450-TNOSP-Space Shuttle
(Supersedes 501-602/Space Shuttle)

MISSION SERVICES PROGRAM OFFICE

Tracking and Data Relay Satellite System Network Operations Support Plan (TNOSP) for the Space Shuttle

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Goddard Space Flight Center
Greenbelt, Maryland

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Tracking and Data Relay Satellite System Network Operations Support Plan for the Space Shuttle

Effective Date: June 2003

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This document supersedes the *Tracking and Data Relay Satellite System Network Operations Support Plan for the Space Shuttle*, 501-602/Space Shuttle, Revision 4 dated October 1995 and all changes thereto. Dispose of superseded documents in accordance with CSOC-CEN-SOP-000205.

Goddard Space Flight Center
Greenbelt, Maryland

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Preface

The purpose of this Space Shuttle Tracking and Data Relay Satellite System (TDRSS) Network Operations Support Plan (TNOSP) is to provide mission-unique operations procedures and configurations information required by the Space Network (SN) element of the Spaceflight Tracking and Data Network (STDN) and Johnson Space Center (JSC) Mission Control Center (MCC) during support of Space Shuttle missions. Standard procedures for intra- and inter-element operations and for SN interface activities are contained in the applicable documents identified in the list of referenced documents contained in Appendix B of this document. Where conflicts exist with other documents, the provisions in this document take precedence over and supersede the contents of those documents.

The configuration information contained in this document consists of automated data base contents and manual configuration instructions as appropriate to the element. In providing this mission-unique information, this document forms the point of control for automated data bases in use in the TDRSS element of the STDN, and for the manual configurations required.

Between revision or reissue cycles, all changes to this document (and thus to the data base, manual configuration, and mission-unique procedures contained herein) will be made by Documentation Change Notice (DCN). At present, the procedures defined in the *Network Control Center and Spaceflight Tracking and Data Network Station Interface Procedures*, 451-SIP-NCC/STDN (with the exception of the DCN approval cycle), will be used for DCN implementation. DCNs to this issue will be coordinated with the appropriate SN line organization and approved by the Goddard Space Flight Center (GSFC) Customer Commitment Office, Code 451.

Questions from SN elements or project organizations concerning the information contained in this document should be transmitted to the Network Integration Center (NIC) using Request for Information or Clarification (RIC) procedures. All RICs or Interim Support Instruction (ISI) requests will be coordinated through GSFC Network Integration. Message headers for RICs, DCNs, and ISIs are defined in Section 9 of this document.

Current supporting documentation does not reflect the transfer of activities from the GSFC NCC to the WSC DSMC, however work is in progress to update existing documents and create required new documents to support the new configuration. Refer to Appendix B for a complete list of available supporting documents.

Questions or comments regarding this document may be addressed to:

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Section 1. Mission Support Overview

1.1 General

1.1.1 Space Shuttle Support

The Space Shuttle will require support from the National Aeronautics and Space Administration (NASA), Space Network (SN), and Ground Network (GN). The SN will be the prime support element for overall Space Shuttle Tracking and Data Acquisition (T&DA) activities, supplemented with GN support. This document provides the necessary procedures, information, and configurations for the SN that are required in support of Space Shuttle flight operations. The SN is supported by two ground stations located at the White Sands Complex (WSC) in New Mexico. WSC currently consists of the Second Tracking and Data Relay Satellite System (TDRSS) Ground Terminal (STGT) Facility and the White Sands Ground Terminal (WSGT) Facility. Space Shuttle operations will require T&DA support during the pre-launch, launch, orbital, landing, and post-landing phases of each mission. The GN support consists of pre-launch tests, launch, special orbital tests, contingency and emergency orbital support, end-of-mission, landing, and post-landing operations. The GN is supported by the Air Force Satellite Control Network (AFSCN), Sunnyvale, CA Remote Tracking Stations (RTS), the NASA Jet Propulsion Laboratory (JPL) Deep Space Network (DSN) and the GSFC GN core stations. Detailed GN support information is contained in the *Network Operations Support Plan for the Space Shuttle Program*, 450-601-NOSP/Space Shuttle.

1.1.2 Support Coverage

1.1.2.1 Launch and Early-orbit Phase

The GN and SN will be used to provide the maximum amount of S-band (Command [CMD], voice, Telemetry [TLM], and Track [TRK]) communication coverage between the Johnson Space Center (JSC) Mission Control Center (MCC) and the Space Shuttle in support of the launch, ascent, and early-orbit phase.

1.1.2.2 Nominal Orbital Operations Phase

During the nominal orbital operations phase when the Orbiter is switched to the TDRSS mode, support will be as follows:

a. S-band Single Access (SSA) Forward and Return Links. All available in-view coverage.

b. K-band Single Access (KSA) Forward and Return Links. All available in-view coverage.

1.1.2.3 Deployment Operations Phase

Support for the deployment operations phase will be as follows:

a. SSA Forward and Return Links. One hundred percent in-view coverage.

b. KSA Forward and Return Links. One hundred percent in-view coverage.

1.1.2.4 Landing Phase

During the landing phase, the SN will provide S-band support through Weight on Wheels (WOW) or until GN support becomes prime.

1.1.2.5 Post-landing Phase

The GN and/or SN will be used to provide S-band CMD, voice, and TLM communications coverage between the JSC MCC and Space Shuttle, and TLM support to Kennedy Space Center (KSC) until post-landing TLM and playback requirements are completed.

1.1.3 Support Duration

1.1.3.1 Mission Duration

The duration of each Space Shuttle mission will vary depending upon that mission's objectives.

1.1.3.2 Committed Support

Spaceflight Tracking and Data Network (STDN) resources will be scheduled for Space Shuttle mission support as required for each desired orbit.

1.2 Mission Description

1.2.1 General

1.2.1.1

The objectives of the Space Shuttle are to substantially reduce the cost of space operations and provide a capability to support a wide range of scientific, defense, and commercial uses. Space Shuttle missions involve direct delivery of payloads to low-earth orbits; placement of payloads and transfer stages in parking orbits for subsequent transfer to other orbits; rendezvous and station keeping with detached payloads for on orbit checkout; return of payloads to Earth from orbit; and provisions for special support to space activities such as sortie missions, rescue, repair, maintenance, servicing, assembly, disassembly, and docking.

1.2.1.2

For Space Shuttle/SN operations, the SN will relay TLM, Air-to-Ground (A/G)/Ground-to-Air (G/A) voice, and CMD signals between the Space Shuttle and JSC MCC.

1.2.2 Space Shuttle Orbiter

1.2.2.1 Space Shuttle Flight Hardware

a. The Space Shuttle flight hardware consists of a reusable Orbiter Vehicle (OV) including installed Main Engines (ME), an expendable External Tank (ET), and reusable Solid Rocket Boosters (SRB).

b. The flight hardware in the launch configuration is shown in Figure 1-1.

c. The OV is shown in Figure 1-2.

1.2.2.2 Flight Profile

A typical Space Shuttle mission flight profile is shown in Figure 1-3 and is described in the following paragraphs:

a. The Space Shuttle SRBs and Main Propulsion System (MPS) engines burn in parallel from lift-off. Thrust vector control commands are provided to the SRBs and the MPS by the OV guidance and control system.

b. SRB burnout and staging occurs at approximately 2 minutes, 6 seconds into the flight. At this time, the SRBs are pyrotechnically separated from the ET and eight separation solid rocket motors on each SRB are ignited to accelerate the expended SRB casings from the vehicle. The SRB casings follow a ballistic trajectory after separation, decelerate by parachute, and are retrieved and refurbished.

c. The ET provides approximately 0.638 million kg of liquid oxygen and 0.104 million kg of liquid hydrogen for use by three 213,000-kg thrust MPS engines. At approximately 8.5 minutes into the flight, the MPS engines are shut down and the ET is pyrotechnically separated. After separation, the tank follows a ballistic trajectory with impact in a designated unpopulated ocean area. The ET is not recoverable.

d. The Space Shuttle achieves orbital insertion through use of the OMS engines, first burn (OMS-1); a second OMS burn (OMS-2) circularizes the Space Shuttle orbit. Earth-orbit operations are then conducted.

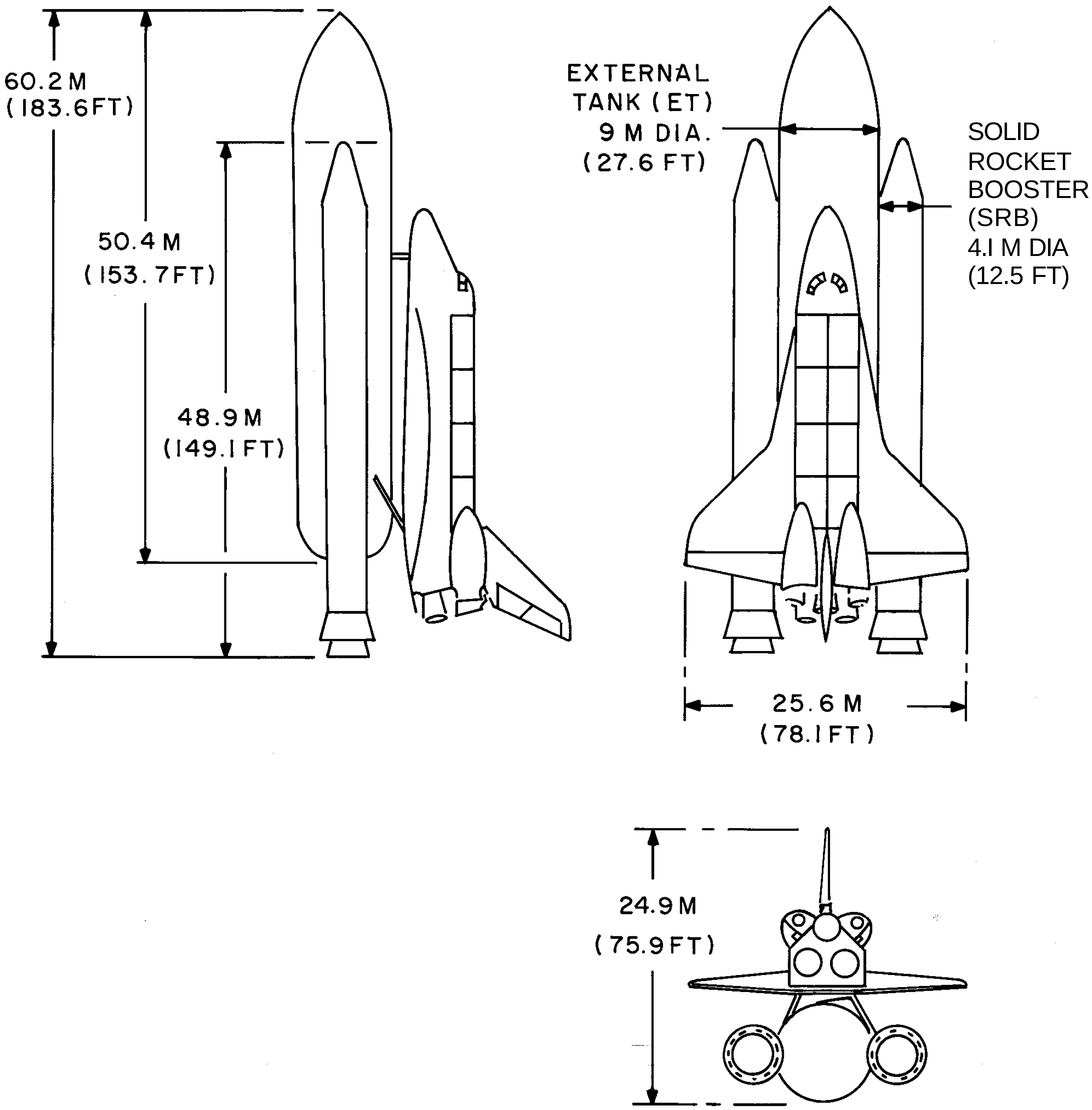


Figure 1-1. Space Shuttle Launch Configuration

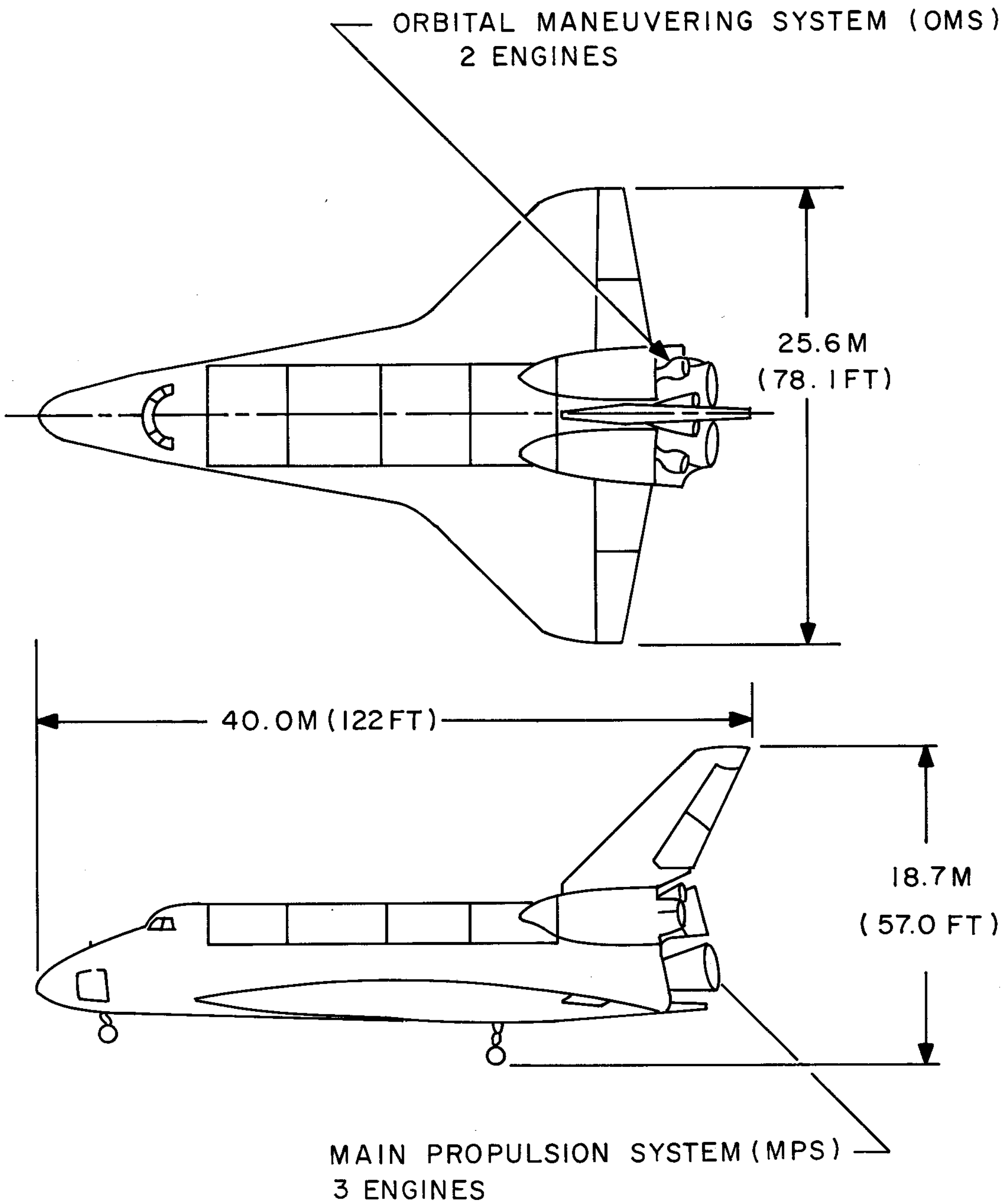


Figure 1-2. Space Shuttle Vehicle

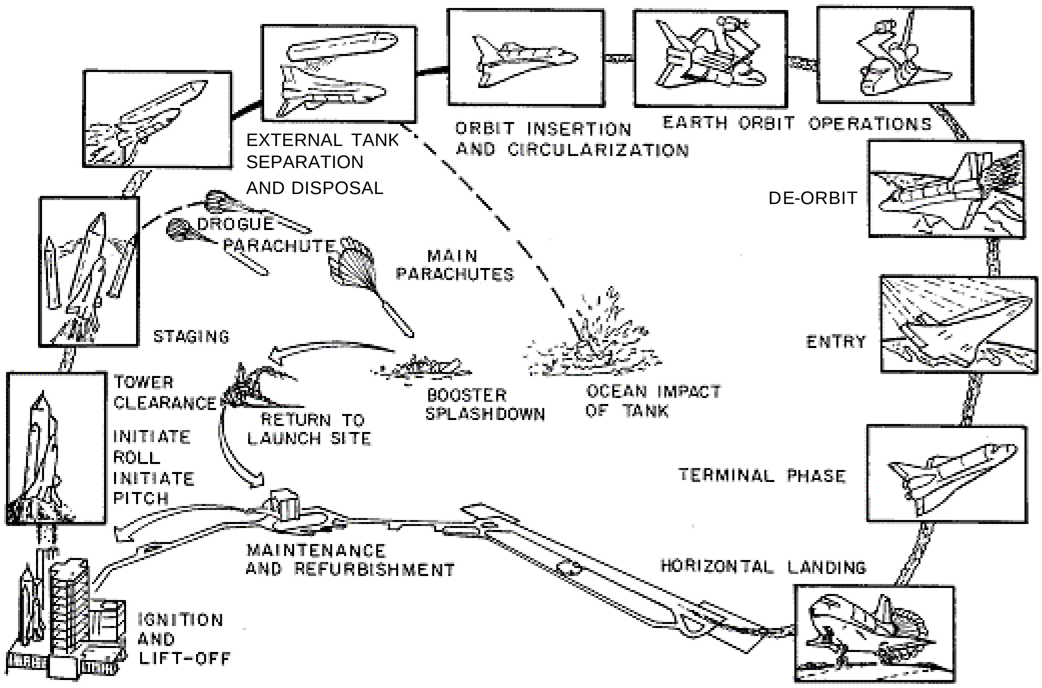


Figure 1-3. Typical Space Shuttle Flight Profile

e. On completion of earth-orbit operations, de-orbit, entry, and landing sequences are initiated. De-orbit is achieved by an OMS burn which reduces Space Shuttle velocity before it enters earth atmosphere. Atmospheric drag further slows the Space Shuttle so that it can maneuver to perform an unpowered horizontal landing. After landing, the Space Shuttle is returned to the Orbiter Processing Facility (OPF) at KSC for refurbishing.

1.2.3 Abort Modes

If a malfunction occurs during the launch phase and prior to achieving orbit, there are seven abort modes from which to select. The abort modes are as follows:

a. Return to Launch Site (RTLS).

b. Abort Once Around (AOA).

c. Abort To Orbit (ATO).

d. Transoceanic Abort Landing (TAL).

e. Ditch.

f. Bermuda Abort Landing (BAL).

g. East Coast Abort Landing (ECAL).

1.2.4 Landing Sites

1.2.4.1

The Space Shuttle has four types of planned recovery (landing) sites (refer to Table 2-6), as follows:

a. The first type is the End of Mission (EOM) site. This site has a full-up convoy, Space Shuttle landing aids, dedicated rescue forces, and other support as required. KSC and Edwards Air Force Base (EAFB) are primary EOM sites. Mission objectives/ requirements dictate as to which one is the planned EOM site for that specific mission. The primary site not designated as the planned EOM site will be the weather site, and White Sands Space Harbor (WSSH) will be the tertiary site. Only the prime site will have a full-up convoy for a specific mission.

b. The second type of recovery site is the Augmented Landing Site (ALS). This type includes the RTLS, AOA, and TAL sites. ALSs typically have Space Shuttle landing aids, Space Shuttle-trained crash/rescue forces, NASA representation, and other support, as required.

c. The third type of landing site is the Augmented Emergency Landing Site (AELS). These are Emergency Landing Sites (ELS) that have been specifically augmented to fill abort coverage gaps. These sites have Space Shuttle landing aids, Space Shuttle trained crash/rescue forces, and a minimal NASA/AFSCN staff to operate the landing aids. No NASA communications have been implemented to these sites.

d. The fourth type of landing site is the ELS. These sites offer a landing runway and Tactical Aircraft Navigation (TACAN) or Distance Measuring Equipment (DME) only; NASA has no specified support requirements. A subset of the ELSs are operated by the AFSCN. These AFSCN bases offer communication and logistical support that may not be available at other ELSs. The AFSCN Manager's Space Shuttle Support Office will inform these AFSCN bases on possible support requirements, provide training, and provide status reports to them before/during each mission. Increased readiness may be possible with adequate advance notification and appropriate request from NASA.

1.2.4.2

When the Space Shuttle does not land at KSC, it is ferried from the landing site to KSC using the Space Shuttle Carrier Aircraft (SCA) as shown in Figure 1-4.

1.2.4.3

The flow of the Space Shuttle refurbishment functions at KSC from landing to launch is illustrated in Figure 1-5.

1.2.5 Space Shuttle/TDRSS Links

1.2.5.1

The Space Shuttle/TDRSS links will consist of S-band and K-band forward and return links. Because of the stowed configuration of the Space Shuttle K-band antenna during launch and landing, the S-band links will be used to support the Space Shuttle until the K-band antenna is deployed. The Space Shuttle/TDRSS links are shown in Table 1-1.

Table 1-1. Space Shuttle/TDRSS Links

Link	Frequency
SSA Forward	2041.94790/2106.40630 MHz
SSA Return	2217.5/2287.5 MHz
KSA Forward	13.775 GHz
KSA Return	15.0034 GHz

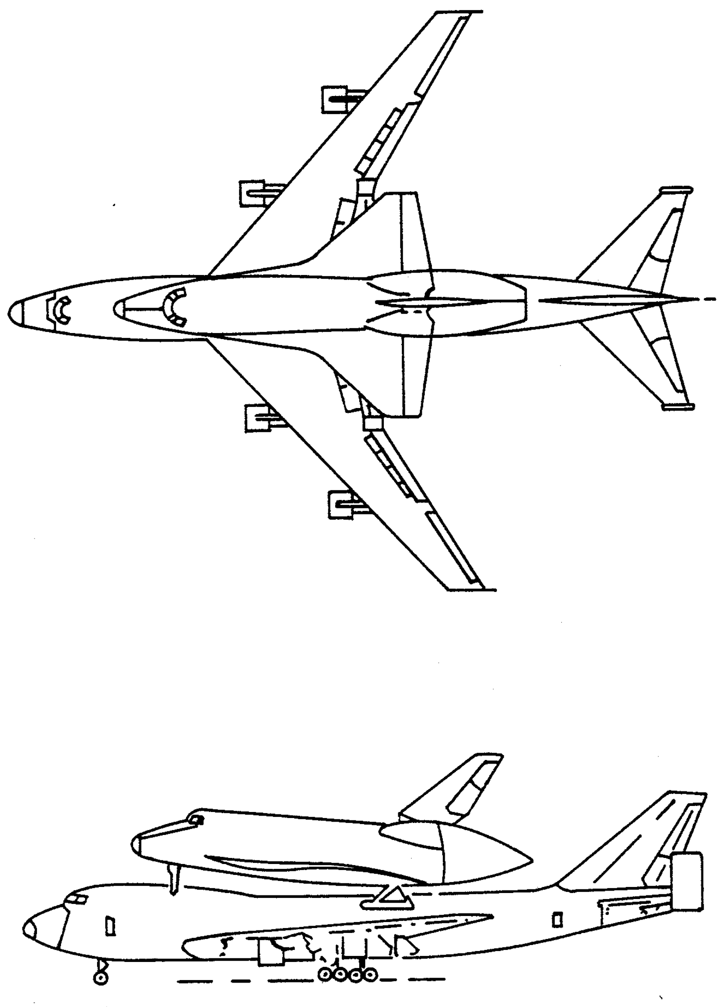


Figure 1-4. Space Shuttle Carrier Aircraft/Space Shuttle Ferry Configuration

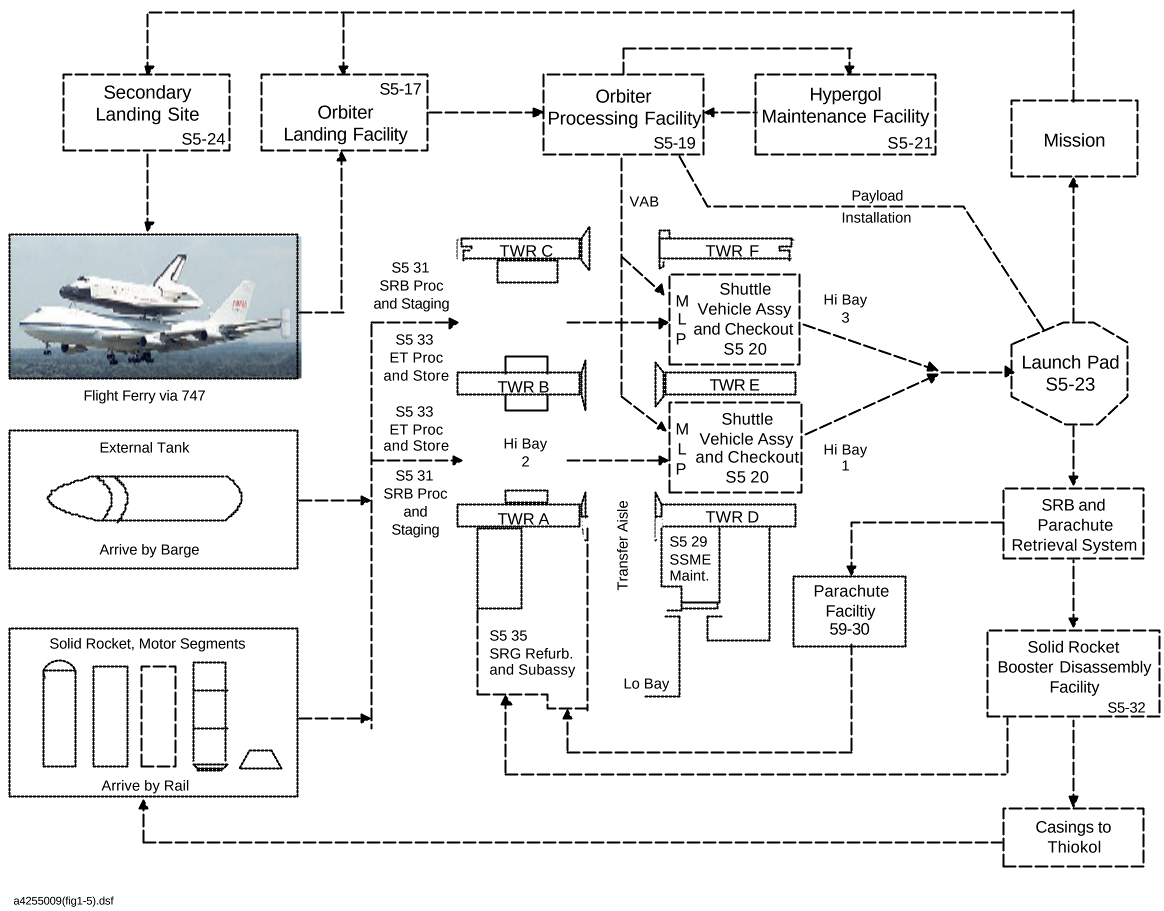


Figure 1-5. KSC Space Shuttle Landing-to-Launch Flow

1.2.5.2

The forward link will consist of A/G voice and CMD signal composite from JSC MCC to the Space Shuttle. The return link will consist of Space Shuttle real-time TLM, and Operations Recorder dump TLM (including Space Shuttle Main Engine [SSME] data) A/G voice composite, TV, and payload real-time and recorder dump TLM data from the Space Shuttle to the MCC via the TDRSS.

1.2.6 Nominal Space Shuttle Link Configuration

1.2.6.1

During the ascent phase, the Space Shuttle will be configured via Stored Program Commands (SPC) for Tracking and Data Relay Satellite (TDRS) S-band forward and return link support.

1.2.6.2

The Space Shuttle K-band system will be activated after the payload doors are opened and the K-band antenna deployed. The K-band forward and return links will be used during the TDRSS events when the K-band antenna is clear of masking or blockage and there are no payload

K-band Radio Frequency (RF) constraints. When the K-band link cannot be used, the S-band link will be used. If the K-band forward link is not received on-board the Space Shuttle, it will automatically configure to the S-band forward link for support.

1.2.6.3

Prior to de-orbit, the payload bay doors will be closed and the Space Shuttle will be configured for the TDRS S-band forward and return links.

1.2.6.4

The TDRS S-band forward and return links will be used during de-orbit support through WOW unless GN support is designated as prime during the landing approach. The Space Shuttle may be programmed to automatically change from the TDRS S-band mode to the GN mode.

1.2.7 Payload Operations

1.2.7.1

Most of the payloads carried into space by the Space Shuttle require that payload data be interleaved in the Space Shuttle's TLM downlink while in the attached phase. When a payload is deployed (in some cases), the Space Shuttle will be required to receive the payload RF transmitted TLM, interleave it, and retransmit it to the TDRS for relaying to the ground systems.

1.2.7.2

K-band return link Channels 2 and 3 can be configured to support the various payload data link requirements.

1.3 Detailed Support Definition

1.3.1 TDRSS Services

1.3.1.1 General

The Space Shuttle mission uses various TDRSS services to support CMD and TLM transfers between the Space Shuttle and JSC MCC, and various tracking services to support orbit determination and transponder frequency trend analysis. In addition, simulation services are allocated to provide for data flow testing and mission simulations either prior to launch or prior to commencement of TDRSS support for Space Shuttle. The following paragraphs define service use in relation to Space Shuttle mission operations activities.

1.3.1.2 TDRSS-to-Space Shuttle S-band Forward Link

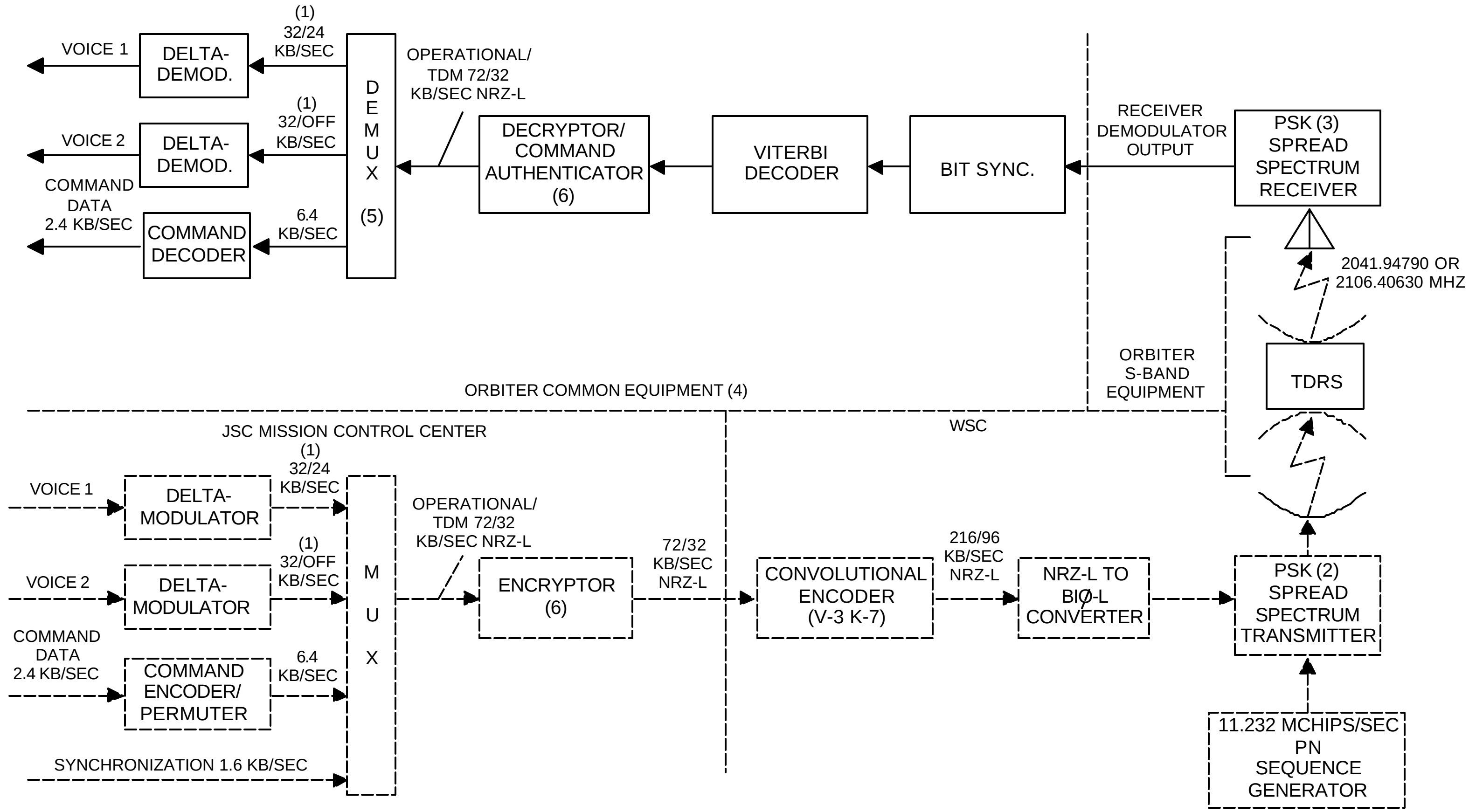
a. The TDRSS-to-Space Shuttle forward link can provide both low- and high-data rate transmission (32- and 72-kb/sec) (refer to Table 1-2). CMD authentication data encryption provides CMD security, and convolutional encoding provides error correction. Spectrum spreading techniques are employed on the forward link. The forward link carrier serves as a reference frequency for the return link during coherent operation.

b. Figure 1-6 illustrates the functional link configuration for the S-band forward link. The 6.4-kb/sec encoded and permuted command data is Time Division Multiplexed (TDM) with one (Low Data Rate [LDR]) or two (High Data Rate [HDR]) voice channels, and a 1.6-kb/sec synchronization channel.

c. The 32- or 72-kb/sec data is then encrypted (encryption can be bypassed) at JSC and transmitted to WSC, where it is convolutionally-encoded at a 1/3 rate, converted from Non-return-to-zero Level (NRZ-L) to Biphase Level (BiØ-L) format, and Modulo-2 added to a Pseudo Noise (PN) NRZ-L code at 11.232 Mchips/sec. The resultant spread spectrum is used to Phase Shift Key (PSK) the carrier for transmission to the TDRS. The nominal S-band carrier center frequency is 2106.40630 MHz (high frequency) or 2041.94790 MHz (low frequency).

Table 1-2. TDRSS-to-Space Shuttle S-band Forward Link Interfaces

Link	Data	Frequency	Contents
S-band Forward Link	CMD and Voice	2041.94790 or 2106.40630 MHz	a. Data Mode 1 (Low Data Rate): The 32-kb/sec data is 1/3 convolutionally encoded, converted to a BiØ-L format, and Modulo-2 added to the PN code at 11.232-Mchips/sec for the PSK spread spectrum transmitter. The 32-kb/sec data consists of the following: 1. 6.4 kb/sec: CMD. 2. 1.6 kb/sec: Synchronization and Station ID.3. 24 kb/sec: Digital Voice. b. Data Mode 2 (High Data Rate): The 72-kb/sec data is conditioned in the same manner as LDR (32-kb/sec) prior to transmission. The 72-kb/sec data consists of the following: 1. 6.4 kb/sec: CMD. 2. 1.6 kb/sec: Synchronization and Station ID. 3. 32 kb/sec: Digital Voice 1. 4. 32 kb/sec: Digital Voice 2.
NOTE Doppler compensation for the S-band carrier and PN chip rate can be enabled or inhibited independently. The carrier will be compensated with ±1.1 kHz of the specified center frequency, and the PN chip rate will be compensated within ±29 chips of 11.232 Mchips/sec.			



NOTES:

1. HIGH OR LOW DATA RATE.
2. CAPABLE OF SWITCHING DATA MODULATION ON OR OFF AND INDEPENDENTLY SWITCHING CARRIER SPREADING ON OR OFF.
3. CAPABLE OF OPERATING WITH DATA MODULATION ON OR OFF AND WITH CARRIER SPREADING ON OR OFF.
4. SAME EQUIPMENT FOR S-BAND DIRECT UPLINK AND S-BAND FORWARD LINK.
5. FRAME SYNC USES 1.6 KB/SEC SYNCHRONIZATION CHANNEL.
6. CAPABLE OF UNENCRYPTED.

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Figure 1-6. TDRSS-to-Space Shuttle S-band Forward Link Functional Configuration

d. On-board the Space Shuttle, a spread spectrum demodulator performs the PN code acquisition and tracking, and despreads the spectrum. A coherent PSK demodulator in the receiver is used to restore the baseband 72-kb/sec (HDR) or 32-kb/sec (LDR) encoded sequence. A bit synchronizer produces a soft-decision version of the encoded sequence, and a Viterbi algorithm decoder is used to resolve encoded symbol inversion and to provide the 72-kb/sec (HDR) or 32-kb/sec (LDR) encrypted, operational TDM sequence with the same polarity as the encrypted operational TDM sequence at the WSC encoder input. A decryptor produces the 72- or 32-kb/sec operational TDM sequence, and the CMD authenticator replaces the 6.4-kb/sec permuted CMD data with 6.4-kb/sec encoded CMD data in the operational TDM sequence. Then a frame synchronization demultiplexer is used to identify the synchronization pattern, control encrypted bit inversion, and separate the two (HDR) or one (LDR) voice channels and the encoded CMD channel. The voice channels are routed to the Delta demodulators, and the encoded CMD channel is routed to the CMD decoder.

1.3.1.3 Space Shuttle-to-TDRSS S-band Return Link

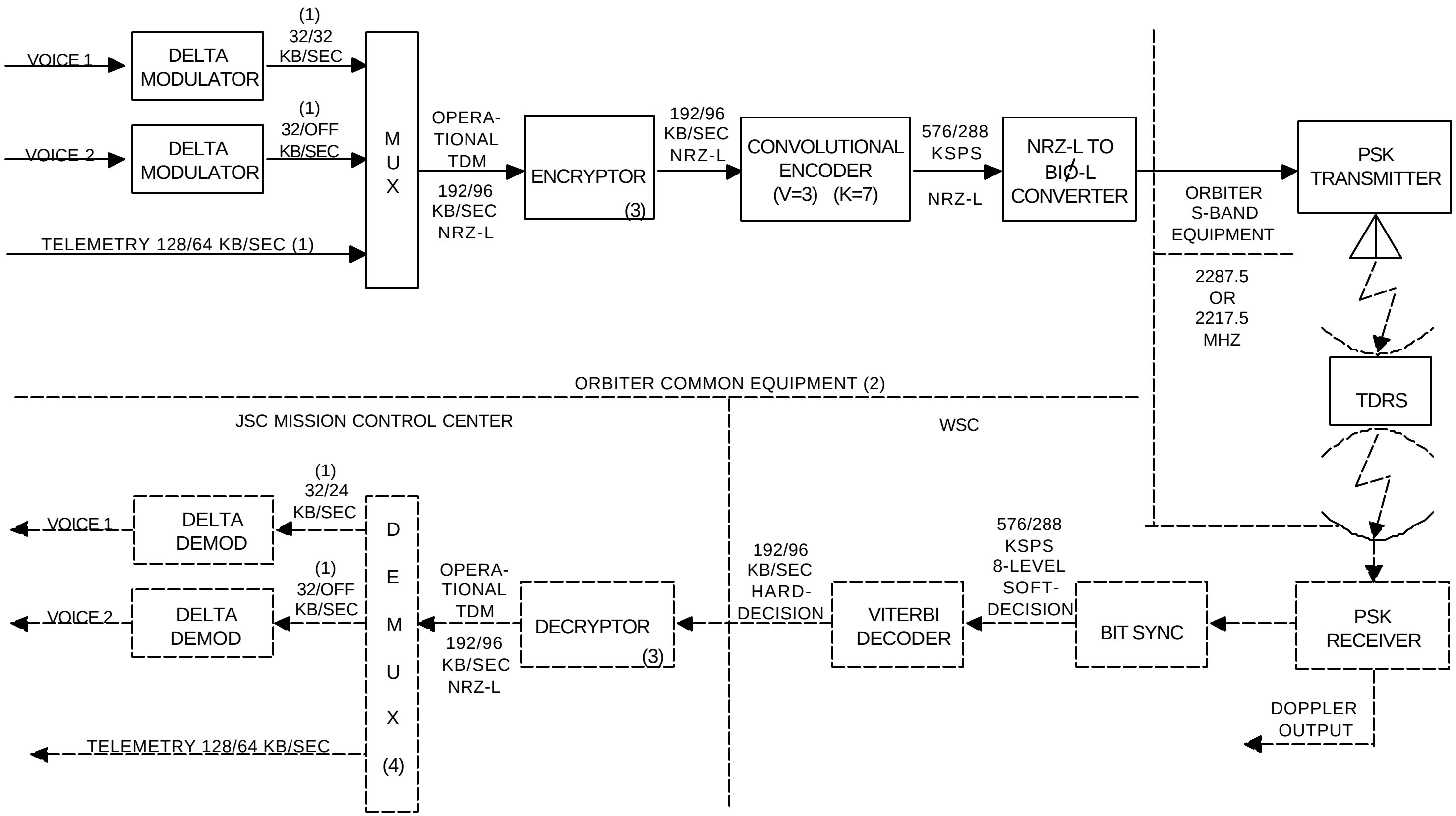
a. The Space Shuttle-to-TDRSS S-band return link (refer to Table 1-3) can provide both low- and high-bit rate data transmission (96- and 192-kb/sec) of TDM encrypted data (encryption can be bypassed), which is convolutionally-encoded for bit error correction and is PSK-modulated for carrier suppression. The return link carrier is a coherent turnaround of the S-band forward link carrier or is generated by an on-board auxiliary oscillator.

b. Figure 1-7 illustrates the functional configuration for the S-band return link. The 96- or 192-kb/sec data exits the on-board operational multiplexer in NRZ-L format to be encrypted (encryption can be bypassed). After encryption, the data is convolutionally-encoded at a 1/3 rate to produce 288- or 576- kilosymbols per second (ksps), and is converted from NRZ-L to BiØ-L format to PSK modulate the carrier for transmission to the TDRS.

c. The coherent return link is derived by applying a 240/221 multiple to the forward link carrier frequency. The auxiliary oscillator return link carrier frequency is 2287.5 or 2217.5 MHz. A coherent PSK demodulator at WSC recovers the baseband 576 ksps (HDR) or 288 ksps (LDR) encoded sequence, and a soft-decision bit synchronizer and Viterbi decoder are used to resolve encoded symbol inversion and to provide the 192-kb/sec (HDR) or 96-kb/sec (low data rate) encrypted operational TDM sequence with the same polarity as the encrypted operational TDM sequence at the Space Shuttle encoder input. The decryptor (at JSC) produces the 192-kb/sec (HDR) or 96-kb/sec (LDR) operational TDM sequence. A frame sync demultiplexer identifies the synchronization pattern in the TLM data format, controls encrypted bit inversion, and separates the two (HDR) or one (LDR) voice channels and the TLM channel. The voice channels are routed to the Delta demodulators. WSC also provides two-way Doppler extraction.

