALT (two) tb - bp
WBOI PRI(ALT) - OFF
PRI,ALT (two) tb - bp
NORM BUS PWR PRI(ALT) - OFF
PRI,ALT (two) tb - bp

NOTE
TORS batteries will remain
on until commanded off by
the ground

70

3-118

3-119

(34) The alternate AFTA may be disengaged only by using the explosive pin
puller.

(35) Power to IUS systems is removed to reduce Orbiter/ASE electrical
loads.

(36) IUS TLM is lost when IUS bus power is removed. Since the IUS S/C
batteries are already powered down, the TDRS batteries will come on
line once Orbiter power is removed.

(37) Both PCP and CIU are powered down as they are no longer needed.

(38) The ground can still command the TORS directly through a ground site.

(39) These are the nominal TFL's for on orbit.
RESTOW IUS (UMBILICAL RELEASED)

CAUTION

MID lights may be on no longer than 15 min

1 CAMERA PREP

MS2 A7

PL BAY FLOOD MID, AFT (four) - ON
FWD BHD - ON
VTR RCD - C
MOM 1 - B (tilt table)
MOM 2 - C (tilt indicator)

Sufficient tape remaining

2 IUS (PI) SETUP

PI SETUP:

MS1 AIL

/S BD PL CNTL - CMD
/ANT POLAR - R CIRC
/XMT PWR - MED
CH SEL INTRG 1,2 tw(six)-906,906
MOD - OFF
/PWR SYS - I
SEL - BOTH
/PSP CMD OUTPUT - INTRG
CNTL - PNL

AIU

SIG STRENGTH sel - S-BD PL
Verify S/S > 1.43 volts

CRT

/SM 62 PCMU/PL COMM
/PL INTRG PHASE LOCK - YES

/SM 20A IUS/TDRS
/IUS RCVR CMD LOCK (*)

* If IUS RCVR not locked, then PI
* FREQ SWEEP - ON for up to 35 sec
* until RCVR CMD LOCK indicated,
* then release

S-BD PL MOD - ON

Overview: This procedure is used to stow the IUS if the umbilical has been released. This would result in a mission abort.

1. This is because of TDRS thermal constraints.
2. VTR and monitors are set up to view tilt table lowering.
3. Without the umbilical, the PI must be used to transmit powerdown commands to the IUS. The PHASE LOCK and S/S indicate the PI is receiving IUS TLM.
4. The IUS receiver must be locked onto the PI signal to communicate with the CIU. CMD LOCK indicates the IUS receiver is locked onto the PI signal.
5. Turning on the PL modulation enables the CIU to command the IUS through the PI.
**POWER KILL (RF)**

**MSI L11**

Send CIU CMD 50, [02PP9]
No CIU CMD feedback

Send CIU CMD 51, [02229]
No CIU CMD feedback

**NOTE**
Crew will receive SM ALERT - "S62 PDI DECOM FAIL" as a result of loss of IUS RF data. Ignore message

**AIU**

SIG STRENGTH sel - S-8D PL
Verify S/S = 0.0 volts

(6) This turns the S/C bus stage 1 battery off.
(7) This turns the IUS avionics stage 1 battery off.
(8) Turning off the avionics battery causes loss of IUS TLM.
4 TDRS(PI) SETUP

MSI L11 PL LK - HDLN 16(64) KBPS

PI SETUP:

\( S-BD \) PL CNTL - CMD
\( \checkmark \) ANT POLAR - R CIRC
\( \checkmark \) XMTR PWR - MDE
CH SEL INTRG 1,2 tw(six)-089,089
MOD - OFF
\( \checkmark \) PWR SYS - 1
SEL - BOTH
\( \checkmark \) PSP CMD OUTPUT - INTRG
CNTL - PNL

AIU SIG STRENGTH sel - S-BD PL
Verify S/S > 1.43 volts

CRT \( \checkmark \) PL INTRG PHASE LOCK - YES
\( \checkmark \) ERR - not changing

