NASA/GSFC	NETWORKS AND MISSION SERVICES PROJECTS (N&MSP) CONFIGURATION CHANGE REQUEST (CCR)

1. CCR. NO.	2. DATE	3. PRIORITY	4. CHANGE LEVEL
CCR-451-ICD-11	August 18, 1998	☐ EMERGENCY ☐ URGENT ☒ ROUTINE	☐ A ☒ B ☐ C

5. TITLE OF CHANGE:
Update to Reflect HIJ CDR Baseline Design (ECP-27)

6. DOCUMENT TITLE: Interface Control Document (ICD) between the NCC/FDF and the WSC, Revision 5, through DCN 01, 6/30/98

DOCUMENT NO.: 530-ICD-NCC-FDF/WSC, Rev. 5 through DCN 01

LIST ALL AFFECTED DOCUMENTS INCLUDING PROCEDURES: 405-TDRS-RP-ICD-001, 12/95 through SCN 01

(CONT. ON ATTACHMENT)

7. REASON FOR CHANGE: To incorporate TDRS HIJ Project Contractor inputs for HIJ Project/WSC compatibility.

(CONT. ON ATTACHMENT)

8. DESCRIPTION OF CHANGE: Pages xiii, 2-7, 2-8, 2-11, 2-12, 2-13, 2-14, 2-15, 2-16, 9-50, 9-62, 9-64, 9-65, 9-66, 9-82, 9-90, 9-91, 9-92, 9-94, AB-4

(CONT. ON ATTACHMENT)

9. IMPACT

Y	N	SYSTEM	Y	N		Y	N	
☐	☒	SCHEDULE	☐	☒	BUDGET	☐	☒	FACILITIES
☐	☒	TESTING	☐	☒	TRAINING	☐	☒	CONTRACTOR SUPPORT
☒	☐	INTERFACES	☐	☒	SECURITY	☐	☒	HARDWARE
☒	☐	SOFTWARE	☐	☒	LOGISTICS	☒	☐	DOCUMENTATION
☒	☐	GROUND SEGMENT				☐	☒	SPACE SEGMENT
☐	☐	OTHER _____						

ORGANIZATIONAL

Y	N		Y	N		Y	N	
☐	☒	450	☐	☒	_____	☐	☒	MSFC
☒	☐	451	☐	☒	_____	☐	☒	JSC
☐	☒	452	☐	☒	_____	☐	☒	LERC
☐	☒	453	☒	☐	Code 405	☐	☒	KSC
						☐	☒	JPL

10. COMMENTS:

11. ORIGINATOR	CODE 451	12. SEGMENT MANAGERíS APPROVAL	CODE
D. Littmann, x7643			
SIGNATURE _____	DATE _____	SIGNATURE _____	DATE _____
13. BOARD CHAIRPERSON SIGNATURE	**DATE**	**14. BOARD CHAIRPERSON COMMENTS**	
15. BOARD ACTION ☐ Approved ☐ Withdrawn ☐ Disapproved ☐ Deferred _____		**16. ACTION REQUIRED** ☐ Publish Document ☐ Publish DCN ☐ Deviation ☐ Waiver ☐ Implement Change ☐ Other _____	

Section 10. Polynomial Encoding And Decoding

2. The user will remain in the real-time mode until completion of the updating of the user ephemeris. This will generally be within 30 seconds of receipt of the OPM or, in the case of a maneuver, 30 seconds after receipt of the last vector in the sequence. (Receipt of multiple Delta-T OPM's may delay implementation.)

3. The WSC will notify the NCC when a user enters and exits the real-time mode.

4. Deleted.

5. There can only be one real-time user per SGLT at any given time.

6. Once maneuver sequence support in the real-time mode has begun, if current time exceeds the epoch of the last maneuver sequence vector at the WSC, the remainder of the sequence will be rejected and maneuver sequence support will be terminated.

2.2.2 Schedule Order (SHO) Ground Rules

The following ground rules apply to routine service scheduling:

1. In a SHO structure, the sequence of the data sets for the normal services is: Forward - Return - Tracking. Sections 9.2.3.15 and 9.2.3.17 describe how End-to-End Test data sets are incorporated into a SHO structure.

2. Periodic SHOs (type 8) shall be used to schedule user services whose start times are greater than or equal to 2 hours and less than 48 hours from receipt of the SHO at WSC.

3. Routine SHOs (type 2) shall be used to schedule user services whose start times are greater than or equal to five minutes and less than two hours from receipt of the SHO at WSC. These SHOs will be rejected (OPM-51, Problem Code 1) if a service start time is less than five minutes from receipt at WSC.

4. Shuttle does not currently use ~~MA~~KaSA, SMA, MA or cross-support services.~~, and therefore does not use cross-support~~. All KaSA, SMA, MA ~~MA service parameters~~ and ~~all~~ cross-support service parameters apply only to normal users.

5. Deleted.

6. The NCC will ensure that the service reconfiguration period is adequate for slewing the SA antenna to a user position. If the service reconfiguration period is less than three (3) minutes, pre-service testing is not required.