Table 1-3. Space Shuttle-to-TDRSS S-band Return Link Interfaces

Link	Data	Frequency	Contents
S-band Return Link	TLM and A/G Voice	2217.5 or 2287.5 MHz	a. Data Mode 1 (Low Bit Rate): The 96-kb/sec data is 1/3 convolutionally encoded and converted to a BiØ-L format to PSK-modulate the carrier prior to transmission. The 96-kb/sec data consists of the following: 1. 64 kb/sec: TLM/Sync. 2. 32 kb/sec: Digital Voice. b. Data Mode 2 (High Bit Rate): The 192-kb/sec data is conditioned in the same manner as Low Bit Rate (96-kb/sec) prior to transmission. The data consists of the following: 1. 128 kb/sec: TLM/Sync. 2. 32 kb/sec: Digital Voice 1. 3. 32 kb/sec: Digital Voice 2. c. Data Mode 3 (Carrier Only): Return link (carrier only) acquisition and two-way Doppler tracking shall be provided when the return link signal consists of an unmodulated carrier and the Shuttle Effective Isotropic Radiated Power (EIRP) is greater than or equal to minus 5 dBw. For Mode 3, the Shuttle return link carrier will be coherently related to the forward link carrier.



NOTES:

1. HIGH OR LOW DATA RATE.
2. SAME EQUIPMENT FOR S-BAND DIRECT DOWNLINK AND KU-BAND RETURN LINK.
3. CAPABLE OF UNENCRYPTED OPERATION.
4. FRAME SYNCRONIZATION USES TELEMETRY SYNC PATTERN.

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Figure 1-7. Space Shuttle-to-TDRSS S-band Return Link Functional Configuration

1.3.1.4 TDRSS-to-Space Shuttle K-band Forward Link

a. General. The TDRSS-to-Space Shuttle K-band forward link (refer to Table 1-4) provides two modes of operation (216- and 72-kb/sec). This link is capable of either spread-spectrum or unspread operation, and can be either encrypted or unencrypted.

b. Mode 1

1. In Mode 1, this link transmits the following data channels simultaneously:

   (a) Two independent real-time digital voice channels at 32 kb/sec each.

   (b) One CMD channel at 6.4 kb/sec.

   (c) One synchronization channel at 1.6 kb/sec.

   (d) One forward data channel at 128 kb/sec.

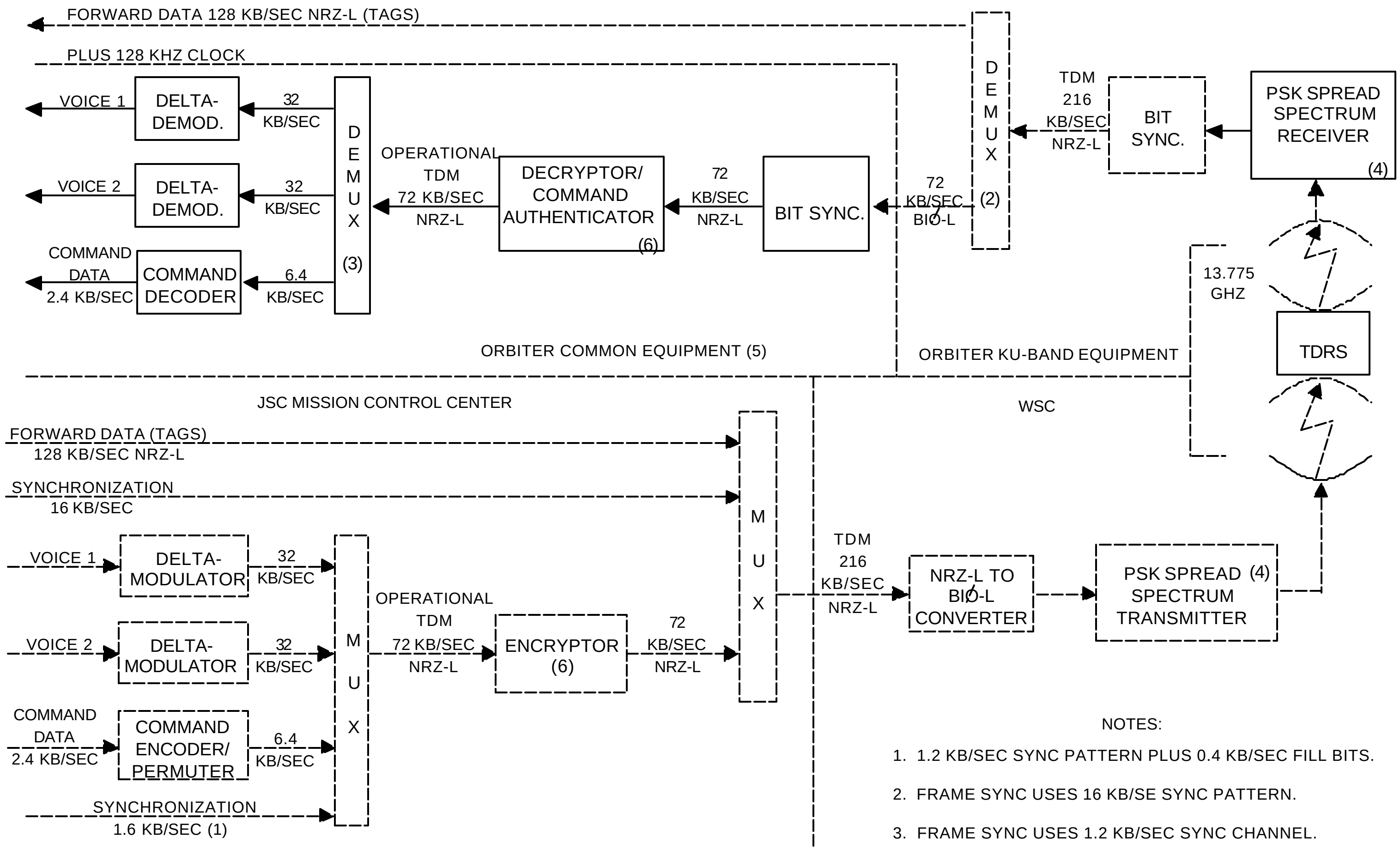
   (e) One synchronization channel at 16 kb/sec.

2. Figure 1-8 illustrates the functional configuration for this link in mode 1. Each of the two analog voice channels is encoded into a 32-kb/sec digital voice channel by a Delta modulator. The 2.4-kb/sec CMD channel is Bose-Chaudhuri-Hocquenghem (BCH) encoded into a 6.4-kb/sec encoded CMD channel by a CMD encoder, and is further processed into a 6.4-kb/sec permuted time-authenticated CMD channel. The 1.6-kb/sec channel consists of a 1.2-kb/sec synchronization pattern TDM with 0.4 kb/sec of arbitrary fill data. The two digital voice channels, the permuted CMD channel, and the 1.6-kb/sec sync channel are multiplexed into a 72-kb/sec NRZ-L operational TDM channel and encrypted into a 72-kb/sec encrypted operational TDM channel. The 72-kb/sec encrypted operational TDM channel, 128-kb/sec forward data channel (Text and Graphics System [TAGS]), and 16-kb/sec synchronization channel are then multiplexed into a 216-kb/sec TDM channel, and transmitted to WSC, where it is converted from an NRZ-L to a BiØ-L (Manchester II) signal format. To obtain spread-spectrum operation, the 216-kb/sec BiØ-L TDM data is multiplied by an NRZ-L PN sequence at a nominal chip rate of 3.028 Mchips/sec, and the resulting spread-spectrum sequence is used to PSK modulate the carrier for transmission to the Space Shuttle. The nominal carrier frequency received by the Space Shuttle is 13.775 GHz. On the Space Shuttle, the receiver provides PN despread and PSK demodulation, and a bit synchronizer restores the baseband 216-kb/sec TDM channel. A frame sync demultiplexer identifies the 16-kb/sec synchronization pattern, controls bit inversion, and separates the 128-kb/sec forward data and the 72-kb/sec encrypted operational TDM channels. The encrypted operational TDM is routed to the Space Shuttle common equipment, where a bit synchronizer, decryptor, and CMD authenticator produce the 72-kb/sec operational TDM. Then the operational TDM frame sync demultiplexer identifies the 1.2-kb/sec synchronization pattern, controls encrypted bit inversion, and separates the voice channels and the encoded CMD channel. Delta demodulators restore the analog voice channels, and a CMD BCH decoder restores the CMD data channel.

Although the Space Shuttle S- and K-band systems may both function simultaneously, the Space Shuttle common equipment selects its input signal from only the S-band or the K-band system (Network Signal Processor [NSP] source).

Table 1-4. TDRSS-to-Space Shuttle K-band Forward Link Interfaces

Link	Data	Frequency	Contents
K-band Forward (Modes 1 and 2)			a. The forward link can be Doppler-compensated. The BiØ-L TDM data is converted by an NRZ-L PN sequence (chip rate 3.028 Mchips/sec), and the resultant spread spectrum is used to PSK-modulate the forward link carrier. The forward link is also capable of unspread operation.
K-band Forward Link (Mode 1)	CMD, A/G Voice, Text and Graphics	13.775 GHz	b. Mode 1 (216 kb/sec): The following data channels are transmitted simultaneously: 1. 32 kb/sec: Digital Voice 1. 2. 32 kb/sec: Digital Voice 2. 3. 6.4 kb/sec: CMD (encoded and permuted). 4. 1.6 kb/sec: Synchronization channel. 5. 128 kb/sec: Forward data channel (text and graphic data). 6. 16 kb/sec: Synchronization channel.
K-band Forward Link (Mode 2)	Command and A/G Voice	13.775 GHz	c. Mode 2 (72 kb/sec): The following data channels are transmitted simultaneously: 1. 32 kb/sec: Digital Voice 1. 2. 32 kb/sec: Digital Voice 2. 3. 6.4 kb/sec: CMD (encoded and permuted). 4. 1.6 kb/sec: Synchronization channel.



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NOTES:

1. 1.2 KB/SEC SYNC PATTERN PLUS 0.4 KB/SEC FILL BITS.
2. FRAME SYNC USES 16 KB/SE SYNC PATTERN.
3. FRAME SYNC USES 1.2 KB/SEC SYNC CHANNEL.
4. NOMINAL PN CHIP RATE 3.028 MCHIPS ALSO CAPABLE OF UNSPREAD OPERATION.
5. SAME EQUIPMENT FOR S-BAND DIRECT UPLINK AND FORWARD LINK.
6. CAPABLE OF UNENCRYPTED OPERATIONS..

Figure 1-8. TDRSS-to-Space Shuttle K-band Forward Link Mode 1 Functional Configuration

c. Mode 2

1. In Mode 2, this link transmits the following data channels simultaneously:

   (a) Two independent Real-time (R/T) digital voice channels at 32 kb/sec each.

   (b) One CMD channel at 6.4 kb/sec.

   (c) One synchronization channel at 1.6 kb/sec.

2. Figure 1-9 illustrates the functional configuration for this link in Mode 2. The two analog voice channels, 6.4-kb/sec CMD channel, and 1.6-kb/sec sync channel are processed, multiplexed, and encrypted to produce the same 72-kb/sec encrypted operational TDM channel (as for this link in Mode 1). Then, the encrypted operational TDM channel is transmitted via the same TDRSS Relay and Space Shuttle receiver configuration as for Mode 1. In contrast to Mode 1, the Mode 2 Space Shuttle K-band configuration bypasses the 216-kb/sec bit synchronizer and frame sync/demultiplexer and routes the PSK receiver post detection signal (72 kb/sec BiØ-L) plus noise directly to the Space Shuttle common equipment, which produces the voice and CMD channels as in Mode 1. Also, as in Mode 1, the Space Shuttle common equipment selects its input signal from only the S- or the K-band system at any one time (NSP source).

1.3.1.5 Space Shuttle-to-TDRSS K-band Return Link

a. General. The Space Shuttle-to-TDRSS K-band return link is capable of providing two modes of operation (refer to Table 1-5).

b. Mode 1

1. In Mode 1, the Space Shuttle K-band return link transmits the following three data channels simultaneously:

   (a) Channel 1: Two independent real-time digital voice channels simultaneously at 32 kb/sec each, and one real time TLM channel at 128 kb/sec.

   (b) Channel 2: One of the following:

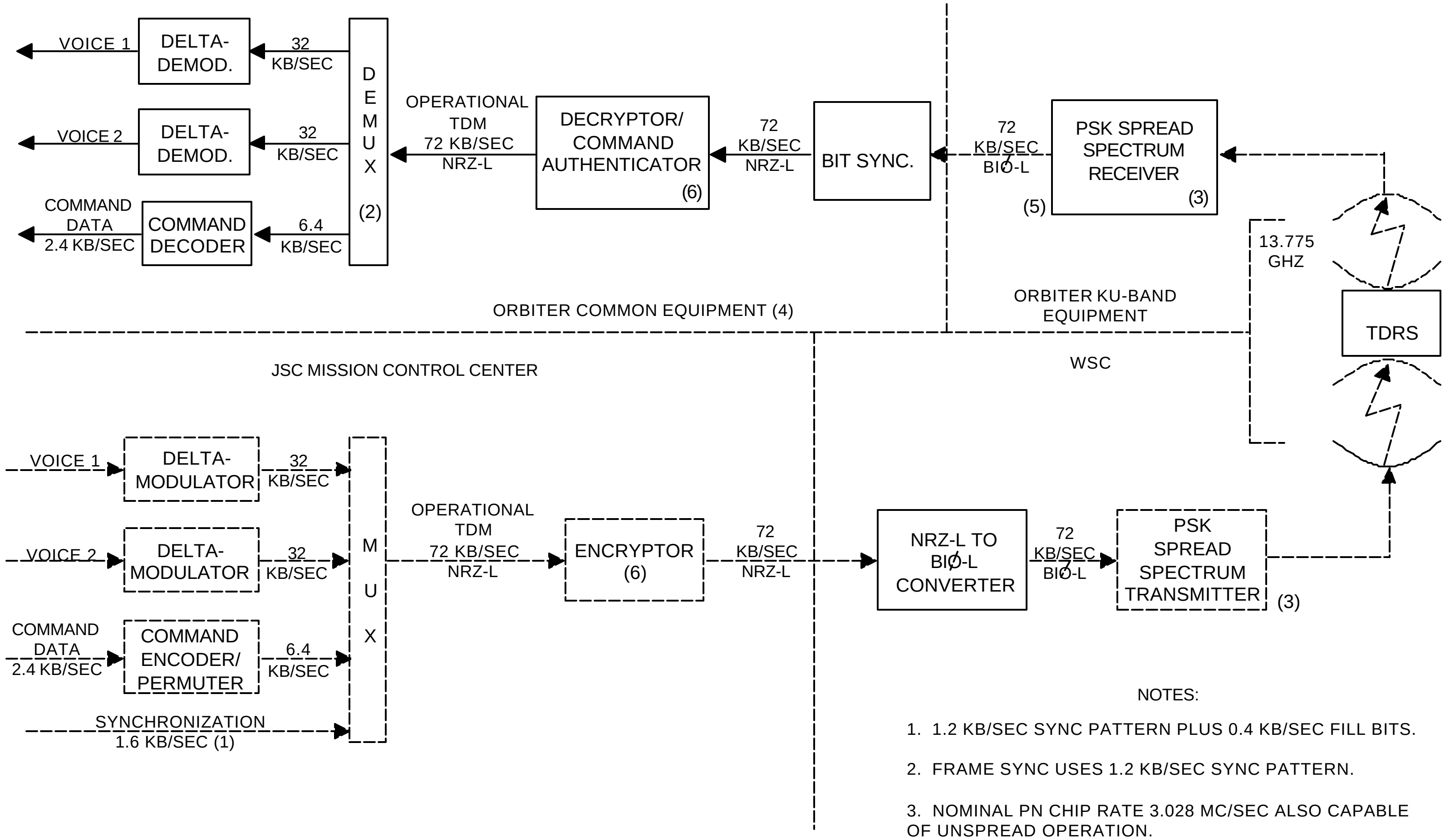
      (1) Attached payload digital data from 16 kb/sec to 2 Mb/sec, NRZ-L, NRZ Mark (NRZ-M), or NRZ Space (NRZ-S) and from 16 kb/sec to 1024 kb/sec, BiØ-L, BiØ-phase Mark (BiØ-M), or Bi-phase Space (BiØ-S).

      (2) Payload Recorder playback from 25.5 to 1024 kb/sec, BiØ-L, M, or S.

      (3) Operations Recorder playback from 60 to 1024 kb/sec, BiØ-L. (Solid state recorders have max PB rate of 2048 kb/sec.)

      (4) Payload bent-pipe digital data from 16 kb/sec to 2 Mb/sec, NRZ-L, M, or S, or from 16 to 1024 kb/sec, BiØ-L, M, or S.

   (c) Channel 3: Attached Payload digital data (real-time or playback) or Payload bent-pipe digital data from 2 to 50 Mb/sec, NRZ-L, M, or S.



NOTES:

1. 1.2 KB/SEC SYNC PATTERN PLUS 0.4 KB/SEC FILL BITS.
2. FRAME SYNC USES 1.2 KB/SEC SYNC PATTERN.
3. NOMINAL PN CHIP RATE 3.028 MC/SEC ALSO CAPABLE OF UNSPREAD OPERATION.
4. SAME EQUIPMENT FOR S-BAND DIRECT UPLINK AND FORWARD LINK.
5. BYPASS KU-BAND BIT SYNC/DEMUX.
6. CAPABLE OF UNENCRYPTED OPERATION.

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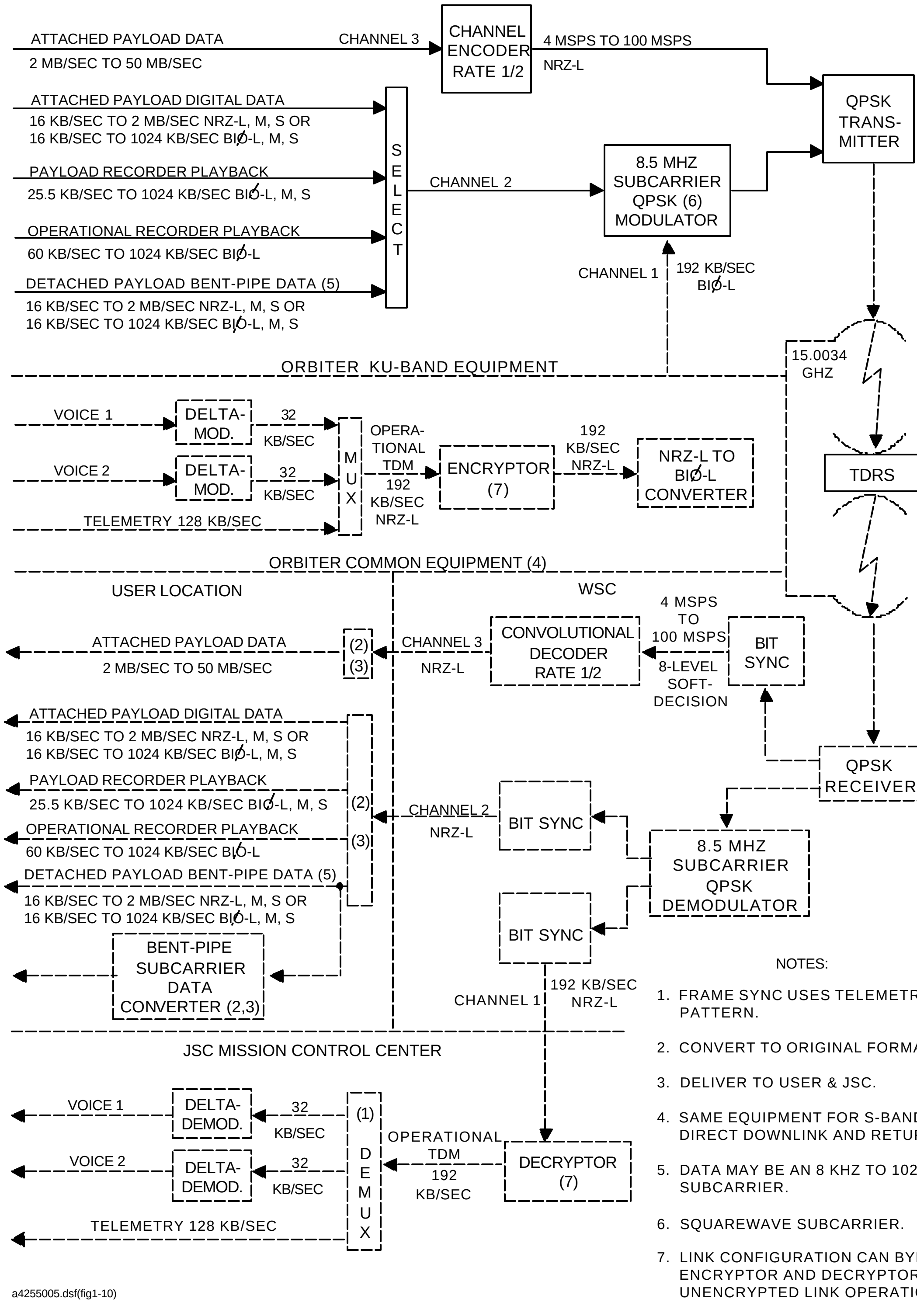
Figure 1-9. TDRSS-to-Space Shuttle K-band Forward Link Mode 2 Functional Configuration

Table 1-5. Space Shuttle-to-TDRSS K-band Return Link Interfaces

Link	Data	Frequency	Contents
K-band Return Link (Mode 1)	OD TLM, A/G Voice, PL Digital	15.0034 GHz	a. Mode 1: The K-band Phase Modulated (PM) return link consists of three channels. Channel 1 data is converted from NRZ-L to BiØ-L, and is combined with channel 2 data in an 8.5-MHz sub-carrier Quadrature PSK (QPSK) modulator. Channel 3 data is encoded at a 1/2 rate. The Channel 3 encoded data and the QPSK square wave subcarrier are used to QPSK the link carrier (15.0034 GHz) to the TDRS. 1. Channel 1: 192-kb/sec TDM Operational Data. (a) 128 kb/sec: TLM. (b) 32 kb/sec: Digital Voice 1. (c) 32 kb/sec: Digital Voice 2. 2. Channel 2: One of the following: (a) Operations Recorder playback, 60 to 1024 kb/sec. (b) Payload Recorder playback, 25.5 to 1024 kb/sec. (c) Attached Payload Digital Data: (1) 16 kb/sec to 2 Mb/sec (NRZ-L, M, and S formats). (2) 16 to 1024 kb/sec (BiØ-L, M, and S formats). (d) Detached Payload Bent-pipe Data: (1) 16 kb/sec to 2 Mb/sec NRZ-L, M, and S formats). (2) 16 to 1024 kb/sec (BiØ-L, M, and S formats). 3. Channel 3: Attached Payload Data, 2 to 50 Mb/sec (NRZ-L, M, and S formats).
K-band Return Link (Mode 2)	OD TLM, A/G Voice, PL Digital, and TV Video	15.0034 GHz	b. Mode 2: The K-band Frequency Modulated (FM) return link consists of three data channels. Channel 1 data is (Mode 2) converted from NRZ-L to BiØ-L, and is combined with Channel 2 data in an 8.5-MHz subcarrier QPSK modulator. Uncoded Channel 3 data is linearly added to the 8.5-MHz subcarrier to frequency modulate the return link carrier. 1. Channel 1: 192-kb/sec TDM Operational Data: (a) 128 kb/sec: TLM. (b) 32 kb/sec Digital Voice 1. (c) 32 kb/sec Digital Voice 2. 2. Channel 2: One of the following: (a) Operations Recorder Playback, 60 to 1024 kb/sec. (b) Payload Recorder Playback, 25.5 to 1024 kb/sec. (c) Attached Payload Digital Data: (1) 16 kb/sec to 2 Mb/sec (NRZ-L, M, and S formats). (2) 16 kb/sec to 1024 kb/sec (BiØ-L, M, and S formats). 3. Channel 3: One of the following: (a) TV video to 4.5 MHz. (b) Attached Payload Analog Data to 4.2 MHz. (c) Attached Payload Digital Data, 16 kb/sec to 4 Mb/sec. (d) Detached Payload Bent-pipe Data, 16 kb/sec to 4 Mb/sec.

2. The link performance is enhanced by using channel encoding/decoding for the Channel 3 High-rate Payload data and by using suppressed carrier modulation for the link carrier.

3. Figure 1-10 illustrates the functional configuration for this link in Mode 1. In the Space Shuttle common equipment, the two analog voice channels are encoded into 32-kb/sec digital voice channels by Delta modulators, and are multiplexed with the 128-kb/sec TLM channel into a 192-kb/sec operational TDM channel. The operational TDM channel is encrypted to obtain a 192-kb/sec encrypted operational channel. After encryption, the data is convolutionally-encoded at a 1/3 rate to produce 576-kilosymbols per second (ksps), and is converted from NRZ-L to BiØ-L signal format. In the K-band return link, Channel 1 consists of the high-data-rate encrypted operational TDM at 192 kb/sec, BiØ-L. Channel 2 is selected from one of the four options listed above. The Channel 1 encrypted operational TDM data and the Channel 2 selected data are used to QPSK an 8.5-MHz square wave subcarrier. The Channel 3 attached payload digital data at 2 to 50 Mb/sec, NRZ-L, M, or S, is encoded at a rate of 1/2 into an encoded data channel at 4 to 100 Msps, NRZ-L. The Channel 3 encoded data and the QPSK squarewave subcarrier are used to QPSK the link carrier (15.0034 GHz) to the TDRS. The subcarrier and the carrier frequencies are generated in the Space Shuttle by auxiliary oscillators. On the ground at WSC, a QPSK receiver derives reference quadrature carriers for coherent QPSK demodulation to obtain the Channel 3 encoded data and the QPSK subcarrier. The Channel 3 encoded data is reconstructed in an eight-level soft-decision signal format by a bit synchronizer, and is decoded by a rate 1/2 decoder to obtain the decoded Channel 3 attached payload digital data. A coherent sinusoidal QPSK demodulator is used to obtain the Channel 1 operational encrypted TDM data and the Channel 2 selected data from the QPSK squarewave subcarrier, and both Channels 1 and 2 are reconstructed by bit synchronizers. The three channel data signals are all output from the WSC in NRZ-L format via digital transmission facilities. If the Space Shuttle digital data format is NRZ-M or S or BiØ-M or S, the received data at WSC is converted to NRZ-L without bit inversion. If the Space Shuttle digital data format is NRZ-L or BiØ-L, WSC may output the data in NRZ-L format with a possible bit inversion, which JSC is responsible for resolving. The Channel 3 and 2 digital data are subsequently converted to the original Space Shuttle format for delivery to JSC. The Channel 1 encrypted operational TDM data is decrypted in the MCC to obtain the operational TDM data. Then the operational TDM data is demultiplexed into the separate two digital voice channels and the TLM channel using the master synchronization pattern in the TLM channel for control of encrypted bit inversion and for frame synchronization. Delta demodulators restore the analog voice channels. This link is functionally capable of unencrypted operation.



NOTES:

1. FRAME SYNC USES TELEMETRY SYNC PATTERN.
2. CONVERT TO ORIGINAL FORMAT.
3. DELIVER TO USER & JSC.
4. SAME EQUIPMENT FOR S-BAND PM DIRECT DOWNLINK AND RETURN LINK.
5. DATA MAY BE AN 8 KHZ TO 1024 KHZ PM SUBCARRIER.
6. SQUAREWAVE SUBCARRIER.
7. LINK CONFIGURATION CAN BYPASS ENCRYPTOR AND DECRYPTOR UNITS FOR UNENCRYPTED LINK OPERATION.

Figure 1-10. Space Shuttle-to-TDRSS K-band Return Link Mode 1 Functional Configuration

c. Mode 2

1. In Mode 2, this link transmits the following three data channels simultaneously:

   (a) Channel 1: Same as in Mode 1.

   (b) Channel 2: Same as in Mode 1.

   (c) Channel 3: One of the following, one at a time:

      (1) TV (color or black and white) attached payload analog from Direct Current (dc) level to 4.5-MHz.

      (2) Real-time attached payload analog data from dc to 4.5-MHz.

      (3) Real-time attached payload digital data from 16-kb/sec to 4-Mb/sec, NRZ-L, M, S.

      (4) Detached payload bent-pipe analog data from 1-kHz to 4-MHz, or digital data from 16-kb/sec to 4-Mb/sec, NRZ-L, M, S.

2. In Mode 2, this link provides for linear transmission of analog data in Channel 3 by using carrier FM.

3. Figure 1-11 illustrates the functional configuration for this link in Mode 2. Channels 1 and 2 are the same as in Mode 1, and are used to QPSK-modulate an 8.5-MHz sinewave subcarrier. Channel 3 is selected from the four options listed in paragraph 1.3.1.5 c(1)(c). The Channel 3 selected data and the QPSK subcarrier are added linearly to produce a TDM signal which is used to frequency-modulate the link carrier (15.0034 GHz) to the TDRS. The subcarrier and the carrier frequencies are generated in the Space Shuttle by auxiliary oscillators. At WSC, a linear FM demodulator recovers the TDM signal, which is routed to a 4.2-MHz low-pass filter to obtain the Channel 3 TV composite video, the real time attached payload analog data, or the detached payload bent-pipe analog data, and to a subcarrier coherent QPSK demodulator to obtain the Channel 1 and 2 data. Channel 3 analog data is output from the WSC via analog transmission facilities to JSC. Channels 1 and 2 are handled the same as in Mode 1.

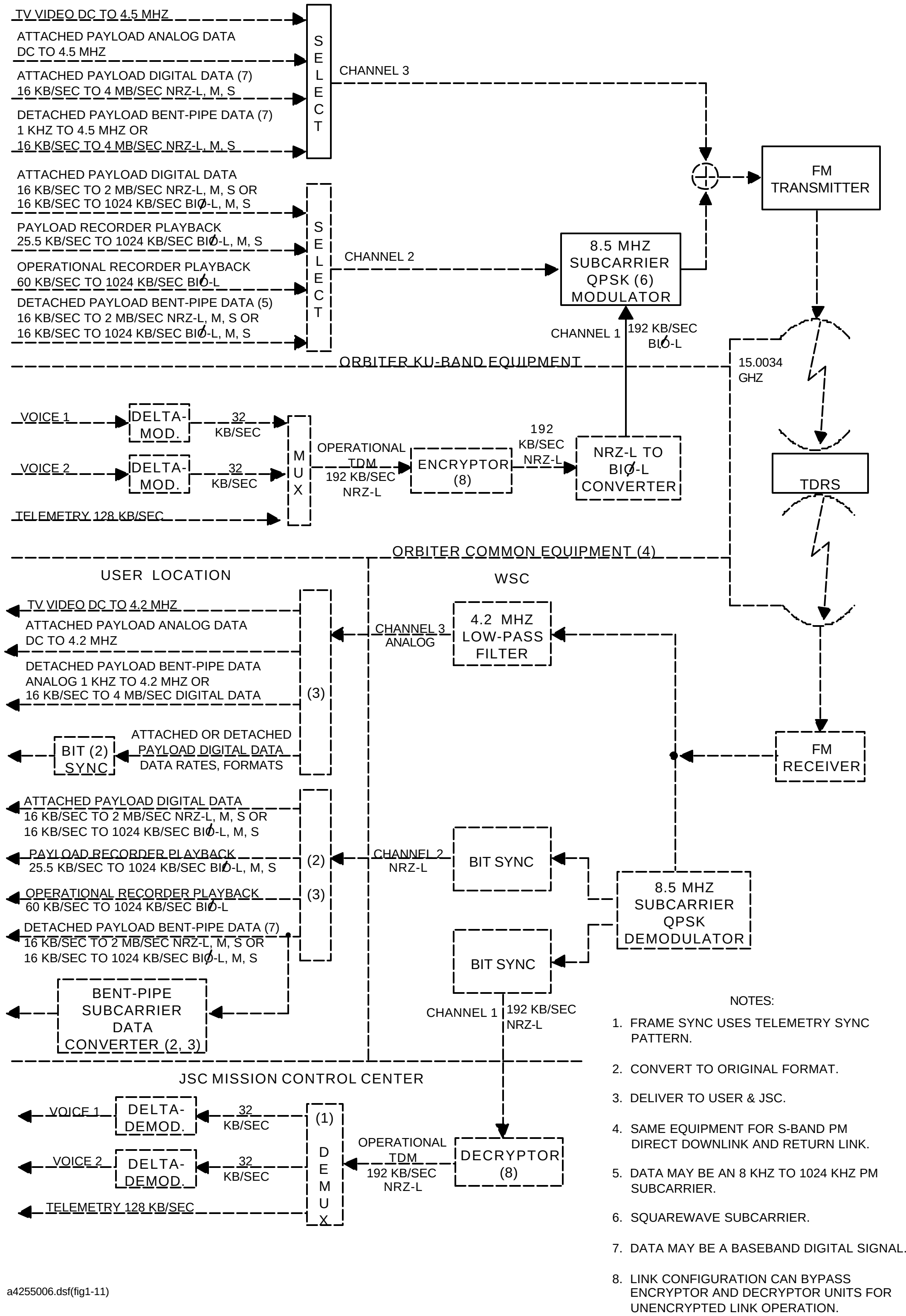


Figure 1-11. Space Shuttle-to-TDRSS K-band Return Link Mode 2 Functional Configuration

1.3.2 SN Element Support

1.3.2.1 General

The following paragraphs define the nominal support each SN element will provide for a Space Shuttle mission. Specific operations scripts and overall procedures are contained in Section 2 for the specific phase of operations encountered.

1.3.2.2 Data Services Management Center

The STDN, is comprised of GN and SN elements. The Data Services Management Center (DSMC) located at WSC provides the management function that schedules both the Ground and Space Networks and controls, and monitors the Space Network. The WSC provides a real-time support interface between the SN, STDN support elements (e.g., Flight Dynamics Facility [FDF], NASA Integrated Services Network [NISN], Simulation Operations Center [SOC]), and other facilities including Payload Operations Control Centers (POCC), Mission Planning Terminals [MPT], and Sensor Data Processing Facility [SDPF]). This capability includes control of available network resources, schedule processing and conflict resolution, network testing, data monitoring, data base maintenance, and management reporting on network performance.

1.3.2.3 WSC

The WSC processes, monitors, and routes data flowing between WSC and the common carrier communications links. The common carrier links, primarily operating through domestic satellite terminals, transport data and control and status signals between WSC, JSC, Marshall Space Flight Center (MSFC), Merritt Island (MIL) elements, and GSFC. WSC records data that exceeds the data rate capabilities of the communication link, spacecraft data in the event of communication link/line failures, spacecraft data for systems/data link reliability studies, video (TV), and High-rate Multiplexer (HRM) data during missions involving TDRSS KSA return Channels 2 and 3 activity (e.g., Spacelab).

1.3.2.4 NIC

The Network Integration Center (NIC) (located at GSFC) houses several GN and SN remote network work Stations which are interfaced to the WSC Network Control Center Data System (NCCDS). The ND, SMM, GSFC Ops, and Goddard test personnel monitor specific GN and SN operations. NIC operations include SN and GN testing functions, ELV launches, Space Shuttle launch/on-orbit/landing operations, ISS on-orbit operations, and other specified monitoring functions. The ND also monitors other selected mission operations and provides directions to the Networks as required. The SMM monitors operations and provides directions to the networks in the ND's absence.

1.3.2.5 NISN

NISN provides the communications between WSC, JSC, MIL elements, and GSFC through the common carrier facilities. The NISN Government-Furnished Equipment (GFE), Multiplexer/ Demultiplexer (MDM), and Statistical Multiplexer (SM) are used for the channelized digital traffic between WSC and JSC. The Closed IONET provides connectivity from JSC/WSC to

GSFC and MSFC as well as other NASA centers. At GSFC, data received from the common carrier links is routed to the other elements through the NISN switching resources. Video and voice are also extended. The Voice Switching System (VSS) provides longline connectivity to the other NASA centers and the Voice Distribution System (VDS) provides local connectivity on GSFC. The Digital Matrix Switch (DMS) provides circuit switching and local distribution for digital data on GSFC, interfacing with the Closed IONET routers and conversion devices to route blocked and formatted digital data to the intended recipients.

1.3.2.6 FDF

The FDF is responsible for coordination of pre-mission, launch, on-orbit, and landing acquisition data, and tracking data processing services for all stations in the Space Shuttle T&DA Network. For SN support the FDF has responsibility for the generation and transmission of acquisition data for all missions. Pre-mission acquisition data is generated from JSC-supplied trajectory tapes. On-orbit and landing acquisition data is generated from JSC-supplied Improved Inter-range Vectors (IIRV).

1.3.2.7 SOC

The SOC (located at GSFC) provides for testing the operation of elements of the network or satellites without requiring full dedication of the operational network elements. In addition, the SOC will act as a substitute for the JSC MCC if the Electronic Systems Test Laboratory (ESTL) is implemented for TDRS contingency testing.

1.3.2.8 Compatibility Test Vans

There are two transportable Compatibility Test Vans (CTV) which provide test systems to reflect the current capabilities of the SN. These vans are used at WSC, the spacecraft manufacturer's plant, and the launch site to ensure that STDN operational parameters are compatible with actual mission requirements.

1.3.2.9 MIL

The MIL tracking station provides tracking of launch events and, through the Shuttle Launch Support System (SLSS), translates the TDRS-compatible Space Shuttle signals into formats suitable for distribution through the GN common carrier links to GSFC and eventually to JSC. Also at MIL, the MIL Relay provides bent pipe signal routing between the TDRS and payloads or satellites under test prior to launch.

a. The Bilateration Ranging Transponder System (BRTS) consists of six unattended SN user transponders located in four fixed and surveyed positions around the globe. The BRTS transponders send and receive signals via the TDRS to WSC.

b. The forward and return services are used to make four link range and Doppler measurements between the TDRS and BRTS, and return services are used for collecting BRTS TLM housekeeping data. The data is routed to FDF, where TDRS definitive and predicted ephemerides are calculated and BRTS health is evaluated.

1.3.3 Simplified End-to-End Configuration

The simplified end-to-end functional configuration for Space Shuttle SN support is shown in the control and data flow block diagram, Figure 1-12.

1.3.4 Referenced Abbreviations and Acronyms

The abbreviations and acronyms used throughout this document are conveniently tabulated along with definitions in Appendix A.

1.3.5 Supporting Documents and Related Web Sites

Documents which provide supporting data for this TNOSP and documents that are referenced in the text of this TNOSP are presented in alphamerical order in Appendix B. Also presented are Internet web sites which may contain data useful to the users of this TNOSP.

1.3.6 Data Stream Assignments

Data Stream Identification codes help coordinate fault isolation efforts within the SN. Current data stream assignments are tabulated in Appendix C for quick reference.