ALL S-BD FREQUENCY SWEEP - ON (until PL
INTRG ERR (CRT) begins changing)
S-BD PL MOD - ON

5 TDRS XMTR OFF

| CAUTION | TDRS XMTR must be OFF before
|         | lowering Tilt Table |

*************** STDN AOS ***************

MCC will cmd TDRS XMTR off
On MCC GO or LOS:

ALL S-BD PL CNTL - CMD
MCC will cmd PI

*************** STDN LOS ***************

(9) This prevents any inadvertent RF commands being sent from the CIU through the PI.
(10) This is the nominal setup for TDRS/PI link.
(11) This verifies that the PI is receiving the TDRS signal.
(12) This verifies that the TDRS receiver is locked onto the PI signal. The TDRS transmit frequency is proportional to its receiving frequency when in the coherent mode. This frequency changes as the PI frequency changes.
(13) The PL modulation is turned on to allow communication between the TDRS and PI.
(14) If the TDRS transmitter radiates into the PLB, its transmitter could overheat.
(15) The ground turns the TDRS transmitter off through the PI over a ground site.
6 LOWER TILT TABLE TO 0°

VTR pb - PLAY, RCD (simo)

√STBY - RUN

NOTE
Alternate between recording Camr B & C to cover lowering of IUS/TDRS

VPL RETEN LAT 1, 2 (two) - REL

TILT TBL DR ENA PRI(ALT) - MAX

MOTION PRI(ALT) - LOWER (hold
until tb-gray, start watch)

vPOS PRI(ALT) tb - bp

At 0° (~3:45 (7:30 max) from 29° or
~7:15 (14:30 max) from 59°)

√TILT TBL POS PRI,ALT (two) tb - gray

vMOTION PRI(ALT) tb - bp

(Rcd time ___/____:____)

* If MOTION PRI(ALT) tb - bp prior *
* to 0° or POS tb - bp at 0°, then *
* Go to PL SYS, PL MAL, 1.3e *]

16 (17) The PRLA's on the forward ASE must be open to allow reberthing of the IUS.

17 This unlocks the tilt table actuator drive motor.

18 These talkbacks verify tilt table motion and position.

19 This could be caused by a stalled tilt table, bad AFTA, or inadequate electrical drive.

20 The actuator drive motor must be unlocked during PRLA capture to allow the IUS to move freely to the latched position.

7 ENGAGE PRLAs

CAUTION
TILT TBL ACT DR ENA must be INTERM
or MAX prior to closing PRLAs. If
TILT TBL POS tb - pb, hold MOTION -
LOWER while latching PRLAs or until
TILT TBL POS tb - gray

MS2 CCTV Visually verify tilt table at 0°

VTR pb - STOP

74
This firmly latches the IUS to the forward ASE frame.

Once the PRLA's have latched, power is removed to reduce Orbiter electrical loads.

This locks the tilt table actuator drive motor to prevent any further actuator motion.

VTR and monitors are set up to record the disengagement of the alternate (port) AFTA.

VTR and monitors are set up to record the disengagement of the primary (STBD) AFTA.

The PCP must be in the ALT mode to nominally disengage the primary actuator.

When disengaged, the actuator will be tilted up from its nominal position. CCTV is used to verify this.
If not disengaged, use pin pusher:

* cb IUS SW PWR - cl
* IUS ACT ORD PREAM - PREAM
  * ARM - ARM (tb-gray)
  * ACT 1 DISENG - DISENG

* √PRI ACT DISENG on PCP:

* √TILT TBL PRI ACT 1 ENGAGED
  * (tb-bp)

* IUS ACT 1 DISENG - OFF
  * ACT ORD ARM - SAFE (tb-bp)
  * PREAM - OFF

* cb IUS SW PWR - op

The pin pusher uses an explosive charge to release the AFTA if the nominal disengagement procedure fails.