   For TDRS F1-F7, ~~T~~the service reconfiguration period (the interval between the stop time of a SHO and the start time of the next SHO on the same Single Access (SA) antenna or using the same Multiple Access (MA) return link ID or using the same MAF link) will be at least 30 seconds. ~~The NCC will ensure that the service reconfiguration period is adequate for slewing the SA antenna to the user position.~~ A slew rate of approximately 0.25°/sec. is assumed. ~~If the service reconfiguration period is less than three (3) minutes, pre-service testing is not required.~~

   For TDRS HIJ, the service reconfiguration period (SRP) (the interval between the stop time of a SHO and the start time of the next SHO on the same Single Access (SA) antenna or using the same S-band Multiple Access (SMA) return link ID or using the

same SMAF link) will be at least (2) minutes for SA and at least 30 seconds for SMA. The following algorithm is used to calculate the necessary SA SRP:

t (sec.) = $50 + \theta/0.325$ (or 120 seconds, whichever is greater)

where:

θ is the track-to-track slew angle (degrees)

(NOTE: TDRS HIJ SA track-to-track slews greater than 62 degrees may result in late arrival of the SA antenna at the user position. Lateness of SA antenna arrival at the user position is defined relative to the scheduled user service start time and will be no greater than Δt, where $\Delta t = [(\theta-62)(0.361)/(0.325)^2] + 2.0$ seconds. The SRP for track-to-track slews greater than 62 degrees must be at least 241 seconds. A track-to-track slew is defined as an antenna slew which matches both the user position and velocity at the start and end of the slew. For SRPs the starting velocity is always zero.)

7. All SHO's have a unique SHO ID. If a SHO is to be replaced, it will be cancelled by a Cancel SHO Request, OPM-Class 12, prior to sending the replacement SHO.

8. The minimum and maximum times which may be contained within the contiguous time interval covered by a SHO are one minute (minimum time) and 24 hours (maximum time).

9. Schedule conflicts will result in the discard of the later received SHO which caused the conflict and the generation of a conflict message (OPM) which will be sent to the NCC. All previously planned and currently ongoing services will continue.

10. Back-to-back (or overlapping) user support periods may be scheduled by separate SHO's on different links. A minimum of 15 seconds between Shuttle SHOs scheduled at the same ground terminal (Danzante or Cacique) is required for service support.

11. When requested in the SHO, return link time delay data will be provided on the equipment configuration in use at the start and conclusion of service, when the equipment configuration changes and at reconfigurations during the service period. These return link time delay data will be sent after service termination. The Return Channel Time Delay (RCTD) measurement is valid for DIS MDM return services with symbol rates $\leq$ 6 Msps for NRZ data (3 Msps for biphase) per I or Q channel.

12. All services in the SHO must cover a contiguous time period. During the time interval from the earliest service start time to the latest service stop time in the SHO, there must not be any period for which no service is being provided to the user. Within a SHO, the minimum time between the stop time of a service and the start time of the same service shall be 15 seconds. MA Return (MAR) Channel availability is based on the assumption that a MAR Channel is allocated to a SHO from the earliest MAR service start time to the latest MAR service stop time in the SHO. Overlapping of MAR services in a SHO shall be rejected by the WSC. This ground rule applies to SMAR also.

13. All services in the SHO must be for the same TDRS. With the exception of S-band Single Access (SSA) combining, all services in the SHO shall be for the same TDRS SA antenna.

14. For tracking services, the related forward and/or return services must be scheduled for the entire duration of the tracking service and must be described in the same SHO. Simultaneous SSA and Ku-band Single Access (KSA) services from the same SA antenna must be described in the same SHO.

15. For optimal performance, all coherent services (i.e., Data Group 1 (DG-1) Modes 1 and 3 and all coherent carrier services) should have the forward and return services starting at the same time. If operational considerations require starting the forward service before the return service, no reconfigurations of the forward service (i.e., OPMs 02, 03, and 11) shall be sent within 30 seconds of the start of return service. OPM 04 shall not be sent within 150 seconds of the start of the return service. These messages will not be rejected, but could cause inaccuracies in subsequently scheduled tracking data.

16. For a User Reconfiguration Request OPM, the reconfigurable parameters shall be contained in the Reconfiguration OPM. The SHO contains the initial configuration (the fixed parameters plus the initial group of reconfigurable parameters for that service).

17. Deleted.

18. Deleted.

19. All SHO's (periodic and routine) shall have the same format.

20. The SHO ID is unique for each new schedule. A SHO retains the same ID for each subsequent schedule change or deletion for reference purposes.

21. The first data block containing scheduling data must be flagged for message acknowledgment in the TDRSS header, i.e., SHOs require acknowledgment of successful receipt by WSC. The message acknowledgment will occur after the successful receipt of all blocks comprised in the message.

22. Each scheduling data message (single block or multiblock) can contain only one SHO. This constraint makes a SHO and a scheduling data message synonymous.

23. Scheduling order data and operations messages cannot occupy the same 4800-bit block.

24. A scheduling order data message is limited to a maximum group of 15 blocks.

25. The maximum number of services in a SHO is 16. An SSA combining service counts as two, i.e., there will only be one set of SSA Return (SSAR) parameters in the SHO with the SSA combining byte set to 1 = yes, however, this counts as two services. The SSA combining parameters shall be specified as SSA1 parameters.

26. At any point in time, the number of SHOs awaiting execution shall not exceed 600.

27. Deleted.

28. The Support Identifier Code (SUPIDEN) is a spacecraft-unique coded number assigned by NASA. For the TDRS series, the SUPIDENs have been assigned as follows:

TDRS Serial #1 (F-1) = TDRS A = SUPIDEN 1300
TDRS Serial #2 (F-2) = TDRS B = SUPIDEN 1301
. .
. .
. .
TDRS Serial #10 (F-10) = TDRS J = SUPIDEN 1309

Although the TDRS may not be launched in this ordered sequence, these designations are fixed and shall not change.