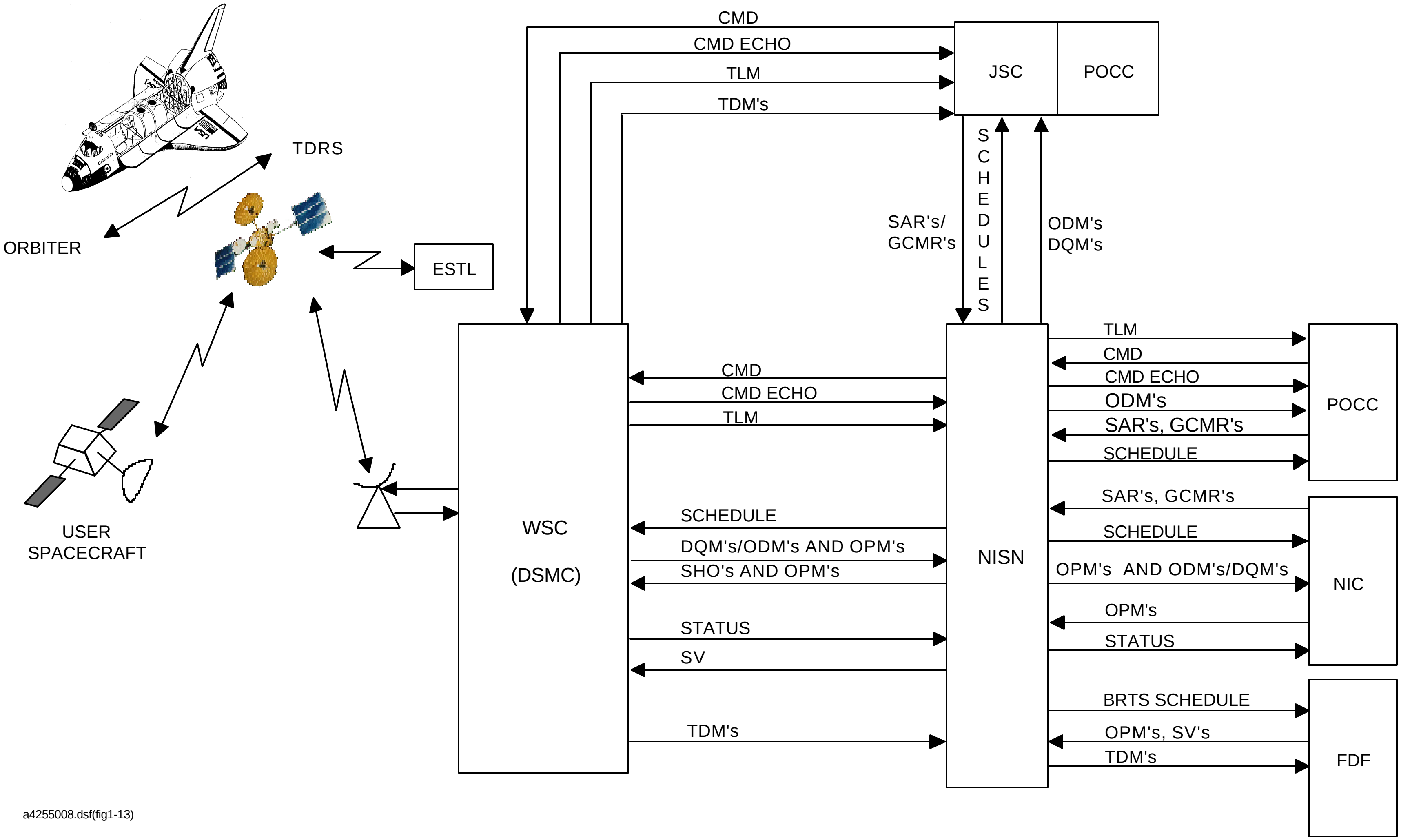


Figure 1-12. Simplified SN Control and Data Flow Block Diagram

Section 2. Mission/Network Operations

2.1 Overview

This section provides the mission-specific operations procedures and data base information required of SN operations for the Space Shuttle. Procedures in this section provide for mission unique scheduling and interfacing of all services offered by the TDRSS and network in support of Space Shuttle missions. This includes SSA forward and return services, KSA forward and return services, two-way (coherent) tracking services, simulation services for the above, and scheduling coordination of the MDM communications functions to support CMD, housekeeping/engineering, and payload data transfers. Most of these activities are accommodated by standard operating procedures in accordance with the Operations Interface Procedure (OIP) between the White Sands Complex (WSC) and Spaceflight Tracking and Data Network (STDN) Customers and Elements, and other applicable Operations Interface Procedures listed in the referenced document portion of Appendix B. Where general procedures are applicable, they are referenced by document. Where mission-specific procedures are required, either they are contained within this section or a reference is made to a mission-specific procedures document.

2.2 DSMC

The JSC MCC requires DSMC support for scheduling and interfacing of all services offered by the TDRSS in support of Space Shuttle missions. This includes SSA forward and return services, KSA forward and return services, two-way (coherent) tracking services, simulation services for the above, and scheduling coordination of the MDM communications functions to support CMD, housekeeping/engineering, and payload data transfers. In addition, the DSMC must provide for scheduling and coordination of the Space Shuttle mission-unique functions and certain playback operations at WSC. Most of these activities are accommodated by standard DSMC procedures in accordance with WSC LOPS and the current OIPs listed in Appendix B. The WSC/NCCDS data base contains Service Specification Codes (SSC) used to configure the SN for service support. These SSCs must be resident in the WSC/NCCDS data base prior to the JSC/DSMC interface for Space Shuttle and/or ESTL support via the TDRSS. Procedures specific to the Space Shuttle are contained in the following paragraphs.

2.3 Voice Interfaces

2.3.1 General

Callsigns will be used for voice interfaces during Space Shuttle operations involving the SN. The White Sands Ops/STGT Ops is the point-of-contact for interface activities.

2.3.2 Voice Callsigns for Space Shuttle SN Event Interfaces

Established procedures will be used for all voice interfaces. The following are callsigns that are normally used during interface activities for SN Space Shuttle operations. Each element has a point-of-contact for interface activities involving that element.

	Position	Callsign
a.	GSFC NIC:	
1.	Network Director	ND
2.	Goddard Test Director	Goddard TD (point-of-contact)
3.	STDN Mission Manager	SMM
4.	Goddard Network Operations Mgr.	Goddard Ops (point-of-contact)
b.	GSFC NISN:	
1.	Mission Communications Manager	Mission Comm Mgr (point-of-contact)
2.	Communication Manager	Comm Mgr
3.	Goddard Voice Controller	Goddard Voice
4.	Goddard Technical Controller	Goddard Tech Control
5.	Television Communications Manager	Goddard TV
6.	Conversion Device Manager	CD Mgr
7.	IP Network	IP NOC
c.	GSFC FDF:	
1.	FDF Mission Manager	FDF Comm (point-of-contact)
2.	FDF Data Analyst	FDF Data
d.	JSC MCC:	
1.	Ground Controller	GC (point-of-contact)
2.	Data Flow Engineer	Houston DFE
3.	Command Controller	Houston CMD
4.	TV Controller	Houston TV
5.	Instrumentation Communications Officer	INCO
6.	Communications Controller	Houston Comm Control

	Position	Callsign
7.	Communications Technician	Houston Comm Tech
8.	Houston Voice Controller	Houston Voice

e. WSC:

1.	WSC Operations Supervisor	WSC OS (point-of-contact)
2.	WSGT/STGT Site Specialist (Vector Controllers)	White Sands Ops/STGT Ops
3.	WSGT/STGT Technician	White Sands Tech/STGT Tech
4.	Communications Services Controller	CSC-X Controller (where X = positions 1 through 6)
5.	Television Controller	White Sands TV/STGT TV
6.	White Sands Scheduling Operator	White Sands Scheduling
7.	White Sands Forecast Analyst	White Sands FA
8.	White Sands Technical Operations and Analysis	White Sands TO&A

f. MSFC:

1.	MSFC Operations Controller	Marshall Ops (point-of-contact)
2.	MSFC Communications Controller	Marshall Comm Control
3.	MSFC Communications Technician	Marshall Comm Tech
4.	Television Studio	Marshall TV
5.	Distribution	Marshall Tech
6.	Marshall Network Control Center	Marshall NCC
7.	Data Controller	Marshall Data
8.	Data Control Engineer Coordinator	Marshall DACON COORD
9.	Data Control Engineer	Marshall DACON
10.	Scheduler	Marshall Scheduling
11.	MSFC POP	MSFC POP
12.	MSFC Systems Controller	SYSCON

g. KSC: KSC Record and Playback System — KSC RPS

2.4 Scheduling Procedures

2.4.1 Space Shuttle-unique Scheduling

2.4.1.1 Purpose

This procedure describes the JSC and WSC interfacing that is required for Space Shuttle unique scheduling of the SN. General scheduling procedures are contained in WSC LOPS .

2.4.1.2 Participants

a. Houston CMD.

b. White Sands Scheduling.

c. White Sands Forcast Analyst (FA).

d. WSC Data Base Manager (DBM).

2.4.1.3 Procedure

a. Houston CMD will provide the necessary approval to the WSC DBM to manually copy an existing data base from a previous flight into the new Support Identification (SUPIDEN) code. Necessary changes to codes will be electronically transmitted to the Data Base Administrator (DBA) for implementation at least 2 weeks prior to the effective date of the change. After all configuration codes have been implemented, a hardcopy of the codes will be sent to JSC for verification. These activities will be accomplished prior to the start simulation date at JSC.

b. Houston CMD will prepare a SN Support Plan consisting of Specific Schedule Requests (SSR) on the User Planning System (UPS) after entering all approved configuration codes. This support plan will be reviewed at JSC and transmitted to the WSC 14 to 21 days prior to the first scheduled event. The White Sands FA will prepare a conflict-free schedule using the established priority list. Seven to 13 days prior to the first scheduled event, the WSC will transmit the schedule to the JSC UPS. Transmission of schedule messages to NISN and WSC, and Scheduling Orders (SHO) to WSC will be in accordance with internal WSC schedule transmission procedures.

2.4.2 Pre-mission Scheduling Conflict Resolution

2.4.2.1 Purpose

This procedure describes the process to work pre-mission scheduling conflicts.

2.4.2.2 Participants

a. Houston CMD.

b. White Sands Scheduling.

c. GC.

2.4.2.3 General

Approximately 2 weeks prior to a launch. Houston CMD will schedule projected TDRS satellite times. There is a possibility of conflicts arising on the WSC Scheduling data base due to other users.

NOTE

Houston CMD does not have the authority to either approve or disapprove requests from White Sands Scheduling.

2.4.2.4 Procedure

a. Before launch, if there are scheduling conflicts that affect JSC, White Sands Scheduling will notify Houston CMD. White Sands Scheduling will send Houston CMD a message stating the affected day and time. Houston CMD will notify the Lead GC.

b. White Sands Scheduling may make the change to the schedule. Following a launch, any schedule changes will be treated as conflicts.

c. Houston CMD will notify White Sands Scheduling if there is a conflict after launch.

2.4.3 Mission Scheduling Conflict Resolution

2.4.3.1 Purpose

This procedure describes the process to work mission scheduling conflicts.

2.4.3.2 Participants

a. Houston CMD.

b. White Sands Scheduling.

c. GC.

2.4.3.3 General

After launch, there is a possibility of conflicts that could occur due to scheduling updates from both JSC and other GSFC POCCs.

NOTE

Houston CMD does not have the authority to either approve or disapprove requests from White Sands Scheduling.

2.4.3.4 Procedure

a. Other POCCs rescheduling causes a conflict.

   1. If there are scheduling conflicts due to other GSFC POCCs, White Sands Scheduling will notify Houston CMD.

2. Houston CMD will inform the GC of the conflict information and the impact to JSC.

   (a) If approved, Houston CMD will delete and reschedule per the request.

   (b) If disapproved, Houston CMD will notify White Sands Scheduling.

b. JSC rescheduling causes a conflict.

   1. If Houston CMD requests a change to the scheduling data base and a conflict arises, White Sands Scheduling will try to resolve the conflict.

   2. If the conflict cannot be quickly resolved, Houston CMD will schedule a placeholder event.

   3. Houston CMD will inform the GC of the conflict information and the impact to JSC.

   4. GC will inform Houston CMD if loss of support is approved.

      (a) If loss is approved, Houston CMD informs White Sands Scheduling that no further action is required.

      (b) If loss is not approved, Houston CMD informs White Sands Scheduling.

         (1) White Sands Scheduling will advise Houston CMD when the conflict is resolved.

         (2) Houston CMD will delete the placeholder and reschedule.

2.4.4 Launch Slip Rescheduling

2.4.4.1 Purpose

This procedure describes the process required to slide and reschedule Space Shuttle events following a launch slip.

2.4.4.2 Participants

a. GC.

b. Houston CMD.

c. White Sands Scheduling.

d. White Sands Ops/STGT Ops.

2.4.4.3 Procedure

a. The GC will announce on the TDRSS Network Voice Coordination Loop (TN COORD) to White Sands Ops/STGT Ops that a launch slip has occurred. A new lift-off time will be provided by the GC when it becomes available.

b. Houston CMD will notify White Sands Scheduling on the JSC SHO Time to delete Space Shuttle event 2 from the WSC data base (note that event 1 will not be deleted).

The WSC will also delete the remaining current day's events at Houston CMD's direction.

c. Houston CMD will slide and reschedule event 2 with the new event start time based on the actual lift-off time. Houston CMD will then slide and reschedule the remaining events for the current day.

d. The scheduled events for subsequent days will be deleted by White Sands Scheduling on direction from Houston CMD.

e. Houston CMD will reschedule the remaining mission events as follows:

1. In the case of a launch slip:

   (a) Launch + 6 hours: Houston CMD will begin the process of transmitting mission schedules for the next 24 hours.

   (b) Launch + 12 hours: Houston CMD will begin the process of transmitting the remainder of the mission schedule. This will be accomplished in three day intervals. Three day blocks should be scheduled, conflict resolution performed, and retransmitted to the WSC as soon as possible. Houston CMD should then begin the scheduling process for the next three day block and retransmit it to the WSC as soon as possible. This process should continue until the entire mission is scheduled.

2. In the case of a launch scrub:

   (a) Launch scrub is 24 hours or less. Launch (revised T-0) - 12 hours: Houston CMD will begin the process of transmitting the schedules for the first 6 hours of the mission.

   (b) Launch scrub is greater than 24 hours. Launch (revised T-0) - 24 hours: Houston CMD will begin the process of transmitting the schedules for the first 6 hours of the mission.

   (c) The remainder of the mission schedule should be retransmitted to the WSC as described above in paragraph 2.4.4.3e1(b).

   (d) If the launch scrub moves the new launch date outside of the real-time period (14 days), then the updated schedules should be retransmitted into the forecast period, if at all possible.

3. In the event of a Space Shuttle slip or scrub, the updated shuttle events will be given priority as if the events were being scheduled in the forecast period. Once these updated events are scheduled and confirmed, any updates to the schedule

   will follow the guidelines in the STDN priority list; that is, events scheduled in the forecast period have priority over real-time updates unless that update is an absolute priority (item d of the priority list).

2.4.5 Verbal Schedule Add Request Relay

2.4.5.1 Purpose

This procedure provides a method for verbally relaying Space Shuttle Schedule Add Requests (SAR) to the WSC in near-real time should an anomalous condition exist.

2.4.5.2 Participants

a. WSC OS.

b. Houston CMD.

c. White Sands Scheduling.

d. WSC DBM.

e. White Sands Ops/STGT Ops.

2.4.5.3 Procedure

a. Should an extended UPS interface outage exist or if a time constraint prohibits the processing and transmission of SARs via the UPS, Houston CMD may verbally notify White Sands Scheduling on the JSC SHO Time of the requirement for an event to be scheduled by the WSC.

b. Houston CMD will provide White Sands Scheduling with the Space Shuttle service specification code, start time, and duration of each service of the requested support.

c. White Sands Scheduling will enter the SAR into the White Sands scheduling system for conflict identification, scheduling, and transmission to the SN. If scheduling conflicts are identified by the White Sands scheduling system, White Sands Scheduling will implement established conflict resolution procedures.

d. If respecifiable parameter changes are required, Houston CMD will identify the configuration codes and provide the White Sands Scheduling with new parameter values. White Sands Scheduling will forward the request to the WSC DBM, who will generate the temporary configuration codes with the requested parameter changes. If the WSC DBM is unavailable, White Sands Scheduling will obtain authorization from the WSC Operations Supervisor (OS) to build the temporary configuration codes with the requested parameter changes. The event will then be scheduled as described in paragraph 2.4.5.3c.

e. White Sands Scheduling will notify Houston CMD on the JSC SHO Time when the specific event has been scheduled. White Sands Scheduling will also keep White Sands Ops/STGT Ops informed of the event status.

2.4.6 Contingency Scheduling

2.4.6.1 Purpose

This procedure defines the method by which the MCC requests support and the WSC confirms requested support in the event the MCC UPS or the high-speed data lines between the WSC and MCC have failed.

2.4.6.2 Participants

a. White Sands Scheduling.

b. Houston CMD.

c. Mission Comm Mgr.

2.4.6.3 Procedure

a. If the UPS or high-speed data line problems prevent the MCC from inputting a request for support via normal scheduling procedures, requests may be prepared on the SSR Form (see Figure 2-1) and delivered either verbally, or by facsimile to the WSC.

NOTE

> Verbal requests should be made only if the start time of the requested event is 2 hours or less from the current time. The verbal request must be followed by a facsimile request.

b. The SSR form may be used to add or delete scheduled events.

c. Houston CMD prepares the SSR form, placing data in all the required fields (except under the TDRS antenna column), and transmits the request to the WSC or forwards as facsimile.

d. The data sets for normal services are listed in the following sequences:

   1. All forward services.

   2. All return services.

   3. All tracking services.

e. White Sands Scheduling processes the requests, conducts conflict resolution, and (if no reason for further coordination is required) schedules the event and verbally notifies the Mission Comm Mgr of the added event.

f. When an event has been successfully scheduled, White Sands Scheduling transmits the granted request to the MCC, inserting the appropriate TDRS antenna and actual event start time in the applicable fields. (Refer to Note 2 of Figure 2-1.)

SPECIFIC SCHEDULE REQUEST

(Request Granted - Denied) (Reject Code)
(For White Sands Scheduling Use Only)

FROM: ____________________________

PREMIUM: (Yes) (No) Entered by at

ADD DELETE Forecast Real Time

1. Spacecraft SUPIDEN: ___________ (MS or PB)

2. Start: _ _ : : : _
D O Y H R M N S C

3. Plus Tolerance: _ : : _ (NA for playback)
H R M N S C

4. TDRS: (NA for playback)

5. Event Duration: _ : : _
H R M N S C

6. Minus Tolerance: _ : : _ (NA for playback)
H R M N S C

7. Service Spec. Code	Start (In relation to Event Start)	Duration	TDRS Antenna
(1) _ _ _	_ : : _ H R M N S C	_ : : _ H R M N S C	_ _
(2) _ _ _	_ : : _	_ : : _	_ _
(3) _ _ _	_ : : _	_ : : _	_ _
(4) _ _ _	_ : : _	_ : : _	_ _
(5) _ _ _	_ : : _	_ : : _	_ _
(6) _ _ _	_ : : _	_ : : _	_ _
(7) _ _ _	_ : : _	_ : : _	_ _
(8) _ _ _	_ : : _	_ : : _	_ _
(9) _ _ _	_ : : _	_ : : _	_ _
(10) _ _ _	_ : : _	_ : : _	_ _
(11) _ _ _	_ : : _	_ : : _	_ _
(12) _ _ _	_ : : _	_ : : _	_ _
(13) _ _ _	_ : : _	_ : : _	_ _
(14) _ _ _	_ : : _	_ : : _	_ _
(15) _ _ _	_ : : _	_ : : _	_ _
(16) _ _ _	_ : : _	_ : : _	_ _

NOTES

1. 16 service specification codes are the maximum number permissible.
2. Actual event start time and TDRS antenna assigned to be supplied by White Sands Scheduling.
3. Codes to be used with Specific Schedule Request (SSR) when transmitting a Schedule Reject Message (SRM) are as follows:

Data Item	Range of Values
Result Code	*01 = Request rejected by operator
	*02 = Request rejected due to conflict
	*07 = Request rejected due to invalid parameter
	*11 = Referenced event cannot be found

*Only codes used for contingency scheduling because of manual processing.

4. Spacecraft in conflict or activities affecting network capability will not be identified to individual users.

Figure 2-1. Specific Schedule Request Form

g. When an event cannot be scheduled, WSC Scheduling transmits the denied request with the applicable reject code to the MCC. (Refer to Note 3 of Figure 2-1 for codes.)

h. The receipt of the requests with the REQUEST GRANTED field completed will be confirmation of the requested support. It is the responsibility of the MCC to maintain and update their network support schedule.

NOTE

> These procedures are followed for deletion requests. Deletion requests require that the user provide only the spacecraft SUPIDEN, event start date/time, and TDRS.

i. If a problem is encountered, White Sands Scheduling coordinates resolution of the problem and notes any negotiated changes on the message returned to the MCC. Spacecraft in conflict or activities affecting network capability will not be identified to individual users.

j. When submitting a verbal request to the WSC, Houston CMD must read the scheduling data in the exact order it is listed on the request form.

k. White Sands Scheduling repeats back each field as it is read to confirm that it was received correctly.

l. White Sands Scheduling enters the request into the system, and (if no reason for further coordination is required) schedules the event and verbally notifies Houston CMD.

m. All verbal requests (e.g., add/delete) to the WSC must be followed by written requests. The above-described process of confirmation and transmission of requests to the MCC is followed by White Sands Scheduling.

2.4.7 Space Shuttle Landing Schedule Add Request

2.4.7.1 Purpose

This procedure describes the process required for the transmission and processing of landing SARs for support of a Space Shuttle landing.

2.4.7.2 Participants

a. GC.

b. Houston CMD.

c. White Sands Scheduling.

d. White Sands Ops/STGT Ops.

2.4.7.3 Procedure

a. Houston CMD will notify White Sands Scheduling on the JSC SHO Time prior to transmission of the landing SAR to WSC.

b. White Sands Scheduling will acknowledge receipt of the landing SAR, and perform a review of event functions.

c. In the event of a Space Shuttle waveoff, the GC will notify White Sands Ops/STGT Ops on the TN COORD of the new landing time and/or new landing site.

d. Houston CMD will notify White Sands Scheduling and request that the currently scheduled landing event be deleted by the WSC.

e. White Sands Scheduling will delete the currently scheduled landing event on Houston CMD’s “mark”, and will advise when WSC is ready to receive the updated SAR transmission.

f. Houston CMD will advise White Sands Scheduling when the updated SAR transmission has been completed; White Sands Scheduling will acknowledge receipt of the message.

2.4.8 MI/RFI Data Processing via the ACRS/TLAS System

2.4.8.1 Purpose

This procedure provides the method JSC will use (following a JSC system check point), to avoid the loss of scheduling messages used by the WSC Automated Conflict Resolution System (ACRS)/TDRS Look Angle System (TLAS) SHO data base to generate predicted Mutual Interference (MI) and Radio Frequency Interference (RFI) data.

2.4.8.2 Participants

a. Houston CMD.

b. White Sands Ops/STGT Ops.

c. White Sands Scheduling.

2.4.8.3 Procedure

a. During Space Shuttle missions, JSC will periodically execute a system checkpoint causing a temporary interruption of operational support. The JSC interface line (scheduling circuit) will lose continuity if any computer-to-computer message traffic is not acknowledged per standard protocol. When the JSC line loses continuity, the ACRS/TLAS at WSC will not receive scheduling messages. The ACRS/TLAS system uses the Operational Message (OPM) 99/01 (Schedule Delete), 94/01 (Normal Support), and 94/02 (Premium Support) messages to verify the ACRS/TLAS SHO data base and to generate predicted MI and RFI data for Space Shuttle support.

b. To alleviate this problem, Houston CMD will refrain from transmitting scheduling messages to WSC 5 minutes prior through 5 minutes after a JSC system checkpoint.

2.4.9 MRT Coordination and Scheduling Procedure

2.4.9.1 Purpose

This procedure describes the process required to coordinate and schedule Mission Readiness Tests (MRT) at the WSC in preparation for Space Shuttle mission support.

2.4.9.2 Participants

a. SMM.

b. ND.

c. White Sands FA.

d. GC/Houston CMD.

e. White Sands Scheduling.

f. WSC OS.

g. White Sands Ops/STGT Ops.

h. White Sands TO&A.

2.4.9.3 Procedure

a. Approximately 3 weeks prior to a scheduled Space Shuttle launch, the White Sands FA will coordinate with Houston CMD and White Sands TO&A to determine the mission data rate support requirements.

b. The White Sands FA will schedule the MRT events between L-48 and L-24.

c. The White Sands TO&A will provide local SHOs with mission specific parameters to White Sands Ops/STGT Ops. WSC will perform the MRT with these local SHOs and provide results to the WSC OS.

d. The WSC OS will notify the SMM/ND and GC of the MRT results.

2.5 SN Operations Procedures for Space Shuttle Pre-mission Interfaces

2.5.1 Launch Minus Count/Pre-event TV Validation Interface Test

2.5.1.1 Purpose

This procedure describes the process required to request and conduct a launch minus count or pre-event TV validation interface test between WSC, GSFC, and JSC. This type of interface test may be necessary prior to an upcoming event or during the minus count to revalidate the network capabilities following a failure.

2.5.1.2 Participants

a. GC.

b. Houston TV.

c. Goddard TV.

d. White Sands TV/STGT TV.

e. Mission Comm Mgr.

f. White Sands Ops/STGT Ops.

g. White Sands Tech/STGT Tech.

2.5.1.3 Procedure

a. The GC will notify White Sands Ops/STGT Ops of a requirement to conduct a pre-event or launch minus count TV system re-validation test. Upon notification from the GC of the test requirements, White Sands Ops/STGT Ops will direct the Mission Comm Mgr, White Sands TV/STGT TV, and Goddard TV, to configure and prepare for the test. The test conductor for these TV system re-validation activities will be the White Sands Tech/STGT Tech.

b. White Sands TV/STGT TV will direct the test in accordance with the procedures outlined in c below, following the scripts in Tables 2-1 and 2-2. All TV activity between Goddard TV and Houston TV will be conducted on the TV Conference. Upon completion of the test, White Sands TV/STGT TV will inform White Sands Ops/STGT Ops and report the status.

c. Launch Minus Count TV Interface and Pre-event Validation Interface Tests

1. Television Validation Interface Testing. Two types of TV validation tests may be performed. A Launch Minus Count TV Interface may be required to revalidate the integrity of the SN to support TV following a system failure between the time the SN verification/validation is run and the terminal launch count. In addition, a Pre-event TV Validation Interface may be required to revalidate the system following a failure during real-time operations. These tests are conducted in accordance with paragraph 2.5.2 and the following procedures/scripts.

(a) Launch Minus Count TV Interface Test. During the launch count for a Space Shuttle mission, a Launch Minus Count TV Interface Test may be required with Houston TV (refer to the script in Table 2-1). The Mission Comm Mgr will ensure interface checks with the Earth station and White Sands TV/STGT TV have been completed prior to activation of the satellite link. WSC will output television on the scheduled transponder. The Comm Mgr will complete initial interface checks with WSC for video/audio before turning the link over to Houston TV. Prior to interfacing with Houston TV for a launch minus count interface, White Sands TV/STGT TV will perform

Table 2-1. Launch Minus Count TV Interface Test

Sequence	Position	Action
1	Houston TV, Station TV, Ops Sup	a. White Sands TV/STGT TV notifies Houston TV that the station is ready for interface. b. Houston TV verifies color-converted quality display in MCC. c. RF turnaround test is performed (with or without scheduled SIM SHO) with a full-field multiburst signal through the prime and backup processing systems.
2	Houston TV, Station TV	a. Verify video/audio levels and frequency response on prime and backup systems. b. Verify VITS/VIRS levels and quality on lines 10, 20, and 21. c. Verify proper station ID on line 10 (both fields). Composite with modulation for White Sands. 100 IRE Modulated Ramp for STGT.
3	Houston TV, Station TV	a. Process a composite signal with modulation, prime and backup. b. Verify differential gain and phase.
4	Houston TV, Station TV	a. Process full-field color bars, prime and backup. b. Verify color vectors.
5	Houston TV, Station TV	a. On cue, White Sands TV/STGT TV processes VIDD test video through the RF turnaround and the prime and backup processing systems. b. Verify VIDD test video VITS on lines 14 through 19 via both prime and backup processing systems. c. On cue from Houston TV, input a 1-kHz test tone to the VIDD test audio input. d. Verify digitized interleaved audio present on VIDD test video, prime and backup. e. Verify proper operation of VIDD unit via both processing systems, confirm proper Alphanumeric (AN) display.
6	Houston TV, Station TV	a. Reconfigure for normal support. b. White Sands TV/STGT TV processes and outputs system test video via prime TV system with a 1-kHz test tone on the audio output line to Houston TV.
7	Houston TV	a. Perform desired measurements on VITS/VIRS and confirm proper equipment operation. b. Verify color-converted quality display in MCC.
8	Houston TV, Station TV	White Sands TV/STGT TV confirms to Houston TV that correct audio levels from the SUE were verified during station interface.
9	Station TV	Configure for scheduled support.

Table 2-2. Pre-event TV Interface Test

Sequence	Position	Action
1	Houston TV	a. Confirm system test video on line from the station to JSC/GSFC via prime TV processing channel. b. Verify 1-kHz test tone on audio link. c. Verify video/audio levels. d. Verify converted color quality at MCC. e. Repeat steps a and c for full-field color bars.
2	Houston TV, Station TV	a. Station outputs VIDD test video via prime TV processing channel. b. Verify video level. c. Verify VITS/VIRS (lines 10, 14 through 19, 20, and 21). d. Verify and display readiness from VIDD unit.
3	Station TV	Apply 1-kHz test tone to VIDD test audio input.
4	Houston TV, Station TV	Verify VIDD strips 1-kHz tone from VIDD test video signal, remove tone.
5	Houston TV, Station TV	a. Configure to backup processing system video (system test video with VITS/VIRS). b. Verify 1-kHz tone on audio link. c. Verify video/audio levels. d. Verify VITS/VIRS (lines 10, 20, and 21). e. Verify converted color quality at MCC. f. Repeat steps a and c for full-field color bars.
6	Station TV	Configure for scheduled support.

the following on-site checkouts and report the results to White Sands Ops/STGT Ops.

(1) Step 1. Confirm with the Mission Comm Mgr that the satellite video/ audio lines are configured.

(2) Step 2. Verify processing of system test video signal levels and quality via the prime then the backup TV system.

(3) Step 3. Verify VITS/Vertical Interval Reference Signal (VIRS) on lines 10, 14, 15, 20, and 21.

(4) Step 4. Perform on-site TV test with a full-field multiburst signal through the prime and backup systems. White Sands TV/STGT TV will select prime and then backup system on output line and verify frequency response/differential gain and phase.

(5) Step 5. Process a composite signal with modulation, prime and backup.

(6) Step 6. Process full-field color bars on prime and backup system and verify color vectors.

(7) Step 7. Process VIDD test video through the prime and backup processing systems. Verify VIDD test video VITS on lines 14 through 19 (inclusive) on both processing systems. Then put a 1-kHz test tone to the VIDD test audio input and verify digitized interleaved audio present via both prime and backup systems.

(b) Pre-event TV Interface Test. A Pre-event TV Interface Test between the station and Houston TV may be conducted prior to an event calling for TV support (refer to the script in Table 2-2 and procedure 2.5.2).

2. Television Event Time Activity

(a) The TV technician will start VCRs 1 minute prior to scheduled TV event.

(b) When video modulation is present, the TV technician will place the downlink video on-line to JSC/GSFC via prime TV processing channel and put audio on-line only if requested by Houston TV.

(c) White Sands TV/STGT TV announces to Houston TV, "Video downlink on line."

(d) When WSC is transmitting TV to JSC MCC, station personnel are cautioned not to inhibit the downlink except during extended television LOS (i.e., Ku-band antenna blockage periods). During those times, White Sands TV/STGT TV will place the station Font pattern with station VITS on-line through the TV prime system while continuing to monitor the backup system for TV downlink reacquisition. Anomalies will be reported to Houston TV immediately. Corrective action/editing will be taken after coordination/request of JSC.

3. TV Announcements. White Sands TV/STGT TV makes announcements to JSC MCC in accordance with Table 2-3.

4. Video/Audio Assessments. Table 2-4 provides a five-grade assessment scale for television video and audio.

d. White Sands Ops/STGT Ops will notify the GC of the test completion and status; upon the GC's concurrence, White Sands Ops/STGT Ops will notify the Mission Comm Mgr, White Sands Tech/STGT Tech, and Goddard TV to reconfigure for routine operations.

2.5.2 Pre-Mission Testing Requirements

2.5.2.1 Purpose

This procedure provides the requirements for pre-mission testing and makes reference to the documentation required for conducting the tests.

2.5.2.2 Participants

a. SMM.

b. JSC GC.

c. JSC ESTL Test Director (ESTL TD).

d. Goddard TD.

2.5.2.3 Procedure

a. Pre-mission test requirements and test schedules will be coordinated between the JSC GC and the SMM assigned to a specific mission.

b. Testing requiring JSC/ESTL will be coordinated by the SMM who will contact ESTL representatives to schedule resources for the required support.

c. Testing requirements for the mission will be defined by the SMM. The SMM will then coordinate with the JSC GC for the JSC MCC participation requirements. The SMM will coordinate with Goddard TD who will prepare the briefing messages and schedule the required resources. The Goddard TD will submit the briefing messages to the SMM for a final review before being transmitted to the Network(s) and other participants. The Goddard TD will conduct the actual test(s) from the NIC and will develop the test results report for distribution to the appropriate elements as required. Test procedures and requirements are defined in the following documents:

   1. *Network Verification Manual for the Space Shuttle Program*, 532-VTR-STDN.

   2. *Spaceflight Tracking and Data Network Test and Simulation Support Plan*, 530-NOP-STDN/TS.

Table 2-3. Station TV Announcements

Station Cue	Monitor/Confirm	Announcement
Video Modulation Present	Downlink test patterns, live video or analog data	a. "(Station callsign) has TV AOS" (report quality as requested or if video becomes degraded; refer to Table 3-5) b. "(Station callsign) has analog data"
VTR Dump	a. Time base instabilities on downlink b. No time base instabilities on downlink	a. "TV system in bypass" b. "TV system processing VTR dump" c. "VTR dump terminated"
Loss of Modulation	No TV picture or analog data	a. "(Station callsign) has TV LOS" b. "Analog data LOS" c. "If not a scheduled LOS, give reason if known"

Table 2-4. Video/Audio Assessments

Grade	Video	Audio	Corresponding Impairment
5	Excellent	Excellent	No perceptible impairment, stable horizontal and vertical sync. Excellent audio signal.
4	Good	Good	Perceptible impairment detectable under close examination, stable horizontal and vertical sync. Noise noticeable in audio when voice is not present.
3	Fair	Fair	Impairment readily noticeable but not objectionable; noise detectable mixed with audio. Slight horizontal sync instability.
2	Poor	Poor	Impairment objectionable but video still useable; audio distorted or noisy but generally understandable. Horizontal sync unstable, occasional loss of vertical sync.
1	Unusable	Unusable	Impairment so objectionable as to be considered not useable. Audio only occasionally understandable. Repeated loss of horizontal and vertical sync.

2.6 Vector Management Procedures

2.6.1 Pre-launch Vector Management

2.6.1.1 Purpose

These procedures outline the FDF pre-launch activities conducted prior to each Space Shuttle launch.

2.6.1.2 Participants

a. FDF Comm.

b. SMM.

c. ND.

d. White Sands Ops/STGT Ops.

2.6.1.3 Pre-launch/Launch Procedures

a. The FDF generates nominal launch and contingency acquisition data for the SN support of the Space Shuttle based on trajectory data received from JSC. JSC deliveries may be satisfied in one of two ways: first, by the generation of mission-specific trajectory data; or second, by the selection of previously generated and delivered trajectory data which most closely resembles the mission specifications and criteria. The FDF maintains a generic trajectory data library in accordance with JSC-22689, Trajectory D-Tape Interface Document.

b. The FDF will conduct a Vector Verification test at approximately launch minus 7 days to evaluate and exercise the vector processing capabilities of the FDF and WSC.

c. The FDF may run a proficiency simulation(s) prior to each flight to provide training and to exercise contingency vector management procedures.

d. At approximately launch minus 24 hours, the FDF will:

  1. Transmit the appropriate nominal launch and contingency vectors to WSC.

  2. Email/Fax the appropriate backup support vectors to GSFC/NIC and WSC.

NOTE

These vectors will be used to support a nominal launch, an RTLS, a BAL/ECAL, a TAL, or an AOA in the event of a NISN or FDF facility contingency.

2.6.2 Launch Vector Management

2.6.2.1 Purpose

These procedures outline the methods of handling vectors for nominal launch, launch slip, RTLS, BAL/ECAL, TAL, Ditch, AOA, and ATO support. Unless otherwise stated, all vector coordination between the FDF and WSC will be done on the TDRS-3 voice circuit.

2.6.2.2 Participants

a. FDF Comm.

b. SMM.

c. ND.

d. Houston DFE.

e. White Sands Ops/STGT Ops.

2.6.2.3 Launch Procedures

a. For nominal SN launch support, the FDF will use two Type 8 vectors and a launch support Type 1 (post-MECO) vector based on pre-launch JSC-supplied trajectory data. At approximately launch minus 2 hours (L-2), JSC will transmit predicted post-MECO and post-OMS-2 vectors to the FDF. These L-2 hour vectors will be compared with the corresponding pre-launch vectors, and, if necessary, the L-2 hour post-MECO vector will be used to update the launch support Type 1 vector at WSC.

b. At launch minus 1 hour, WSC will enable the autothroughput mode for the appropriate SIC/VIC. The FDF will transmit a Type 8 vector, with an epoch of launch and centered at the launch pad, to WSC to verify the interface. All subsequent vector transmissions by the FDF to WSC will use the autothroughput mode until approximately WOW minus 4 hours, when the FDF will request that the autothroughput mode be inhibited.

c. At liftoff, the FDF will transmit the launch support Type 8 vectors and the launch support Type 1 post-MECO vector to WSC.

d. At approximately launch plus 15 minutes, an actual post-MECO vector will be received by the FDF from JSC, quality assured, and transmitted to WSC. At approximately launch plus 25 minutes, a predicted post-OMS-2 vector will be received by the FDF from JSC, quality assured, and transmitted to WSC.

2.6.2.4 Launch Slip Procedures

Following a launch slip, JSC will announce a new liftoff time. The FDF and WSC will coordinate the slipping of the epoch times of all vectors and maneuver sequences resident at both facilities to correspond to the new lift-off time.

2.6.2.5 RTLS Procedures

a. Upon notification of an RTLS by JSC, the ND/SMM will direct the FDF to transmit the RTLS landing maneuver sequence to WSC.

b. The FDF will notify the ND/SMM, on the TN COORD, when the TDRS Beam Angle (TBA) display indicates that the contingency vectors have gone into effect at WSC.

c. If required, the FDF will transmit the RTLS backup support vectors (consisting of two Type 8 vectors with velocity and a stationary Type 8 vector) to WSC.

d. In the event that the FDF is unable to transmit, WSC will also have the RTLS maneuver sequence and backup vectors available for transmission to the WSC user system.

2.6.2.6 BAL or ECAL Procedures

a. Upon notification of a BAL/ECAL by JSC, the ND/SMM will direct the FDF to transmit the appropriate Type 8 support vectors to WSC.

b. The FDF will notify the ND/SMM, on the TN COORD, when the TBA display indicates that the contingency vectors have gone into effect at WSC.

c. In the event that the FDF is unable to transmit, WSC will also have the BAL/ECAL vectors available for transmission to the WSC user system.

2.6.2.7 TAL Procedure

a. Following notification of a TAL by JSC, the ND/SMM will direct the FDF to transmit the appropriate TAL maneuver sequence to WSC.

b. If possible, Houston DFE will generate and transmit an updated TAL maneuver set to the FDF in real-time. The FDF will generate and transmit the updated TAL maneuver sequence to WSC.

c. White Sands Ops/STGT Ops will transmit the appropriate TAL maneuver sequence to the WSC ground system.

d. The FDF will notify the ND/SMM, on the TN COORD, when the TBA display indicates that the contingency vectors have gone into effect at WSC

e. If required, the FDF will transmit the TAL backup support vectors (consisting of Type 8 vectors with velocity and a stationary Type 8 vector) to WSC.

f. In the event that the FDF is unable to transmit, WSC will also have the TAL maneuver sequences and backup vectors available for transmission to the WSC user system.

2.6.2.8 AOA Procedures

a. Upon notification of an AOA by JSC, the ND/SMM will direct the FDF to transmit the appropriate AOA landing maneuver sequence to WSC. The AOA landing maneuver sequence will replace the post-MECO vector already resident at WSC. If the post-MECO vector (used for on-orbit support prior to AOA landing) is not resident at WSC, the FDF will transmit the post-MECO vector to WSC before transmitting the AOA landing maneuver sequence.

b. If possible, Houston DFE will generate and transmit an updated AOA landing maneuver set to the FDF in real time. The FDF will generate and transmit the updated AOA maneuver sequence to WSC.

c. White Sands Ops/STGT Ops will transmit the AOA landing maneuver sequence to the WSC ground system.

d. If required, the FDF will transmit the backup AOA support vectors, consisting of a Type 1 on-orbit vector, Type 8 vectors with velocity, and a stationary Type 8 vector, to WSC.

e. In the event that the FDF is unable to transmit, WSC will also have the AOA maneuver sequences and backup vectors available for transmission to the WSC user system.

f. The FDF will notify the ND/SMM on the TN COORD when the TBA display indicates that the contingency vectors have gone into effect at the WSC.

2.6.2.9 Ditch Procedures

a. Upon notification of a ditch by JSC, the ND/SMM will direct the FDF to generate (on a best-effort basis) a Type 8 vector with velocity and a landing support Type 8 vector based on geodetics and the approximate impact time supplied by JSC on the Orbit Data File (ODF) voice circuit and to transmit these vectors to WSC.

b. If possible, JSC will transmit a ditch landing maneuver set to the FDF. Immediately upon receipt of a ditch landing maneuver set and limited quality assurance, the FDF will generate the corresponding ditch landing maneuver sequence and transmit it to WSC.

c. The FDF will notify the ND/SMM, on the TN COORD, when the TBA display indicates that the contingency vectors have gone into effect at WSC

2.6.2.10 ATO Procedures

In the event of an ATO, the FDF is dependent on JSC to provide trajectory data in real time.

2.6.2.11 Transmission Contingency Procedures

The FDF will use one of the following contingency procedures when conditions exist that prevent electronic transmission of vectors to WSC.

a. Contingency support using the support vectors that were transmitted to WSC at approximately 24 hours before launch:

   1. The FDF will advise WSC and the SMM, via the TDRS-3 voice circuit, that contingency procedures are being implemented using the vectors that were transmitted to WSC approximately 24 hours before launch.

   2. The FDF will advise WSC which vectors are to be transmitted from the DSMC system to the WSC user system by specifying the following vector information:

      (a) Case (for example, TAL).

      (b) Vector types (for example, maneuver ignition, Type 1, Type 8).

      (c) Vector epochs (DDD/HH:MM:SS.MMM Z).

   3. Following a valid read back, the FDF will authorize the transmission of the vectors to the WSC user system. WSC will inform the FDF when the vectors have been transmitted to the WSC user system.

   4. The FDF will update the appropriate ephemeris file for TBA support.

   5. The FDF will verify that the appropriate ephemeris file has been updated for TBA support. The FDF will verify that the observed TBAs are not anomalous. The FDF will report any anomalies and take appropriate corrective action as soon as possible.

b. Contingency support using backup-support vectors resident at WSC:

   1. The FDF will advise WSC and the SMM, via the TDRS-3 voice circuit, that backup-vector procedures are being implemented using the vectors that were previously e-mailed or faxed to WSC at launch minus 48 hours.

