NASA/GSFC	MISSION OPERATIONS & DATA SYSTEMS DIRECTORATE (MO&DSD) CONFIGURATION CHANGE REQUEST (CCR)			
1. CCR NO. 8136	CCR-405-ICD-02	**2. DATE** July 17, 1998	**3. PRIORITY** ☐ EMERGENCY ☐ URGENT ■ ROUTINE	**4. CHANGE LEVEL** ☐ A ☐ B ☐ C ■ D ☐ E ☐ F

5. TITLE OF CHANGE

Update to Reflect HIJ CDR Baseline Design (ECP-27)

6.

DOCUMENT TITLE Interface Control Document (ICD) between the Network Control Center (NCC)/Flight Dynamics Facility (FDF) and the White Sands Complex (WSC) for the TDRS HIJ Era

DOCUMENT NO. 405-TDRS-RP-ICD-001, 12/95

LIST ALL AFFECTED DOCUMENTS INCLUDING PROCEDURES 530-NCC-FDF/WSC ICD, Rev. 5

(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 iv, v, xii, 2-7, 2-7a, 2-7b, 2-11, 2-12, 2-12a, 2-12b, 2-13, 2-13a,2-13b, 2-14, 2-14a, 2-14b, 9-52, 9-65, 9-66, 9-67, 9-67a, 9-67b, 9-83, 9-91, 9-92, 9-93, 9-95, AB-3

(CONT ON ATTACHMENT)

9. IMPACT

YES	NO	
☐	■	SCHEDULE
☐	■	BUDGET
☐	■	FACILITIES
☐	■	TESTING
☐	■	TRAINING
☐	■	SPECIFICATIONS
☐	■	CONTRACTOR SUPPORT
■	☐	INTERFACES

SYSTEM

YES	NO	
☐	■	RELIABILITY/MAINTAINABILITY/SAFETY
☐	■	USER SERVICES/MANUALS
☐	■	RISK MANAGEMENT
☐	■	SECURITY
☐	■	USAF FUNDING REQ'D
☐	■	POWER
☐	■	WEIGHT

YES	NO	
■	☐	GROUND SEGMENT
☐	■	SPACE SEGMENT
☐	■	LOGISTICS
■	☐	DOCUMENTATION
☐	■	HARDWARE
☐	■	SOFTWARE
☐	■	OTHER

ORGANIZATIONAL

YES	NO		YES	NO	
☐	■	501	■	☐	530
☐	■	502	☐	■	540
☐	■	503	☐	■	550
☐	■	510	☐	■	560
☐	■	520	■	☐	OTHER

Code 405

YES	NO	
☐	■	MSFC
☐	■	JSC
☐	■	LERC
☐	■	KSC
☐	■	JPL

YES	NO	
☐	■	CODE E
☐	■	CODE S
☐	■	CODE T
☐	■	OTHER

10. COMMENTS

	SIGNATURE	DATE
STel ANALYST		
HARDWARE ENGINEER		
OPERATIONS REPRESENTATIVE		
SYSTEMS ENGINEER		
I AND T MANAGER		

CONCURRENCE:

CODE 285

DATE

11. BOARD ACTION

☐ APPROVED ☐ WITHDRAWN
☐ DISAPPROVED ☐ DEFERRED UNTIL _____

12. DIRECTION/ACTION REQUIRED

☐ ECP ☐ TECH DIRECTION ☐ CONTRACT MOD
☐ WAIVER ☐ PUBLISH DOCUMENT ☐ PUBLISH DCN
☐ DEVIATION ☐ C.O. LETTER ☐ OTHER _____

13. ORIGINATOR D. Littmann x7643 CODE 451

SIGNATURE _____ DATE _____

14. SEGMENT MANAGER'S APPROVAL CODE _____

SIGNATURE _____ DATE _____

15. CCB APPROVAL

SIGNATURE _____ DATE _____

16. CCR IMPLEMENTED

ATR SIGNATURE _____ DATE _____

CCB SIGNATURE _____ DATE _____

Change Information Page

List of Effective Pages	
Page Number	**Issue**
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ii through xiii	Original
1-1 through 1-2	Original
2-1 through 2-14	Original
3-1 through 3-3/3-4 (blank)	Original
4-1 through 4-3/4-4 (blank)	Original
5-1/5-2 (blank)	Original
6-1 through 6-3/6-4 (blank)	Original
7-1/7-2 (blank)	Original
8-1/8-2 (blank)	Original
9-1 through 9-106	Original
10-1/10-2 (blank)	Original
11-1/11-2 (blank)	Original
12-1 through 12-21/12-22 (blank)	Original
13-1 through 13-3/13-4 (blank)	Original
AB-1 through AB-5/AB-6 (blank)	Original