29. For KSA/KaSA and SSA DG2, Staggered Quadrature Phase Shift Keying (SQPSK), Single User coded data service (where concurrent encoder symbols are placed on the I and Q phase of the SQPSK carrier), it is necessary that the user's I and Q phase relationship be known in order to properly decode the user data. The definition of the I Channel G2 Inversion parameters, in this case is as follows:

    G2 Inversion - I Channel

    0 = G2 polynomial normal - I leads Q, or
    G2 polynomial inverted and I lags Q

    1 = G2 polynomial inverted - I leads Q, or
    G2 polynomial normal and I lags Q

30. The four character SIC for a user spacecraft is the same as the four numeric characters of the user SUPIDEN. The second through the fifth characters of the SUPIDEN, along with the Vehicle Identification Code (VIC) are used to identify the User and, in turn, to correlate SHO's with the User spacecraft state vector.

31. Definition of Effective Isotropic Radiated Power (EIRP) - The user spacecraft minimum and maximum EIRP (paragraphs 9.2.3.8, 9.2.3.10, 9.2.3.12) over the scheduled service period are defined as follows:

$$EIRP(t) = EIRP_u(t) - 20 \log \frac{R_u(t)}{R_{spec}} + n \text{ dBW}$$

where:

EIRP(t)	is the User's apparent EIRP, assuming the User spacecraft is located at a range R_{spec} from TDRS.
$EIRP_u(t)$	is the time User's actual EIRP based on the User's transmitter power, antenna gain, efficiency, and pointing losses.
$R_u(t)$	is the time varying range of the user spacecraft from TDRS.
R_{spec}	is the range of the user spacecraft from TDRS corresponding to a propagation space path loss of -192.2 dB for S-band and -209.2 dB for K-band.
n	is a factor which accounts for antenna polarization loss due to imperfect circular polarization of the User spacecraft transmit antenna.

Hence, $EIRP_{max}$ is the maximum value of EIRP(t) and $EIRP_{min}$ is the minimum value of EIRP(t) over the scheduled service period. WSC shall use the minimum EIRP value, in conjunction with TDRS performance parameters, to compute a C/N_o for configuring the IR. Maximum Data Rate values shall be provided in the SHO. For User End-to-End Test Services, the "EIRP of Simulated User" (paragraph 9.2.3.15) is EIRP(t) at the return End-to-End Test service start time.

32. For a User transmitting DG1 data from a single source by Quadrature Phase Shift Keying (QPSK) modulation, the SHO data rate for the I and Q channels should be set to the same value - that which is the data rate of the user single source. However, if either I or Q modulator of the user is inoperative, then that corresponding I or Q channel data rate should be set to a value of zero in the SHO. For DG2, the I and Q Channel data rates shall be one-half the single source data rate.

33. For a user transmitting data by Binary Phase Shift Keying (BPSK) modulation, the SHO data should be as follows:

DG1 -	I Channel only:	Specify I channel data rate only; set Q Channel data rate to American Standard Code for Information Interchange (ASCII) space.
DG1 -	Q Channel only:	Specify Q channel data rate only; set I channel data rate to ASCII space.
DG2:		Specify I channel data rate; set Q channel data rate to ASCII space.

34. For a User transmitting either QPSK or BPSK from a single data source, the constraints of 32 and 33 above, which specify I and Q values for the SHO data rate parameters, also apply to these other SHO parameters:

    Data Format
    Data Bit Jitter
    Data Coding
    Symbol Format Conversion
    G2 Inversion

35. On a TDRS, each SA antenna has one polarizer for each frequency band. ~~there is a single polarizer for S-band and another single polarizer for K-band.~~ Therefore, for SHO's and user reconfiguration OPM's, the antenna polarization parameter code (0 = Left-hand Circular Polarization (LCP), 1 = Right-hand Circular Polarization (RCP)) for simultaneous forward and return services, (either SSA or KuSA/KaSA~~or KSA~~) which use a single SA antenna, must be the same. For MA/SMA, only LCP is applicable.

36. Simultaneous MA Forward (MAF) or SMAF, SSA Forward (SSAF), and KSA Forward (KSAF/KaSAF) services to a single user shall be provided. These services will be requested in a single SHO. The maximum number of simultaneous forward services for a single user in one SHO is three; one MAF or SMAF, one SSAF, and one KSAF/KaSAF.

37. For users sending "idle pattern" (no useful data), the SHO shall contain the baud rate in the reconfigurable parameters but zero in the data rate in SHO Subheader 6. If reconfiguration of the channel is not required, the SHO Subheader shall contain an "N".

38. EET Services, SSA Combining and Cross Support Services shall be required. Any two of these three capabilities shall be supported simultaneously. Simultaneous support of all three is not required.

39. The Data Quality Monitor (DQM) Sync Strategy Parameters are defined as follows:

    a. N1, Number from 0 to 5 bit errors allowed for acceptable sync word detection in the search, check, lock, and flywheel modes.

    b. N2, Number from 1 to 5 of consecutive, detected sync words in the check mode.

    c. N3, Number always equal to 1, undetected sync words in the lock mode.

    d. N4, Number from 0 to 5 of consecutive, undetected sync words in the flywheel mode.

    e. N5, Enable/Disable of best match strategy in the search mode (1 = enable, 0 = disable).