   2. The FDF will advise WSC which vectors are to be prepared for transmission from the WSC TOCC2 to the WSC user system by specifying the following vector information:

      (a) Case (for example, launch Type 1).

      (b) Vector set and numbers (on e-mail or fax form from the FDF).

      (c) Vector epochs (DDD/HH:MM:SS.MMM Z).

   3. WSC will inform the FDF when the data has been entered into the WSC TOCC2 and then read back the following parameters from the display:

      (a) Case.

      (b) Vector numbers (from email or fax form from the FDF).

(c) Vector epochs (DDD/HH:MM:SS.MMM Z).

NOTE

If the vector is a Type 8 vector, WSC will inform the FDF whether or not the true-of-date rotating (TDR*)* velocity components (XDOT, YDOT, ZDOT) have been entered as zero (0.0 km/s).

4. Following a valid read back, the FDF will authorize the transmission of the vectors to the WSC user system. After authorization, WSC will announce when the vectors have been transmitted to the WSC user system.

5. The FDF will update the appropriate ephemeris file for TBA support.

6. The FDF will verify that the appropriate ephemeris file has been updated for TBA support. The FDF will verify that the observed TBAs are not anomalous. The FDF will report any anomalies and take appropriate corrective action as soon as possible.

c. Contingency support using backup-support vectors not resident at WSC.

1. The FDF will advise WSC and the SMM, via the TDRS-3 voice circuit, that backup support vector procedures are being implemented using vectors not resident at WSC and which will now be provided to WSC via voice. The voice method is the prime mode and is to be implemented for time-critical activities. Backup vectors may be sent to WSC via facsimile if time allows.

2. The FDF will provide the following parameter information for each vector to be entered by WSC in preparation for transmission from the WSC TOCC2 to the WSC user system:

(a) Vector SIC/VIC.

(b) Vector type (Type 1 or Type 8).

(c) Vector epoch (DDD/HH:MM:SS.MMM Z).

(d) TDR X, Y, Z (in km, read appropriate negative/minus sign, decimal point, and “km” for each).

NOTE

Do not use leading zeros or scientific notation.

(e) TDR XDOT, YDOT, ZDOT, (in km/s, read appropriate negative/minus sign, decimal point, and “km per sec” for each).

NOTE

Do not use leading zeros or scientific notation.

3. WSC will inform the FDF when the data has been entered into the WSC TOCC2 and then read back the following parameters for each vector from the display:

   (a) Vector SIC/VIC.

   (b) Vector type (Type 1 or Type 8).

   (c) Vector epoch (DDD/HH:MM:SS.MMM Z).

   (d) TDR X, Y, Z (in km, read appropriate negative/minus sign, decimal point and "km" for each).

NOTE

Do not use leading zeros or scientific notation.

   (e) (TDR) XDOT, YDOT, ZDOT, (in km/s, read appropriate negative/minus sign, decimal point, and "km per sec" for each).

NOTE

Do not use leading zeros or scientific notation.

4. Following a valid read back, the FDF will authorize the transmission of the vectors to the WSC user system. WSC will announce when the vectors have been transmitted to the WSC user system.

5. The FDF will update the appropriate ephemeris file for TBA support.

6. The FDF will verify that the appropriate ephemeris file has been updated for TBA support. The FDF will verify that the observed TBAs are not anomalous. The FDF will report any anomalies and take appropriate corrective action as soon as possible.

2.6.3 On-orbit and On-orbit Maneuver Vector Management

2.6.3.1 Purpose

These procedures outline the method of handling vectors for on-orbit and on-orbit maneuver support.

2.6.3.2 Participants

a. FDF Comm.

b. Houston DFE.

c. White Sands Ops/STGT Ops.

2.6.3.3 On-orbit Procedure

a. At approximately launch plus 2 hours, the FDF will request JSC to place the FDF on the "autoqueue" to begin the automatic transmission of hourly Type 1 vectors to the FDF. The automatic transmissions will continue until approximately landing minus 4 hours.

b. The FDF will transmit each hourly Type 1 vector to WSC.

2.6.3.4 On-orbit Maneuver Procedure

a. Houston DFE will transmit on-orbit maneuver sets to the FDF.

b. The FDF will transmit on-orbit maneuver sequence(s) to WSC

c. In the event the scheduled maneuver was nonnominal or canceled, the FDF will request a current time vector from JSC and transmit it to WSC.

2.6.4 Landing Vector Management

2.6.4.1 Purpose

These procedures outline the methods of handling vectors for Space Shuttle landing and wave-off support.

2.6.4.2 Participants

a. FDF Comm.

b. Houston DFE.

c. White Sands Ops/STGT Ops.

d. SMM.

2.6.4.3 Nominal Landing Procedure

The FDF will generate SN acquisition data based on the nominal landing maneuver set received from JSC at approximately landing minus 4 hours and 30 minutes. Landing maneuver sets for one-rev late or alternate landing sites may also be transmitted by JSC. Upon receipt, the FDF will perform the following activities:

a. Generate and transmit SN landing maneuver sequences for the nominal and/or alternate opportunities to WSC at a time specified in the mission specific landing count.

b. Generate and transmit backup landing Type 8 stationary vectors for each landing maneuver set that is received by WSC at a time specified in the mission specific landing count.

NOTE

These Type 8 vectors will be provided to WSC for use in the event that a problem is encountered in the generation, transmission, or use of the landing maneuver sequence. The backup vectors will not be processed by WSC unless directed by the FDF.

2.6.4.4 Wave-Off Procedure

a. For a wave-off to the next landing opportunity the FDF will:

   1. Contact JSC and request a reentry set for the next opportunity, if required.

   2. Generate and transmit the SN landing maneuver sequence to WSC per paragraph 2.6.4.3.

   3. Generate and transmit the updated backup support vectors to WSC. WSC will confirm receipt of the vectors and advise the FDF. These backup vectors will not be processed by WSC unless directed by the FDF.

b. Upon notification of a wave-off to the next day, the FDF will:

   1. Request WSC to enable the autothroughput mode.

   2. Transmit the most recent Type 1 hourly vector to WSC to continue SN on-orbit support.

   3. Request JSC to put the FDF back on “autoqueue” for hourly vector transmissions.

   4. Resume normal on-orbit support.

2.7 SN Operations Procedures for Space Shuttle Nominal Event Interfaces

2.7.1 Pre-event and Post-event Briefings

2.7.1.1 Purpose

This procedure defines the information content of the pre-event and post-event briefings for SN support.

2.7.1.2 Participants

a. Houston CMD/GC/OST.

b. White Sands Ops/STGT Ops.

c. CSC-X Controller.

d. Mission Comm Mgr.

e. Comm Mgr.

2.7.1.3 Procedure

a. Pre-event Briefing

1. Houston CMD will conduct a pre-event briefing for the next two TDRSS events. The briefing will occur prior to the start of the TDRS West (TDW) event, approximately 5 minutes before the Zone of Exclusion (ZOE).

2. The Houston GC will alert the JSC participants to the upcoming briefing. The briefing will be conducted on the TN COORD. White Sands Ops/STGT Ops will alert SN elements of an upcoming briefing.

3. Houston CMD will conduct a pre-event briefing to include the Forward/Return link Handover (H/O) options, planned Ground Control Message Request (GCMR) activities, and other events/activities, as applicable.

4. White Sands Ops/STGT Ops will report any potential SN conditions that may affect Orbiter communications.

b. Post-event Briefing

1. White Sands Ops/STGT Ops will conduct a SN internal post-event briefing of the two previous events with the WSC, and GSFC elements while the Space Shuttle is in the ZOE, as required.

2. Negative reporting procedures will be employed. Anomalies, which occurred during the event, will be documented as applicable utilizing the WSC Discrepancy Report (DR) or TDRSS Trouble Report (TTR) as appropriate.

3. The GC will conduct an internal MCC post-event briefing of the two previous events with appropriate personnel while the Space Shuttle is in the ZOE, as required.

4. The GC and White Sands Ops/STGT Ops will then conduct a final post-event briefing of any problems noted during the previous TDW and TDRS East (TDE) events, as required.

2.7.2 TDRS Acquisitions and OD Data Handovers

2.7.2.1 Purpose

This procedure describes a typical initial acquisition/reacquisition sequence and the Operations Data (OD) handover sequence for S-band and K-band during mission support.

2.7.2.2 Participants

a. Houston CMD.

b. INCO.

c. White Sands Ops/STGT Ops.

d. Houston DFE.

2.7.2.3 Procedure

a. S-band Acquisition

1. Houston CMD will verify S-band forward link receiver lock, signal strength, and phase error are all nominal prior to applying forward modulation.

2. If acquisition is not achieved, see Figures 8-1 and 8-2 for fault isolation methods.

b. K-band Acquisition

1. K-band modulation will be on during initial acquisition and Doppler compensation enabled.

2. Houston CMD will verify K-band UPLINK SOURCE, 216 SYNC and DATA GD parameters are normal.

3. If acquisition is not achieved and fail safe is disabled, see Figures 8-4 and 8-5 for fault isolation methods.

c. S-band Forward Reacquisition

1. All reacquisition requests will be initiated by Houston CMD.

2. Whenever the Space Shuttle transponder loses lock (suspected or verified via TLM), Houston CMD will disable the S-band forward link modulation to WSC (if necessary), and wait 20 seconds for reacquisition to occur.

3. If the Space Shuttle Orbiter (SSO) transponder lock is not achieved when expected, S-band forward link modulation will be disabled. If acquisition is still not achieved, see Figure 8-3 for fault isolation methods.

d. S-band Return Reacquisition

1. In the event of a loss of return carrier and/or channel lock occurs after the initial acquisition of the Space Shuttle by TDRSS, WSC will automatically attempt to reacquire the lost lock. This will occur continually until a good lock is achieved or the service ends.

2. If the S-band return fails to acquire, Houston CMD will disable S-band forward modulation and wait 20 seconds for reacquisition to occur. See Figure 8-3 for fault isolation methods.

2.7.3 Typical Space Shuttle SN Activity

2.7.3.1 Purpose

This procedure identifies operational activities of a typical Space Shuttle event.

2.7.3.2 Participants

a. Houston CMD.

b. GC.

c. White Sands Ops/STGT Ops.

2.7.3.3 Procedure

a. At event start, the TDRSS automatically initiates an acquisition sequence which causes the following conditions:

   1. Radiation of a forward carrier S/Ku-band, if scheduled.

   2. Acquisition of return equipment specified in the event.

   3. Output of WSC Operations Data Messages (ODM).

   4. Output of DQMs and User Performance Data (UPD) which are activated and transmitted from/by the WSC to MSFC (as required) and/or JSC.

b. S- and/or Ku-band forward link modulation is either enabled or disabled by Houston CMD and Doppler compensation is normally enabled for better acquisition of the forward link service. After confirmation of both phase lock (transponder) and NSP bit and frame sync lock (modulation), the MCC will proceed with operations. The above is verified within the S-band and/or Ku-band Channel Orbiter Downlink (OD) telemetry data (128-kb/sec).

c. If either the forward and/or return S/Ku-band links do not acquire and all normal recovery procedures have failed, refer to Section 8 (Fault Isolation procedures) for further instructions.

2.7.4 SN Support Status Reporting

2.7.4.1 Purpose

This procedure is used to keep the WSC and MCC informed of SN equipment status, configurations, and support capabilities.

2.7.4.2 Participants

a. GC.

b. White Sands Ops/STGT Ops.

c. ND.

d. SMM.

e. Flight Director (FD).

2.7.4.3 Procedure

When a failure of mission-required SN hardware/software occurs that directly affects support capability, the following steps will be initiated:

a. WSC will reconfigure to a backup mode (if available) as soon as possible to prevent a loss of support capability (WSC will also coordinate with NISN for circuit reconfigurations, if required).

b. If the hardware/software required for Space Shuttle support is declared Red (cannot support) during the terminal count, White Sands Ops/STGT Ops will report immediately to ND/SMM and GC the system failure, support impact, corrective action, and ETRO.

c. The GC will immediately advise the FD, who will make the decision whether to hold the launch. A launch hold will not be called by any SN elements (e.g., ND or White Sands Ops/STGT Ops).

NOTE

When a support capability is defined as mandatory, the hardware and software required to provide the capability also assume a mandatory status.

2.7.5 Forward Link Echo

2.7.5.1 Purpose

This procedure defines the S-band and K-band forward link command echo from WSC to JSC, and the interface required for implementation. The forward link command echo is a loopback from WSC of the JSC forward link command data streams.

2.7.5.2 Participants

a. Mission Comm Mgr.

b. Houston CMD.

c. Houston Comm Control.

d. White Sands Ops/STGT Ops.

2.7.5.3 Procedure

a. WSC and JSC will coordinate with the NISN Mission Comm Mgr to configure the appropriate MDM port address channels for pre-launch testing. ITUs are automatically configured and enabled at event start time for SN based on scheduling messages received from the White Sands scheduling system. Simultaneous support of K-band and S-band command echo is not provided due to bandwidth constraints. The WSC systems will not automatically configure an ITU for K-band echo support during real-time mission operations based on scheduling messages.

b. The DQM at WSC is used to provide status messages (containing data stream qualitative and quantitative information) to JSC. The DQM detects the frame sync fields of the monitored links and generates statistical data such as the presence of clock and data, frame count, bit error rate, and data rate. This statistical data allows White Sands Ops/STGT Ops to coordinate fault isolation efforts within the SN in the event of an anomaly (refer to Appendix C for Data Stream Assignments).

c. Prior to handover of two-way support (S/K-band), Houston CMD will advise White Sands Ops/STGT Ops.

d. Following handover of two-way support from S-band to K-band or vice versa, WSC will manually configure forward link DQMs and CMD echo for the current supporting command link (S/K-band), unless otherwise directed by Houston CMD.

e. For monitoring of forward data quality, only S- or K-band forward can be monitored at any given time. Selection is made via the Voice band select commands issued from the console in response to verbal requests from JSC. The DQM for forward is via the processor DQM card. DQM setups are hard coded for the voice processor.

f. Return data quality is monitored via the User Service Base Band Switch DQM circuit card, with setup parameters provided in the SHO/GCMR.

g. During scheduled TDRS switchovers, (TDW to TDE) White Sands/STGT will automatically reconfigure for S-band command echo support at the start of the TDE event.

h. Prior to the start of each event, JSC and the NISN Mission Comm Mgr will ensure the appropriate MDM port address channels are configured for command echo support based on JSCs Output Terminal Unit (OTU) availability and command requirements.

2.7.6 Automatic Space Shuttle Orbiter Failover from K-band to S-band

2.7.6.1 Purpose

This procedure describes JSC actions in the event of an automatic Space Shuttle Orbiter failover from K-band to S-band.

2.7.6.2 Participants

a. Houston CMD.

b. INCO.

c. Houston DFE.

d. White Sands Ops/STGT Ops.

2.7.6.3 Typical Support Configuration Prior to Failover

a.	K-band	Forward	Carrier Lock
			Bit/Frame Sync Lock NSP Command Source Ku-band "Go for command"
		Return	192-kb/sec (1/3 rate coded) (Channel 1)
b.	S-band	Forward	Modulation ON Doppler Compensation ON
		Return	Mode-2 192-kb/sec (1/3 rate coded)

2.7.6.4 Procedure

a. The Space Shuttle fails over from K-band to S-band (NSP command source reconfigures to S-band).

b. INCO will immediately inform Houston DFE the Orbiter has failed over to S-band.

c. When automatic failover occurs, the S-band data rate changes to low data rate up and down. Houston CMD must send the appropriate GCMRs to match the ground configuration to that of the Space Shuttle Orbiter and notify White Sands Ops/STGT Ops of any pending handover of two-way support (S/K-band).

d. Houston CMD will perform a normal acquisition.

e. INCO may now select the desired data rate.

2.7.7 Dual TDRS Switchover

2.7.7.1 Purpose

This procedure defines the method by which the SN will conduct SA service switchovers between TDRSs in support of Space Shuttle missions.

2.7.7.2 Participants

a. White Sands Ops/STGT Ops.

b. White Sands Scheduling.

c. Houston CMD.

d. GC.

e. Houston DFE.

f. INCO.

2.7.7.3 General

On-orbit support of the Space Shuttle is provided by contiguous use of TDRSs and associated SN resources. Adequate planning and proper control of the SA service switchover sequences are essential to ensuring a smooth transition and avoiding service losses. Premium SARs requesting TDRSS support must be received and processed by the WSC at least 7 minutes prior to the requested start times. Scheduled support that requires a switchover of SA services from TDW/Spare to TDE are generally supported in accordance with one of the three options listed in the following paragraphs.

NOTE

> Improper use of GCMRs during a TDRS service switchover sequence could result in a late acquisition and/or data loss.

2.7.7.4 Procedure

a. Option One: Simultaneous S-/K-band Service Switchover. When this option is scheduled, all on-going S-/K-band services via TDW will remain active until scheduled SHO termination, followed by a minimum of 20 seconds inter-service interval with no S-/K-band active services via either TDRS. The SA service switchover sequence will have been completed when the S-/K-band services via TDE are activated and data is acquired. Space Shuttle support will continue via TDE until scheduled SHO termination. The following scenario depicts a typical switchover sequence.

   1. Following initial data acquisition via TDW, the JSC MCC confirms valid S-/K-band return link data and applies S-band forward link modulation when the Space Shuttle's transponder has locked.

   2. Space Shuttle support continues via TDW S-/K-band services until scheduled SHO termination.

   3. Prior to initiating the switchover, the Space Shuttle S-/K-band antennas must be redirected/reselected for TDE acquisition.

   4. The TDE SHO goes active as scheduled following the minimum 20-seconds S-/K-band inter-service interval. The S-/K-band return links are verified, and S-band forward link modulation may be applied when the Space Shuttle's transponder has locked. K-band forward link modulation may be applied at the MCCs discretion.

   5. The MCC proceeds with real-time Space Shuttle support via S-/K-band services, and completes command and GCMR activities prior to TDE SHO termination.

b. Option Two: S-band Service Switchover Precedes K-band Service Switchover. When this option is scheduled, the S-band service switchover from TDW to TDE precedes the switchover of K-band service. The following scenario depicts a typical switchover scenario.

1. Prior to initiating a TDRSS service switchover, the S-/K-band services via TDW will be verified by the MCC. The Space Shuttle's S-band antennas must be reconfigured for nominal acquisition via TDE.

2. TDW S-band service will terminate as scheduled (K-band services will remain active), followed by a 20-second (minimum) inter-service interval (no scheduled S-band services via either TDRS).

3. The TDE S-band services are then activated as scheduled, followed by S-band return link acquisition.

4. S-band forward link modulation may be applied via TDE when the Space Shuttle's transponder has locked to the S-band forward link. The Space Shuttle is reconfigured by INCO, as required, prior to TDW SHO termination.

5. The TDW SHO (K-band services) terminates as scheduled, followed by a 20-second inter-service interval.

6. K-band services are then activated via the TDE SHO as scheduled, followed by K-band return link acquisition (if K-band signal blockage is not a factor). K-band forward link modulation may be applied at the MCCs discretion.

7. Following a successful switchover, the MCC proceeds with real-time Space Shuttle support via S-/K-band services and completes Space Shuttle command and GCMR activities prior to TDE SHO termination.

c. Option Three: K-band Service Switchover Precedes S-band Service Switchover. When this option is scheduled, the K-band service switchover from TDW to TDE precedes the S-band service switchover. The following scenario depicts a typical switchover sequence.

1. Prior to initiating a TDRSS service switchover, the S-/K-band services will be verified by the MCC. The Space Shuttle's K-band antennas must be reconfigured to allow normal acquisition via TDE.

2. TDW K-band services will terminate as scheduled (S-band services will remain active), followed by a 20-second (minimum) inter-service interval.

3. The TDE SHO is then activated as scheduled, followed by a K-band return link acquisition (if K-band signal blockage is not a factor). K-band forward link modulation may be applied at the MCCs discretion.

4. The Space Shuttle will be reconfigured by INCO, as required, prior to TDW SHO termination.

5. The TDW SHO (S-band services) terminates as scheduled, followed by a 20-second (minimum) inter-service interval.

6. S-band services are then activated via the TDE as scheduled, followed by S-band return link acquisition. S-band forward link modulation may be applied when the Space Shuttle's transponder has locked to the S-band forward link.

7. Following a successful switchover, the MCC proceeds with real-time Space Shuttle support via S-/K-band services and completes command and GCMR activities prior to TDE SHO termination.

2.7.8 Ascent Dump and Playback Coordination

2.7.8.1 Purpose

This procedure defines SSME and/or OD ascent dump and playback coordination operations.

2.7.8.2 Participants

a. INCO.

b. Houston CMD.

c. Houston DFE.

d. Mission Comm Mgr.

e. White Sands Ops/STGT Ops.

f. Marshall Data.

g. MIL.

h. KSC RPS.

i. Goddard Ops.

j. SMM.

2.7.8.3 General

During ascent, the SSME data is recorded on Ops Recorder-1 while the OD is recorded on Ops Recorder-2. Following successful liftoff, Goddard Ops will conduct a briefing with all parties required to participate in the SSME and/or OD ascent dump support to be conducted at approximately launch plus 2 hours, via the TDRSS.

2.7.8.4 Ascent Dump Procedure

a. At launch plus 2 hours, MIL will verify that a voice interface has been established with the KSC Record and Playback System (KSC RPS) on the Operational Intercommunications System (OIS) 238 voice circuit and bridged onto the MCC Voice Coordination Loop (MCC COORD).

b. The Mission Comm Mgr will verify data circuits to MIL and MSFC. MIL will verify the data circuit to KSC RPS is configured.

c. Houston DFE will conduct a voice check with MIL, KSC RPS, White Sands Ops/STGT Ops, and Marshall Data on the MCC COORD.

d. 15 minutes prior to an expected ascent dump, INCO will advise Houston DFE of the following parameters:

   1. Start time and type of ascent dump (e.g., SSME or OD).

   2. Data rate.

   3. Direction of dump (forward or reverse).

   4. TDRS Satellite.

e. Houston DFE will inform Marshall Data, MIL, KSC RPS, White Sands Ops/STGT Ops, and the Mission Comm Mgr of the dump parameters.

f. INCO will also advise Houston CMD to GCMR the network with the appropriate data rate, data stream ID, etc.

g. Houston CMD will transmit the appropriate GCMR for ascent dump support.

h. Houston DFE will coordinate with MIL, KSC RPS and Marshall Data on the MCC COORD to confirm station readiness for ascent dump support.

i. Houston DFE will announce, on the MCC COORD, when a dump segment is about to start, and ensure KSC RPS and Marshall Data are standing by for dump with recorders online.

j. Houston DFE will announce the start and stop time of each segment of the dump.

k. Marshall Data and KSC RPS will verbally confirm data quality to Houston DFE.

l. Houston DFE will advise all elements of any revised and/or new dump parameters.

m. Upon completion of successful SSME data processing, Marshall Data will transmit an Operations Recorder Release Message via fax to JSC (Houston DFE 281-244-5727; INCO 281-483-4947) to release the Operations Recorder-1 from SSME dump support. Houston DFE will release STGT/WSGT Ops, GSFC MCM, MIL, and Marshall Ops from SSME dump support on the MCC COORD. DFE will also ensure each element acknowledge his release announcement. Upon receiving word of the release, GSFC MCM/CDMGR will reconfigure the KSC CD4 port 0 from LPA 233 to the Marshall Merged Playback mode.

n. Upon completion of Operations Recorder-2 (Ops Rcdr) OD dump data support, Marshall Data will advise Houston DFE that OD dump requirements have been met. Houston DFE will release all elements from OD dump support.

o. Upon release, MIL will remove the OIS 238 voice circuit from the MCC COORD.

p. Marshall Data will inform Houston DFE and White Sands Ops/STGT Ops if a playback of ascent data will be required.

q. Ascent data received at KSC RPS will be recorded for later analysis. If the ascent data quality is found to be unacceptable, KSC RPS will coordinate with Marshall Data to obtain a tape dub or a playback.

2.7.8.5 Ascent Playback Procedure

a. In the event KSC RPS incurred a loss of real-time data due to line outage or system failure, KSC RPS will notify Marshall Data, MIL, White Sands Ops/STGT Ops and Mission Comm Mgr, and will request a data playback. MSFC will advise all elements of the planned playback time.

b. When advised by MSFC Data that SSME data is ready for playback to MIL/KSC RPS, GSFC Mission Comm Mgr will ensure the following data circuits are configured:

   1. MSFC to GSFC (1024 kb/sec data via Internet Protocol [IP]).

   2. GSFC to MIL (1024 kb/sec via circuit GKSC-05963).

   3. MIL to KSC RPS (1024 kb/sec via Wideband [WB] data circuit).

c. MIL will be configured to deblock the playback data as follows:

   1. PBF: Ops Rcdr-2 data (1024 kb/sec).

   2. ESB and PBF: SSME ascent data playbacks (960 kb/sec).

d. MSFC will transmit SSME (Ops Rcdr-2) or OD data (Ops Rcdr-2) to KSC RPS via IP interface at a rate of 960 kb/sec or 1024 kb/sec.

e. MIL and KSC RPS will monitor the incoming data and report data quality to MSFC. Any anomalies will be reported to White Sands Ops/STGT Ops. White Sands Ops/STGT Ops will generate a Comprehensive Discrepancy System (CDS) for any unresolved anomalies.

f. MSFC will notify White Sands Ops/STGT Ops and the Mission Comm Mgr upon completion of the data playbacks.

g. White Sands Ops/STGT Ops will advise the SMM upon playback completion and of any anomalies reported.

2.7.9 Television System

a. General. WSC receives, processes, and records real-time and dump television transmissions from the Space Shuttle (as scheduled), and remotes scrambled video and audio via satellite link. Prior to transmission, WSC will always encode (scramble) the video and audio signals. The audio signal shall not be remoted with video in the clear unless directed by Houston TV. The audio signal to be scrambled with video shall be A/G 1 conferenced on channel 1 or A/G conferenced on channel 2 or in the event of contingency support, the deinterleaved audio from the Vertical Interval Data Detector (VIDD) unit. The A/G 1 conferenced and A/G 2 conferenced signals are made available to the television system audio patch panel.

b. Channel 3, Mode 2 Data Downlink. Following is the expected Space Shuttle Channel 3, Mode 2 data:

   1. Real-time TV. Audio interleaving optional.

   2. Dump TV. Audio interleaving optional.

3. Digital Data. Digital data below 2 Mb/sec is not addressed in this section.

c. Video Recorders

1. Video. Video recording requirements for the Sony VO-9600 Video Cassette Recorders (VCR) are as follows:

(a) VCR No. 1: Processed video from the primary processing channel (Video frame synchronizer or processing amplifier) of the station television system.

(b) VCR No. 2: Configured as a backup recorder to VCR No. 1 for operations as follows:

(1) When TDRSS TV pass exceeds 50 minutes, VCR No. 2 will be started at TV Acquisition of Signal (AOS) plus 50 minutes.

(2) In the event of a prime recorder failure (VCR No. 1), VCR No. 2 will be immediately started.

(3) In the event there is an outage of the TV link to JSC, VCR No. 2 will be started and operated with VCR No. 1.

NOTE

Should a specific anomaly occur, Houston TV may direct White Sands TV/STGT TV to configure VCR No. 2 to record filtered (nonprocessed) video.

2. Audio. Audio recording requirements for the VCR video tape recorder audio tracks are as follows:

(a) Audio 1: Conferenced A/G-1 or -2 uplink and downlink audio.

(b) Audio 2: Backup for Audio 1 or contingency requirement.

(c) Audio levels should peak at 0 Volume Units (VU) as observed on VU meters of the audio recorder tracks.

(d) Audio levels should be preset using a 1-kHz tone from the Audio Test Set adjusted to a level of -10 dBm. TV system variable gain bridges should be adjusted to an output level of -10 VU with this test signal applied to the input.

NOTE

Conferenced A/G 1 and A/G 2 are provided as inputs to the TV system audio amplifiers.

d. Space Shuttle Video Tape Recorder (VTR) Time Base Jitter. Time base jitter problems may occur during Space Shuttle VTR dumps, causing a significant problem for WSC processing the signal. The following procedure is to be used when a Space Shuttle VTR dump is received at WSC:

1. White Sands TV/STGT TV will closely monitor the prime processing system output on the system output waveform monitor when notified by Houston TV that a VTR dump is in progress or about to be initiated.

2. Time base instabilities will be evident in the horizontal line display on the waveform monitor as variations in the start of active video line time in relation to the processing system sync signal.

3. Time base instabilities may also be observed on the picture monitors, appearing as horizontal "tearing" of the picture.

4. White Sands TV/STGT TV will notify Houston TV on the TV COORD if the above anomalies occur, and select BYPASS/DIRECT mode on the primary processing system, only if directed by Houston TV.

5. White Sands TV/STGT TV will monitor the secondary processing system (set to NORMAL) for comparison with the primary system for best picture quality.

6. White Sands TV/STGT TV will notify Houston TV if the secondary system video quality is better than the primary system video quality and prepare to switch the primary processing system to NORMAL if requested by Houston TV.

NOTE

Time base instabilities may cause intermittent lock indications on television system VCRs as well as erratic picture on monitor displays. These periods should be noted in the TV system log.

7. White Sands TV/STGT TV will return the primary processing system to NORMAL mode upon notification from Houston TV that the VTR dump has been terminated.

e. Remoting Requirements. White Sands TV/STGT TV will ensure the following requirements are met when the TV system is interfaced to the satellite TV link:

1. Color Bars or station Font test pattern with station Vertical Interval Test Signals (VITS) through the TV system will be on-line (prior to TV AOS).

2. The output signal is not to exceed a peak video level of 115 Institute of Radio Engineers (IRE) units. (White clip level on system processing amplifier will be set for 115 IRE units) and Soft/Hard clip set for 111.4 IRE units on video frame synchronizer.

3. VTR playback levels will be verified on the system output waveform monitor during playback activities. The levels will be adjusted prior to switching the VTR

playback on the satellite link by observing the playback signal on the system preview monitor.

4. Downlink audio will not be remoted in the clear mode with video unless otherwise notified by Houston TV.

5. The output video and audio signals will be encoded (scrambled) at all times. All of the decoders (DSW1-1 through DSW1-10 and DSW2-11) shall be authorized unless otherwise directed by Houston TV.

f. Contingencies. If a contingency occurs (or in special cases), the station could be requested to configure for remoting of deinterleaved audio; configuration instructions will be voiced to the station by JSC.

NOTE

Audio level output will be -10 VU from TV system.

2.7.10 Overlapping S-band Services for SSO Landing Support

2.7.10.1 Purpose

This procedure defines the method by which the SN will support overlapping SA (S-band) services utilizing TDRSS resources in support of SSO landing scenarios.

2.7.10.2 Participants

a. White Sands Ops/STGT Ops.

b. White Sands Scheduling.

c. GC.

d. Houston CMD.

e. INCO.

f. Houston DFE.

2.7.10.3 General

a. SSO landing support is provided by contiguous use of the TDRSS and associated SN resources until hand-over to ground station(s) at the selected landing site.

1. Dual TDRS (overlapping S-band) support may be required for some inclinations and SSO attitudes to prevent a loss of communications between TDRS and the SSO for long periods of time.

2. Dual TDRS support can be routinely scheduled by JSC and supported by WSC, however, special procedures are required when the two TDRSs being scheduled are supported out of the same ground terminal at WSC.

3. When dual TDRS landing support is scheduled, JSC will cancel the overlapping East event prior to 10 minutes before event start time if it is determined by JSC that the overlapping coverage is not required.

b. The GC will advise the network after the de-orbit burn, during the pre-landing briefing if the East event is to be canceled.

2.7.10.4 Procedure

a. The JSC MCC will determine if the SSO landing profile requires dual-TDRS (S-band) overlapping service configuration.

1. Houston CMD will notify White Sands Scheduling and White Sands Ops/STGT Ops at least 90 minutes (one orbit) before de-orbit burn sequence starts if overlapping support is required. This will allow the network adequate time to perform conflict resolution, if necessary, before JSC schedule requests are sent to WSC.

2. Houston CMD will submit delete requests and/or SARS to schedule the required S-band services to support dual-TDRS (overlapping) activities. SN overlapping services will be scheduled for no greater than 20 minutes of contiguous dual-TDRS support. This will minimize SN resource allocation conflicts.

3. White Sands Ops/STGT Ops will alert Houston CMD of pending start of SSO/TDRS overlapping S-band events (5 minutes alert). Houston CMD will in turn notify JSC internal positions (Houston DFE, INCO, GC, etc.).

b. When overlapping support scheduling occurs at a single ground terminal the following procedure will be followed at WSC to ensure adequate support requirements are met:

1. WSC will locally command the second SHO (East) command echo ITU to the other WSC ground terminals' logical command echo MDM port address. This will result in both an East and West command echo stream being sent to JSC. JSC will select the command echo data to process, as required.

2. During the overlapping TDRS support scenario the West forward data is disconnected from the Forward Data Voice Processor (FDVP), when the East SHO becomes active. This will result in the inability to locally monitor the West forward data quality via the FDVP. On a best effort basis, during overlapping support, the WSC will configure the West SHO forward data stream to the offline FDVP, if available, to enable local frame sync monitoring of both the West and East SHO forward data streams.

NOTE

When overlapping landing SHOs (East and West) are scheduled at a single ground terminal the Data and Information System (DIS) Shuttle Forward Data Quality Monitoring (DQM) software process fails. This results in static DQM status in the West SHO ODMs and no DQM status in the East SHO ODMs. There is no way to recover from this failed DQM process.

2.7.11 TDRS Maneuver Procedure

2.7.11.1 Purpose

This procedure defines the restrictions on the performance of TDRS maneuvers during Space Shuttle mission support.

2.7.11.2 Participants

a. White Sands Ops/STGT Ops.

b. FDF.

c. SMM.

d. JSC Nav.

e. JSC Space Shuttle GC.

f. JSC ISS GC.

2.7.11.3 Procedure

a. The possibility exists that some effects on Space Shuttle navigation could occur following the performance of a TDRS maneuver via WSC. Therefore, WSC is directed to ensure that the minimum interval between the completion of a TDRS maneuver and the start of a designated "JSC Nav Critical period" for Shuttle is two (2) hours. JSC Nav Critical periods are defined as:

    1. Launch phase.

    2. Rendezvous phase.

    3. Deorbit and landing phase.

    4. Other periods as defined by JSC Nav.

b. The interval specified above affords GSFC FDF sufficient time to update TDRS post-maneuver state vector(s) prior to any planned Space Shuttle maneuvers.

c. WSC will notify the SMM prior to implementing TDRS maneuvers and upon maneuver completion.

d. The GSFC SMM will verbally notify the Space Shuttle GC (and ISS GC if mission is Space Shuttle/ISS) of the planned TDRS maneuver upon being notified by WSC.

e. TDRS maneuvers may be performed by WSC during Space Shuttle Mission critical periods, except as directed in subparagraph "a" above.

f. If a TDRS maneuver is required by WSC during a designated JSC Nav critical period, an alternate TDRS satellite will be provided for mission support.

2.7.12 WSC/TDRS Sun Interference

2.7.12.1 Purpose

This procedure defines the WSC and JSC coordination activities associated with predicted sun interference between the WSC and a TDRS.

2.7.12.2 Participants

a. White Sands Ops/STGT Ops.

b. Houston CMD.

2.7.12.3 General

Possible degradation to Space Shuttle service may occur on the downlink from a TDRS when the sun passes within the WSC K-band (SGL) antenna boresight. This sun interference occurs at each equinox (normally a 5-day period) for a duration of approximately 2 minutes each day.

2.7.12.4 Procedure

White Sands Ops/STGT Ops will verbally notify Houston CMD upon receipt of information indicating sun interference is expected.

2.7.13 WSC High-rate Common Mode Switch Configuration

2.7.13.1 Purpose

This procedure defines the method for reconfiguration in the type of operations (digital, analog, or video mode) being conducted for Space Shuttle K-band, Channel-3 activities which require a manual change to the Hi-Rate Common Carrier Mode switch at the STGT. Mode selection is accomplished by pushbutton panels co-located in the White Sands/STGT STAT MUX area (rack 1092), Shuttle TV area (rack 1076), or at the DIS Tech Console.

2.7.13.2 Participants

a. White Sands Ops/STGT Ops.

b. Houston CMD.

2.7.13.3 Procedure

a. Five minutes prior to the required change time, or as far in advance as practical, Houston CMD will verbally notify White Sands Ops/STGT Ops of any reconfiguration necessary to meet K-band, Channel 3 support requirements.

NOTE

> Change may have to be implemented at White Sands/STGT to accommodate event-by-event, or a notification resulting from on-going support requirements.

b. For changes implemented via Reconfiguration GCMR, Houston CMD will also provide a “MARK” at the time of transmission to the WSC.

c. White Sands Ops/STGT Ops will verbally notify Houston CMD on the TN COORD circuit after the required changes have been implemented at the ground station.

2.7.14 Private A/G Communications

2.7.14.1 Purpose

This procedure defines the coordination and SN equipment reconfiguration required for support of A/G Private Medical Conference (PMC) communications.

2.7.14.2 Participants

a. FD.

b. GC.

c. Houston Comm Tech.

d. White Sands Ops/STGT Ops.

e. CSC-X Controller.

f. Houston Voice.

2.7.14.3 Procedure

a. General. Private A/G voice is recorded at the WSC in digital form on the Multiplexer/Demultiplexer (MDM) Line Outage Recorder (LOR).

   1. WSC will attach the special Space Shuttle private conversations label STDN No. 2166, to both the reel and tape container (see Figure 2-2).

   2. Disposition of the tape will be in accordance with procedures delineated in Section 9 of this document.

b. Coordination

   1. At least 5 minutes prior to implementing a private A/G communications (private medical conference, etc.) with the Orbiter, the GC will instruct Houston Comm Tech to request White Sands Ops/STGT Ops and to configure for support of a pending private A/G conference.

   2. WSC tech will disconnect the voice processor audio outputs from all WSC systems by performing the following configuration in accordance with on-station procedures:

      Remove the following patch cords or looping plugs:

      SUE-A AUDIO PATCH PANEL J2, J4, J6, J8.
      SUE-B AUDIO PATCH PANEL J2, J4, J6, J8.

3. Private A/G communications will not be monitored by the station unless specifically requested by JSC. The CSC-X Controller will notify Houston Comm Tech and White Sands Ops/STGT Ops when configured for support.

4. Houston Comm Tech will notify Houston Voice to turn off DMS speakers.

5. Houston Comm Tech will then notify the GC, who will forward the information to the FD.

6. Following completion of the private A/G communications conference, Houston Comm Tech will notify WSC, GC, and White Sands Ops/STGT Ops, that the private A/G communications conference is completed and request WSC to normalize operations.

7. WSC will normalize operations in accordance with local on station private A/G procedures, and notify and Houston Comm Tech on the TN COORD.

SPACE SHUTTLE

PRIVATE CONVERSATIONS

DO NOT RETRANSMIT

NOTE

1. Labels are black on fluorescent orange.

2. Voice from tapes containing this label will not be converted to analog; therefore, data transmission is permissible.

Figure 2-2. Space Shuttle Private Conversations, STDN Label 2166

2.7.15 Private Video Conferences

2.7.15.1 Purpose

This procedure defines the coordination and the WSC TV equipment reconfigurations required for support of Private Video Conferences.

2.7.15.2 Participants

a. Houston TV.

b. White Sands Ops/STGT Ops.

c. White Sands TV/STGT TV.

2.7.15.3 Procedure

a. General

    1. Audio associated with the Private Video Conferences is recorded digitally on the MDM LORs at the WSC. The completed tape reel is specially labeled and stored in the Tape Storage Room to ensure the privacy of the communication.

    2. When the MDM LOR tape upon which the Private Video Conference digital audio has been recorded is full, the Space Shuttle Private Conversation Label (STDN No. 2166) is applied to the hub reel and tape container (see Figure 2-2). The tape is then stored in the tape storage area, separate from other stored tapes.

    3. Disposition of the tape will be in accordance with procedures delineated in Section 9 of this document.

b. Coordination

    1. At least 10 minutes prior to conducting a Private Video Conference with the Orbiter, Houston TV will notify White Sands Ops/STGT Ops, on the TN COORD that they are going to configure the network for a Private Video Conference. Actual network TV configuration will be conducted between Houston TV and White Sands TV/STGT TV on the TV Conference.

    2. White Sands TV/STGT TV will advise Houston TV on the TV conference when they are configured for the Private Video Conference.

    3. At the termination of the Private Video Conference, Houston TV will notify White Sands Ops/STGT Ops on the TN COORD, that the Private Video Conference has ended and that the network is to be normalized. White Sands TV/STGT TV will notify Houston TV on the TV Conference, that their respective station has been normalized.

c. WSC Configuration. White Sands TV/STGT TV will configure the site and their TV equipment as follows:

1. Cease recording audio/video associated with the Private Video Conference.

2. Terminate the following jacks with 75 ohm termination plugs:

   Racks 1076/1077: J20, J22, J34, J36, J38, J40, J42.
   Rack 7641: J1 through J8.

3. Remove bottle plugs from the SUE/ICS interface, Rack 1081/1082 audio patch panel locations: J2, J4, J6, J8.

4. Turn off the TV monitors at the following locations:

   Rack 1074/1075: Tektronix 650 monitors.
   DIS Console: TV monitors.

5. Ensure the VM700A is not in the picture mode.

6. White Sands TV/STGT TV will disable DSW1-2 through DSW1-10, and DSW2-11 at the online encoder. DSW1-1 (JSC Medical) will remain enabled. White Sands TV/STGT TV will advise Houston TV when the decoders have been disabled. Houston TV will verify that all disabled stations are not decoding the received video.

2.7.16 SN Reconfiguration Procedures

2.7.16.1 General

These procedures describe the methods by which Shuttle TDRS services may be reconfigured. Refer to Table 2-5, which defines the SSA and KSA forward and return link services that can be reconfigured during an on-going event. Refer to paragraph 2.8.4 for verbal contingency procedure.