Document History			
Document Number	**Status/Issue**	**Publication Date**	**CCR Number**
405-TDRS-RP-ICD-001	Original	8 December 1995	
405-TDRS-RP-ICD-001	SCN-01	30 June 1998	CCR-405-ICD-02/ TDRS Project CCR 8136

Change Record

Issue	Date	Affected Contents	Authority
SCN-01	30 June 1998	SCN-01 incorporated ECP 027 SCN-01 changes are highlighted on the pages as follows: ECP-027 – pages iv, v, xii, 2-7, 2-7a, 2-7b, 2-11, 2-12, 2-12a, 2-12b, 2-13, 2-13a, 2-13b, 2-14, 2-14a, 2-14b, 9-52, 9-65, 9-66, 9-67, 9-67a, 9-67b, 9-83, 9-91, 9-92, 9-93, 9-95, AB-3	TDRS Project CCR 8136

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Section 10. Polynomial Encoding And Decoding

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Section 11. Support Identifier Code (SUPIDEN)

2. The user will remain in the real-time mode until completion of 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 STGT will notify the NCC when a user enters and exits the real-time mode.

4. Acknowledgement of all blocks of a maneuver sequence shall be requested if the epoch of the Type 4 vector is more than 7 minutes later than start of transmission. If the epoch of the Type 4 is less than 7 minutes later than start of transmission, only the blocks containing the type 4 vector and the type 5 vector shall request acknowledgement.

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 passes the epoch of the last maneuver sequence vector at the STGT, 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 STGT.

3. Routine SHOs (type 2, Classes 1 and 3) 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 STGT. These SHOs will be rejected (OPM-51, Problem Code 1) if a service start time is less than five minutes from receipt at STGT.

4. Shuttle does not currently use ~~MA~~ KaSA, SMA, MA or cross-support services.~~, and therefore does not use cross-support.~~ All ~~MA~~ KaSA, SMA, 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, ~~The~~ 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:

$t\ (\text{sec.}) = 50 + \theta/0.325$

where:

θ is the track-to-track slew angle (degrees) or 120 seconds, whichever is greater.

(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.

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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. 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.)

47. 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.

48. 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. Shuttle End-to-End Test and pre-service test shall not overlap on the same SA antenna on any TDRS, e.g., if Shuttle End-to-End Test services are on-going on SGLT1 SA-1, then in order to avoid conflict, schedule overlapping Shuttle pre-service tests on SA-2 of SGLT1, 2 or 3, i.e., not on SA-1 of SGLT2 or 3. Shuttle SHO's shall not be rejected if End-to-End Tests and pre-service tests overlap, i.e., the Shuttle SHO shall be serviced without pre-service test.
7. End-to-End Test services which use forward and return data from NASA shall be reconfigurable by OPM classes 02 (return only), 03, and 11. Local mode End-to-End Tests shall not be reconfigurable.
8. Shuttle End-to-End Tests shall be supported only in the local mode.

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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. These EET services 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. 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 STGT 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 STGT 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.

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5. NASA has assigned the following numbers:

	SIC	VIC
STGT	1540	01
WSGTU	1373	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 TOCC2 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. 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 STGT.

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.

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# of Bytes	Data Item
2	Carriage Return*
2	Line Feed*
5	End of Message:*
	I T E R M } Fixed Code
1	Delete Character*
4	Origination ID*
2	Carriage Return*
2	Line Feed*
196	

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.

* See last textual paragraph of 9.3.3.10.

9.3.4.13 Time Transfer, OPM - Class 66

This message shall be used to provide time transfer data to the NCC. This message shall be transmitted to the NCC within 1 minute of termination of service for which time transfer was requested in the SHO. Multiple blocks may be required.