40. DIS Pre Service Test (PST) shall not be performed when any DIS Shuttle chain is already assigned. A DIS Shuttle chain is assigned from the earliest SHO service start time minus PST period to last service stop time.

41. The minimum value of the Max Data Rate parameter in a SHO shall be 1000 bps.

42. For users transmitting from a single source by QPSK modulation, only the I Channel data of Subheader 6 is applicable. For users transmitting BPSK, the applicable channel of Subheader 6 is as specified in Ground Rule 33.

43. MA services are applicable for TDRS A-G only. SSA and KSA services are applicable for TDRS A-J. SMA and KaSA services are applicable for TDRS H-J only. Incorrectly scheduled services for a TDRS shall be rejected.

44. Simultaneous scheduling of Ku and Ka Band services on the same SA antenna is not permitted. Within a SHO, the minimum time between the stop time of the Ku(Ka)-Band services and the start time of the subsequent Ka(Ku)-Band services shall be 20 seconds.

45. Ka-Band services are DG-2, noncoherent only. There are no tracking services at Ka-Band.

46. IFL SHOs shall be applicable for Cacique only and shall not be reconfigurable. The number of services in an IFL SHO is always 1. Each service in a normal or EET SHO that specifies potential use of the Danzante HDRM will result in an IFL SHO being scheduled at Cacique. The number of data channels which may be accounted for in the IFL SHO's Subheader 6 is always 2. For Shuttle KSAR, channel 1 is always omitted.

47. The recording (Line Outage Recording (LOR) and Record Only services) of all GRGT supported user services will be performed at Cacique.

48. GRGT will not support Shuttle Analog Data (Shuttle Mode 2, Channel 3 Analog) services.

49. GRGT will have two schedulable MA Return Links, but has the capability to be increased to five.

50. The NCC is responsible for ensuring that the common carrier (Danzante/Cacique-to-GSFC and GRGT-to-Cacique) composite forward and return data rates available for scheduling of user services is not exceeded.

51. Scheduling of SA user services outside the Primary Elliptical Field of View (PEFOV, ± 22.5 degrees East-West and ± 31 degrees North-South) should be avoided during planned TDRS HIJ stationkeeping/stationchange maneuvers. A window is reserved for TDRS HIJ stationkeeping/stationchanging maneuvers. This window will begin prior to a scheduled maneuver and will terminate after the maneuver. Any SA services outside the PEFOV that are ongoing at the initiation of the maneuver window or that start at any time during the maneuver window, will not be supported during or after the maneuver window. (Ongoing SA Services that overlap the maneuver window will be supported until the initiation of the maneuver window.)

52. KaSA User Receive and Transmit Frequency service parameters shall fall within the following ranges. Parameter values outside of these ranges shall be rejected.

    User Transmit Frequencies: 25253.4 ± 0.7 MHz to 27478.4 ± 0.7 MHz in 25 MHz steps.

    User Receive Frequencies: 22555.0 ± 0.7 MHz to 23545.0 ± 0.7 MHz in 5 MHz steps.

53. Two SGLTs supporting collocated TDRSs (two TDRSs occupying the same longitudinal orbital slot) shall support the same number of SSA, KSA/KaSA services as a single SGLT supporting a non-collocated TDRS. If an HIJ TDRS and an F1-F7 TDRS are collocated, either MA or SMA services are supported but not both. If two HIJ TDRSs are collocated, 5 SMAR services from each TDRS may be supported. One SMAF service may be supported to each TDRS, but not simultaneously. The two SGLTs may be from different ground terminals.

2.2.3 End-To-End Test (EET) Data Ground Rules

The following ground rules apply to End-to-End Test SHO's:

1. Deleted.

2. End-to-End Test services cannot be scheduled alone, i.e., the related traffic services must be included in the SHO.

3. In an End-to-End Test SHO, the start time specified in an End-to-End Test data set must be the same as that of the related traffic service and the stop time in the End-to-End Test data set must be the same as that of the related traffic service.

4. End-to-End Test services cannot be included in a normal SHO. An End-to-End Test SHO must be used for End-to-End Test services.

5. All End-to-End Test SHO reject messages shall be sent to the NCC without operator intervention.

6. If Shuttle End-to-End Test SHOs overlap with Shuttle SHO pre-service test periods and both require use of the same DIS resources, the Shuttle SHO shall be serviced without pre-service test.

7. End-to-End Test services shall be reconfigurable by OPM classes 02, 03, 07, and 11.

8. MOC Shuttle End-to-End Tests shall be limited to digital data only.

9. EET EIRP calibration shall be performed during preservice testing.

10. There will only be one S-band (forward and return) and one K-band (forward and return) service per EET SHO. The EIRP of the return EET service shall not be reconfigured.

11. An End-to-End Test SHO which does not have a three minute Preservice Test period shall be rejected with a Problem Code 6 in OPM 51.

12. End-to-End Test for Ka services is not applicable. End-to-End Test SHO's for Ka services shall be rejected with an OPM 51 Problem Code of 18 (End-to-End Test SHO format error).

13. Shuttle End-to-End Test (EET) services (S-Forward, S-Return, K-Forward, K-Return) shall not be required simultaneously at the same ground terminal and shall be scheduled with separate EET SHO's.