2.7.16.2 GMCR Procedure

a. Participants

1. Houston CMD.

2. White Sands Ops/STGT Ops.

b. General. Under normal conditions, the reconfiguration of SN TDRS resources is an automated function requiring no manual intervention. A GCMR is used to initiate reconfiguration of the SN TDRS service and/or, verbal requests from a customer. Proper execution of GCMRs and/or manual reconfigurations are reflected in changes to the ODMs/DQMs and/or spacecraft data.

Table 2-5. SN Reconfigurable Parameters

Parameter	Format
SSA Forward	
Orbiter Receive Frequency (dHz)	0210640300 (Least Significant Digit [LSD] = tens)
Antenna Polarization	0 = Left-hand Circular Polarization (LCP) 1 = Right-hand Circular Polarization (RCP)
Carrier Doppler Compensation	0 = No 1 = Yes
PN Rate Doppler Compensation	0 = No 1 = Yes
PN Modulation	0 = No 1 = Yes
Forward Link Data Rate (kb/sec)	1 = Mode-1 (32 kbps) 2 = Mode-2 (72 kbps)
KSA Forward	
Forward Link Data Rate (b/sec)	72000/216000
Orbiter Receive Frequency (dHz)	1377500000 (LSD = tens)
Antenna Polarization	0 = LCP 1 = RCP
Command Channel PN Modulation	0 = No 1 = Yes
Doppler Compensation	0 = No 1 = Yes
SSA Return	
Antenna Polarization	0 = LCP 1 = RCP
Maximum Effective Isotropic Radiated Power (EIRP) (dBW x 10 and sign; +14.5 dBW assumed)	+145
Minimum EIRP (dBW x 10 and sign; +14.5 dBW assumed)	+145
Data Bit Jitter Tolerance (percent)	0 = None 1 - 0.01 2 = 0.1 3 = 0.5 4 = 1.0 5 = 2.0
Orbiter Transmit Frequency if Noncoherent (dHz)	0228750000 (all zeros if coherent mode)
Shuttle Mode/Return Link Data Rate (kb/sec)	1 = Mode-1 (96 kbps) 2 = Mode-2 (192 kbps) 3 = Mode-3 (Carrier only)
Data Stream ID (TLM)	020, 026, 252, 260 (octal)

Table 2-5. SN Reconfigurable Parameters (cont)

Parameter	Format
KSA Return	
Antenna Polarization	0 = LCP, 1 = RCP
Maximum EIRP (dBW x 10 and sign; +60.0 dBW assumed)	+600
Minimum EIRP (dBW x 10 and sign; +46.0 dBW assumed)	+460
Orbiter Transmit Frequency (dHz)	1500340000
Shuttle Mode	1 = PM, 2 = FM
Data Format	Channels 1 and 2: 0 = NRZ-L 1 = NRZ-M 2 = NRZ-S 3 = BiØ-L 4 = BiØ-M 5 = BiØ-S Channel 3: 0 = NRZ-L 1 = NRZ-M 2 = NRZ-S
Data Bit Jitter Tolerance (percent)	Channels 1, 2, and 3: 0 = None 1 = 0.01 2 = 0.1 3 = 0.5 4 = 1.0 5 = 2.0
Return Link Data Rates (b/sec)	Channel 1: 192000 Channel 2: 16000 to 2000000 Channel 3: 16000 to 50000000 (PM Mode) or (dc to 4.2-MHz) Analog/TV - Mode 2
Data Stream ID (octal)	Channel 1: 021, 027, 253, 261 Channel 2: 022, 030, 116, 254, 262 (attached payload DSID’s 246, 247) Channel 3: 031, 023, 255, 263 (attached payload DSID’s 246, 247)
Autotrack	00000000 = Enable 00000001 = Disable

c. GCMRs. GCMRs are formatted electronic messages that specify the parameter(s) to be reconfigured during an on-going event. Houston CMD will transmit GCMRs to the DSMC NCCDS, which in turn forwards the reconfiguration requirements to the appropriate SGLT ADPE for execution.

1. GCMR Transmission Constraints

(a) GCMR Transmission Intervals. A 35-second interval is required between all service reconfiguration messages transmitted to WSC. Transmitting a second reconfiguration message (GCMR) to WSC prior to the 35-second implementation interval of the first GCMR could cause the Integrated Receiver (IR) to lock out and the link will not reacquire.

(b) Forward Frequency Sweep GCMR:

(1) The forward link frequency sweep GCMR required 2 and one half minutes to be fully implemented by WSCs equipment.

(2) No other GCMRs should be transmitted during the sweep period.

(c) GCMR Transmission Timing. GCMRs transmitted xx seconds prior to the end of a service will not be implemented by the WSC system due to insufficient time to implement. The forward frequency sweep GCMR should not be sent with less than 2 and one half minutes left in the SHO.

2. GCMR Transmissions

(a) Normally Houston CMD will announce on the TN COORD, prior to transmission of a GCMR, his intention to reconfigure a TDRS service (e.g., "Stand by for a GCMR to reconfigure channel 2 to 1024 kbps on my mark, 3-2-1 Mark."). The following sequence will be followed when transmitting follow up GCMRs to prevent IR lock out.

(b) Before transmitting a follow-up GCMR, ensure that one or both of the following has occurred:

(1) A change in the Orbiter's telemetry is observed, (characteristic of the implementation of the first GCMR).

(2) Ensure a minimum of 35-seconds has elapsed between transmissions of reconfiguration messages.

(c) Twenty seconds after a GCMR is transmitted to the ground terminal, the NCCDS will send an "assume accept" message. This is normally interpreted as an "OK" for JSC to send another GCMR, providing one or both of the conditions stated in the paragraph above has occurred.

3. Data Stream Identification (DSID) Change "ONLY" GCMRs. The NCCDS data base provides DQM setup data to the WSC ADPEs based on an algorithm that uses the DSID and data rate to define a specific set of DQM parameters. This data is inserted into the initial SHO and can be re-specified in reconfiguration messages as appropriate. To ensure a proper DQM setup in the event a data stream ID only reconfiguration is required, the following procedure will be implemented.

    (a) Houston CMD will ensure that GCMR messages transmitted to reconfigure only a data stream ID will also specify the applicable data rate parameter, even though an actual data rate change may not be necessary.

    (b) WSC CSCs will also comply with these provisions when entering GCMRs locally to reconfigure TDRS services.

2.8 SN Operations Procedures for Space Shuttle Contingency Support

2.8.1 Launch/Landing Phase Contingency Notification

2.8.1.1 Purpose

This paragraph defines the procedures to be used by the integrated networks and JSC when reporting lift-off/launch slip/landing plan revisions and the following abort contingencies: RTLS, ECAL, BAL, Ditch, TAL, AOA, or ATO. Contingency vector data is transmitted to the network with nominal vector data prior to launch by FDF. For nominal vector management procedures, refer to paragraph 2.6. When conditions exist that prevent electronic transmission of vectors to WSC from FDF, the transmission contingency procedures in paragraph 2.6.2.11 will be followed. For an overview of approved contingency landing sites, refer to Table 2-6. In addition to the Contingency procedures contained here, refer to the GSFC and STDN Contingency Action Plans, 534-CAP-Space Shuttle and 534-CAP-STDN, listed in Appendix B.

2.8.1.2 Participants

a. GC.

b. ND.

c. SMM.

d. FDF Comm.

e. Comm Mgr.

f. White Sands Ops/STGT Ops.

g. Goddard Ops.

h. JSC Nav.

i. Goddard Voice Control.

Table 2-6. Approved Landing Sites and Site Usage

	EOM	RTLS	AOA	TAL	ECAL	ELS		ELS		Remarks
						LOW	MID	High (50° - 53.5°)	High (53.6° - 63.5°)	
Amberley, Australia						X	X	X	X	
Amilcar Cabral, Cape Verde Is						X	X			
Anderson AFB, Guam, USA						X	X	X	X	
Arlanda, Sweden									O	Above 57°
Ascension AUX AF, Ascension Is								X		
Atlantic City Intl, Atlantic City, NJ, USA					X			X		
Banjul, the Gambia				X		X	X			
Beja, Portugal								X		
Ben Guerir, Morocco				X		X	X	X	X	
Bermuda Intl, Bermuda						X	X			
Cherry Point MCAS, NC, USA					X			X	X	
Dakar, Senegal						X				No agreement for use
Darwin, Australia						X	X	X	X	
Diego Garcia, Chagos Is, U.K.						X	X	X	X	
Dover AFB, DE, USA					X				X	
Dyess AFB, TX, USA						X	X	X	X	NOR AOA Weather (WX) Alternate
Edwards AFB, CA, USA	X		X			X	X	X	X	
Ellsworth AFB, SD, USA								O	O	
Elmendorf AFB, Anchorage AK								X		
Esenboga, Turkey								X	X	
Fairford, England								X	X	Ascent Only
Gander, NFLD, Canada					X			X	X	
Goose Bay, NFLD, Canada					X				X	
Grant County, WA, USA								O	O	
Grissom AFB, IN, USA										
Halifax Intl, NS, Canada					X			X	X	
Hao Atoll, Society Is, France						X	X	X	X	
Hickam AFB, HI, USA						X	X	X	X	
Hoedspruit, South Africa						X	X			

Table 2-6. Approved Landing Sites and Site Usage (cont)

	EOM	RTLS	AOA	TAL	ECAL	ELS		ELS		Remarks
						LOW	MID	High (5o° - 53.5°)	High (53.6° - 63.5°)	
King Khalid Intl, Saudi Arabia						X	X	X	X	
Kinshasa, Zaire						X				
Koln-Bonn, Germany								X	X	
KSC (SLF), FL, USA	X	X	X			X	X	X	X	
Lajes AB, Azores, Portugal							X	X	X	Approved High & Mid Inclin. Only
Las Palmas, Canary Is, Spain						X	X			
Le Tube, Istres, France								X		Ascent Only
Lincoln Municipal, NE, USA								O	O	
Mataveri, Easter Is, Chile										
Miramar NAS, CA, USA										
Moron AB, Spain				X		X	X	X	X	
Mountain Home AFB, ID, USA								O	O	
Myrtle Beach, SC, USA					X				X	
Nassau Intl, Bahamas						X	X	O	O	Underburn in Software
Northrup (WSSH), NM, USA	X		X			X	X	X	X	
Oceana NAS, VA, USA					X			X	X	
Orlando Intl, FL, USA						X	X	O	O	Underburn in Low Software
Otis ANGB, MA, USA					X			X	X	
Pease, NH, USA					X			X	X	
Plattsburgh AFB, NY, USA										
Roberts Field, Liberia						X	X			
Rota NS, Spain										
St. Johns, NFLD, Canada					X			X	X	
Santiago, Spain										No Agreement for Use
Shannon, Ireland								X	X	Ascent Only
Shearwater/Halifax, NS, Canada										
Souda Bay, Crete, Greece						X	X			Above 40° Inclin. Only
Stephenville, NFLD, Canada					X			X	X	Prior Coordination for Night Use
Tamanrasset, Algeria						X	X			Mid Inclin. Ascent Only

Table 2-6. Approved Landing Sites and Site Usage (cont)

	EOM	RTLS	AOA	TAL	ECAL	ELS		ELS		Remarks
						LOW	MID	High (50° - 53.5°)	High (53.6° - 53.5°)	
The Francis S. Gabreski, Airport, Westhampton Beach, NY, USA					X			X		
Upper Hayford, U.K.										
Wake Island AAF, Wake Is								X		
Wallops Flight Facility, VA, USA					X			X		
Westover AFB, MA USA										
Wilmington Intl, Wilmington, NC, USA					X			X		
Wright-Patterson AFB, OH, USA										
Yokota, Tokyo, Honshu I., Japan								X		
Zaragoza AB, Spain				X			X	X	X	

Sites not currently being used on the Landing Site Tables

ELS LOW - Emergency Landing Sites available for low inclination KSC launches

ELS MID - Emergency Landing Sites available for mid inclination KSC launches

ELS HIGH - Emergency Landing Sites available for high inclination KSC launches

O - Downrange abort or de-orbit underburn sites; coordinates not carried in onboard software

2.8.1.3 Procedure

a. At launch minus four (4) hours, Goddard Voice Control will remove the JSC voice link from the SN Conference Loop during launch support. At launch plus one (1) hour, Goddard Voice Control will reconfigure the JSC voice link back into the SN Conference Loop for mission support.

b. The ND, SMM, FDF, and WSC will monitor the TN COORD during the launch and landing phases for mission-related announcements by Houston GC.

c. For abort contingencies, Houston GC will make the announcement on the TN COORD utilizing the phrase "Attention All Stations …." followed by a declaration of one of the following Abort contingencies:

    1. RTLS.
    2. ECAL and landing site.
    3. BAL.
    4. Ditch.
    5. TAL and landing site.
    6. AOA and landing site.
    7. ATO.

d. Upon notification by the GC on the TN COORD of an abort contingency as listed in paragraph c, the ND will provide a positive response to a commitment of all necessary mission operations and data systems resources. The GC will acknowledge the ND's response. The SMM will then inform White Sands Ops/STGT Ops, White Sands Vector Controller, and FDF (via SN Conference loop), Goddard Ops (via Internal STDN COORD), and Comm Mgr (via Comm Mgr COORD) of the contingency call. The SMM will also direct FDF, White Sands Vector Controller, and White Sands Ops/STGT Ops to initiate vector contingency procedures, as required. FDF will coordinate the selection/transmission, and processing of vectors with WSC on the TDRS-3 COORD voice circuit. Fault isolation of SN-related problems may also be coordinated on TDRS-3 COORD, or the SN Conference Loop if TDRS-3 COORD is in use.

e. Goddard Ops will notify DFRC, MIL, WPS, and RTS of the contingency that was announced by JSC.

f. Following verification that WSC has begun using the contingency acquisition data, FDF will advise the SMM on the TN COORD. The SMM will acknowledge FDFs announcement.

g. If the GC announces a re-designation of landing site, the steps in paragraphs d, e, and f above will be repeated.

h. For Mission Status Announcements, Houston GC will notify the SMM via TN COORD of the following mission status conditions:

   1. Launch slip, new lift-off time, and notification when count resumes.

   2. Scheduled and actual lift-off times.

   3. Landing plan revisions with new landing time and/or locations.

i. Upon notification by the GC of any mission status conditions in paragraph h above, the SMM will acknowledge the announcement and immediately notify the ND, White Sands Ops/STGT Ops (Vector Controller), FDF (via SN Conference Loop), Goddard Ops (via Internal STDN COORD), and Comm Mgr (via Comm Mgr COORD) of the mission status including existing conditions, revision times, and landing sites, as appropriate.

j. In the event a voice circuit outage occurs between any SN participants (WSC, FDF, NIC, Comm Mgr, JSC) during launch phase, contact will be made via commercial telephone, if necessary. If possible, the affected element(s) will notify the SMM via any available voice interface (TN COORD, TDRS-3, SN COORD, etc.). The White Sands Vector Controller will coordinate with STGT Ops/WSGT Ops via TDRS-3 during vector transmission contingencies until voice communications are established with FDF via commercial telephone line. If TDRS-3 becomes unavailable, then White Sands Ops/STGT Ops (Vector Controller) will communicate with WSC participants via internal voice circuits until normal voice circuits are re-established. The following is a Point-of-Contact (POC) list via commercial telephones for SN participants:

1.	GSFC NIC: ND	301-286-1819
	SMM	301-286-1824 (prime), or 301-286-1817 (backup)
2.	FDF: FDF COMM	301-286-8191, 301-286-8064, or 301-286-2024 (backup)
3.	WSC: STGT Ops	505-527-7050,
	WSGT Ops	505-527-6273
	White Sands Vector Controller	505-527-7185, and
	Ops Supv	505-527-7157
4.	JSC: GC	281-483-0364,
	Houston Nav	281-483-8704
5.	NISN: Comm Mgr	301-286-6141 or 301-286-6577
	If no contact, use 3rd order backup:	301-474-6984

k. In the event Goddard Ops loses voice circuit contact with any GN participant during the launch phase, contact can be re-established via commercial telephone as listed below:

1.	GSFC: Goddard Ops	301-286-1874, 1875, or 4178
2.	WPS: Link Controller	757-824-2375 or 2377
3.	DFRC: Dryden TM	661-276-3904, 2139 or 2159
4.	Sunnyvale RTS: DICE	408-752-3352 or 4395
5.	MIL: Ops Controller	321-867-3518 or 4326

2.8.2 Spacecraft Emergencies Procedures

2.8.2.1

When a spacecraft emergency is declared, refer to the spacecraft emergency procedures described in the current Operations Interface Procedures for WSC, CSOC-WSC-PRO-002904, as listed in Appendix B.

2.8.2.2

The latest Network Advisory Messages (NAM) should also be referred to for the most current changes to standard operating procedures when emergency conditions are declared.

2.8.3 Space Shuttle Voice Interface Contingency

2.8.3.1 Purpose

This procedure defines the process required to establish voice communications with the Space Shuttle following a data circuit outage between WSC and JSC MCC.

2.8.3.2 Participants

a. Capsule Communicator (CAPCOM).

b. Houston Comm Tech.

c. GC.

d. ND.

e. Goddard Voice.

f. White Sands Ops/STGT Ops.

g. CSC-X Controller.

h. SMM.

2.8.3.3 Procedure

a. WSC will monitor all forward and return link voice communications between the MCC and Space Shuttle. Normally, no voice contact is initiated with the Space Shuttle by WSC personnel; however, if a data communications link to the MCC is inoperative and the crew calls, WSC will intervene and establish emergency voice communications with the Orbiter as outlined in subparagraphs b and c. The appropriate forward link data rate to be used will be determined by the station depending on the current TDRSS configuration (32- or 72-kb/sec via S-band; 72-kb/sec via K-band.)

NOTE

This procedure assumes the crew's voice contingency procedures are compatible.

b. If CAPCOM fails to respond to calls from the Space Shuttle crew, WSC will attempt to notify the GC on the TN COORD that the flight crew is calling. The GC may respond with a request for the station to transmit specific information to the flight crew. If, however, the GC does not respond because of circuit outages, that station Ops Sup will notify White Sands Ops/STGT Ops and advise the flight crew of the current interface problems between the WSC and MCC. To ensure that the flight crew recognizes the responding element, WSC will use their callsign and their location. A typical scenario is as follows:

The flight crew calls:

"Houston, ______________."
(Space Shuttle name)

WSC personnel answers:
"(Space Shuttle name), this is (Station Callsign) at the White Sands Complex. The communications circuits with Houston are temporarily inoperative. We are standing by to record your comments for relay to Houston when communications are restored."

c. If the MCC voice circuits to WSC are operational during a data circuit outage, the Houston Comm Tech (at the GC's direction) will configure an analog A/G long-line to WSC via Goddard Voice Control. At the request of Houston Comm Tech, the station will establish a voice interface between the Space Shuttle and MCC by enabling A/G 1 and/or A/G 2 at the emergency key panel on the operations console. The forward link data rate, 32 kb/sec or 72 kb/sec via S-band or 72 kb/sec via K-band will be determined by MCC/WSC in real time. Following a successful configuration of the A/G circuit to the Delta Modulation Test Console (DMTC), WSC will revert to monitor only. The MCC must use a tone keying system to communicate with the Space Shuttle through the DMTC. In the event the MCC experiences a tone transmit and receive keying problem, the Houston Comm Tech will request the station to configure the DMTC for constant keying to provide the MCC with continuous transmit capability. Following a restoration of data circuits between MCC and WSC, Houston Comm Tech will request a normalization of the station's DMTC equipment. The GC will notify White Sands Ops/STGT Ops when the contingency configuration is no longer required.

d. If all voice and data circuits to JSC are inoperative, GC/CAPCOM options are as follows:

   1. Contact WSC via commercial telephone and request that specific information be transmitted to the crew. WSC will relay verbal communications between the flight crew and MCC, as requested.

   2. Contact Goddard Voice via telephone and request the telephone line be patched to A/G-1 circuit and extended to WSC. At the GC's direction, the CSC-X Controller will patch the A/G circuit to the DMTC in a constant transmit mode to establish a voice interface with the Space Shuttle.

e. Following a restoration of data circuits, Houston Comm Tech will request a normalization of the station's DMTC equipment.

2.8.4 Verbal Reconfiguration Coordination Procedure

During active mission periods when electronic GCM capabilities between JSC and WSC are lost and the GC and/or Houston CMD determines the need for a TDRS service reconfiguration, he will verbally coordinate a local/manual reconfiguration with the WSC CSCs. Refer to paragraph 2.7.16 for nominal GMCR procedure.

a. Houston CMD will verbally relay the configuration requirements to the CSC as specified in Table 2-2.

b. The CSC will build an NCCDS GCMR and transmit it to the DIS, which in turn will forward it to the SGLT ADPE for execution.

c. In the event the NCCDS is down, the CSC will build and transmit the GCMR using the WSC Canned SHO Editor using local operating procedures.

2.8.5 DSID Reconfiguration

a. Purpose. The purpose of this procedure is to specify the parameters required in a reconfiguration message (GCM) to effect a reconfiguration of only the data stream ID at WSC.

b. Participants

   1. White Sands Ops/STGT Ops.

   2. JSC/Houston CMD.

c. General. The WSC data base provides DQM setup data based on an algorithm that uses the DSID and data rate to define a specific setup. This data is inserted into the initial SHO and respecified in reconfiguration messages as appropriate. To ensure a proper DQM setup in the event a data stream reconfiguration is required where only the DSID is changed and not the data rate, the following procedure will be implemented.

d. Procedure

1. Houston CMD will ensure that reconfiguration messages (GCMRs) transmitted to the network to reconfigure only a data stream ID will also specify the data rate parameter, even though an actual data rate change may not be necessary.

2. White Sands Ops/STGT Ops will comply with provisions in paragraph-a when entering GCMs locally.

2.8.6 Forward Link Encryption Mode Reconfiguration

a. Purpose. This procedure describes the process to coordinate a configuration change of the Forward Link Encryption Mode.

b. Participants

1. Houston CMD.

2. GC.

3. White Sands Ops/STGT Ops.

4. LMT.

5. SMM.

c. Procedure

1. General. The forward link can be supported in the Clear (bypass) mode and Secure mode. For either forward mode configuration, data is routed through the WSC COMSEC Work Area MYK-12 decrypter. Normal on-orbit operations are supported in the Secure mode.

2. In the event MCC would like to change the forward mode of operations Houston CMD will contact White Sands Ops/STGT Ops to request the configuration change.

3. White Sands Ops/STGT Ops will notify and coordinate internally with the station LMTs the forward mode configuration change using local operating procedures.

4. White Sands Ops/STGT Ops will notify MCC when the forward mode configuration change is complete.

2.8.7 Fault Isolation of Channel 2 Payload Data

a. Purpose. This procedure defines the coordination required to initiate fault isolation of Ku-band channel 2 data problems observed at MSFC POCC.

b. Participants

1. Marshall Data.

2. Mission Comm Mgr.

3. White Sands Ops/STGT Ops.

4. CSC-X Controller.

5. Houston CMD.

6. Houston DFE.

7. Houston Comm Control.

8. Houston GC.

c. Procedure

1. If Houston DFE detects degraded payload data or non-receipt of channel 2 data, Houston DFE will coordinate with Marshall Data (if supporting) to determine if the problem is common to both facilities. If the ODM data indicates WSC does not have lock on payload data, Houston DFE will coordinate the problem with White Sands Ops/STGT Ops.

2. White Sands Ops/STGT Ops will initiate fault isolation procedures by confirming the status of DQM data. If WSC verifies the output of valid channel 2 data, White Sands Ops/STGT Ops will request the Mission Comm Mgr to initiate troubleshooting of the data circuit interface with the element(s) experiencing the problem.

3. If GCMR support is required to restore data (e.g., reacquisition request, reconfiguration request, etc.), Houston DFE will verbally coordinate such requests with Houston CMD. White Sands Ops/STGT Ops will provide backup GCMR support when requested by Houston CMD.

4. Upon restoration of data, Houston DFE and/or Mission Comm Mgr will report the nature and resolution of the fault to White Sands Ops/STGT Ops and Houston GC.

2.8.8 Channel 1 Rate 1/3 Decoding Contingency

a. Purpose. This procedure describes the process required to coordinate the reconfiguration of WSC and the orbiter from support of K-band channel 1 coded data (rate 1/3) to uncoded data during a contingency.

b. Participants

1. Houston CMD.

2. GC.

3. White Sands Ops/STGT Ops.

c. Procedure

1. General. The standard WSC configuration for Shuttle support provides for rate 1/3 decoding on sides A and B for KSA 1 and 2 K-band channel 1 OD data with the IR auto failover enabled. If an orbiter anomaly occurs, or if WSC experiences a K-band decoding problem that preclude the support of coded data on K-band channel 1, the MCC will coordinate with WSC to determine the most expedient recovery procedure.

2. Failover/configuration for Uncoded Data. The method of recovery requires the WSC to disable the rate 1/3 decoding function from the IR. The process of reconfiguring from coded-to-uncoded data, or vice versa can be accomplished within 10 minutes.

   (a) If a determination is made by the MCC and WSC to implement the recovery procedure, WSC will disable the rate 1/3 decoding function on the appropriate KSHR IR(s) in accordance with on-station standard operating procedures, and notify the GC when completed.

   (b) WSC will implement its standard operating procedure for the KSHR channel 1 uncoded contingency configuration by ensuring the appropriate KSHR IR (prime and High Speed Message [HSM] modes) are configured to support uncoded data.

   (c) When advised by White Sands Ops/STGT Ops that SN reconfigurations are completed, the MCC will reconfigure the orbiter for uncoded K-band channel 1 data.

   (d) WSC will notify GC when lock on channel 1 uncoded data is acquired.

3. Failover/reconfiguration Back to Coded Data

   (a) Following restoration of WSC and/or the orbiter's capability to support K-band channel 1 coded data, the element rectifying the anomaly will notify White Sands Ops/STGT Ops. White Sands Ops/STGT Ops will coordinate the reconfiguration back to coded data.

   (b) WSC will implement its standard operating procedure to reconfigure the appropriated KSHR IR(s) (prime and HSM modes) to support coded data, and will notify the GC.

   (c) When advised by White Sands Ops/STGT Ops that SN reconfigurations for coded data are completed, the MCC will reconfigure the orbiter for coded data on K-band channel 1.

   (d) WSC will notify the GC when lock on channel 1 coded data is acquired.

2.8.9 K-band Intermodulation Troubleshooting

2.8.9.1 Purpose

This procedure defines the method to be utilized for troubleshooting K-band intermodulation problems between channels 2 and 3.

2.8.9.2 Participants

a. White Sands Ops/STGT Ops.

b. White Sands Tech/STGT Tech.

c. GC.

d. Houston DFE.

e. Houston TV.

f. Houston CMD.

2.8.9.3 Procedure

a. When K-band Channel 2 data is degraded and channel 3 TV over modulation is suspected, White Sands Ops/STGT Ops will first troubleshoot the network to verify that the cause for the degraded data does not emanate from the SN or other identifiable source(s).

b. White Sands Ops/STGT Ops will request Houston CMD/Houston DFE to verify that the source of the problem does not result from a known on-board configuration or anomaly.

c. To troubleshoot the problem further, White Sands Ops/STGT Ops will advise GC, Houston CMD, and Houston DFE prior to implementing this procedure.

d. White Sands Ops/STGT Ops will direct the White Sands Tech/STGT Tech to perform the following:

    1. Use a terminated oscilloscope to measure and record peak-to-peak voltages at the TV filter input and output. Use a spare output port of the Shuttle Return Data Processor (SRDP) video switch to make these measurements.

    NOTE

    Nominal modulation voltages are:

    1. Before filter: Approximately 1.1 vpp.
    2. After filter: Approximately 1 vpp.

    2. Report measurement results to White Sands Ops/STGT Ops and Houston TV.

e. White Sands Ops/STGT Ops will report the results to the Houston GC on the TN COORD.

f. WSC will retain the resulting data for post-mission usage.

2.8.10 TV Contingency Interfaces

For TV interface problems, refer to the TV validation interface tests in paragraph 2.5.1.

2.8.11 Contingency Support Caused by Facility Evacuations

Procedures for problems encountered at GSFC which require movement of the control center are described in the *Space Shuttle Program Contingency Support Plan During Evacuation/Bypass of Goddard Space Flight Center Building 3/13/14 Complex*, 534-CAP-GSFC. Procedures for movement of the Mission Control Center are contained in the *Human Spaceflight Program Emergency Mission Control Center Activation and Operations Procedures*, 450-CAP-EMCC.

2.9 Data Playback Procedures

2.9.1 Purpose

This procedure defines the method by which the JSC, MSFC, GSFC FDF, and Space Shuttle user POCCs may request and coordinate playbacks of low-rate and high-rate data recorded at WSC.

2.9.2 Participants

a. White Sands Ops/STGT Ops.

b. White Sands Scheduling.

c. GC.

d. Houston CMD.

e. Houston DFE.

f. Houston Comm Tech.

g. Marshall Ops.

h. Mission Comm Mgr.

i. GSFC FDF.

2.9.3 General Procedure

a. WSC will record all low-rate data ($\leq$2 Mb/sec) including OD, TDM dump data, etc., and all high-rate data ($>$2 Mb/sec).

b. WSC will normally retain all recorded data in accordance with Section 9 of this document unless otherwise directed by JSC. Following successful playback and release, WSC is authorized to reuse the recording medium.

2.9.4 Playback Request Procedure

a. If a playback is required, the requester must submit a playback request message to White Sands Scheduling via facsimile/e-mail within 24 hours of the completion of the real-time data take. The playback request will include a start/stop time (playback window) indicating when the data recipient can be ready to receive the data, the start/stop time of the original data transmission, the data rate, Logical Port Address (LPA), and the destination channel ID.

b. All playback requests will be coordinated between the requester and the GC/Houston CMD to ensure that playbacks will not impact real-time operations.

c. If a playback request is denied, White Sands Scheduling will respond to the requester detailing the reason for the rejection.

d. If a playback cannot be scheduled as requested, the requestor may elect to resubmit the playback request message after including modifications to the original request.

e. After White Sands Scheduling successfully coordinates a time for the playback with all participants, a Playback Event Confirmation message will be sent to Comm Mgr, White Sands Ops/STGT Ops, and the requestor.

f. Routine playbacks are normally scheduled and executed within 48 hours of completion of the real-time data take. If this cannot be accomplished, the requester will submit a data hold request and WSC will hold the data until the playback is completed.

g. If a requestor determines that a playback cannot be supported as scheduled due to unavailability of their resources, or is no longer required, the requestor will transmit a Playback Event Delete message to WSC to delete the scheduled playback event (with appropriate comments regarding data retention requests).

h. If a requester notifies WSC that a playback is no longer required after it has been scheduled, WSC will send a cancellation e-mail message accordingly.

2.9.5 Playback Coordination Procedure

a. Fifteen minutes prior to a scheduled playback, White Sands Ops/STGT Ops will alert the intended data recipient and Comm Mgr to establish the interface and verify that all participants are added to the playback coordination loop. The Comm Mgr will verify the playback configuration with WSC, if required.

b. When all elements are ready, WSC will start the data playback and will terminate the playback no later than the scheduled stop time. If the playback cannot be completed during the scheduled time period, a reschedule of the playback may be required.

c. At the completion of the playback, or if the scheduled time expires, the data recipient will notify White Sands Ops/STGT Ops and advise of any problems occurring during the playback. White Sands Ops/STGT Ops will release all participants from the playback support.

2.10 Summary of Anomalies Requiring Post-mission Follow-up/Analysis Report

2.10.1 Purpose

This procedure defines the point of contact and the content of the Summary of Anomalies requiring Post-mission Follow-up/Analysis Report.

2.10.2 Participants

a. ND.

b. All networks/ranges.

c. SMM.

2.10.3 Procedure

a. The ND will transmit a summary of anomalies requiring Post-mission Follow-up/Analysis Report. The report will be sent following WOW.

b. The report will contain a list of anomalies which occurred during the mission that require post-mission investigation, analysis, and reporting. Each listing will contain the station and/or event and orbit, the problem, and the action to be taken. Examples of anomalies which could be included are low signal strength, computer failures, data dropouts, communications outages, and any problems not resolved during the mission.

Section 3. White Sands Complex

3.1 Overview

WSC provides the operational interface to the NISN Wide Area Network (WAN), monitors the quality of service from TDRSS, provides a scheduling interface, backup GCMR capability, and emergency voice in contingency situations. This interface allows for the transmission of TV video, analog and digital data, and voice to the SN elements and JSC MCC in support of the Space Shuttle. Basic procedures for station operations including Space Shuttle-unique functions are contained in WSC Local Operating Procedures (LOP).

3.2 Emergency Voice Procedures

In the event the communications interfaces between JSC and WSC become inoperable, emergency voice communications must be established with the Space Shuttle crew. To establish these emergency voice communications, a single two-way A/G voice interface via the S-band link (32/72 kb/sec) or K-band link (72 kb/sec) will be implemented from JSC or WSC. Standard operating procedures for the emergency voice communications equipment are contained in WSC LOPs. Interface procedures are contained in Section 2 of this document and the *Human Spaceflight Program Emergency Mission Control Center Activation and Operations Procedures*, 450-CAP-EMCC.

3.3 Data Recording Requirements

WSC will record all Low-rate and High-rate data on station. High-rate data is recorded at the output of the High Rate Digital System (HRDS) in parallel with the STAT MUX feed, prior to being multiplexed. Low-rate data is recorded via the MDM LOR.

3.4 WSC Data Retention Requirements

WSC will retain recorded data and voice in accordance with data disposition requirements in Section 9 of this document, and playback procedure requirements in Section 2 of this document.

3.5 Space Shuttle Mission-unique Functions

3.5.1 Shuttle Voice Processor System

a. All Space Shuttle unique equipment is remotely controlled via the DIS ADPE system and the Space Shuttle Sub-system Controller. Control is under DIS program control in response to SHOs from the White Sands system. Operators can monitor equipment status via the Man/Machine Interface (MMI) at the DIS Operations Console or from the TOCC.

b. Forward and return processors are equivalent units, but dedicated as per forward or return function in the installed slots. Space Shuttle voice processors can be configured in any of the following modes:

1. Mode 0. Idle.
2. Mode 1. 216-kb/sec forward.
3. Mode 2. 72-kb/sec forward.
4. Mode 3. 32-kb/sec forward.
5. Mode 4. 192-kb/sec return.
6. Mode 5. 96-kb/sec return.
7. Mode 6. VIDD de-interleaved audio.

c. Status is monitored via the displays at the MMI: GT_T_SHT10 through GT_T_SHT13.

3.5.2 Voice-Operated Monitor Recorder (VOMR)

WSC will record all voice coordination loops and voice circuits. Track assignments, which may vary from mission-to-mission, will be in accordance with the Space Shuttle mission-specific NISN Circuit Assignment message from the NISN Mission Communications Manager. (Refer to Table 3-1.

Table 3-1. VOMR Track Assignments

T R K 1 2 3 4 5 6 7 8 9	Type: 2R/P40 (or equivalent) Speed: 15/32 in./sec DSS No: 330T NOTE Track assignments will be in accordance with the Space Shuttle mission-specific NISN Circuit Assignment message from the NISN Mission Comm Mgr.
10 - 40	NASA 36/1 kHz Time Code

3.6 WSC High-rate Common Mode Switch Configuration

3.6.1 Purpose

This procedure defines the method for reconfiguration in the type of operations (digital, analog, or video mode) being conducted for Space Shuttle K-band, Channel-3 activities which require a manual change to the Hi-Rate Common Carrier Mode switch at the STGT. Mode selection is accomplished by pushbutton panels co-located in the White Sands/STGT STAT MUX area (rack 1092), Shuttle TV area (rack 1076), or at the DIS Tech Console.

3.6.2 Participants

a. White Sands Ops/STGT Ops.

b. Houston CMD.

3.6.3 Procedure

a. Five minutes prior to the required change time, or as far in advance as practical, Houston CMD will verbally notify White Sands Ops/STGT Ops of any reconfiguration necessary to meet K-band, Channel-3 support requirements.

NOTE

> Change may have to be implemented at White Sands/STGT to accommodate event-by-event, or a modification resulting from on-going support requirements.

b. For changes implemented via Reconfiguration GCMR, Houston CMD will also provide a "MARK" at the time of transmission to the WSC.

c. White Sands Ops/STGT Ops will verbally notify Houston CMD on the TN COORD circuit after the required changes have been implemented at the ground station.

Section 4. NASA Integrated Services Network

4.1 Overview

4.1.1 General

This section provides a detailed definition of the SN operational communication interfaces required for NISN support to the Space Shuttle Program. Elements of the STDN are serviced by the NISN IP Operational Network (Closed IONET). The NISN Mission Comm Mgr is the initial POC for all NISN activities.

4.1.2 NISN Closed IONET Interface

The GSFC Closed IONET is an existing IP infrastructure that includes NISN current 4800-bit block protocol and is used for the data transport functions required by the Space Shuttle. (See Figure 4-1.)

4.1.3 Conversion Devices

Conversion devices are placed at each user location to encapsulate serial 4800-bit block data into IP data packets at message origin, and de-encapsulate packets back to 4800-bit blocks at the message destination. Each conversion device is attached via Ethernet to a Closed IONET IP router. These routers send the IP packets to the appropriate multicast destination(s). Simple Network Management Protocol (SNMP) is used by the GSFC Closed IONET Network Operations Center (IP NOC) to control and receive alarms and status from the conversion devices, however; the conversion devices are controlled and configured by the GSFC Conversion Device Managers (CD Mgr).

4.1.4 Diversity

Router and T-1 diversity allows for complete transmission redundancy utilizing the Closed IONET. The system is composed of Wide Area Network (WAN) and Local Area Network (LAN) equipment located at JSC, GSFC, and WSC. Each location has two redundant WAN routers and each router is considered to be the prime link for one center and the alternate link for the other center. The router interface with the most direct route with another center is considered to be the prime link for that center's data transmission. GSFC uses IP conversion devices, JSC uses a combination of conversion devices and MDM equipment, and WSC uses modified MDM equipment to process data to and from the Closed IONET.

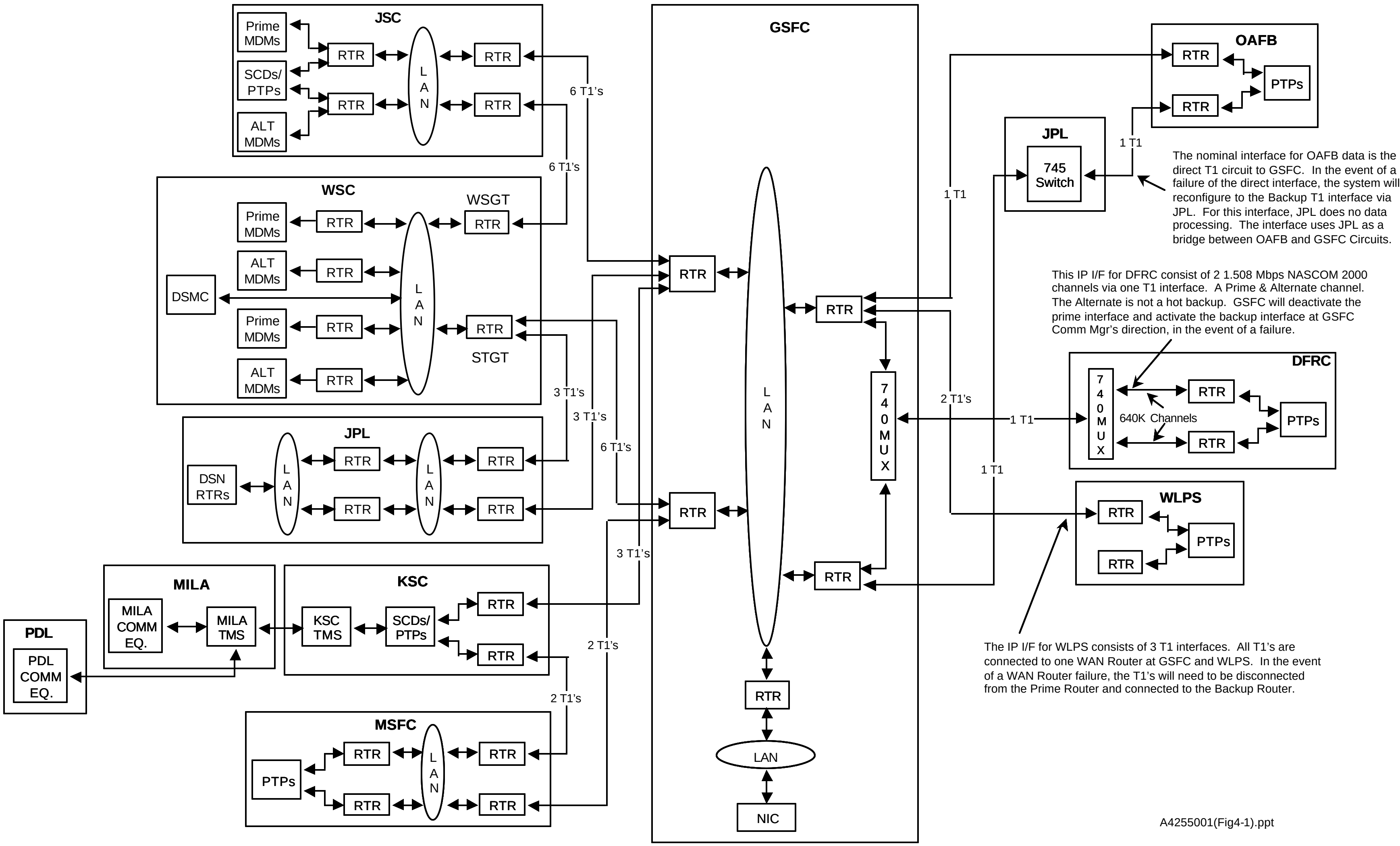


Figure 4-1. JSC/NISN Closed IONET Interface

4.1.5 NISN Tracking Data System

Space Shuttle low-speed tracking data in the form of C-band and S-band radar data is received by the NISN Tracking Data System (TDS) for blocking and forwarding via the Closed IONET to the Flight Dynamics Facility (FDF) and JSC. Interrange Vectors (IRV), Improved Interrange Vectors (IIRV), Internet Predicts (INP), and acquisition data are blocked at FDF and forwarded via Closed IONET for high-speed delivery or back to TDS for transmission to low-speed message users. Space Shuttle pointing data received by the Closed IONET is forwarded to TDS for deblocking and sent out in ASCII format to correspondents. TDS applications access Closed IONET via conversion devices.