PRI is the nominal panel mode for the remaining PCP operations.

The alternate AFTA may be disengaged only by using the explosive pin puller.

Go to step 10

9 ALT ACT DISENGAGE

cb IUS SW PWR - cl
IUS ACT ORD PREAM - PREAM
  ARM - ARM (tb-gray)
ACT 2 DISENGAGE - DISENGAGE

ALT AFTA tilted up

IUS ACT 2 DISENG - OFF
  ACT ORD ARM - SAFE (tb-bp)
  PREAM - OFF

cb IUS SW PWR - op
**CLOSEOUT**

10  IUS HTRs BATT PRI(ALT) - OFF
    PRI,ALT (two) tb - bp
    WBVI PRI(ALT) - OFF
    /PRI,ALT (two) tb - bp
    ASE BATT PRI(ALT) - OFF
    /PRI,ALT (two) tb - bp
    ORB S/C CONV PWR PRI(ALT) - OFF
    /PRI,ALT (two) tb - bp
    CONV PWR PRI(ALT) - OFF
    /PRI,ALT (two) tb - bp

31  Cb PNL PWR PRI,ALT (two) - op
    /All PCP tbs - bp

11  CIU PWR - OFF

**NOTE**

32  TORS batteries will remain on until commanded off by the ground.

33  The ground can still command the TDRS directly through a ground site.

34  These are the nominal TFL's for on orbit.

---

(31) Power to IUS systems is removed to reduce Orbiter/ASE electrical loads.

(32) Both PCP and CIU are powered down as they are no longer needed.

(33) The ground can still command the TDRS directly through a ground site.

(34) These are the nominal TFL's for on orbit.
3.6.6 LOSS OF FWD RCS DEPLOY

Overview: The following steps are used in the nominal deploy procedures for tail-only RCS.

1. Since only aft RCS jets are used, the forward manifolds are closed.
2. This prevents any GPC-generated commands from firing the forward RCS jets.
3. This configures the DAP for tail-only pitch and yaw.
4. Loss of forward verns results in poor tail-only attitude control; loss of forward +X NORMs eliminates low Z capability.
5. Raising/lowering the tilt table using PRCS jets could cause structural damage to the tilt table.
6. Discrete mode maintains Orbiter attitude hold.
3.6.7 DEPLOY WAVE-OFF

Overview: This procedure is performed if the IUS deploy is postponed a rev. It is used to preserve IUS internal battery life.

(1) This saves time and propellant.

(2) REM heaters could cause the catalyst bed and RCS valves to overheat. The heaters may remain on indefinitely if only one string is active.

(3) The CIU is the only means the crew has to deactivate the REM heaters.

(4) The MET is recorded to keep track of how long the REM heaters are off to prevent RCS valves and propellant lines from freezing.

(5) This supplies the IUS avionics bus with Orbiter power.

(6) IUS internal batteries are powered down to preserve their useful life.

(7) IUS S/C batteries are powered down to preserve their useful life.

Maintain deploy attitude

CAUTION
If both REM HTRs are on, turn off ASAP
If only one REM HTR is on, no action is reqd

MS1 L11
If reqd to turn off REM HTR, send CIU CMD 44, [OPC79]
No CIU CMD feedback

Record MET __/__/__:

If Umbilicals attached, transfer IUS/TORS to orbiter power:

L10
IUS CONV PWR PRI(ALT) - ON (mom)
 venues PRi,ALT (two) tb - gray
 venues PWR PRI,ALT (two) tb - gray
 A FEED PRI(ALT) - ON (mom)
 venues PRI,ALT (two) tb - gray
 BUS A BATT PRI(ALT) - STAGE I & II OFF (mom)
 venues PRI,ALT (two) tb - bp
 B FEED PRI(ALT) - ON (mom)
 venues PRI,ALT (two) tb - gray
 BUS B BATT PRI(ALT) - STAGE I & II OFF (mom)
 venues PRI,ALT (two) tb - bp

L10
 venues S/C REG PWR PRI,ALT (two) tb - gray
 venues PWR PRI(ALT) - ON (mom)
 venues PRI,ALT (two) tb - gray
 IUS S/C BATT PRI(ALT) - STAGE I & II OFF (mom)
 venues PRI,ALT (two) tb - bp
3.6.8 LOSS OF COMM

Overview: This procedure recovers payload data if comm is temporarily lost or if the wrong downlink format is loaded.