14. In order to prevent RF interference with S-band Command and Telemetry, the following S-band EET frequency ranges are excluded:

    EET Forward ~~2031~~ 2025 to 2041 MHz
    EET Return ~~2206~~ 2200 to 2216 MHz

15. EET Forward and Return frequencies for non-coherent carrier services are constrained as follows:

    [Return Frequency - (240/221) Forward Frequency] $\leq$ 1 MHz (S-Band)

    [Return Frequency - $\left(\frac{1600}{1469}\right)$ Forward Frequency] $\leq$ 1 MHz (K-Band)

    Non-coherent Forward and Return carrier frequencies cannot be reconfigured by more than 1 MHz.

16. Forward EET services shall always be scheduled with Doppler compensation enabled. For Shuttle SSAF EET services, Doppler compensation of both carrier and PN rate shall be scheduled.

17. GRGT will support local end-to-end testing only.

18. In End-to-End Test SHOs the specified PN code shall be ignored. The following PN codes shall be used for End-to-End Test at WSC:

Service	Danzante PN Codes	Cacique/GRGT PN Codes
Multiple Access (MA)/S-Band MA (SMA)	39	26
S-Band Single Access (SSA)	40	27
K-Band Single Access (KSA)	41	28
K-Band Shuttle (KSH)	42	29
S-Band Shuttle (SSH)	3	2

Each TDRS will provide either MA or SMA services but not both, thus only one PN code is required. (See STDN 108 for more details on PN code).

19. Two SGLTs supporting collocated TDRS spacecraft shall support up to the same number and type of EET services as a single SGLT supporting a non-collocated TDRS spacecraft.

2.2.4 Operations Message (OPM) Ground Rules

The following ground rules apply to operation messages:

1. A message (single or multiblock) shall not contain more than one OPM.
2. OPM's sent by the NCC to WSC which require processing shall be contained in one 4800-bit block message. OPM's which do not require processing (text messages) may contain 1 to 15 4800-bit blocks.
3. The reference to a SHO from a service-related OPM is by SHO ID, TDRS ID, and link ID (service support type and subtype).
4. An OPM received at the WSC which references a specific service is valid only for an ongoing service. An OPM which applies to all services in the referenced SHO (i.e., cancel SHO OPM) is valid at any time prior to the termination of the last service in the referenced SHO.
5. NASA has assigned the following numbers:

	SIC	VIC
Danzante	1540	01
Cacique	1373	01
GRGT	1375	01

6. A reacquisition OPM will be rejected if there is an inoperative status indication for any equipment in the string being used for that service and an OPM reject message will be sent to the NCC.
7. All outbound OPM's will be sent to the NCC without TOCC intervention.
8. MA OPMs apply to TDRS A-G only. KaSA and SMA OPMs apply to TDRS H-J only. Incorrectly received OPMs for TDRS capabilities shall be rejected.
9. Return Channel Time Delay (OPM-52) will not be provided for any scheduled GRGT support irrespective of the setting of the RCTD SHO parameter.

10. KaSA User Receive and Transmit Frequency reconfiguration parameters shall fall within the following ranges. Parameter values outside of these ranges shall be rejected.

    User Transmit Frequencies: 25253.4 ± 0.7 MHz to 27478.4 ± 0.7 MHz in 25 MHz steps.

    User Receive Frequencies: 22555.0 ± 0.7 MHz to 23545.0 ± 0.7 MHz in 5 MHz steps.

2.2.5 Operations Data Messages (ODM's) Ground Rules

The following ground rules apply to ODM's:

1. An ODM may consist of 1 to 15 4800-bit data blocks.
2. ODM's are sent to the NCC once every five seconds for ongoing (including End-to-End Test) services only.
3. The first ODM to report on a specific service will be sent within five seconds of the service support start time and the last message to report that service will be sent within five seconds of the service stop time.
4. Separate SA/SMAR, MA/SMAF and End-to-End Test ODMs will be used to report the active services for each TDRS. These ODMs shall not be combined within a single message.
5. An ODM does not require an acknowledgment of message received.
6. An End-to-End Test ODM can report data for up to 4 (two forward, and two return) End-to-End Test services.
7. When an End-to-End Test service is active, an End-to-End Test ODM shall be sent to the NCC in addition to any other SA or MA ODMs.
8. In ODM's, Radio Frequency (RF) beam-pointing data associated with a user are not reported when a End-to-End Test service (for the User) is ongoing. Instead, the RF beam-pointing data reported shall be derived from the simulated user being located at the respective WSC ground termial.
9. In an ODM if a parameter is not applicable, then the value for the parameter will be set to ASCII space.
10. For SQPSK services in which alternate bits/symbols of the I and Q Channels are interleaved to form a single data channel, the Bit Error Rate (BER) status in the ODM's shall be reported under the I Channel.

Note: If this message is to contain a second (and third) state vector, the preceding data items are repeated in order, without the OPM Header.

184	Second State Vector
184	Third State Vector
564	

9.3.3.11 Doppler Compensation Inhibit Request, OPM - Class 11

Forward link Doppler compensation shall be terminated upon receipt of a Doppler compensation inhibit request from the NCC. Within 10 seconds from receipt of this Doppler Compensation Inhibit Request message, OPM - Class 11, a transition profile shall be initiated to slowly change the frequency from the compensate profile to an integer multiple of 221 Hz (S-Band) or 146.9 Hz (Ku-Band). Within an additional 10 seconds, the forward link frequency shall be fixed at a set value where it will remain throughout the remainder of the service unless Doppler compensation is re-enabled. When Doppler compensation is re-enabled via OPM-03, the re-enabling shall be interpreted as requiring a transition profile (analogous to the compensation inhibit profile) to slowly change the frequency from the fixed frequency to the applicable Doppler compensation profile. ~~For Ka-Band the slow transition for Doppler Compensation Inhibit is not required, i.e., the fixed frequency shall be the frequency at receipt of the OPM-11.~~For Ka-Band, the forward link frequency Doppler compensation shall be inhibited within 20 seconds of receipt of the OPM-11 at the DIS, leaving the forward frequency fixed at the frequency of the Doppler compensation profile at the time of inhibition.