4.2 NISN Resources

4.2.1 General

NISN resources supporting Space Shuttle operations consist of voice, teletype, low-rate data, high-rate data, and television/analog interfaces. JSC/SN direct NISN interfaces are used for routing S-band and Ku-band data to and from the SN via the WSC and JSC. The message traffic to WSC from JSC consists of forward link (command, voice, and 128-kb/sec uplink data). The message traffic from SN to JSC consists of the return link (telemetry [TLM]/voice), the forward link echo, tracking data, and video data. Figure 4-2 illustrates the functional NISN SN data flow, via the Closed IONET, in support of Space Shuttle. Figure 4-3 illustrates the NISN circuit interfaces for SN Space Shuttle support.

4.2.2 Voice and Teletype Interfaces

Voice and teletype circuits are provided on a full-period basis and are available for activation/use procedurally without a specific scheduling input to NISN.

4.2.3 Low-rate Data Interfaces

4.2.3.1 WSC-to-JSC/GSFC and JSC/GSFC-to-WSC

Low-rate data (up to 2 Mb/sec) between WSC and JSC/GSFC is transported via the Closed IONET. WSC and JSC utilize the NISN MDM equipment to interface to the Closed IONET. The WSC MDM equipment is configured via the WSC DIS/ADPEs. JSC's MDMs are manually configured. The JSC/WSC MDMs are interfaced in a broadcast mode of operation through the use of wideband circuits via the Closed IONET. The bundle of T-1 circuits between JSC, WSGT/STGT, and GSFC are IP interfaces with a bandwidth capability of 8 Mb, via NSAP circuitry (not via satellite). GSFC receives low-rate data directly off the router interface of the Closed IONET.

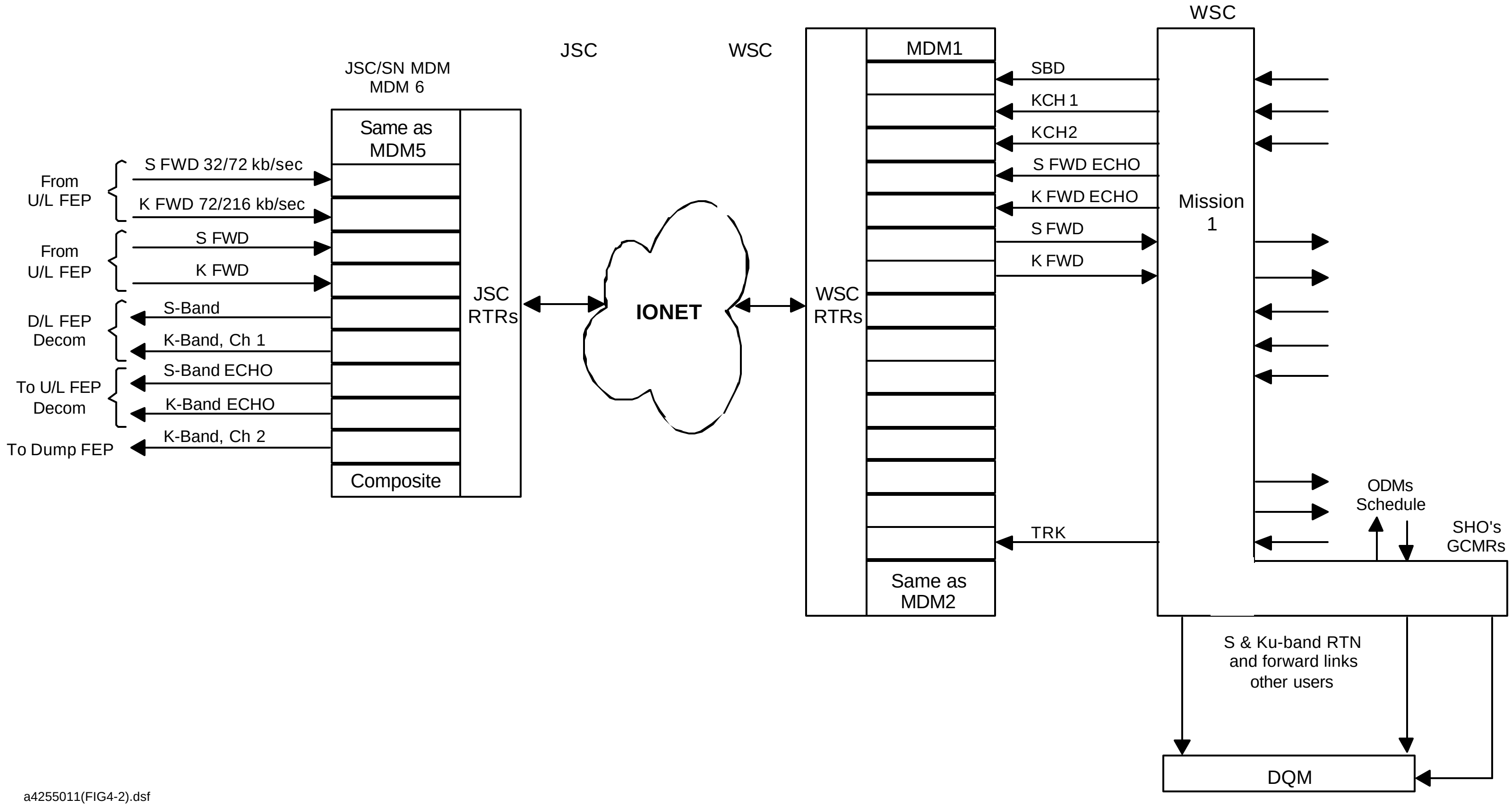
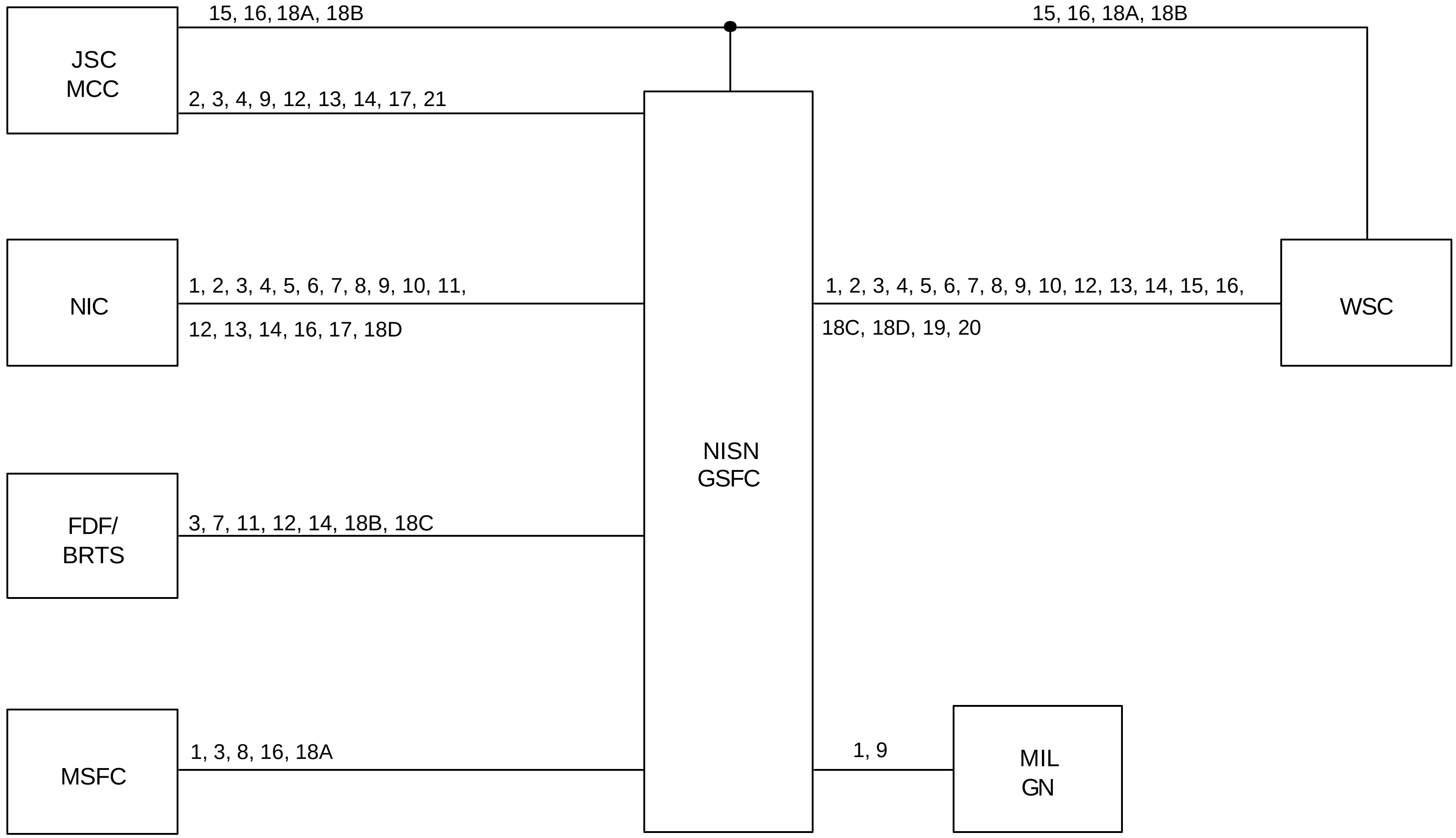


Figure 4-2. Functional SN Data Flow



a4255010(fig4-1).dsf

Figure 4-3. NISN Interfaces for SN Space Shuttle Support

Legend

1. GSFC/MSFC COORD. GSFC NOM coordination with MIL GN station and MSFC for data bit rate changes.
2. SHO Time COORD. WSC coordination with JSC concerning Space Shuttle schedules.
3. TDRSS-7/TN COORD. Primary real-time troubleshooting and prepass/postpass briefing loop.
4. TV Conf. For coordinating video checkout, validation, and handovers of video operations between White Sands TV/STGT TV, Houston TV and Goddard TV.
5. TDRSS East COORD. Operations coordination loop between WSC and POCC.
6. TDRSS West COORD. Operations coordination loop between WSC and POCC.
7. TDRSS-3. Scheduling/vector coordination between FDF and White Sands Ops/STGT Ops.
8. WSC P/B COORD. Playback coordination between WSC, JSC, and MSFC.
9. Network Management COORD. For ND coordination of resolution for operational anomalies.
10 NIC/Comm Mgr COORD (CCL-1). For general operations coordination, troubleshooting, and verbal relay from NIC of reconfiguration requests and Low-rate/High-rate data playbacks from WSC and for general operations coordination and troubleshooting concerning GN Space Shuttle support.
11. NIC/FDF COORD (CCL-47). For NIC/FDF coordination of FDF Mission Requirements.
12. SN Conference. Coordination between NIC, JSC, and WSC for long-term discussions of engineering problems and operations anomalies.
13. MDM COORD Loop. For MDM network voice coordination between GSFC (NISN Comm Mgr/Comm Mgr, Tech Control, Voice Control) and MDM operator positions at WSC and JSC.
14. Teletype Operations Facilities. Full-duplex eight-level circuitry provided for operations administration. Baud rates from 110 baud to 1200 baud provided, based on interface needs.
15. High-rate Data System. 50-Mb/sec system used to extend 2.0 to 48.0 Mb/sec data via full-transponder (real-time or playback) to JSC.
16. Analog/Television. Used to extend 4.2-MHz analog data or 4.5-MHz video to JSC or GSFC separately via existing full-transponder with 50 Mb/sec data capability.
17. GOSS-8 COMM Coordination. For coordinating network communications problems between Houston Comm Control, Houston Voice, Mission Comm Mgr, and Comm Mgr/Goddard Voice.
18. Low-rate Data Interfaces

    18A - Spacecraft Command/Telemetry.

    18B - Tracking Data.

    18C - Bilateration Telemetry.7

    18D - WSC Status/Scheduling.
19. A/G 1 Contingency Voice
20. A/G 2 Contingency Voice
21. JSC/WSC Scheduling

Figure 4-3. NISN Interfaces for SN Space Shuttle Support (cont)

4.2.3.2 GSFC-to-MSFC and MSFC-to-GSFC

Low-rate data for the extension of Space Shuttle OD, SSME, payload data, and other required data are interfaced between GSFC and MSFC using IP conversion devices via IONET interfaces. This system is configured in accordance with applicable mission documentation.

4.2.4 High-rate Data Interfaces

High-rate data (2 to 48 Mb/sec) is transported from WSC to JSC by a 50-Mb/sec Statistical Multiplexer (SM) system using SN2XP5 for the transmission of the TDRSS K-band data.

4.2.5 Television/Analog Data Interfaces

SN2XP5 is used to transmit Space Shuttle K-band Channel 3 video to JSC, where it is color-converted and then relayed to GSFC, MSFC, and other locations. (Television/analog data interfaces are illustrated in Figure 4-4.)

4.3 NISN Event Scheduling Terminal

The NISN Event Scheduling Terminal (NEST) provides the scheduling interface between NISN and the WSC/NCCDS. The WSC is responsible for scheduling the SN and the NEST assumes that a schedule is correct if one is sent to it, and simply acknowledges it. The NEST does not allocate resources. The NEST transmits the advanced schedule and real-time changes to JSC. JSC configures their MDMs manually in accordance with the NEST Schedule.

4.4 MDM Configurations

4.4.1 WSC MDMs

MDM transmit/receive units (Input Terminal Units [ITU]/Output Terminal Units [OTU]) at WSC are automatically configured via the DIS ADPE in accordance with NISN-oriented information extracted from the SHO sent to the WSC. The MDM User Options (NISN parameter record) for the ITU/OTU combinations, to support the data transport functions, are contained in SHO sub-headers 5 and 6 and are listed in Table 4-1.

4.4.2 JSC MDMs

MDM transmit/receive units ITU/OTUs at JSC are manually configured in accordance with schedule messages received via the NEST. (Refer to Table 4-1 for MDM user options).

4.4.3 Event Setup for Television

4.4.3.1 Purpose

This procedure provides the information necessary for a television event setup.

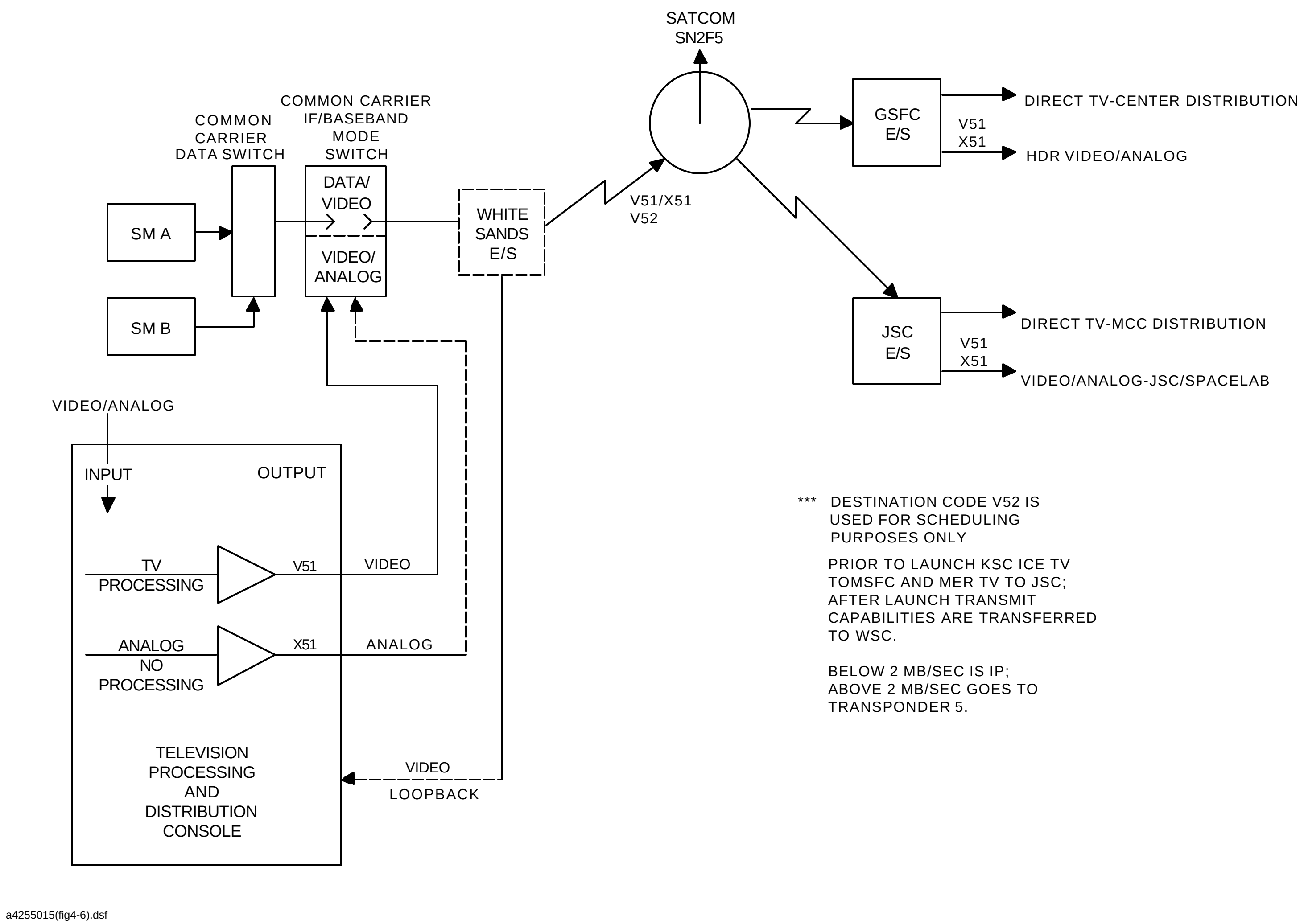


Figure 4-4. Space Shuttle Video/Analog Data High Speed Interfaces from WSC to JSC/GSFC

Table 4-1. NISN Parameter Records for the Space Shuttle

Type-1 Data			
SSAF			
ITU/OTU			
X		Blocked Data Source	No
X		Modified Header	No
X		1-second Timeout	No
X		Time Tag Required	No
	X	Blocked Data Destination	No
	X	Clock Internal	Yes
	X	Clock Clamping Required	Yes
	X	Clock Tracking Required	No
	X	CAB Enable	No
SSAR			
ITU/OTU			I Channel
X		Blocked Data Source	No
X		Modified Header	No
X		1-second Timeout	No
X		Time Tag Required	No
	X	Blocked Data Destination	No
	X	Clock Internal	Yes
	X	Clock Clamping Required	No
	X	Clock Tracking Required	Yes
	X	CAB Enable	No
KSAF			
ITU/OTU			
X		Blocked Data Source	No
X		Modified Header	No
X		1-second Timeout	No
X		Time Tag Required	No
	X	Blocked Data Destination	No
	X	Clock Internal	Yes
	X	Clock Clamping Required	Yes
	X	Clock Tracking Required	No
	X	CAB Enable	No

Table 4-1. NISN Parameter Records for the Space Shuttle (cont)

Type-1 Data		
	KSAR (Channel 1)	
ITU/OTU		
X	Blocked Data Source	No
X	Modified Header	No
X	1-second Timeout	No
X	Time Tag Required	No
X	Blocked Data Destination	No
X	Clock Internal	Yes
X	Clock Clamping Required	No
X	Clock Tracking Required	Yes
X	CAB Enable	No
	KSAR (Channel 2)	
ITU/OTU		
X	Blocked Data Source	No
X	Modified Header	No
X	1-second Timeout	Yes
X	Time Tag Required	No
X	Blocked Data Destination	No
X	Clock Internal	Yes
X	Clock Clamping Required	No
X	Clock Tracking Required	Yes
X	CAB Enable	No

4.4.3.2 Participants

a. Comm Mgr.

b. Goddard TV.

c. Goddard Voice.

d. Houston Voice.

e. White Sands Tech/STGT Tech.

f. Houston TV.

g. Marshall TV.

h. Houston ACR.

i. KSC TV.

j. GYVW (KSC).

k. GYCC (KSC).

l. KSC Audio.

m. MILA TV (KSC).

n. Dryden TV.

o. Vandenberg TV.

p. JPL TV.

q. AGS Greenbelt Earth Station.

r. AGS Woodbine.

s. JSC Earth Station.

t. Kennedy Earth Station.

u. Marshall Earth Station.

v. Dryden Earth Station.

w. Vandenberg Earth Station.

4.4.3.3 Procedure

a. Voice. Goddard Voice is required to maintain configuration of voice circuits/ conferences (primarily TV Conference/SCAMA 5 and PAO QUE/SCAMA 224) at all times.

b. Video (Transponder 5, General). Prior to utilizing transponder 5 for any video support function, Goddard TV personnel will contact the Comm Mgr to confirm the transponder may be released from Data Mode. After the release has been authorized, Goddard TV will coordinate the video configuration/uplink site change via the TV Conference. Anytime a video configuration/uplink change is made, Goddard TV personnel will record the GMT time/date, video bar and sync levels, luminance weighted signal-to-noise ratios, and audio levels. If any of the recorded levels do not meet predetermined specifications, Goddard TV will coordinate troubleshooting and adjustment procedures to correct the problem.

c. Video (Transponder 9, General). Prior to changing the uplink site for transponder 9, Goddard TV personnel will coordinate the change by first notifying NASA Headquarters.

NOTE

> This step may be eliminated during a Space Shuttle mission/prelaunch period once control of the TV Network has been turned over to KSC TV or Houston TV. Goddard TV will only initiate the uplink site change after present uplink site personnel have released the transponder. All data specified in paragraph 4.4.3.3.b will also be recorded for any transponder 9 switch. Goddard TV will coordinate troubleshooting procedures anytime signal quality does not meet predetermined NTC-7 specifications.

4.4.4 Video and Analog Data Handling

4.4.4.1 Purpose

This procedure provides the information necessary to describe how analog data and Space Shuttle video is handled by WSC/NISN.

4.4.4.2 Participants

a. White Sands Tech/STGT Tech.

b. Comm Mgr.

c. Goddard TV.

d. Houston TV.

e. Marshall TV.

f. WSC Earth Station

g. AGS Woodbine Earth Station.

h. AGS Greenbelt Earth Station.

i. JSC Earth Station.

4.4.4.3 Procedure

a. Video/Analog Handling. Both the analog data and the Space Shuttle video are routed to the TV systems at WSC for conditioning for transmission by the common carrier. The TV system is checked and tested before receiving a real-time analog/video downlink. Goddard TV will conduct carrier interface configuration validation using the TV conference for voice coordination.

b. Preliminary Space Shuttle Video Checkout

   1. Prior to the first scheduled Space Shuttle video downlink or when requested, the White Sands Tech/STGT Tech will pass video and audio test signals through both the primary and secondary TV processing channels to verify proper video and audio output signals at Houston TV's discretion. The signals used for these checks will be the VIDD output test signal, system test video, FCC composite, FCC Multiburst, NTC-7 Combination, 100 IRE White Bar, Full Field Color Bars, and/or SMPTE Color bars, signals at Houston TVs discretion.

   2. Goddard TV personnel will monitor any tests performed by Houston TV and provide troubleshooting assistance as required.

c. Arriving Analog Data or Video (WSC/STGT)

   1. Analog data or video arriving via the return link is routed to the station TV system. The White Sands Tech/STGT Tech configures the TV system to allow analog/video to be routed in real-time to the CCI rack for transmission.

   2. At event start time, the White Sands Tech/STGT Tech will announce to JSC that TV is online and verify the quality of the data. During real-time remoting of the TV signal, WSC station personnel will in no way inhibit or edit the downlink TV signal. Abnormal video levels will be reported to WSC immediately. Corrective action will be taken only at the direction of Houston TV.

d. Throughput Data. Analog data or Space Shuttle TV data throughput from the TV system goes to the CCI rack and is extended to the CCI switch and mode switch. (See Figure 4-4.)

4.5 High-rate/Video/Analog Data Configurations

4.5.1 General

High-rate/Video/Analog configurations at WSC are automatically configured via the DIS ADPE. The DIS/ADPE system enables/disables the applicable SM transmit port or provides for necessary switch actions for analog/video support in accordance with NISN-oriented information extracted from the SHO sent to the WSC. Schedule information for JSC is received via the NEST system and configurations are coordinated with the GSFC Comm Mgr via the MDM full-period voice orderwire established for this and other High Data Rate (HDR) activities.

4.5.2 Discrepancies

Discrepancies noted by any of the HDR control locations are immediately reported to the Comm Mgr via the MDM orderwire. WSC scheduling will be contacted to resolve any schedule anomalies or discrepancies.

4.5.3 Real-time Schedule Changes

Real-time schedule changes will be at the direction of WSC scheduling and the GSFC Comm Mgr.

4.5.4 STAT MUX (48 Mb/sec) Comm Test

At a scheduled time in the launch (terminal) count, a STAT MUX interface test will be conducted using a 604/607 DTTS to verify continuity using both STAT MUX Channel 3 and 4 interfaces to Houston Comm Control. Houston Comm Control/White Sands Tech/STGT Tech will advise the Comm Mgr when these actions are completed at all locations. The Comm Mgr, in turn, will advise White Sands Ops/STGT Ops.

4.5.5 Mode Switch

The Mode Switch will be configured according to the schedule or in accordance with paragraph 2.7.13 contained herein, as verbally directed by JSC. All Mode Switch reconfigurations will be reported to the Comm Mgr.

NOTE

> The Earth Station's uplink on SN2F5 (Space Shuttle video) will be controlled by NISN.

4.6 Circuit Restoration

4.6.1 Purpose

This procedure provides instructions for restoration of circuits or channels in the event of an outage during support.

4.6.2 Participants

All.

4.6.3 Procedure

a. Voice or Teletype

1. In the event of an outage on a supporting circuit, the discovering party reports the outage to the Comm Mgr at telephone number (301) 286-6141 if no other loop is available for such reporting.
2. White Sands Ops/STGT Ops normally uses the MDM orderwire for this purpose.
3. SN elements report outages to White Sands Ops/STGT Ops, who relay the report to the Comm Mgr.
4. The Comm Mgr will instruct Goddard Voice to check the reported circuit and, if necessary and possible, establish a make-good for the duration of the event.
5. The Comm Mgr will advise White Sands Ops/STGT Ops of all trouble responses and what actions have been taken or are being initiated by NISN.

b. Low-rate Data Paths

1. If, during support, a channel interruption is identified by a SN element, JSC, MSFC, or GSFC, the party detecting the interruption will report the problem to White Sands Ops/STGT Ops. White Sands Ops/STGT Ops will relay the problem report to the Comm Mgr via the MDM orderwire.
2. White Sands Ops/STGT Ops should verify whether or not WSC is outputting nominal data. White Sands Ops/STGT Ops will coordinate with the reporting entity to determine whether corrective action is to be taken immediately or delayed until a later time during the event.
3. With White Sands Ops/STGT Ops approval, the Comm Mgr will direct Goddard Tech Control to check the channel in question and verify proper performance.
4. Goddard Tech Control coordinates with White Sands Tech/STGT Tech and Houston Comm Control to verify MDM channel integrity. If the channel problem is not within NISN support facilities, the Comm Mgr advises White Sands Ops/STGT Ops and/or Houston Comm Control (as applicable) and awaits further coordination requests. If the problem is within NISN facilities, Goddard Tech Control immediately initiates corrective action and, when accomplished, advises

the Comm Mgr. The Comm Mgr relays this report to White Sands Ops/STGT Ops and/or Houston Comm Control (as applicable), and informs of the nature of the corrective action taken.

c. High-rate Data Paths

1. Failure or degraded data on an SM channel is normally detected first by Houston Comm Control. Problem reports are forwarded to White Sands Ops/STGT Ops.

2. White Sands Ops/STGT Ops should verify whether or not WSC is outputting nominal data. White Sands Ops/STGT Ops notifies the Comm Mgr of the condition. The Comm Mgr immediately advises Goddard Tech Control to initiate appropriate troubleshooting procedures.

3. If a channel problem is confirmed (prime and backup SM) at Houston Comm Control, the data service is transferred to another SM channel if time and channel availability permits.

4. If the entire 50 Mb/sec circuit is verified to have failed, NISN turns the circuit over to the commercial carrier for corrective action. The Comm Mgr will advise Goddard TV, White Sands TV/STGT TV, and Houston TV of the outage via the TV Conference. The Houston GC and Comm Control personnel will also be advised of outage.

d. Video

1. Failure or degraded data is normally detected first by the user, who will report the problem to Goddard TV.

2. Goddard TV will verify what type of signal GSFC is receiving, and then effect fault isolation to determine where the failed or degraded video/data is occurring.

3. Once the trouble has been isolated, Goddard TV will advise the user on TV Conference and White Sands Ops/STGT Ops via the Comm Mgr. If the trouble is in NISN-provided facilities, corrective action will be initiated by NISN.

4. If the full-transponder service is verified to have failed, NISN turns the appropriate transponder circuit over to the commercial carrier for corrective action.

5. The Comm Mgr immediately advises White Sands Ops/STGT Ops of the status and action being taken by NISN or other corrective action necessary, as applicable.

6. Space Shuttle camera video is recorded at WSC.

Section 5. Flight Dynamics Facility Operations

5.1 Overview

This section provides information pertinent to FDF operations during nominal and contingency Space Shuttle support. Refer to paragraph 2.6 for vector management procedures for nominal and contingency support between the FDF and WSC.

5.2 FDF Services

5.2.1 General

5.2.1.1

FDF support activities for Space Shuttle include the following:

a. Planning and scheduling aids generation.

b. Tracking data receipt and evaluation.

c. Tracking data event status reporting.

d. Prime Orbit Determination (OD) during EMCC support.

e. Prime or backup OD for STS payloads.

f. Space Shuttle acquisition data generation/validation/transmission.

g. Providing TDRS IIRVs to JSC.

h. Providing real-time displays.

5.2.1.2

There are no current documents that apply to the new FDF-WSC interface. All documents referencing an NCC/FDF interface have not been rewritten to reflect the DSMC at WSC. New documents are being prepared. Refer to the list of referenced documents in Appendix B.

5.2.2 Scheduling Aids

The FDF generates SN scheduling aids in the form of one-line summary view period data for SN Space Shuttle support. The scheduling aids define the nominal view periods during which the Space Shuttle is in view of a specific TDRS. One-line summary view period data is available via the web-based Flight Dynamics Product Center (FDPC) (http://fdf.gsfc.nasa.gov).

5.2.3 Tracking Data Evaluation

5.2.3.1 General

During STS missions, the FDF receives TDRSS tracking data that is used for OD and tracking data evaluation.

5.2.3.2 Tracking Data Validation/Calibration

The FDF performs the analysis required to identify tracking-related problems. This function is performed by comparing the actual GN and SN tracking data received with a set of computed values. Overall system performance is monitored by performing noise analysis and by evaluating the data for biases, gross drift, and spikes.

5.2.3.3 Tracking Data Reports

The FDF can provide JSC and WSC with near-real-time preliminary evaluation of tracking data as needed when the FDF is staffed. These preliminary evaluation reports may be verbal. The FDF also provides post-event data evaluation reports.

5.2.4 Orbit Determination

JSC will provide the prime orbit determination processing for Space Shuttle on-orbit support. In the event that JSC loses the capability to support the mission, the FDF will provide prime orbit determination support in accordance with the Emergency Mission Control Center (EMCC) procedures contained in the *Human Spaceflight Program Emergency Mission Control Center Activation and Operations Procedures*, 450-CAP-EMCC.

5.2.5 Acquisition Data

5.2.5.1 General

The FDF will provide acquisition data to the SN in accordance with the vector management procedures described in Section 2, paragraph 2.6 of this document. The FDF-generated acquisition data is based on JSC-provided pre-mission data and real-time updates during the mission. General ground rules for vector and maneuver sequence processing at WSC are contained in 405-TDRS-RP-ICD-001. (Refer to Appendix B.) Space Network (SN) Nominal and Contingency Acquisition Supports Acquisition data for launch, contingency, on-orbit, and landing support will be sent from the FDF to WSC via electronic transmission and backup e-mail, facsimile, or voice.

Section 6. Data Base Information

6.1 Overview

a. The NCCDS data base (located at WSC) contains the Service Specification Codes (SSC) used to set-up the SN (e.g., NISN, TDRSS, and WSC) in a desired posture. An SSC is a set of fixed and reconfigurable parameters which define a single service for a given SN user. Each STS mission is assigned a Support Identification Code (SIC) and within the SIC data base, a set of SSCs are maintained. When JSC requests a new SIC for support of an upcoming mission, usually a previously flown mission SIC is copied to the new SIC, hence, all the SSCs are copied.

b. Each STS SIC contains a unique ID/PASSWORD for scheduling and real-time support. Since JSC can use one system to schedule multiple STS SICs, the schedule request and resulting scheduling messages from NCCDS for each STS SIC are uniquely identified. The JSC Scheduling data base manager and the NCCDS data base manager agree on a unique ID/PASSWORD whenever new SICs are entered into the NCCDS data base.

c. Schedule requests must contain a SUPIDEN. Schedule requests for ESTL TDRSS support are submitted with a STS SIC, however, are discriminated from Shuttle support by the SUPIDEN. Each SIC may contain multiple SUPIDENs (e.g., M2107MS, M2107EE).

d. An SSC must be resident in the NCCDS data base in order for JSC to successfully schedule an event. Changes to all SSCs are coordinated as referenced in paragraph 6.3.

6.2 NCCDS Data Base-SSCs

6.2.1

SSCs have been developed for STS S-band Forward, S-band Return, Ku-band Forward, Ku-band Return, and Tracking services. The convention for naming SSCs is as follows:

a. Hxx - Forward SA service.

b. Ixx - Return SA service.

c. Nxx - Forward KuSA service.

d. Pxx - Return KuSA service.

e. Txx - Tracking service.

f. Where xx is a number from 00 to 99.

6.2.2

In early 2002, Houston CMD agreed to begin scheduling with open antenna selection. Antenna selection for each of the forward and return codes with odd numbers were changed to “Either” and the even codes and their respective track codes were deleted.

6.2.3

Table 6-1 gives the current listing of the codes in the NCCDS data base for SIC 2107.

Table 6-1. Service Specification Codes

SSC	Service
H51	SSAF
H53	SSAF
H61	SSAF
H63	SSAF
N51	KuSAF
I51	SSAR
I61	SSAR
P51	KuSAR
P53	KuSAR
P55	KuSAR
P61	KuSAR
P63	KuSAR
T51	Track
T53	Track
T61	Track
T63	Track

6.2.4

This distinction between the four SSAF codes are frequencies (high and low) and WSC command interface ports. The distinction between the 2 SSAR codes are the WSC data interface ports. There are multiple KuSAR codes to accommodate the various support scenarios (e.g., Channel-3 Digital TV, 48 M science data).

6.2.5

Figures 6-1 through 6-5 are example SSC Reports for SIC 2107 and provide a listing of data base parameters required for each type of service (i.e., SSAF, KuSAF, SSAR, KuSAR, and Tracking service.

Service Specification Code Report as of 2002/322/21:49:04

Last updated by: BENJAMIN at: 2002/174/20:26:58

SIC 2107

Service Specification Code ID (H##) H51

Service Specification Code Type .... SSAF

Service Configuration (Normal or Shuttle) .... Shuttle

Antenna (SA1, SA2, Either) .... Either

User Interface Channel ID (UIFC ID) J27

Shuttle PN Rate (00000001 to 99999999 chips/sec) 011232000

Maximum Data Rate (000072000 bps) 0000072000

Initial Data Rate (000032000 or 000072000 bps) 0000072000

*Receiver Frequency (0204100000 to 0212000000 daHz) 210639630

*PN Modulation .... Yes

*Polarization (Left or Right) .... Right

*Carrier Doppler Compensation .... Yes

*PN Rate Doppler Compensation .... Yes

*Shuttle Configuration Mode (1=32 kbps or 2=72 kbps) 2

*TSW Set ID (AAAAAAAAAA) .... N/A

**Power Mode (NormalPower or HighPower) .... HighPower

* = reconfigurable and respecifiable

** = reconfigurable

Figure 6-1. SSC SSAF-S Report

Service Specification Code Report as of 2002/322/21:28:29

Last updated by: BENJAMIN at: 2002/174/20:27:57

SIC 2107

Service Specification Code ID (N##) N51

Service Specification Code Type .... KuSAF

Service Configuration (Normal or Shuttle) .... Shuttle

Antenna (SA1, SA2, Either) .... Either

User Interface Channel ID (UIFC ID) J25

Maximum Data Rate (000216000 bps) 00000216000

*Initial Data Rate (0, 000072000, 000216000 bps) 00000216000

*Receiver Frequency (1375000000 to 1380000000 daHz) 1377500000

*Command Channel PN Modulation .... Yes

*Polarization (Left or Right) .... Right

* Doppler Compensation .... Yes

*TSW Set ID (AAAAAAAAAA) .... N/A

**Power Mode (NormalPower or HighPower) .... HighPower

* = reconfigurable and respecifiable

** = reconfigurable

Figure 6-2. SSC KuSAF-S Report

Service Specification Code Report as of 2002/322/21:50:10

Last updated by: BENJAMIN at: 2002/174/20:28:10

SIC 2107

Service Specification Code ID (I## to L##) I51

Service Specification Code Type ....SSAR

Service Configuration (Normal or Shuttle) .... Shuttle

Antenna (SA1, SA2, Either) .... Either

SSA Combining .... No

Return Channel Time Delay .... No

User Interface Channel ID (UIFC ID) J58

Maximum MDM Data Rate (000192000 bps) 000192000

Maximum Data Rate (000192000 bps) 000192000

Initial Data Rate (0, 000096000, 000192000 bps) 000192000

*Data Stream ID (three-digit octal) 020

*Data Bit Jitter (0.00%, 0.01%, 0.10%) 0.10%

*Polarization (Left or Right) .... Right

*Shuttle Configuration Mode (1 = 96k, 2 = 192k, 3 = 0 kbps) 2

*Minimum EIRP (0.1 dBW) 145

*Maximum EIRP (0.1 dBW) 145

*Transmit Frequency (0221600000 to 02300000000 daHz) 00

*TSW Set ID (AAAAAAAAAA) .... N/A

* = reconfigurable and respecifiable

Figure 6-3. SSC SSAR-S Report

Service Specification Code Report as of 2002/322/21:38:36
Last updated by: BENJAMIN at: 2002/174/22:06:52

SIC 2107
Service Specification Code ID (O## to R##) P51
Service Specification Code Type .... KuSAR
Service Configuration (Normal or Shuttle).. Shuttle
Antenna (SA1, SA2, Either) .... Either
Return Channel Time Delay .... No
*Polarization (Left or Right).. Right
*Autotrack (0 = Enabled or 1 = Disabled).. 1
*Shuttle Mode (1 = PM, 2 = FM/ch3=digtl, 3 = FM/ch3=anlg, 4 = FM/ch3=video).. 4
*Minimum EIRP (0.1 dBW) 460
*Maximum EIRP (0.1 dBW) 600
*Transmit Frequency (1489000000 to 1512000000 daHz) 1500340000
*Shuttle Subcarrier (1 = Not Used, 2 = ch2, 3 = ch3) 1
*TSW Set ID (AAAAAAAAAA) .... N/A

Channel 1:
User Interface Channel ID (UIFC ID) J59
Maximum MDM Data Rate (000192000 bps) 000192000
Maximum Data Rate (000192000 bps) 000192000
Initial Data Rate (000192000 bps).. 000192000
Data Format (BiP-L).. BiP-L
*Data Stream ID (three-digit octal) 021
*Data Bit Jitter (0.00%, 0.01%, 0.10%) 0.10%

Channel 2:
User Interface Channel ID (UIFC ID) J60
Maximum MDM Data Rate (000001000 to 002000000 bps).. 0002000000
Maximum Data Rate (000001000 to 002000000 bps).. 0002000000
*Initial Data Rate (000001000 to 002000000 bps) 0001024000
*Data Format (NRZ-L, NRZ-M, NRZ-S, BiP-L, BiP-M, BiP-S).. BiP-L
*Data Stream ID (three-digit octal) 022
*Data Bit Jitter (0.00%, 0.01%, 0.10%, 0.50%, 1.00%, 2.00%) 2.00%

Channel 3:
User Interface Channel ID (UIFC ID) V51, Z54
Maximum MDM Data Rate (000000000 to 002000000 bps).. 000000000
Maximum HDRM Data Rate (000125000 to 048000000 bps).. 00048000000
Maximum Data Rate (000000000 to 050000000 bps).. 00048000000
*Initial Data Rate (000001000 to 050000000 bps) 000000000
*Data Format (NRZ-L, NRZ-M, NRZ-S, BiP-L, BiP-M, BiP-S).. NRZ-L
*Data Stream ID (three-digit octal) 023
*Data Bit Jitter (0.00%, 0.01%, 0.10%) 0.10%

* = reconfigurable and respecifiable

Figure 6-4. SSC KuSAR-S Report

Service Specification Code Report as of 2002/322/21:53:03
Last updated by: BENJAMIN at: 2002/264/19:37:27

SIC 2107
Service Specification Code ID (T##) T51
Service Specification Code Type .... Tracking
Tracking Configuration (Normal or Cross) .... Normal
Range Tracking .... No
Doppler Tracking (0 = Not Required, 1 = 1 way, 2 = 2 way) 2
Return Service Type .... Shuttle S-band
*Forward-Link Reference SSC ID H51
*Return-Link Reference SSC ID I51
*Sample Rate (1/1, 1/5, 1/10, 1/60, 1/300 sec) 1/10
*Time Transfer Required .... No
*Number of Time Transfer Samples (0, 20-255) 0

* = reconfigurable and respecifiable

Figure 6-5. SSC Track-N Report

6.3 SSC Change Procedure

6.3.1 Purpose

a. This procedure establishes the guidelines to be used when a new STS is added to the data base to support an upcoming mission or a change is required for an existing SSC.

b. ESTL Test Director.

c. SMM.

d. White Sands NCCDS DBM.