(1) This ensures that payload TLM data are available at 64 kbps for the payload recorder.

(2) This gives the crew control of the payload recorder.

(3) This is the nominal setup for recording IUS data.

1 CONFIG CIU/IUS FOR 64 KBPS

Perform XFER 16 + 64, then:

DNLK PL RCDR - TLM

2 CLEAR PAYLOAD RECORDER MDM INTERFACE

SM_1 OPS UTILITY

RTC (PL CREW UTILITY)

ITEM 13 - 0 0 0 9 F F F EXEC

CMD - ITEM 14 EXEC

PL RCDR PNL CNTL tb - gray

3 CONFIG PL RCDR

PL RCDR FUNC - MODE SEL

SPEED - 2

MODE - SERIAL RCD

FUNC - OPERATE
### RTS CMDING SETUP

Overview: This configuration allows direct Remote Tracking Station (RTS) commanding of the IUS.

1. The following steps assume that the IUS transmitter is on.
2. The IUS antenna must be enabled to permit commanding.
3. The PI should be off to permit the IUS receiver to lock onto the ground signal from an RTS site.
4. This sets up the proper signal path in the IUS for RF commanding.
5. The following steps assume that the IUS transmitter is off.
6. This sets up the proper signal path in the IUS for HDLN commanding.
7. CMD 33 turns on the IUS transmitter and power amplifier in preparation for direct RF commanding.

<table>
<thead>
<tr>
<th>L12U</th>
<th>L11</th>
<th>A1U</th>
<th>CRT4</th>
<th>L10</th>
</tr>
</thead>
<tbody>
<tr>
<td>IF IUS DLNLK ON,</td>
<td>PL LK - HDLN 16 KBPS</td>
<td>S-BD PL MOD - OFF</td>
<td>CMD PATH ENA - RF</td>
<td>CMD PATH ENA - HDLN</td>
</tr>
<tr>
<td>✔ IUS RF ANT ENA tb - GRAY</td>
<td>PWR SYS - OFF</td>
<td>CMD PATH ENA - RF</td>
<td>PL LK - DNLK 16 (64) KBPS</td>
<td>CMD PATH ENA - RF</td>
</tr>
<tr>
<td>✔ DSBL tb - bp</td>
<td>CNTL - PNL, then CMD</td>
<td>CMD PATH ENA - RF</td>
<td>CMD PATH ENA - HDLN</td>
<td>CMD PATH ENA - RF</td>
</tr>
</tbody>
</table>

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</tr>
</thead>
<tbody>
<tr>
<td>IF IUS DLNLK OFF,</td>
<td>PL LK - DNLK 16 (64) KBPS</td>
<td>S-BD PL MOD - OFF</td>
<td>CMD PATH ENA - RF</td>
<td>CMD PATH ENA - RF</td>
</tr>
<tr>
<td>✔ IUS RF ANT ENA tb - GRAY</td>
<td>PWR SYS - OFF</td>
<td>CMD PATH ENA - RF</td>
<td>DSBL tb - bp</td>
<td>CMD PATH ENA - RF</td>
</tr>
<tr>
<td>✔ DSBL tb - bp</td>
<td>CNTL - PNL, then CMD</td>
<td>CMD PATH ENA - RF</td>
<td>CMD PATH ENA - RF</td>
<td>CMD PATH ENA - RF</td>
</tr>
</tbody>
</table>

Send CIU CMD 33, L12C111
No CIU CMD feedback