NOTE

Forward link Doppler compensation may also be terminated by using a User Reconfiguration, OPM - Class 03, in which "Doppler Compensation Required" is set to "0 = No."

For Shuttle S-Band forward link service, Doppler compensation of the PN rate shall be terminated only upon receipt of a Doppler compensation inhibit request from the NCC.

The message format and fields in this Doppler compensation inhibit request OPM are defined as follows:

# of Bytes	Data Item	
12	OPM Header	
11	OPM Subheader	
1	Doppler Compensation Inhibit 0 = Other than SSA Shuttle 1 = Carrier only 2 = PN rate only 3 = Both carrier and PN rate	} SSA Shuttle
24		

9.3.4.14 Stationkeeping/Momentum Dump Data, OPM - Class 67

~~The format and transmission requirements of this section are applicable to TDRS F1-F7 only. TDRS H, I, J requirements for OPM-Class 67 are TBS.~~ This message shall be sent only to the FDF and the Special Projects and Missions on the TDM lines.

This message shall be manually generated and sent at least one hour prior to burn start time for stationkeeping maneuvers and at least 30 minutes prior to the first thruster action for momentum dump maneuvers. In the event that a stationkeeping maneuver is cancelled after sending the OPM-Class 67, an additional OPM-Class 67 shall be sent with identical values with the exception that the predicted delta velocity components shall be zero. In the event that a momentum dump is cancelled after sending the OPM-Class 67, an additional OPM-Class 67 shall be sent with identical values with the exception that the predicted momentum wheel delta RPM sum and difference shall be zero.

The message shall start in Byte 23 of the 4800 bit block. Bytes 19 through 22 shall contain zeros. The message structure is:

9.3.4.14.1 TDRS F1-F7 Format

This section describes the OPM Class 67 format for TDRS F1-F7.

# of Bytes	Data Item
2	Message Type 03
	Message Date/Time:
2	Year
3	Day
2	Hour
2	Minute
1	Message Source 0 = Danzante 1 = Cacique/GRGT
2	Message Class 67
4	TDRS SIC (1300-~~1399~~1306)
1	Activity 0 = Stationkeeping 1 = Momentum Dump

	Planned Start Time	Stationkeeping:
3	Day	Accurate to within
2	Hour	± 1 second
2	Minute	Momentum Dump:
2	Second	Accurate to within ± 10 minutes
	Planned Stop Time	Stationkeeping:
3	Day	Accurate to within
2	Hour	± 1 second
2	Minute	Momentum Dump:
2	Second	Accurate to within ± 10 minutes

This page intentionally left blank.

# of Bytes	Data Item	
	Predicted Momentum Wheel	Accurate to ± 20%
7	1) Delta RPM Sum	(± 000.00 to ± 999.00)
7	2) Delta RPM Difference	(± 000.00 to ± 999.00)
140		

9.3.4.14.2 TDRS HIJ Format

This section describes the OPM Class 67 format for TDRS HIJ.

# of Bytes	Data Item
2	Message Type
	03
	Message Date/Time:
2	Year
3	Day
2	Hour
2	Minute
1	Message Source
	0 = Danzante
	1 = Cacique/GRGT
2	Message Class
	67
4	TDRS SIC (1307-1309)
1	Activity
	0 = Stationkeeping
	1 = Momentum Dump
	Planned Start Time
3	Day
2	Hour
2	Minute
2	Second

	Planned Stop Time
3	Day
2	Hour
2	Minute
2	Second

Stationkeeping Information (Zeros if momentum dump)

# of Bytes	Data Item	
	Predicted Thruster Configuration	
4	1) ID #1	(0,A-Z,0-9,0)
4	2) ID #2	(0,A-Z,0-9,0)
4	3) Spare	(Zeros)
4	4) Spare	(Zeros)
	Predicted Delta Velocity (m./sec.)	
8	1) Body R	(± 00.0000 ± 99.9999)
8	2) Body I	(± 00.000 to ± 99.9999)
8	3) Body C	(± 00.0000 to ± 99.9999)

Momentum Dump Information (Zeros if stationkeeping)

# of Bytes	Data Item	
1	Dump Type	
	0 = roll/yaw	
	1 = pitch	
	Predicted Thruster Configuration	
4	1) ID #1	(0,A-Z,0-9,0)
4	2) ID #2	(0,A-Z,0-9,0)
4	3) Spare	(Zeros)
4	4) Spare	(Zeros)
2	Spare (Zeros)	
	Predicted Start Momentum (N-m-s)	
5	1) Hx	(0.00 ± 10.0)
5	2) Hy	(-61.0 ± 12.0)
5	3) Hz	(0.00 ± 10.0)

	Predicted Stop Momentum (N-m-s)	
5	1) Hx	(0.00 ± 10.0)
5	2) Hy	(-61.0 ± 12.0)
5	3) Hz	(0.00 ± 10.0)
14	Spare (Zeros)	
140		

9.4 Message Subfield for SLR's (Service Level Status Report)

The WSC service level status information shall be sent from the WSC to the NCC in the form of service level status report (SLR's) as changes in equipment status occur or as requested verbally by the NCC. The service level status information for GRGT will be provided within Cacique SLRs in the SGLT 3 Service Chains and the End-to-End 3 Ground Antenna data items. The GRGT 11-m ground antenna service level status information will be provided using an OPM-54.