6.3.2 Procedure

Houston CMD or the ESTL Test Director will submit the written new/updated SIC or SSC information to the SMM and the White Sands NCCDS DBM for review and verification. After the new/updated information has been reviewed, verified, and concurred with by the SMM, the White Sands DBM will enter the information in the data base. When the data base has been updated, the White Sands NCCDS DBM will generate an SSC report and distribute copies to the required participants.

Section 7. Testing and Simulations

7.1 Overview

This section provides procedures and information required during SN testing and simulation activities involving preparations for specific Space Shuttle Missions or for evaluation of anomalies experienced during mission support. Nominal operations procedures used while conducting operations are contained in appropriate sections of this document, or are referenced by those sections. Procedures and information which are unique to the test operation being performed are contained in this section.

7.2 Test and Simulation Scheduling

SN testing is intended to be performed in an operating environment which is as realistic as possible. To that end, JSC MCC personnel will be required to schedule SN resources, and operate with those resources in a manner which is as close as possible to nominal Space Shuttle operations scenarios. JSC MCC schedule requests must correlate with time periods allocated to Space Shuttle by the SN master schedule. Test and simulation procedures documents will define appropriate timelines for schedule request submission for each supported activity. Pre-mission testing requirements are described in paragraph 2.5.2.

7.3 Test Procedures

7.3.1 General

Paragraphs 7.3.2 through 7.3.4 provide the interface procedures that are required to exercise Space Shuttle test activities during performance testing. The tests will exercise all SN elements to verify the ability of TDRS to provide the required support and will also provide operations personnel with practical experience in using the SN to support flight operation needs. Specific test scenarios and test operations timelines for testing will be provided in separate test plans and briefing messages.

7.3.2 Standard Interface Procedures

Refer to the applicable sections of this document for the following standard interface procedures required to support Space Shuttle operations activities:

a. FDF Force Model/State Vector Transfers (Section 5).

b. NISN Circuit Configuration (Section 4).

c. Verification of Data Streams (Section 3).

d. FDF Verification of Tracking Data Messages (Section 5).

e. WSC Monitoring of GCM Processing (Section 2).

7.3.3 Test Phases

Interface procedures will be used for three phases, as follows:

a. Pre-mission period for testing, scheduling, and configuration activities. Refer to paragraph 2.5.2.

b. Simulation period (optional for nominal support and for flights with unique mission or payload specific support requirements) during which a particular mission and/or payload support scenario is exercised before the Space Shuttle is launched. These simulations are scheduled as SN STS Operational Readiness Tests (ORT) and may exercise particular mission timelines for planned critical orbital activities.

c. Operations phase which provides real-time command, telemetry, and tracking support to the Space Shuttle and/or payload.

7.3.4 Test Cases

7.3.4.1

The scripts for SN test cases and TDRS performance verification are contained in *Network Verification Manual for the Space Shuttle Program*, 532-VTR-STDN (formerly STDN 508.26) as follows:

a. Test 1201 Calibration Script which provides the ESTL requirements for calibration of links prior to testing.

b. Test 1201 SN Verification Script (First Test Case).

c. Test 1201 SN Verification Script (Second Test Case).

d. Test 1201 PM Script.

7.3.4.2

ESTL/TDRS contingency testing procedures are contained in paragraph 7.4.2.

7.3.5 Simulations

7.3.5.1 General

The Goddard TD conducts Space Shuttle/SN simulations (ascent simulations, ORTs, etc.) utilizing resources at the JSC ESTL, WSC (TDRSS), NISN, and FDF, as required. The JSC MCC will participate when possible. The activities are designed to exercise the user and SN resources under simulated contingency and nominal conditions.

7.3.5.2 Pre-launch Simulations

At least 3 weeks prior to a scheduled Space Shuttle flight, a SN/Space Shuttle Ascent simulation will be conducted by the Goddard TD, if required. The TDRSS will be scheduled to support a minimum of two events. The ascent simulation will serve to exercise the network's personnel and support systems, and to evaluate the user and network's readiness to support a planned Space

Shuttle ascent profile under nominal and contingency conditions using current procedures and exiting hardware/software. The Goddard SMM and/or the Goddard TD will be responsible for coordinating the planning of this effort with the GSFC FDF to develop realistic ascent and abort/contingency scenarios, and will transmit a briefing message to the network in support of each network simulation. The Goddard TD will also coordinate with Houston CMD and White Sands Scheduling to ensure availability of network resources. Other network simulations and/or operations exercises (SN, STS, ORTs) may be scheduled as needed to exercise unique data rates or payload requirements.

7.3.5.3 Participants and Support Functions

The elements designated in the following paragraphs will participate in network simulations and perform the following activities, as required. Additional activities may be outlined in the test script and/or Briefing Message.

a. JSC. When scheduled, JSC elements will be available to support the simulation (DFE, CMD, Track, etc.) as required. Additional activities that may be performed by the MCC are as follows:

    1. The GC will brief the supporting elements on special activities to be performed during each event.

    2. The GC briefs the SN on the Orbiter (ESTL) data configurations.

    3. Houston CMD transmits SARs to the WSC via the MPT for all events at least 12 hours prior to the simulation start time.

    4. Houston CMD Transmits user commands to the Orbiter (ESTL) via the TDRSS and receives and verifies command echo from the WSC.

    5. Houston TV performs interface checks with WSC, as required.

    6. Houston DFE sends nominal and contingency launch, on-orbit, and landing vectors to the GSFC FDF, as required.

b. WSC. White Sands Ops/STGT Ops will serve as the controlling element(s) for all TDRSS supported Space Shuttle/SN simulations and tests. Telemetry data received by the WSC will be recorded and forwarded to the user, as required. The WSC will provide the following additional functions:

    1. White Sands Scheduling ensures the network is scheduled for all events as specified in the briefing message or as requested by Houston CMD, the Goddard SMM or the Goddard TD.

    2. White Sands Ops/STGT Ops coordinates the fault isolation effort for all known and/or suspected anomalies that impact support.

    3. White Sands Ops/STGT Ops transmits nominal and contingency state vectors to the WSC ground station in support of each scheduled event.

    4. White Sands Ops/STGT Ops provides backup support to Houston CMD for GCMR activities.

5. White Sands TV/STGT TV provides Orbiter TV support as required for Space Shuttle/SN simulations or tests to verify and evaluate television quality.

6. White Sands Ops/STGT Ops coordinates with the White Sands FA to ensure real-time system failovers are non-impacting to other users.

7. The WSC will transmit ODM/DQM data to the user during each scheduled event.

8. Remote SSHR and KSHR Low-rate data to the JSC MCC via the MDM; remote analog TV and High-rate data via statistical multiplexer and domestic satellite transponder links.

9. Serve as the data source for Orbiter television signals during initial interface checks of the WSC to JSC link, as required.

10. WSC monitors all Orbiter command/telemetry data streams and reports status to the GC or the Goddard TD, as required.

11. Provide LOR playbacks to the user/GSFC, as required.

12. Ensure WSC systems are scheduled and ready for simulation or test support.

13. White Sands Ops/STGT Ops will conduct fault isolation, as required.

c. ESTL. ESTL will emulate the Space Shuttle Orbiter by receiving and processing command data and serving as a data source for all telemetry data streams. ESTL may also be required to provide the following additional support functions:

1. Perform changes in configurations for all events to provide support as outlined in briefing messages or simulation test scripts.

2. Perform TV simulated signal changes as requested by Houston TV and/or White Sands TV/STGT TV.

3. Modifies simulated Space Shuttle data streams as requested by JSC/WSC.

4. Provide support to the WSC for network fault isolation, as required.

d. FDF. FDF receives acquisition data in the form of ICVs and IIRVs from Houston DFE and generates state vectors for use by the SN. FDF also receives and processes Tracking Data Messages (TDM) from TDRSS in support of Space Shuttle simulation events. FDF will provide the following additional support functions:

1. Generate planning and scheduling aids.

2. Evaluate TDM data and provide verbal status to the WSC and/or JSC upon request.

e. TDRSS/WSC. Prior to each scheduled Space Shuttle/SN simulation or test, the WSC will reconfigure the scheduled TDRS forward link to Shuttle high-power (48.5 dBw) and switch to Right-hand Circular Polarization (RCP). White Sands Ops/STGT Ops will also perform the following additional functions:

1. Perform carrier-to-noise measurements.

2. Monitor TDRSS activities and confirm data link (forward/return) indications to GC when requested.

3. Perform system failover activities as requested by the GC or Goddard TD and ensure other users will not be impacted by the failover.

7.3.5.4 Summary

All elements will utilize their latest authorized software release unless otherwise advised by the Goddard TD or briefing message. The Goddard TD will conduct a debriefing with all participating elements at the termination of each activity.

7.4 Test-unique Configuration Information

7.4.1 General

Paragraph 7.4.2 provides supplemental test-unique information concerning end-to-end and element systems configurations required for test operations. Nominal element and SN end-to-end configuration information for Space Shuttle support is contained in the appropriate sections of this document.

7.4.2 ESTL/TDRS Contingency Testing

7.4.2.1 General

The ESTL/TDRS contingency testing will be implemented in the event that Space Shuttle support is impacted by a suspected SN or Space Shuttle-TDRS mode anomaly. A decision by JSC to implement an extensive investigation of a specific support anomaly may be followed by contingency testing of the SN with ESTL. The JSC ESTL will be available to simulate the Space Shuttle if all existing realtime and near-real-time GSFC, WSC, and JSC troubleshooting methods for fault isolation have been tried and failed.

7.4.2.2 Real-time Troubleshooting Methods

Real-time troubleshooting methods (e.g., command echo, ODM/DQM analysis Bit Error Rate tests, and configuration checks) will be exercised to evaluate the problem if support impact to Space Shuttle prevented proper use of these fault isolation procedures prior to implementing ESTL testing. GN support may be implemented for specific anomalies such as S-band specific command or telemetry anomalies or Ku-band channel 2 data which may be handled on the Space Shuttle GN mode links.

7.4.2.3 Problem Evaluation/ESTL Callup Decision

The Goddard SMM and Houston GC will evaluate the anomaly and determine if the ESTL is required to provide test support as the simulated Space Shuttle. ESTL callup will involve a minimum 4-hour response time. The JSC MCC (Backup Flight Control Room [FCR]) is required for full contingency testing, with no impact to the on-going Space Shuttle mission. The 532-VTR-STDN contains communications performance verification test procedures and will be used to correlate the Space Shuttle problem with the type of testing to be conducted. References in the manual include specific tests for all S-band and Ku-band configurations supported by the SN for the Space Shuttle. Specific mission unique payload testing requirements are included in the SN STS XXX Verification and Validation Test Briefing messages issued for each specific mission. These briefing messages will be retained for the specific mission period by the Goddard SMM and will be referenced to identify unique support requirements for testing.

7.4.2.4 ESTL SN End-to-End Configuration

a. Purpose. This procedure establishes the guidelines to be implemented when TDRSS support to the Space Shuttle is unsatisfactory.

b. Participants

   1. ND/SMM.

   2. White Sands Ops/STGT Ops.

   3. Houston GC.

   4. ESTL.

   5. Mission Comm Mgr/Goddard Voice.

c. Procedure

   1. The SN performs fault isolation procedures and establishes that services from the WSC to GSFC and JSC are correct; the only unknowns at this point are the TDRS system and the Space Shuttle.

   2. Houston GC and ND/SMM determine to implement ESTL contingency testing of the Space Shuttle. Before this occurs, WSC will freeze the TDRSS configuration and establish system performance (first unknown). (See Figure 1-12, Simplified SN Control and Data Flow diagram.) At this time, specific GN support may be implemented to augment the SN support for selected Space Shuttle ceases.

   3. JSC should also consider bringing up the MIL SLSS to verify Space Shuttle S-band performance in the TDRS mode (second unknown). Clearly, this step depends on MIL visibility of the Space Shuttle.

   4. A decision is made by JSC and GSFC to bring up the ESTL for contingency testing. Calling up ESTL requires a minimum of 4 hours.

   5. The Goddard SMM will assist ESTL and JSC personnel in correlating the problem experienced with appropriate test procedures from 532-VTR-STDN.

   6. While the selected Space Shuttle operations are being supported by the GN, MIL SLSS test results should be available for analysis. If these results are satisfactory, JSC and GSFC should consider reverting the Space Shuttle to TDRSS support for the next two orbits while ESTL is being made ready for testing.

   7. If the results in step (6) prove to be unsatisfactory and ESTL is ready, contingency testing should be performed as indicated in step (5).

8. Since the MDMs will be configured for Space Shuttle STDN/TDRSS modes, elements participating in the ESTL contingency testing will provide support as follows:

   (a) NIC: Control for interfacing SN testing elements.

   (b) NISN: Voice/control and status message interface between GSFC and WSC.

   (c) WSC: Forward link data source and return link monitoring.

   (d) ESTL: Substitute for Space Shuttle.

7.4.2.5 Return to SN Space Shuttle Support

A return to full S-band and Ku-band SN Space Shuttle support will be decided by JSC and/or GSFC ND/SMM based on identification and resolution of the problem, followed by successful testing as outlined in the preceding paragraphs.

Section 8. Fault Isolation

8.1 Overview

Fault isolation provides a rapid and effective method of determining the source of a real-time support problem and the specific network element that must initiate and complete fault isolation procedures to correct the problem. General fault isolation procedures are contained in 530-NOP-NCC/SN. Procedures that are unique to Space Shuttle operations (which are not in 530-NOP-NCC/SN) are contained in the following paragraphs.

8.2 Initial Acquisition Failure or Unexpected Loss of Signal

8.2.1 Purpose

This procedure defines the method by which JSC and WSC coordinate initial acquisition failures or unexpected signal losses that occur during real-time Space Shuttle operations.

8.2.2 Participants

a. White Sands Ops/STGT Ops.

b. GC.

c. INCO.

d. Houston CMD.

e. Houston DFE.

8.2.3 Procedure

Fault isolation logic flow diagrams are provided in Figures 8-1 through 8-4 for Space Shuttle/SN unique problems. These flow diagrams are self-explanatory indicating the initial fault experienced, the SN element actions to correct the fault, and the options when all actions are completed. Table 8-1 contains the explanation of the options, prerequisite for the option, time involved to initiate the option and support impact. The following guidelines are established for resolving problems which occur during event support.

8.2.3.1

a. Houston CMD and White Sands Ops/STGT Ops are responsible for identifying problems and coordinating fault isolation. The GC may at any time initiate an investigation of an SN problem as long as mission support is not affected.When the problem has been established as being external to the MCC, the MCC will coordinate with the WSC to assist in the problem resolution.

b. The MCC may request WSC to run an End-to-End Test (EET) SHO to verify a specific service, following termination of the event.The WSC has the capability at all times to configure or reconfigure the network; however, changes to the SN configuration will not be made during mission support without the concurrence of Houston CMD or GC.

c. JSC is to be advised when an SN problem has been corrected.Based on the results of problem coordination, the WSC directs or implements any action taken to resolve or restore the MCC service being provided by the TDRSS.

8.2.3.2

Real-time options available include implementation of various MCC/WSC GCMs, WSC cancellation, and/or rescheduling of the MCC activity. The TOCC or TOCC 2 will not directly intervene or resolve a known or reported SN problem during real time unless specifically directed by the GC. All problems and resolutions will be acknowledged during debriefing and logged in detail by the WSC.

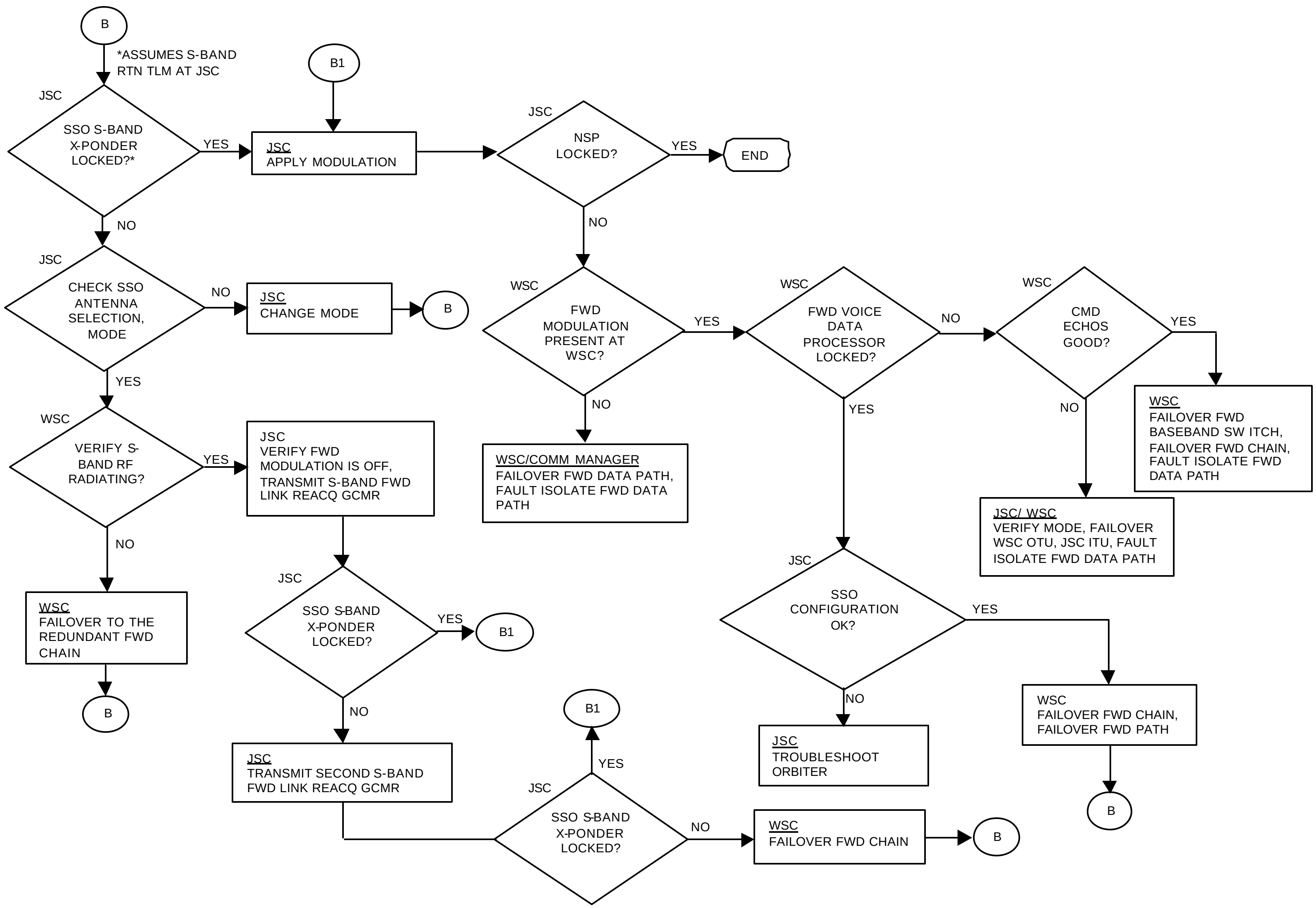


Figure 8-1. Acquisition Failure of SSHF

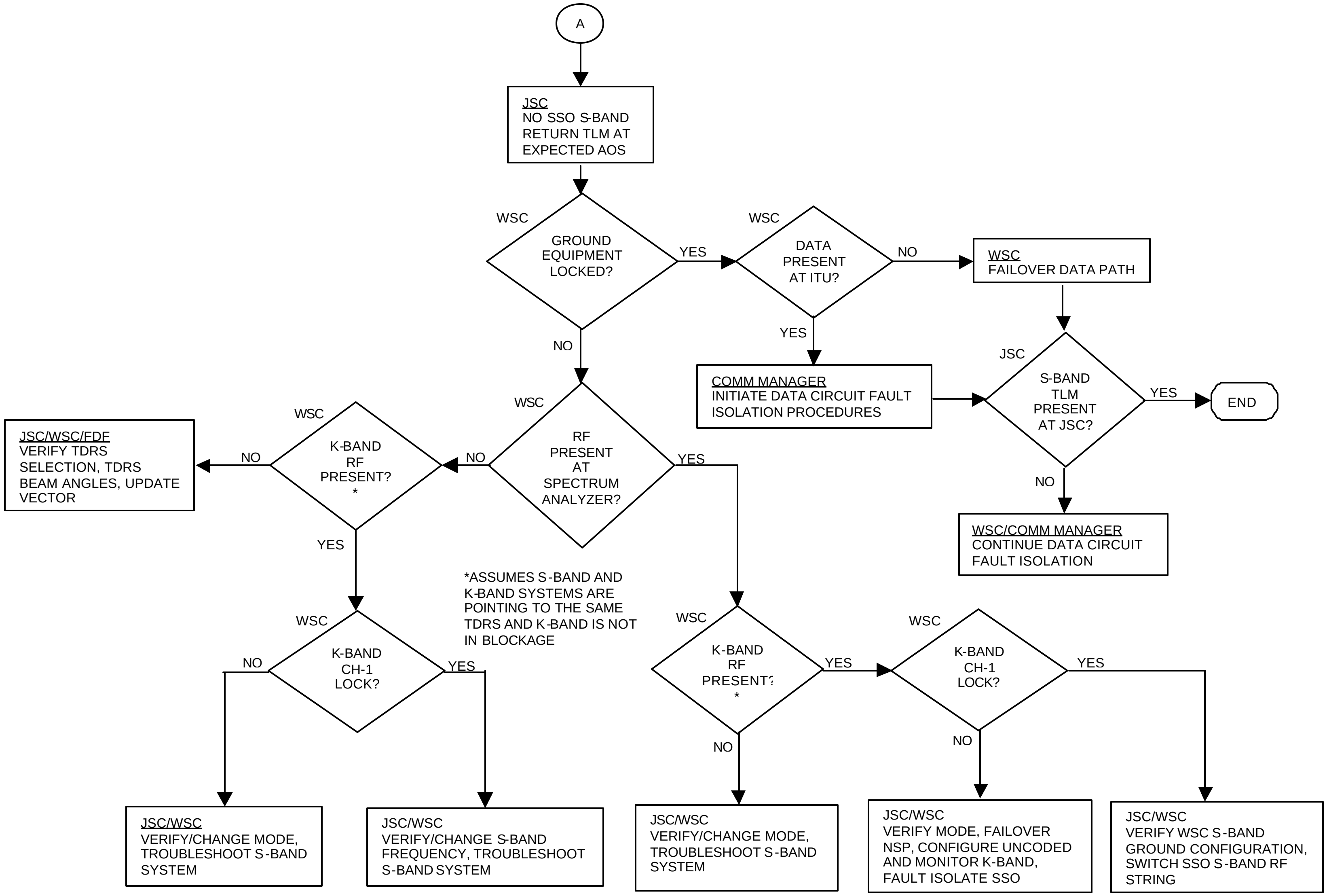


Figure 8-2. Acquisition Failure of SSHR

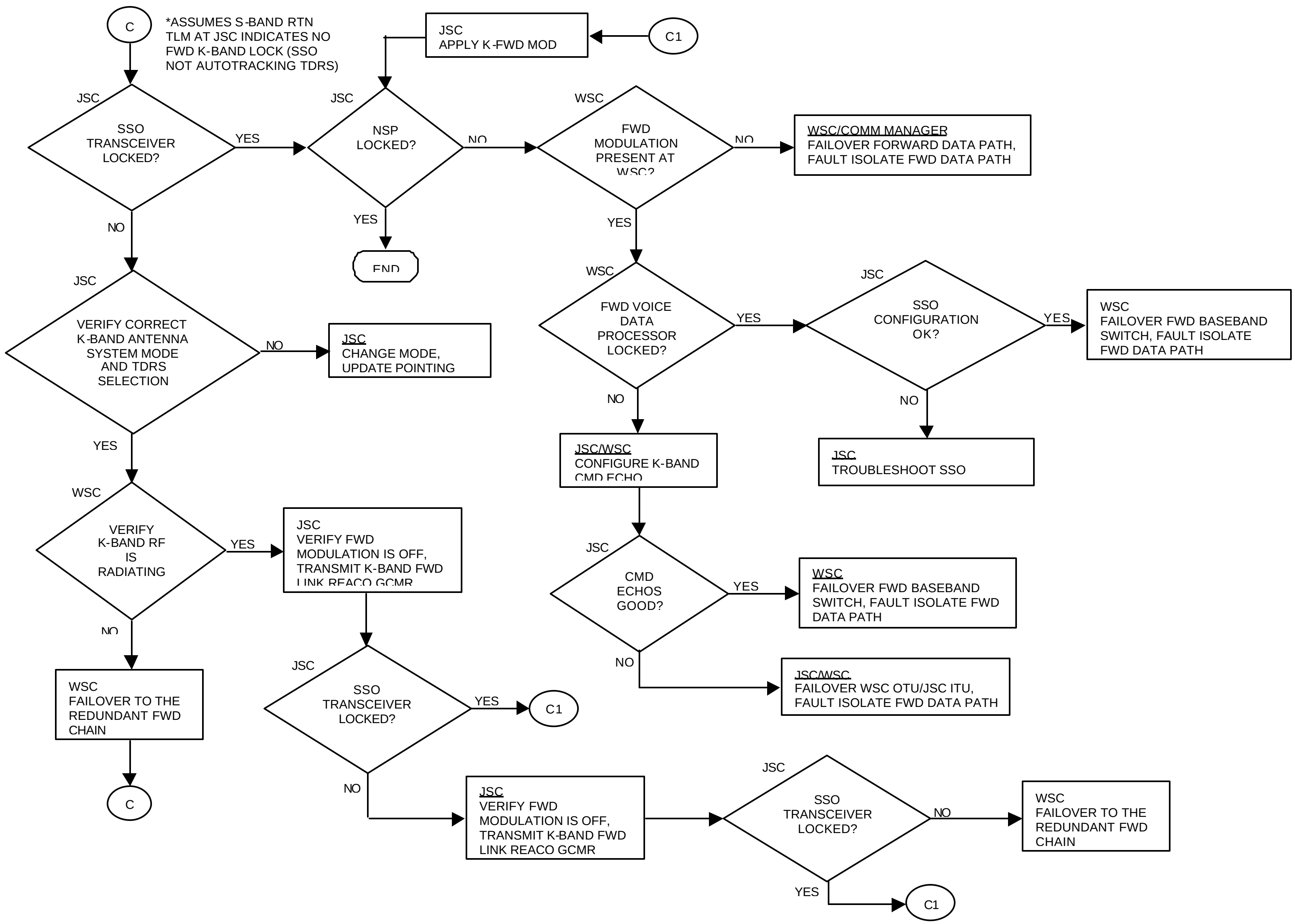


Figure 8-3. Acquisition Failure of KSHF

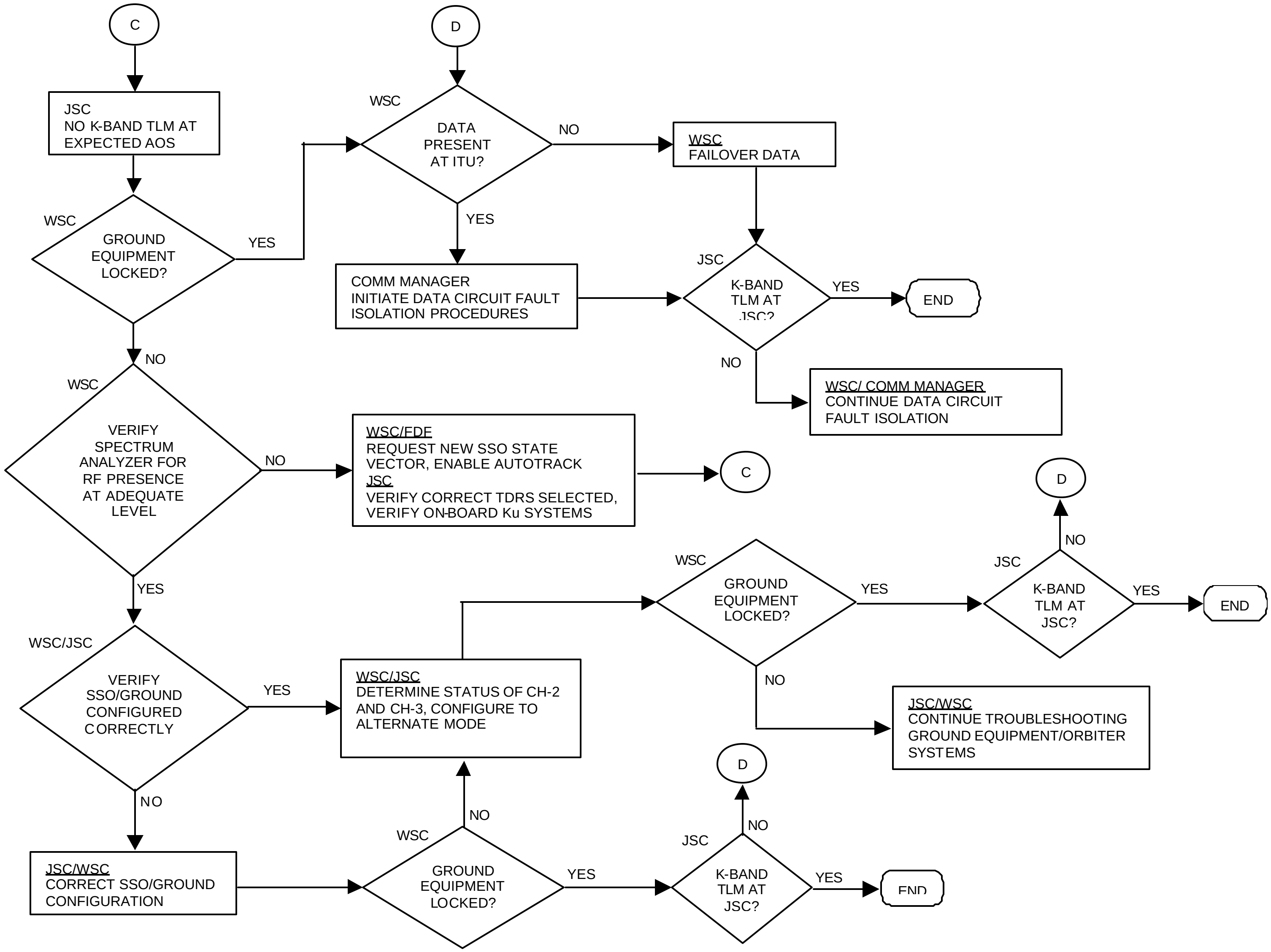


Figure 8-4. Acquisition Failure of KSHR

Table 8-1. Fault Isolation Options Explanations

V`1`-	Prerequisite	Time Involved	Impact
BRTS Pass - Gives the TDRS SA antenna precise location on the earth surface to point (station personnel familiar with SA beam pointing information). Can be scheduled on opposite SA antenna with reasonable assurance any biases will be detected.	One SA antenna not in use for other support; WSC direction.	10 minutes	a. If one SA unused -none. b. Support must be terminated if other SA antenna in use.
Null Search - Test used to determine that the SA antenna has proper reference coordinates for pointing within the ADPE software at WSC. Any residuals are corrected as part of the test performed. Must be performed on suspected SA antenna to determine system biases.	SA antenna must not be in use for other support; WSC direction.	10 minutes	Same as above.
End-to-End SHO - Gives WSC personnel good fault isolation tool as they are familiar with expected indications.	WSC has End-to-End SHO on hand; WSC direction, and user concurrence.	Minimum of 5 minutes for SHO setup time, then 10 minutes for observations.	Possible loss of support, dependent upon when the End-to-End SHO is started.
WSC Manual ADPE Failover - The TT&C, USS, and DIS failover.	WSC direction.		Possible support interruption.
Autotrack Enable - Revert to autotrack vice program mode at WSC.	User concurrence.	Minimum of 20 seconds for WSC to implement.	None.
Mode Change - SSO return mode change. Mode 1 is preferable with Channel 3 configured for zero data rate.	User concurrence and WSC direction	1 minute	Nominal service reconfiguration time.
Chain Failover - Changing a particular chain of equipment for another redundant string of equipment at White Sands.	Equipment availability; user concurrence and WSC direction.	30 seconds	Service interruption.

Table 8-1. Fault Isolation Options Explanations (cont)

Options Description	Prerequisite	Time Involved	Impact
SSO State Vector to WhiteSands - Retransmission of SSO state vector to WSC.	a. Resident at WSC. b. New IIRV from JSC.	1. 2 minutes 2. 30 minutes	None
Low-noise Amplifier (LNA) Switchout - Low noise amplifier at WSC. Only required if TDRS house-keeping data is not present and KSA-2 service scheduled.	WSC direction.		Service interruption.
Autotrack Indicators 0 = Disabled 1 = No Signal present indication 2 = Signal present - No zero crossing 3 = Zero crossing - Both axes 4 = Autotrack - Fine pointing mode	Software in place at WSC.	N/A	None.

Section 9. Data Management/Email Message Communications

9.1 General

This paragraph provides information pertaining to data distribution within the SN in support of the Space Shuttle. The information provided herein addresses SN data products and teletype communications items which specify SN support or for which the SN provides support.

9.2 Data Disposition Instructions

9.2.1 General

Standard procedures for management and disposition of all recorded data are contained in the STDN Network Operations Procedures for Data Management, STDN No. 502.11. Mission-specific data disposition instructions are contained in this section. Instructions contained in the following paragraphs are segregated by SN-element for operations-related items, and by category of activity for data items generated during test/operations fault isolation activities.

9.2.2 White Sands Complex

Data disposition instructions for WSC data items are contained in Table 9-1.

9.2.3 Flight Dynamics Facility

There are no current documents that reflect the new FDF-WSC interface. FDF products are handled in accordance with Section 5 of this manual, and supporting documentation listed in Appendix B. Operational interface procedures are contained in the current WSC OIP listed in Appendix B.

9.2.4 Johnson Space Center

JSC provides (in real-time and/or playback) Space Shuttle Orbiter real-time OD telemetry data or Operations Recorder dumps.

Table 9-1. WSC Data Requirements and Disposition

DSS No.	Data Label	Data Description	Data Disposition
111	2090*	UNISYS 1100 Console Printouts	Hold 30 days, then destroy.
112	2090*	VAX 8550 Terminal Printout	Hold 30 days, then destroy.
131	2096*	UNISYS 2200/412 Dynamic Dump Tape	Hold 30 days, then reuse.
132	2096*	VAX Log Tapes	Hold 30 days, then reuse or destroy.
138T	2102	MDM Line Outage Recorder Tape	Unless otherwise directed, hold 16 days from WOW, then reuse.
140T	2102	SM Input High Data Rate Tape	Unless otherwise directed, hold 50 hours from dismount, then reuse.
531T	2098/2102	Analog Magnetic Tape (8007)	Unless otherwise directed, hold 30 days, then degauss and reuse.
841T	2106	Video Magnetic Tape (VTR-1)	Unless otherwise directed, hold 50 hours from dismount, then reuse.
842T	2106	Video Magnetic Tape (VTR-2)	Unless otherwise directed, hold 50 hours, then reuse.
*Used for on-site control at station option; data labels are required for all data shipped off-site.			

9.3 Email and Station Addressing/STDN Standard Messages

9.3.1 General

The following provides the Email headings, date-time-group, station addressing, and a brief example of text associated with unique messages supporting the Space Shuttle.

9.3.2 Interim Support Instruction

Email:
dsdc, gcap, gsic, gtas, gwsc, vksc, grcc, gcco, gphy, commgr, gcen, ggfd, grov

Date-Time-Group and Stations Addressing:
00/0000Z
FM NIC NASA GREENBELT MD
TO ALL
INFO GFRC/ATR/TSCO
COMMGR/OPS
GSIC/SOC OPS
GSLE/AFSCN ONIZUKA AIR STATION CA MISSION DIRECTOR/5 SOPS/DO/LTOC
GWAC/OPSVR
ANBE/STADIR/STAOPS

GALA/RONALD JOHNSON BETH PASCHALL
GCAP/RRS
GCCO/CSR 3300
GDES/CODE 450.J
LRID/STADIR/STAOPS
GHOS/SCHED/MSFC OPS/COMM
GCEN/RUWODOR/IRO ONIZUKA AS CA
GCEN/RHHMUNE/JFMO PAC HONOLULU HI
GDNS/45 RANS CCAS FL//DOS//
GRCC/LRCC
GROV/30 RANS CCAS CA//DOUF//
GTAS/FF-R-C
GWCC/FSC VAFB CA/OCC
GWSC/OPS
HMSC/GC OFFICE DB/C RUSSELL A BLANCHARD USH-423H/C THOMPSON USH-443E/L ROCHE USH-443F/R CHEN USH-443G
VKSC/TA-B2/GYCC, GYSS COMM CONTROL USK-145/COMM REQ USK-109/ KICS G GRAY USK-216/STM USK-299
GPHY/MANRIQUEZ/BOOTH
DLD/isi-shuttle@ncc-comm.gsfc.nasa.gov

ISI
ISI NR. XXX MXXXXMS STS-XXX/XX

SUBJECT: PRE-MISSION STATUS
ACTION: STADIR/OPSR

9.3.3 Documentation Change Notice (DCN)

Email:
dsdc, gcap, gcnv, gcco, grcc, gops, gsic, gtas, gwsc, grov, commgr, ggfd, gcen

Date-Time-Group and Stations Addressing:
00/0000Z
FM NIC NASA GREENBELT MD
TO ALL
ANBE/STADIR/STAOPS
GFRC/ATR/TSCO
GSLE/AFSCN ONIZUKA AIR STATION CA MISSIONS DIRECTOR/5 SOPS/DO/LTOC
GWAC/OPSVR
INFO GALA/RONALD JOHNSON BETH PASCHALL
COMMGR/OPS
GGFD/OPS
GCAP/RRS
GCCO/CSR 3300
GCNV/RTCS
GDES/CODE 450.J

LRID/STADIR/STAOPS
GHOS/SCHED/MSFC OPS/COMM
GDNS/45 RANS CCAS FL//DOUF//
GSIC/SOC OPS
GTAS/FF-R-C
GCEN/RUWQAAA/ITT FEDERAL SERVICES VANDENBERG AFB CA//MCS//
GCEN/RUWQAAA/ITT FEDERAL SERVICES VANDENBERG AFB CA//NIPLAN//
GWSC/OPS
HMSC/GC/DOCUMENTATION/SIMNET-DG4
DLD/dcn-shuttle@ncc-comm.gsfc.nasa.gov

DCN
450-TNOSP-SPACE SHUTTLE

9.4 Space Shuttle-unique Messages

9.4.1 General

Email support messages unique to Space Shuttle support are contained in this paragraph. The Email headings and station addressing for these messages are as noted in the following paragraphs.

9.4.2 Space Shuttle Contingency Plan

Email:
smm@nccmail.gsfc.nasa.gov, gceb@comm.gsfc.nasa.gov,
gcen@amds.nascom.nasa.gov

Date-Time-Group and Stations Addressing:
00/0000Z
FM HMSC/FLIGHT DIRECTOR
TO SHUTTLE NETWORK DIRECTOR
SUBJECT: SPACE SHUTTLE CONTINGENCY PLAN

1. THE SHUTTLE TRANSITION PHASE CONTINGENCY PLAN IS IN EFFECT AS OF (_______ GMT). ALL RECORDINGS OF TELEMETRY DATA, PLOTBOARD CHARTS TRAJECTORY DATA, VOICE RECORDINGS, HISTORIES, ACQUISITION AID DATA, SIGNAL STRENGTH RECORDINGS, PHOTOGRAPHS, STAFFING, ETC. FROM THE PERIOD ______ GMT TO ______ GMT ARE TO BE CONSIDERED AS OFFICIAL INFORMATION AND HANDLED ACCORDINGLY.

2. SITE PERSONNEL ARE FORBIDDEN TO MAKE NEWS RELEASES, PUBLIC OR PRIVATE STATEMENTS CONCERNING A MISSION CONTINGENCY, OR RELEASE ANY DATA WITHOUT SPECIFIC APPROVAL FROM THE NETWORK DIRECTOR.

SHUTTLE NETWORK DIRECTOR SENDS

9.4.3 Specific Support Requests

This message header is used to submit TV/analog Specific Support Requests (SSR).

Email:
gwsc@ncc-comm.gsfc.nasa.gov, wscos@mail.wsc.nasa.gov
wsnso@mail.wsc.nasa.gov, smm@nccmail.gsfc.nasa.gov,

Data-Time-Group and Station Addressing:
00/0000Z
FM JSC MCC
TO GWSC/DSMC SCHEDULING
INFO GCEN/SMM/SNOM

9.4.4 Data Playback Message Headers and Formats

The following designated Email Headings, Station Addressing, and message formats are outlined for use in support of WSC data playbacks.

a. User Playback Event Add/Delete Message (User to DSMC)

1. Email heading and Station Addresses:

   gwsc@ncc-comm.gsfc.nasa.gov, wscos@mail.wsc.nasa.gov,
   wsnso@mail.wsc.nasa.gov, smm@nccmail.gsfc.nasa.gov,
   ghos@ncc-comm.gsfc.nasa.gov

   00/0000Z
   FM GC or MSFC SCHEDULING
   TO GWSC/DSMC SCHEDULING
   INFO GHOS/MSFC SCHEDULING/OPS
   GWSC OPS

2. Add Format

   UPBA: SUPIDEN ORIG:DDD:HH:MM:SS HH:MM:SS SRC/DES DR:00000K
   DDD:HH:MM:SS 0000MIN B DR:0000K DES DES DES
   COMMENTS: ________________________________

   (a) Line 1: Message name, SUPIDEN, start and stop time of original data stream, original source and destination interface channels, and original data rate.

   (b) Line 2: Playback window start time and window duration, playback mode, playback data rate, and up to three destinations.