# of Bytes	Data Item
12	OPM Header
11	OPM Subheader
4	Forward PN time delay (Binary, LSB = 10 nanoseconds)
4	Return PN time delay (Binary, LSB = 10 nanoseconds)
1	Number of Time Transfer Samples (Binary, 20 - 255)
5	NASA PB-1 Time Sample (Binary)
1	Receiver PN Lock 0 = No Lock 1 = Lock
3	Forward Delta Time (Binary, LSB = 200 nanoseconds)
3	Return Delta Time (Binary, LSB = 200 nanoseconds)
32 + 12n	Repeat last 12 bytes for each measurement

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 manually generated and sent at least one hour prior to the first thruster action for stationkeeping maneuvers or at least 30 minutes prior to the first thruster action for momentum dump maneuvers. This message shall start in Byte 23 of the 4800 bit block. Bytes 19 through 22 shall contain zeros. This message shall be sent only to the LI on the LI TDM lines.

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

# of Bytes	Data Item
1	Message Source 0 = STGT 1 = WSGTU
2	Message Class 67
4	TDRS SIC (1300-~~1399~~1306)
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	(±,A-Z,0-9,A-Z)
4	2) ID #2	(±,A-Z,0-9,A-Z)
4	3) Spare	(Zeros)
4	4) Spare	(Zeros)
	Predicted Delta Velocity (ft./sec.)	
8	1) Body R	(±00.0000 to ±99.9999)
8	2) Body I	(±00.0000 to ±99.9999)
8	3) Body C	(±00.0000 to ±99.9999)

Momentum Dump Information (Zeros if stationkeeping)

1	Dump Type 0 = roll/yaw 1 = pitch

# of Bytes	Data Item	
	Predicted Thruster Configuration	
4	1) ID #1	(±,A-Z,0-9,A-Z)
4	2) ID #2	(±,A-Z,0-9,A-Z)
4	3) Spare	(Zeros)
4	4) Spare	(Zeros)
	Predicted Pulse	
2	Count (00-99)	
	Predicted Start Momentum (Newtons/sec^2)	
5	1) Hx	($\pm$0.00 to $\pm$1.00)
5	2) Hy	($\pm$0.00 to $\pm$1.00)
5	3) Hz	($\pm$0.00 to $\pm$1.00)
	Predicted Stop Momentum (Newtons/sec^2)	
5	1) Hx	($\pm$0.00 to $\pm$1.00)
5	2) Hy	($\pm$0.00 to $\pm$1.00)
5	3) Hz	($\pm$0.00 to $\pm$1.00)
	Predicted Momentum Wheel	
7	1) Delta RPM Sum	($\pm$000.00 to $\pm$999.00)
7	2) Delta RPM Difference	($\pm$000.00 to $\pm$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 = STGT
	1 = WSGTU
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 to ± 99.9999)
8	2) Body I	(± 00.0000 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 STGT service level status information shall be sent from the STGT 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.

9.4.1 SLR Header

The SLR provides the service availability of the STGT 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.

# 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~~ ~~2 = Signal presence - no zero crossing~~ ~~3 = Zero crossing - both axes~~ ~~4 = Autotrack - fine pointing mode~~
6	Spare
109	

~~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

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~~
6	Spare
1	DG2 Modulation 0 = QPSK 1 = BPSK
1	Receiver Coherency Indicator* 0 = Noncoherent 1 = Coherent
1	Spare
108	

~~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

* 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
25-31	7	ODM ID The ID is a seven digit number. ODM's shall be sequentially numbered in the order sent, 1 to 9,999,999 to 1

LSD	Logistics Support Depot
LSD	Least Significant Digit
MA	Multiple Access
MAF	Multiple Access Forward
MAR	Multiple Access Return
Mbps	Megabits Per Second
MCC	Message Class Codes
MDM	Multiplexer/Demultiplexer
MHz	Mega Hertz
MO&DSD	Mission Operations and Data Systems Directorate
MS	Mission Support
MSB	Most Significant Bit
MSD	Most Significant Digit
MSM	Maintenance and Software Delivery Mode
MUX	Multiplexer
NASA	National Aeronautics and Space Administration
NASCOM	NASA Communications Network
NCC	Network Control Center
NCCDS	Network Control Center Data System
ND	Networks Division
NGT	NASA Ground Terminal
NRZ	Non-Return to Zero
NRZ-L	Non-Return to Zero-Level
NRZ-M	Non-Return to Zero-Mark
NRZ-S	Non-Return to Zero-Space
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 Subsys