9.4.1 SLR Header

The SLR provides the service availability of each WSC ground terminal to the NCC for user service scheduling. SLR's shall be sent to the NCC (1) upon verbal request from the NCC, (2) upon change in any reported parameter within 15 minutes of the change.

The structure of an SLR header is:

(Byte #s)	(# of Bytes)	Data Item
23-24	2	Message type 1 = Tracking Data 2 = SHO - Routine 3 = OPM => 4 = SLR 5 = SA/SMAR Operations Data 6 = MA/SMAF Operations Data 7 = End-to-End Test Operations Data 8 = SHO - Periodic
25-31	7	SLR ID - A seven-digit number. SLR's shall be sequentially numbered in the order sent.*

* SLR's which are sent for an equipment status change shall be numbered from 1 to 4,999,999 to 1. SLR's which are sent in response to a NCC request shall be numbered from 5,000,000 to 9,999,999 to 5,000,000

(Byte #s)	(# of Bytes)	Data Item
32	1	SLR Type 0 = Report caused by change in equipment status 1 = Report by the NCC Verbal request
		Date/Time of SLR:
33-34	2	Year
35-37	3	Day
38-39	2	Hour
40-41	2	Minute
42-43	2	Second
	21	

# of Bytes	Data Item
8	Sync Lock Dropout Count (for 5 second reporting interval) 00000000 - 99999999
4	Frame Sync Word BER (at ODM time tag) XEYY (exponent is assumed negative)
19	

9.5.2.9 SA/SMAR ODM Subheader No. 9

The structure of this subheader is:

# of Bytes	Data Item
1	Receiver Configuration 0 = Normal 1 = Cross-support
1	Doppler Tracking Status 0 = Inactive 1 = One-way 2 = Two-way 3 = Cross-support
	Data for SSA1/SMAR (1-5):*
1	IR Lock Indicator 0 = No Lock 1 = Lock
5	IR Signal Strength C/N_o (LSB = 0.1 dB-Hz)**
1	SMA Return Link ID (1-5) (obtained from SHO)
1	SMA Return Link ID (1-~~5~~6) (ID of SMAR equipment string including receiver)

* Data for SSA1 and SMAR service will appear under SSA1. Data for SSA2 service will appear under SSA2, except for "deinterleaving selection," which is common to both SSA1, SSA2 and SMAR. For SSA1/SMAR services the first 18 bytes and the Deinterleaving selection byte of SA/SMAR ODM Subheader No. 9 are applicable. For SSA2 services the first 2 bytes, and bytes 19 through 35 of SA/SMAR ODM Subheader No. 9 are applicable. All non-applicable bytes are set to ASCII space (Ground Rule 9 in Section 2.2.5). For SSA combining all bytes of SA/SMAR ODM Subheader No. 9 are applicable. It is understood that, depending on the SSA combining approach, some parameters in the SSA1/SMAR and SSA2 fields will be identical, i.e., from the same indicators. Data for SSA combining service will appear under both SSA1/SMAR and SSA2.

** When the I or Q Channel BER Status equals 7 or 8, the reported C/N_o will be a minimum.

9.5.3.11 SSA2 Shuttle Return

This ODM structure is the same as that for SSA1 shuttle return (9.5.3.7), except that the service support subtype in Subheader No. 1 equals 2.

9.5.3.12 Deleted

9.5.3.13 KSA1~~/KaSA1~~ DG1 Return

# of Bytes	Data Item
28	SA/SMAR ODM Subheader No. 1
16	SA/SMAR ODM Subheader No. 3
4	SA/SMAR ODM Subheader No. 4
8	SA/SMAR ODM Subheader No. 5
4	SA/SMAR ODM Subheader No. 6
4	SA/SMAR ODM Subheader No. 7
38	SA/MA/SMA ODM Subheader No. 8
~~1~~	~~Autotrack Status~~ ~~0 = Disabled~~ ~~1 = No signal presence indication~~ } ~~Search Mode~~ ~~2 = Signal presence - no zero crossing~~ ~~3 = Zero crossing - both axes~~ ~~4 = Autotrack - fine pointing mode~~ } ~~Enabled~~

(TDRS F1-F7)	Autotrack Status	(TDRS H,I,J)	
Disabled	= 0 =	Disabled	
No signal presence	= 1 =	No signal presence	Search Mode
Signal presence – no zero crossing	= 2 =	Signal presence	Search Mode
Zero crossing – both axes	= 3 =	N/A	Enabled
Autotrack – fine pointing mode	= 4 =	Autotrack – zero crossing both axes	Enabled

6	Spare
109	

9.5.3.14 KSA1/KaSA1 DG2 Return

# of Bytes	Data Item
28	SA/SMAR ODM Subheader No. 1
16	SA/SMAR ODM Subheader No. 3
4	SA/SMAR ODM Subheader No. 4
8	SA/SMAR ODM Subheader No. 5
4	SA/SMAR ODM Subheader No. 6
38	SA/MA/SMA ODM Subheader No. 8
~~1~~	~~Autotrack Status~~ ~~0 = Disabled~~ ~~1 = No signal presence indication~~ ~~2 = Signal presence - no zero crossing~~ ~~3 = Zero crossing - both axes~~ ~~4 = Autotrack - fine pointing mode~~ ~~} Search Mode } Enabled~~
6	Spare
1	DG2 Modulation 0 = QPSK 1 = BPSK
1	Receiver Coherency Indicator* 0 = Noncoherent 1 = Coherent
1	Spare
108	