   (c) Line 3: Comments.

3. Delete Format

   UPBD: SUPIDEN ORIG:DDD:HH:MM:SS SRC/DES
   COMMENTS: ________________________________

(a) Line 1: Message name, SUPIDEN, start and stop time of original data stream, original source and destination interface channels.

(b) Line 2: Comments.

b. DSMC Playback Event Reject Message (DSMC to User)

1. Email:

hmsc@ncc-comm.gsfc.nasa.gov, ghos@ncc-comm.gsfc.nasa.gov
gwsc@ncc-comm.gsfc.nasa.gov

Date-Time-Group and Station Addressing:
00/0000Z
FM WSC SCHEDULING
TO HMSC/DFE/GC
GHOS/MSFC OPS/MSFC SCHEDULING
INFO GWSC/OPS

c. DSMC Playback Event Add/Delete Message (DSMC to NISN and User)

1. Email Heading and Station Addressing:

gwsc@ncc-comm.gsfc.nasa.gov,
commgr@ncc-comm.gsfc.nasa.gov,
hmsc@ncc-comm.gsfc.nasa.gov,
ghos@ncc-comm.gsfc.nasa.gov

00/0000Z
FM WSC SCHEDULING
TO GWSC/OPS
INFO COMMGR/OPS
HMSC/DFE/GC/DI or GHOS/MSFC OPS/MSFC SCHEDULING

2. Add Format

UPBA: SUPIDEN DDD:HH:MM:SS HH:MM:SS SRC DES DES B DR:00000K 123
ORIG: DDD:HH:MM:SS HH:MM:SS SRC/DES DR:00000K
COMMENTS: ____________________

(a) Line 1: Message name, SUPIDEN, start and stop time of playback, WSC assigned source (NISN-use), destination of playback, mode of playback, data rate of playback, and a WSC accounting number.

(b) Line 2: Description of original data stream.

(c) Line 3: Comments.

3. Delete Format

NPBD: SUPIDEN DDD:HH:MM:SS HH:MM:SS REF:123 124
COMMENTS: ____________________

(a) Line 1: Message name, SUPIDEN, scheduled playback start and stop time, original WSC accounting number of the add message, and the WSC accounting number for this message.

(b) Line 2: Comments.

d. DSMC Tape Hold Request/Cancel Message (DSMC to WSC and User)

1. Email Heading and Station Addressing

gwsc@ncc-comm.gsfc.nasa.gov,
hmsc@ncc-comm.gsfc.nasa.gov,
ghos@ncc-comm.gsfc.nasa.gov

00/0000Z
FM WSC SCHEDULING
TO GWSC/OPS
INFO HMSC/DFE/GC
GHOS/MSFC OPS/MSFC SCHEDULING

2. Request Format

NTHR: SUPIDEN DDD:HH:MM:SS HH:MM:SS SRC/DES 125
COMMENTS: ____________________

(a) Line 1. Message name, SUPIDEN, start and stop time of original data stream, original source and destination of data stream, and a WSC accounting number.

(b) Line 2: Comments.

3. Cancel Format

NTHR: SUPIDEN DDD:HH:MM:SS HH:MM:SS SRC/DES REF:123 124
COMMENTS: ____________________

(a) Line 1: Message name, SUPIDEN, start and stop time of original data stream, original source and destination of data stream, original WSC accounting number of the tape hold message, and a new NCC accounting number for this message.

(b) Line 2: Comments.

9.4.5 Summary of SN and GN Anomalies Report

The following message is used to report the SN and GN anomalies requiring post-mission follow-up/analysis. See Figure 9-1 for an example of the SN and GN Anomalies requiring post-mission follow-up report.

```
00/0000Z

FM SMM NASA GSFC GREENBELT MD

TO ALL

SUBJECT:  STS-XX SUMMARY OF SPACE NETWORK AND GROUND NETWORK ANOMALIES REQUIRING
POST-MISSION FOLLOW-UP/ANALYSIS

THE FOLLOWING IS A LIST OF SIGNIFICANT AND OPEN ANOMALIES OCCURING DURING THE STS-XX
MISSION THAT HAVE BEEN IDENTIFIED AS CANDIDATES FOR POST-MISSION ANALYSIS.  ALSO
INCLUDED ARE SOME ANOMALIES THAT ARE CLEARLY UNDERSTOOD FOR THE PURPOSE OF
INCREASING OVERALL AWARENESS AND OUR PREPAREDNESS FOR FUTURE MISSIONS.

PRE-LAUNCH SUPPORT:

A.      GROUND NETWORK (GN)

        FDF 03/24/1119Z.

        BOTH THE F1 AND F2 SYSTEMS FAILED.  BOTH SYSTEMS WERE BACK UP AT 1128Z.
        THERE WAS NO IMPACT TO SUPPORT.

        ACTION:   INFO ITEM ONLY.

B.      SPACE NETWORK (SN) - NONE.

LAUNCH SUPPORT:

A.      GROUND NETWORK (GN) - NONE.

B.      SPACE NETWORK (SN) - NONE.

ORBITAL SUPPORT:

A.      GROUND NETWORK (GN)

        1.      KMTC 03/26/1924Z.  ORBIT 36. JSC DID NOT RECEIVE DATA IN REALTIME.

                PLAYBACK WAS SUCCESSFUL. KMTC WAS FORMATTING THE DATA WITH AN

                EXTRA CHARACTER.  GSFC WOULD NOT PASS THE DATA THROUGH TO JSC.

                OPERATOR ERROR.

                ACTION:   INFO ITEM.

MORE

NOTE

Report listing continues with consecutive numbers until all items have been included.

SPACE SHUTTLE NETWORK DIRECTOR SENDS

END OF MESSAGE
```

Figure 9-1. Summary of SN and GN Anomalies Requiring Post-mission Follow-up/Analysis Report (Example)

Appendix A. Abbreviations and Acronyms

Acronym	Definition
ACC	antenna control console
ACFT	Aircraft Flight Team
ACRS	automated conflict resolution system (WSC)
ADPE	automated data processing equipment
ADS	Acquisition Data System
AELS	augmented emergency landing site
AFC	automatic frequency control
AFSCN	Air Force Satellite Control Network (Sunnyvale, CA)
A/G	air-to-ground
AGC	automatic gain control
AGVE	A-G voice equipment
ALS	augmented landing site
AMDS	automatic message distribution system
AMS	Administrative Message System
AN	alphanumeric
ANCC	Ancillary NCC
ANGB	Air National Guard Base
ANTQ	Antigua Island (U.K., DOD station radar)
AOA	abort once around
AOS	acquisition of signal
APER	analog parameter and event recorder
ARC	ambiguity resolving code
ARMOR	asynchronous real-time multiplexer and output reconstructor
ASC	Ascension Island U.K. (USAF ER station 12)
ASCII	American Standard Code for Information Interchange
ASL	anti-sideband lock
ASN	access stack node
ASPC	Attached Shuttle Payload Center

ATO	abort to orbit
AT&T	American Telephone and Telegraph Company
AVD	alternate voice/data
BAL	Bermuda Abort Landing
BCH	Bose-Chaudhuri-Hocquenghem
BCN	backbone concentrator node
BDA	Bermuda, Island (U.K., STDN station)
BDF	blocked data format
BDP	block discrimination parameters
BED	block error detector
BER	bit error rate
BERT	bit error rate test
BHB	Boeing Huntington Beach
Bi-M	biphase mark
Bi-L	Manchestser II (signal format)
Bi-S	biphase space
BiØ-L	biphase level (signal format)
BLN	backbone link node
BPSK	bi-phase shift keyed
BRMR	briefing message (AMS indicator)
BRTS	bilateration ranging transponder system
BSS	best source select
B/U	backup
BVLDS	buffered very large store
BW	bandwidth
CAA	civil aviation authority
cab	circuit assurance blocks
CAPCOM	Capsule Communicator
CAS	Customer Ancillary System
CCAFS	Cape Canaveral Air Force Station, FL
CCIT	International Telecommunications Consultative Committee
CCL	closed communication loop
CCM	computer-controlled multiplexer

CCSDS	Consultative Committee for Space Data Systems
CCTV	closed-circuit television
CCX	communications condition subsystem
CD	conversion device (IP)
CD Mgr	Conversion Device Manager
CDF	communications data formatter
CDM	conversion device management
CDR	commander
CDS	comprehensive discrepancy system
CDSC	central data switching center
CIF	Central Instrumentation Facility (Merritt Island, KSC, FL)
CLS	contingency landing site
CMAFS	Cheyenne Mountain Air Force Station
CMD	command; JSC Houston Real-time CMD/TDRSS Controller
CMT	Cape Canaveral MPS-39
CNV	Cape Canaveral FPS-16
COTS	commercial off-the-shelf
Comm Mgr	Communication Manager
CP	communication processor
CPU	central processing unit
CPX	communications processor subsystem
CRT	cathode ray tube
CSC	Communications Services Controller
CSL	circuit-switched line
CSOC	Consolidated Space Operations Contract
CSS	control and status system
CT	com tech
CTC	com tech console
CTE	communications test equipment
CTS	Colorado Tracking Station
CTV	compatibility test van
CWA	COMSEC work area
DAC	digital-to-analog converter

DACON	Data Controller
DARTS	dump and reload the system (program)
DBA	Data Base Administrator (WSC)
DBM	Data Base Manager (WSC)
DC	direct current
DCC	Dryden Communications Control
DCE	data communications equipment; Doppler compensation enable
DCI	Doppler compensation inhibit
DCN	documentation change notice
DCS	data communication switch
DCX	data conditioning subsystem
DDD	digital data display
DDIF	digital data interface
DDMS	DOD Manager’s Space Shuttle Support Office
DDQ	main engine data dump monitoring report (AMS indicator)
DEC	decimal
DFD	data format document
DFE	Data Flow Engineer
DFRC	Dryden Flight Research Center
DGS	Diego Garcia Station
DHSS	Data Handling Subsystem
DICE	AFSCN Mission Controller
DIU	digital interface unit
DIS	Data and Information System
DL	downlink
DLMS	Data Link Monitoring System
DLSR	data link summary report
DMCS	Digital Maintenance and Control Subsystem
DME	distance measuring equipment
DMNE	digital message network element
DMS	Delta Modulation System; digital matrix switch

DMTC	Delta Modulation Test Console
DomSat	Domestic Satellite
DQM	data quality monitor
DR	discrepancy report (WSC)
DRI	destination routing indicator
DRS	Digital Recording Subsystem
DRSD	distributed range safety display
DSA	data shipment advisory message (AMS indicator)
DSID	data stream identification
DSIS	Defense Communications System/Satellite Control Facility Interface System
DSMC	Data Services Management Center (WSC)
DSN	Deep Space Network
DSS	Deep Space Station/Data Systems Supervisor
DSSC	Data Sync Setup Controller
DTG	date time group
DTM	Dryden telemetry
DTTS	data transmission test set
DX	duplex
EAFB	Edwards Air Force Base, CA
EC	engineering change
ECAL	east coast abort landing
ECC	Emergency Communications Center
EDB	end of data block
EET	end-to-end test
EFG	earth fixed geocentric
EIRP	effective isotropic radiated power
EIU	engine interface unit
ELS	emergency landing site (Mid, Low, & High refer to inclination for KSC launches)
E&M	ear and mouth
EMCC	Emergency Mission Control Center
EMD	equipment maintenance directive

EOM	end of mission (planned recovery/landing)
EOS	end of segment
ER	Eastern Range, FL
ERVS	emergency routine verification service
ESR	equipment status report (AMS indicator)
ESTL	Electronic Systems Test Laboratory (JSC)
ESTL TD	ESTL Test Director
ET	external tank
ETA	estimated time of acquisition
ETRO	estimated time of return to operation
EVA	extravehicular activity
EVCF	emergency voice command fill
FA	Forecast Analyst
FCC	Flight Control Command/Federal Communications Commission
FCO	Flight Control Officer
FCR	Flight Control Room
FD	Flight Director
FDDI	first distributed data interface
FDF	Flight Dynamics Facility (GSFC)
FDM	frequency data multiplexer
FDO	Flight Dynamics Officer
FDPC	Flight Dynamics Product Center (See Appendix B for internet address.)
FDSB	Flight Dynamics Support Branch
FDVP	forward data voice processor
FDX	full duplex (teletype)
FIMS	Fault Isolation and Monitoring System
FLT	flight
FM	frequency modulation
FM DL	frequency modulated downlink
FMT	format
FOV-1	Flight Operations Version 1
FSM	Facility System Manager

G/A	ground-to-air
GC	Ground Controller
GCC	Ground Communications Coordinator (WSC)
GCEN	NCC Communications Center
GCM	ground control message
GCMR	ground control message request
GDSD	Ground Data Systems Division (JSC)
GET	ground elapsed time
GFE	government-furnished equipment
GMT	Greenwich mean time
GN	Ground Network
GSFC	Goddard Space Flight Center, Greenbelt, MD
HBR	high bit rate
HDDR	high-density digital recorder (WSC)
HDQ	high-speed data queue
HDR	high data rate
HDX	half-duplex
HEX	hexadecimal
H/L	hardline
H/O	handover
HOSC	Huntsville Operations Support Center
HPA	high power amplifier
HRDS	high rate digital system
HRM	high-rate multiplexer
HS	high speed
HSD	high-speed data
HSDL	high-speed data line
HSM	hot standby mode
HSR	high sample rate
HST	Hubble Space Telescope
HTS	Hawaii Tracking Station
IBMTR	intermediate band magnetic tape recorder
ICV	intercenter vector

ID	identification code
I/F	interface
IGMP	internet group management protocol
IIRV	improved interrange vector
INCO	Instrumentation Communications Officer
INH	inhibit
INP	internet predict
I/O	input/output
IONET	internet protocol operational network
IOS	Indian Ocean Station, Seychelles
IP	intercept point/internet protocol
IPCC	interprocessor communications channel
IP NOC	GSFC Closed IONET Network Operations Center
IR	integrated receiver
IRE	Institute of Radio Engineers (video units)
IRIG	Interrange Instrumentation Group
IIRV	improved interrange vector
ISI	interim support instruction
ITU	input terminal unit
IUS	inertial (or interim) upper stage
JPL	Jet Propulsion Laboratory, Pasadena, CA
JSC	Johnson Space Center, Houston, TX
KIDS	Kennedy Integrated Data System
KMR	Kwajalein Missile Range
KMRTS	KSC/MSFC Redundant Transmission System
KPT	Kaena Point, DOD radar station
KSA	K-band single access
KSAF	K-band single access forward
KSAR	K-band single access return
KSC	Kennedy Space Center, FL
KSHF, R	K-band Shuttle Forward, Return
ksps	kilo symbols per second
L&L	launch and landing

LAN	Local Area Network
LBR	low bit rate
LC	link console
LCC	Launch Control Center
LCS	STS launch count status
LCP	left-hand circular polarization
LDES	Launch Data Evaluation System
LDR	low data rate
LLTDS	Launch and Landing Trajectory Data System
LOP	local operating procedures
LOR	line outage recorder
LOS	loss of signal
LOT	liftoff time
LPA	logical port address
LPS	launch processing system
LRCC	Lead Range Control Center (ER)
LRCO	Lead Range Control Officer
LRD	Landing Recovery Director
LSB	least significant bit
LSD	least significant digit
LSR	launch support request/low sample rate
LTAS	Launch Trajectory Acquisition System
MBI	management information base
MC	Mission Controller (AFSCN)
MCC	Mission Control Center (JSC)
MCC COORD	MCC Voice Coordination Loop
MCS	Mission Control Supervisor (WR)/monitor and control subsystem
MDD	mating-demating device
MDDF	minimum delay data format
MDF	Metric Data Facility
MDM	multiplexer/demultiplexer
ME	main engine
MECO	main engine cutoff

MEDS	modular environment for data systems
MET	mission elapsed time
MFR	multifunction receiver
MI	mutual interference
MIA	modulation interface assembly
MIB	management information base
MIDDS	Meteorological Interactive Data Display System
MIL	Merritt Island, FL (STDN station)
MLA	Merritt Island, FL (ER radar station)
MMI	man/machine interface
MOC	Mission Operations Center
MODEM	modulator/demodulator
MOIR	Mission Operations Integration Room
MOIS	Mission Operations Instrumentation Specialist
MOSPF	multicast open shortest path first
MPS	Main Propulsion System; multipurpose simulator (MIL)
MPT	mission planning terminal
MRT	mission readiness test
MRTFB	Major Range and Test Facilities Base
MSB	most significant bit
MSFC	Marshall Space Flight Center, Huntsville, AL
MSFTP	manned space flight telemetry processor
MSL	message-switched line
MSM	mode select matrix; Mission Support Manager
MSP	mission support procedure
MSPC	multiple store program command
MSS	message switching system
MTL	Mt. Lemon, AZ
MTPT	modified throughput
MTR	magnetic tape recorder
MTU	magnetic tape unit/master timing unit

MUX	multiplexer
NAM	Network Advisory Message
NASA	National Aeronautics and Space Administration
NASCOP	NASA Communications Operating Procedure
NAWC	Naval Air Warfare Center
NBD	NISN blocker/deblocker
NC	Network Controller
NCCDS	Network Control Center Data System (WSC/DSMC)
NCPS	Network Command Processing System
ND	Network Director
NDSOL	NASA Director of Station Locations
NES	NISN Event Schedule
NEST	Network Engineering Support Team
NHS	New Hampshire Station
NIA	Network Integration Analysis
NIB	NISN interface board
NIC	Network Integration Center (GSFC)
NIP Sup	Network Input Processor Supervisor
NISN	NASA Integrated Services Network
NLIC	NISN LAN interface card
NLT	no later than
NM	Network Manager
NMCC	National Military Command Center
nmi	nautical mile
NMS	Network Management System
NNSG	NISN Network Scheduling Group
NOAA	National Oceanic and Atmospheric Administration
NOC	Network Operations Center
NOM	Network Operations Manager
NOMI	network output multiplexer input
NON-INH	non-inhibit
NORAD	North American Air Defense Command
NOSP	Network Operations Support Plan

NRT	network readiness test
NRZ	nonreturn-to-zero
NRZ-L	NRZ level
NRZ-M	NRZ mark
NRZ-S	NRZ space
NSP	network signal processor
NST	Network Support Team
NSTS	National Space Transportation System
NTD	NASA Test Director
NTM	Network Test Manager
NTO	Network Test Organization
OAFB	Onizuka Air Force Base
OAFS	Onizuka Air Force Station
OCC	Operations Control Center (WR)
OCR	Operations Control Room (GSFC)
OCT	octal
OD	orbiter downlink; Operations Director (AFSCN); orbit determination; operations data
OD DL	operational data downlink
ODF	orbit data file
ODM	operations data message
OFT	orbital flight test
OI	operational instrumentation
OIP	Operations Interface Procedure
OIS	operational intercommunications system
OMI	operations and maintenance instruction
OMNI	Space Shuttle Orbiter omnidirectional antenna
OMS	Orbital Maneuvering System
OPF	Orbiter Processing Facility (KSC)
OPM	operational message
OPMAN	operator interface
OPN	operations message

OPSR	Operations Supervisor
OPS	operations (Ops)
Ops Rcdr	operations recorder
ORT	Operational Readiness Test
OS	Operations Supervisor (WSC)
OST	Operations Support Team (JSC)
OSTS	Office of Space Transportation Systems
OTU	output terminal unit
OV	Orbiter vehicle
PA	power amplifier
PAFB	Patrick Air Force Base
PAO	Public Affairs Office
PB	playback
PBA	playback event add (message)
PBI	pushbutton indicator
PBN	principle block number
PCA	point of closest approach
PCM	pulse code modulation
PDF	programmable data formatter; portable document format
PDL	Ponce de Leon, New Smyrna, FL, STDN station
PDM	performance data message
PED	polynomial error detector
PEP	polynomial error protection
PET	performance evaluation test
PI	payload integrator
PL	payload
PLT	pilot
PLUM	parameters list update message
PMC	Private Medical Conference
PM DL	phase modulated downlink
PMI	programmable modem interface
PMR	Pacific Missile Range

PMS	Portable Maintenance Subsystem
PM UL	phase modulated uplink
PN	pseudo noise
POA	point of acquisition
POC	point of contact
POCC	Payload Operations Control Center
POP	point-of-presence
PP	present position/patchpanel
PPOV	Pilot's point of view
PPS	Programmable Patch System/packets per second
PRD	program requirements document
PROM	programmable read-only memory
PRT	problem report message (AMS indicator)
PSK	phase shift key
PSS	portable spacecraft simulator
PTP	programmable telemetry processors
PTT	Point Pillar, WR station
Q	radar suffix
QM	quality monitor
QPSK	quadrature PSK
RAP	restricted access processor
RCA	GE Americom
RCC	Range Command Controller (ER); Range Control Center (ER); Rescue Coordination Center
RCI	remote control interface
RCP	right-hand circular polarization
RCO	Range Control Officer (ER)
RE	ranging equipment
RER	receiver-exciter-ranging
REV	revolution
RF	radio frequency
RFI	radio frequency interference

RHC	right-hand circular
RI	Rockwell International
RIC	request for information or clarification
RIMS	Rockwell Integrated Management System
RMCP	receiver/monitor control panel
RNG	range
ROCC	Range Operations Control Center (ER)
ROCS	real-time operational computer data system
RPS	record and playback system (KSC)
RSC	range safety command
RSDP	remote site data processor
RSO	Range Safety Officer
RSS	receiver switching system
R/T	real time
RTC	real-time controller; real-time command
RTCS	real-time computer system
RTDS	Real-time Data System
RTLS	return to launch site (abort mode)
RT OD	Retransmitted Orbiter Data
RTP	range tone processor; real-time transport protocol
RTS	AFSCN remote tracking station
SA	single access
SAR	schedule add request
SBE	S-band exciter
S/C	spacecraft
SCA	Space Shuttle carrier aircraft
SCAMA	switching, conferencing, and monitoring arrangement
SCAN	software catalog for the network
SCD	small conversion devices; serial conversion device (MSFC)
SCE	spacecraft command encoder
SCM	Shift Communications Manager

SCP	Space Shuttle Contingency Plan (AMS indicator)
SCR	stripchart recorder
SCVM	Shuttle command and voice multiplexer
SDB	start of data block
SDPF	Sensor Data Processing Facility (GSFC)
SDS	SUE Data System
SDT	serial decimal time
SDTC	serial data time code
SEL	System Engineering Laboratory
SFL	Shuttle forward link
SGLS	Space-to-Ground Link System
SHO	scheduling order
SIC	spacecraft identification code
SIMDIR	Simulations Director
SIM SHO	simulated scheduling order
SITE COORD	station coordination (loop)
SLDPF	Spacelab Data Processing Facility
SLSS	Shuttle Launch Support System
SLT	STS liftoff time (AMS indicator)
SM	statistical multiplexer
SMM	STDN Mission Manager
S/N	signal-to-noise
SN	Space Network
SND	Space Network Directive
SNI	San Nicolas Island
SNMP	simple network management protocol
SNR	signal-to-noise ratio
SOC	Simulations Operations Center (GSFC)
SOCC	Simulation Operations Control Center
SOPS	Space Operations Squadron
SOS	start of segment
SOSC	STS Operations Support Center
SPA	Shuttle processing area

SPC	stored program commands
SPK	Scott Peak, AZ
SRB	solid rocket booster
SRDP	shuttle return data processor
SRE	STDN ranging equipment
SRLDS	Shuttle Return Link Data System
SRM	schedule reject message
SRO	Superintendent of Range Operations
SRT	station readiness test
SRTE	subcarrier range tone equipment
SSA	S-band single access
SSAF	S-band single access forward
SSAR	S-band single access return
SSC	service specification code (WSC data base)
SSDU	Shuttle status display unit
SSI	software support instruction
SSIU	SUE system interface unit
SSM	site status message
SSME	Space Shuttle main engine
SSO	Space Shuttle Orbiter
SSR	support request message (AMS indicator); specific schedule request (P/O SN support plan); specific support request
STADIR	Station Director
STDN	Spaceflight Tracking and Data Network (composed of SN and GN)
STGT	Second Tracking and Data Relay Satellite System (TDRSS) Ground Terminal, White Sands New Mexico
STPS	S-band Tracking Processor System
STS	Space Shuttle Transportation System
SUPIDEN	support identification code
SVA	spacecraft/vehicle anomaly report (AMS indicator)
SX	simplex
SYNC	synchronization
TACAN	Tactical Aircraft Navigation

TAER	time, azimuth, elevation, and range
TAL	Transoceanic Abort Landing
TBA	TDRS beam angle
TBD	to be determined
TBS	to be supplied
TCDS	Telemetry and Communications Data System
TCDT	terminal countdown demonstration test
TCS	Telemetry and Control Station (Oakhanger)
TCT	time code translator
TD	Test Director
T&DA	tracking and data acquisition
TDE	TDRS East
TDM	time division multiplexed; tracking data message
TDMA	time-division multiplexed access
TDPS	Tracking Data Processing System
TDR	tracking data router; true-of-date rotating (velocity components)
TDRS	Tracking and Data Relay Satellite
TDRSS	Tracking and Data Relay Satellite (System)
TDS	tracking data system
TDW	TDRS West
TEL-4	TLM-4, AFETR Station
TLAS	TDRS look angle system
TLM	telemetry
TM	Technical Manager
TN	TDRSS Network
TN COORD	TDRSS Network Voice Coordination Loop
TNOSP	TDRSS Network Operations Support Plan
TO&A	Technical Operations and Analysis (WSC)
TOCC	TDRSS Operations Control Center-2 (STGT)
TODR	true of date rotating
TOO	AFSCN Test Operations Order
TP	TLM processor
TRACK	Tracking Controller (callsign)

TRACK COORD	Tracking Coordination
TRK	track
TTR	TDRSS trouble report
TTS	Thule Tracking Station
TV	television
TWTA	traveling wave tube amplifier
UDP	user datagram protocol
UHF	ultra-high frequency
UL	uplink
ULT	uplink test
UPBA	user playback add request (message)
UPBD	user playback event delete (message)
UPD	user performance data
UPS	user planning system
USAKA	U.S. Army Kwajalein Atoll
USSPACE COM	United States Space Command
UTDF	universal tracking data format
USAEPG	U.S. Army Electronic Proving Ground
V1	voice 1
V2	voice 2
VAB	vehicle assembly building
VAFB	Vandenberg Air Force Base, CA
VAR	video activity report message (AMS indicator)
VCO	voltage-controlled oscillator
VDS	voice distribution system
VID	vehicle identification
VIDD	vertical interval data detector
VIRS	vertical interval reference signal
VITS	vertical interval test signal
VOMR	voice-operated monitor recorder
VSS	voice switching system
VTR	video tape recorder

VTS	Vandenberg Tracking Station (VAFB, CA [AFSCN])
VU	volume units (audio)
WAN	wide area network
WB	wideband
WBMTR	wideband magnetic tape recorder
WFEP	Wallops front end processor
WFF	Wallops Flight Facility, VA
WLPS	Wallops Island
WOTS	Wallops Orbital Tracking Station
WOW	weight on wheels
WPS	Wallops S-band Station
WR	Western Range
WSC	White Sands Complex, New Mexico (consists of STGT and WSGT)
WSGT	
WSSH	White Sands Space Harbor (tertiary EOM site)
XDOT YDOT ZDOT	TODR velocity components
ZOE	zone of exclusion

Appendix B. Supporting Documents and Related Web Sites

B.1 General

In order to make this list of referenced and supporting documents more useful to the reader, the following conventions have been adopted:

a. Documents shown in *italics* - appear in the Master Index as Active.

b. Documents shown in <u>*italics & underscored*</u> - appear in the On-line Library.

c. Documents shown in normal text either appear in the Master Index as Obsolete, in process, or do not appear in the Master Index because they have not been published.

d. TBD - draft in-process

B.2 Supporting Publications

405-TDRS-RP-ICD-001	Interface Control Document (ICD) between the Network Control Center (NCC)/Flight Dynamics Facility (FDF) and the White Sands Complex (WSC) for the TDRS H, I, J Era (This document is obsolete and no replacement is available.)
450-CAP-EMCC	*Human Spaceflight Program Emergency Mission Control Center Activation and Operations Procedures* (formerly 532-CAP-EMCC)
450-CAP-EMCC/Supplement	*Human Spaceflight Program Emergency Mission Control Center Telephone Reference List, Supplement to 450-CAP-EMCC* (formerly 532-CAP-EMCC/Supplement)
450-601-NOSP/Space Shuttle	<u>*Network Operations Support Plan for the Space Shuttle Program*</u>
450-602/ISS	<u>*Tracking and Data Relay Satellite System Network Operations Support Plan for the International Space Station*</u>
450-SNUG	<u>*Space Network User's Guide (SNUG)*</u>, (supersedes 530-SNUG)
451-ICD-NCCDS/MOC	<u>*Interface Control Document Between the Network Control Center Data System and the Mission Operations Centers*</u>
451-ICD-NCCDS/NEST	<u>*Interface Control Document Between the Network Control Center Data System and the NASA Integrated Services Network (NISN)/NASA Communications (NASCOM) Event Scheduling Terminal (NEST)*</u> (supersedes 530-ICD-NCCDS/NASCOM)

451-OIP-NCC/STDN Users	*Operations Interface Procedure Between the Network Control Center and Spaceflight Tracking and Data Network Customers*
451-SIP-NCC/STDN	*Network Control Center and Spaceflight Tracking and Data Network Station Interface Procedure*
530-ICD-NCC-FDF/WSC	*Interface Control Document between the Network Control Center (NCC)/Flight Dynamics Facility (FDF) and the White Sands Complex (WSC)*
530-NOP-NCC/SN	*Network Operations Procedures for Network Control Center Space Network Real-Time Fault Isolation*
530-NOP-STDN/TS	*Spaceflight Tracking and Data Network Test and Simulation Support Plan* (Formerly STDN No. 502.26)
530-RSD-WSC	*Requirements Specification for the White Sands Complex (WSC)*
530-UGD-NCC/MMDPS	*Network Control Center (NCC) Multi-mission Display Processing System (MMDPS) Users' Guide*
531-STP-STGT/PL-6	*Second Tracking and Data Relay Satellite System (TDRSS) Ground Terminal (STGT) Post-Level 6 Test Plan*
531-STP-STGT/PL-6 Shuttle Annex	*Space Shuttle Program (SSP)/Second TDRSS Ground Terminal (STGT) Communications Performance Verification Test Procedures*
532-OIP-NCC/FDF	*Operations Interface Procedures Between Goddard Space Flight Center Network Control Center and Flight Dynamics Facility*
532-OIP-NCC/JSC MCC	*Space Shuttle Program Operations Interface Procedure between the Goddard Space Flight Center Network Control Center and Johnson Space Center Mission Control Center*
532-OIP-NCC/MTRS	*Operations Interface Procedures for the McMurdo TDRS Relay System*
532-VTR-STDN	*Network Verification Manual for the Space Shuttle Program* (Formerly STDN No. 508.26)
534-CAP-GSFC	*Space Shuttle Program Contingency Support Plan During Evacuation/Bypass of Goddard Space Flight Center Building 3/13/14 Complex*
534-CAP-Space Shuttle	*Goddard Space Flight Center Space Shuttle Program Contingency Action Plan*
534-CAP-STDN	*Spaceflight Tracking and Data Network Contingency Action Plan for Providing Support During Space Shuttle Program Missions*

534-OIP-NCC/DSN	*Operations Interface Procedures between the Goddard Space Flight Center Network Control Center (NCC) and the Deep Space Network (DSN) Network Network Operations Control Center (NOCC)*
534-OIP-NCC/MSFC	*Operations Interface Procedures between the Goddard Space Flight Center Network Control Center and Marshall Space Flight Center Huntsville Operations Support Center*
534-OIP-NCC/NASCOM	*Operations Interface Procedures Between GSFC NCC and NASA Communications Division*
534-OIP-NCC/45 RANS	*Space Shuttle Program Operations Interface Procedures Between the Goddard Space Flight Network Control Center and 45th Range Squadron* (formerly STDN No. 508.4)
534-SOP-STGT	Second TDRSS Ground Terminal (STGT) Standard Operating Procedures (Obsolete - No Replacement Listed)
542-006	NASA Communications Operations Procedures (NASCOP), Volumes I and II (Obsolete - No Replacement Listed)
542-016	*NASA Communications (NASCOM) Space Network Ground Segment Support Data Book*
CSOC-GSFC-DICT-002184	*Support Identification Code Dictionary*
CSOC-GSFC-LOP-001886	*Hardware Engineering Local Operating Procedure for Engineering Change*
CSOC-GSFC-WI-000472	*Hardware Engineering Work Instructions for Engineering Change Process*
CSOC-WSC-PRO-002904	Operations Interface Procedures (OIP) between the White Sands Complex (WSC) and Spaceflight Tracking and Data Network (STDN) Customers and Elements
GSFC-NISN-COM-99-0001	*Digital Data Source/Destination and Format Codes Handbook for the NISN/Nascom Ground Network*
JSC 08118	*Space Shuttle Telemetry and Command Characteristics Handbook* (2 vols)
JSC-11534	*External Interface Control Documents for JSC (10 vols)*
ME-10789	*Multifunction Receiver* (3 vols)
NISN-001-001	NASA Integrated Services Network (NISN) Services Document (Document in-process; not yet published)
NSTS-21063-POC-CAP	*POCC Capabilities Document Payload Support Capabilities Description: MCC, JSC POCC, Remote POCC Interface*
STDN No. 119	*Space Network Operations Policy*

STDN No. 141	*Second Tracking and Data Relay Satellite System Ground Terminal (STGT) Concepts of Operations*
STDN No. 203.6/CTV	*Functional and Performance Requirements for the Compatibility Test Van*
STDN No. 203.6/MIL/TDRSS Relay	*Functional Performance Requirements for the NASA Merrit Island TDRSS Relay System*
STDN No. 203.6/SLSS	*Functional and Performance Requirements for the NASA Shuttle Launch Support System (SLSS)*
STDN No. 203.7	*Functional and Performance Requirements for the Tracking and Data Relay Satellite System/Space Flight Tracking and Data Network (TDRSS/STDN) User Transponder*
STDN No. 203.8	*Performance and Design Requirements Specification for the Second Generation TDRSS User Transponder*
STDN No. 403.2/STS-A1	*Space Transportation System (STS) Communications Performance Verification Test Procedures Annex 1*
STDN No. 502.5	*STDN Network Operations Procedures for Network Computer Systems* (2 vols)
STDN No. 502.6	*STDN Network Operations Procedures for Command Systems*
STDN No. 502.11	*STDN Network Operations Procedures for Data Management*
STDN No. 502.14	*STDN Network Operations Procedures for Air-to-Ground Communications Systems*
STDN No. 502.25	*Network Operations Procedures for Television and Display Console Systems*
STDN No. 509.1	*Goddard Space Flight Center Mission Operations Division Project Operations Control Centers Interface Procedures with the Network Control Center*
STDN No. 724	*Tracking and Acquisition Handbook for the Spaceflight Tracking and Data Network*
STDN No. 819	*Tracking and Data Relay Satellite System (TDRSS) Status Handbook*
S-805-1	Performance Specification for Services via the Tracking and Data Relay Satellite System
TBD	Network Integration Center (NIC) Standard Operating Procedure (SOP) for GSFC (Document in-process; not yet published)

B.3 Related Internet Web Sites

GSFC Home Page	http://www.gsfc.nasa.gov
SN Home Page	http://nmsp.gsfc.nasa.gov/tdrss/tdrsshome.html
SN Webpage Scheduling Interface	http://swsi.gsfc.nasa.gov
WSC Home Page	http://nmsp.gsfc.nasa.gov/tdrss/wsc.html
CSOC on-line Library	https://csoc-ddcs.csoconline.com/ollds/nf/cfm/OnlineLibrary1.cfm
System Centralized Configuration Management System (GDMS CCMS)	http://gdms.gsfc.nasa.gov
Network Director Home Page	http://idm.honeywell-tsi.com/hpshuttle2/hsd/hsd.html
Flight Dynamics Product Center	http://fdf.gsfc.nasa.gov/
MSFC Homepage	http://www.nisn.nasa.gov/
Wallops Flight Facility Home Page	http://www.gsfc.nasa.gov/wff.html
Shuttle Launch Schedule	http://www-pao.ksc.nasa.gov/kscpao/schedule/schedule.htm
International Space Station	http://spaceflight.nasa.gov/station/
GSFC Mission Services Project GSFC Customer Commitment Home Page	http://ccs.honeywell-tsi.com/cco/
Mission Services Program, Code 450 Web Site	http://msp.gsfc.nasa.gov/

Appendix C. Data Stream Assignments

DSID OCT/DEC/HEX	Data Rate	Data Type
023	48 Mb/sec	Orbiter 1 K-band Channel 3
240		GN Orbiter
241		GN Orbiter
250	1024 kb/sec	STS K-band Channel 2 Ops Recorder SSR/MMU
237	48 Mb/sec	STS K-band Channel 3 FM/Digital
000/000/00	64 kb/sec	EMCC GN Command Uplink Monitor
000/000/00	128 kb/sec	EMCC GN Telemetry Downlink Monitor
000/000/00	32 kb/sec	SSO-1 SSAF LDR
000/000/00	72 kb/sec	SSO-1 SSAF HDR/KSAF LDR
000/000/00	216 kb/sec	SSO-1 KSAF HDR
117/079/04F		TDRSS Tracking Data
020/016/10	96 kb/sec	SSO-1 TDE SSAR LDR
024/020/14	32/72 kb/sec	SSO-1 S-band ECHO
025/021/15	72 kb/sec	SSO-1 K-band ECHO
252/170/AA	96 kb/sec	SSO-1 TDW SSAR LDR
020/016/10	192 kb/sec	SSO-1 TDE SSAR HDR
252/170/AA	192 kb/sec	SSO-1 TDW SSAR HDR
021/017/11	192 kb/sec	SSO-1 TDE/TDW KSAR Channel 1
022/018/12	1024 kb/sec	SSO-1 TDE/TDW KSAR Channel 2 FWD/REV Dump
022/018/12	960 kb/sec	SSO-1 TDE/TDW KSAR Channel 2 FWD/REV Dump
116/078/4E	960 kb/sec	SSO SSME KSAR Channel 2 SSME FWD/REV Dump
022/018/12	192 kb/sec	SSO-1 TDE/TDW KSAR Channel 2 Reverse Dump
022/018/12	128 kb/sec	SSO-1 TDE/TDW KSAR Channel 2 Reverse Dump
022/018/12	640 kb/sec	SSO-1 TDE/TDW KSAR Channel 2 5:1 Forward Dump
022/018/12	640 kb/sec	SSO-1 TDE/TDW KSAR Channel 2 5:1 Reverse Dump
022/018/12	192 kb/sec	SSO-1 TDE/TDW KSAR Channel 2 Forward Dump
022/018/12	128 kb/sec	SSO-1 TDE/TDW KSAR Channel 2 Forward Dump
247/167/A7	250 kb/sec	Payload KSAR Channel 2 Reverse Dump
246/166/A6	250 kb/sec	Payload KSAR Channel 2 Forward Dump
247/167/A7	500 kb/sec	Payload KSAR Channel 2 Reverse Dump
246/166/A6	500 kb/sec	Payload KSAR Channel 2 Forward Dump
247/167/A7	1 Mb/sec	Payload KSAR Channel 2 Reverse Dump

DSID OCT/DEC/HEX	Data Rate	Data Type
246/166/A6	1 Mb/sec	Payload KSAR Channel 2 Forward Dump
247/167/A7	2 Mb/sec	Payload KSAR Channel 2 Reverse Dump
246/166/A6	2 Mb/sec	Payload KSAR Channel 2 Forward Dump
247/167/A7	125 kb/sec	Payload KSAR Channel 2 Reverse Dump
246/166/A6	125 kb/sec	Payload KSAR Channel 2 Forward Dump
247/167/A7	4 Mb/sec	Payload KSAR Channel 3 Reverse Dump
246/166/A6	4 Mb/sec	Payload KSAR Channel 3 Forward Dump
247/167/A7	12 Mb/sec	Payload KSAR Channel 3 Reverse Dump
246/166/A6	12 Mb/sec	Payload KSAR Channel 3 Forward Dump
247/167/A7	8 Mb/sec	Payload KSAR Channel 3 Reverse Dump
246/166/A6	8 Mb/sec	Payload KSAR Channel 3 Forward Dump
246/166/A6	48 Mb/sec	Payload KSAR Channel 3 Forward Dump
247/167/A7	48 Mb/sec	Payload KSAR Channel 3 Reverse Dump
246/166/A6	32 Mb/sec	Payload KSAR Channel 3 Forward Dump
247/167/A7	32 Mb/sec	Payload KSAR Channel 3 Reverse Dump
246/166/A6	16 Mb/sec	Payload KSAR Channel 3 Forward Dump
247/167/A7	16 Mb/sec	Payload KSAR Channel 3 Reverse Dump
246/166/A6	24 Mb/sec	Payload KSAR Channel 3 Forward Dump
247/167/A7	24 Mb/sec	Payload KSAR Channel 3 Reverse Dump
246/166/A6	2 Mb/sec	Payload KSAR Channel 3 Forward Dump
247/167/A7	2 Mb/sec	Payload KSAR Channel 3 Reverse Dump
023/019/13	48 Mb/sec	ESTL K-band Channel 3
023/019/13	32 Mb/sec	ESTL K-band Channel 3

Legend

DSID = Data Stream Identification
OCT = Octal
DEC = Decimal
HEX = Hexadecimal
TDE = TDRS-East
TDW = TDRS-West
SSAF = S-band Single Access Forward
SSAR = S-band Single Access Return
KSAF = K-band Single Access Forward
KSAR = K-band Single Access Return
LDR = Low Data Rate
HDR = High Data Rate
SSME = Space Shuttle Main Engine
ESTL = Electronic Systems Test Laboratory (JSC)

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450-TNOSP-Space Shuttle
(Supersedes 501-602/Space Shuttle)

Tracking and Data Relay Satellite System Network Operations Support Plan (TNOSP) for the Space Shuttle

Original