(TDRS F1-F7)	Autotrack Status	(TDRS H,I,J)	
Disabled	= 0 =	Disabled	
No signal presence	= 1 =	No signal presence	} Search Mode
Signal presence – no zero crossing	= 2 =	Signal presence	
Zero crossing – both axes	= 3 =	N/A	} Enabled
Autotrack – fine pointing mode	= 4 =	Autotrack – zero crossing both axes	

* This is an indicator of the user's carrier mode, i.e., coherent or noncoherent, as specified in the SHO or OPM-03.

9.5.3.15 KSA1 Shuttle Return

# of Bytes	Data Item
28	SA/SMAR Subheader No. 1
57	SA/MA/SMA ODM Subheader No. 8
~~1~~	~~Autotrack Status~~ ~~0 = Disabled~~ ~~1 = No signal presence indication~~ ~~2 = Signal presence - no zero crossing~~ ~~3 = Zero crossing - both axes~~ ~~4 = Autotrack - fine pointing mode~~

~~Search Mode~~ ~~Enabled~~

(TDRS F1-F7)	Autotrack Status	(TDRS H,I,J)
Disabled	= 0 =	Disabled
No signal presence	= 1 =	No signal presence
Signal presence – no zero crossing	= 2 =	Signal presence
Zero crossing – both axes	= 3 =	N/A
Autotrack – fine pointing mode	= 4 =	Autotrack – zero crossing both axes

Search Mode

Enabled

1	Receiver Coherency Indicator* 0 = Noncoherent 1 = Coherent
1	Doppler Tracking Status 0 = Inactive 1 = One-way 2 = Two-way
1	HDRR Lock Indication for Mode 1 0 = No Lock 1 = Lock
5	Spare
1	IR Lock Indication for Mode 1 or Mode 2 0 = No Lock 1 = Lock
5	IR Signal Strength Indication for Mode 1 or Mode 2 C/N_O (LSB = 0.1 dB-Hz)**
1	Symbol Synchronizer Lock Indication - Mode 1 or Mode 2, Channel 1 0 = No Lock 1 = Lock

* This is an indicator of the user's carrier mode, i.e., coherent or noncoherent, as specified in the SHO or OPM-03.

** When the IR E_b/N_o estimate exceeds 12 dB, the reported C/N_o will be a minimum.

# of Bytes	Data Item
1	Shuttle Mode 1 = Mode 1 2 = Mode 2, Channel 3-Digital 3 = Mode 2, Channel 3-Analog 4 = Mode 2, Channel 3-TV
9	Spare
117	

9.5.3.16 Deleted

9.5.3.17 KSA2~~/KaSA2~~ DG1 Return

This ODM structure is the same as that for KSA1~~/KaSA1~~ DG1 return (9.5.3.13), except that the service support subtype in Subheader No. 1 equals 4~~ or 7~~. ~~as applicable.~~

9.5.3.18 KSA2/KaSA2 DG2 Return

This ODM structure is the same as that for KSA1/KaSA1 DG2 return (9.5.3.14), except that the service support subtype in Subheader No. 1 equals 4 or 7 as applicable.

9.5.3.19 KSA2 Shuttle Return

This ODM structure is the same as that for KSA1 shuttle return (9.5.3.15), except that the service support subtype in Subheader No. 1 equals 4.

9.5.3.20 Deleted

9.5.4 MA/SMAF ODM Header

The structure of the MA/SMAF ODM Header is:

Byte #	# of Bytes	Data Item
23-24	2	Message Types 1 = Tracking Data 2 = SHO - Routine 3 = OPM (Operations Messages) 4 = SLR (TDRSS Service Level Status) 5 = SA/SMAR Operations Data => 6 = MA/SMAF Operations Data 7 = End-to-End Test Operations Data 8 = SHO - Periodic

ODM	Operations Data Messages
OPM	Operations Messages
PDA	Pin Diode Attenuator
PEFOV	Preliminary Elliptical Field of View
PM	Preventative Maintenance
PMMS	Performance Measuring and Monitoring Subsystem
PTE	PMMS Test Equipment
Q	Quadrature (channel)
QPSK	Quadrature Phase Shift Keying
RCP	Right-Hand Circular Polarization
RF	Radio Frequency
SA	Single Access
SDU	Signal Distribution Unit
SGLT	Space Ground Link Terminal
SHO	Schedule Order
SIC	Support Identification Code
SLR	Service Level Report
SMA	S-Band Multiple Access
SMAF	S-Band Multiple Access Forward
SMAR	S-Band Multiple Access Return
SQPSK	Staggered Quadrature Phase Shift Keying
SRP	Service Reconfiguration Period
SRDP	Shuttle Return Data Processor
SSA	S-Band Single Access
SSAF	S-Band Single Access Forward
SSAR	S-Band Single Access Return
SSH	S-Band Shuttle
SUE	Shuttle-Unique Equipment
SUPIDEN	Support Identifier
TDM	Tracking Data Messages

S-Band Multiple Access refers to the MA services provided by TDRSs with ID's 1307, 1308 or 1309.