Mariner Mars 1971 Mission Support

R. P. Laeser
Mission Support Office

Implementation schedule tradeoffs caused the actual DSN configuration for support of Mariner *Mars 1971 launch/midcourse/cruise to be significantly different from the original plans. This article describes the actual configuration by network system.*

In previous articles, the configuration of the six DSN systems for support of the *Mariner* Mars 1971 Mission were described. Confronted with the realities of implementation problems, slipped schedules, and launch dates, a reduced set of the most critical capabilities and a corresponding configuration were defined and are included here. Table 1 and Figs. 1 and 2 apply to the telemetry system; Table 2 and Fig. 3 to the command system; Table 3 and Figs. 4 and 5 to the tracking system; Table 4 and Fig. 6 to the monitor system; and Table 5 and Fig. 7 to the operations control system. The simulation system is not covered, because it plays no role in operations support. For each capability listed in a table, a figure reference is given to the corresponding element on the cross-referenced figure; in some cases the blocks on a figure are numbered and the figure reference 2-(1) is interpreted as Fig. 2, Block (1).

Table 1. Telemetry system

Launch/cruise capabilities	Figure reference
A. DSIF	
1. Multi-mission telemetry hardware (including receiver (RCV), subcarrier demodulation assembly (SDA), symbol synchronizer assembly (SSA), and Telemetry and Command Processor (TCP) with its GCF interface and interface with the receiver for (AGC)	1
a. At DSS 12, 41, and 51	1
b. At DSS 71	1
2. TCP telemetry software operating at DSS 12, 41, and 51:	
a. Acquire engineering or CC&S telemetry from SDA and perform bit sync at 8⅓ or 33⅓ bps	1-TCP
b. Format telemetry and output on high speed data line to SFOF	1-TCP
c. Frame sync engineering telemetry, decommutate and output to SFOF on TTY	1-TCP
d. Acquire ground AGC and SNR, convert to db, and transmit to SFOF via high speed	1-TCP
e. Acquire receiver, subcarrier demodulation, and bit sync lock status and transmit to SFOF via high speed	1-TCP
f. Acquire and send to station Monitor computer; spacecraft AGC and SPE, configuration changes, alarms and SNR in db	1-TCP
g. Record all received data on a digital Original Data Record	1-TCP
h. Playback portions of ODR to SFOF via high speed	1-TCP
i. a through h at DSS 71	1-TCP
j. Operate simultaneously with TCP command capabilities	1-TCP
3. Provide analog recording of receiver and subcarrier demodulation assembly outputs	1
B. GCF	
1. High speed data (4800 bps) system to SFOF from DSS 12, 41, and 51	1-HSD
2. Teletype to SFOF from DSS 12, 41, and 51	1-TTY 1
3. Internal SFOF teletype distribution of 360/75 formatted data	1-TTY 2
4. Closed circuit TV distribution of DTV formatted telemetry	1-CCTV
5. 1 and 2 for DSS 71 and 2 for MSFN stations	1
C. SFOF	
1. Hardware	
a. 360/75 computer and GCF interface	1
b. Digital TV and its 360/75 interface	1-DTV
c. 2260 (manual input, CRT display)	1-2260
d. Digital TV format request box	1-FRB
e. 1443 line printer	1-1443
f. 2501 card readers	1-2501
2. 360/75 telemetry software for engineering and CC&S data:	
a. Receive high speed data blocks, log, extract bit stream and status information, and frame sync data	2-(1)
b. Automatic selection of best data stream	2-(2)
c. Generate system data record (SDR)	2-(6)
d. Decommutate	2-(3)
e. Perform conversion to engineering units	2-(4)
f. Alarm on supplied alarm limits	2-(4)
g. Perform data suppressions and suppression tolerance tests	2-(4)
h. Perform data averaging	2-(4)
i. Format for 1443 display	2-(5)
j. Format for digital TV display—alphanumeric	2-(5)
k. Format for teletype character printer display	2-(6)
l. Recall data from SDR for display—limited to last 24 hours	2
m. Execute format request box inputs	1-FBB
n. Perform COMGEN mask/CC&S data comparison	1-360
3. Digital TV software	1-DTV
4. Operate simultaneous with other Systems in same 360/75	1-360

Table 2. Command system

Launch/cruise capabilities	Figure reference
A. DSIF	
1. Multi-mission command hardware (including all TCP and GCF interface hardware)	
a. At DSSs 12, 41, and 51	3
b. At DSS 71	3
2. TCP command software operating at DSSs 12, 41, and 51	
a. Configure multi-mission command hardware according to message from SFOF via high speed	3-TCP
b. Locally configure multi-mission command hardware	3-TCP
c. Accept message and transmit verification via high speed	3-TCP
d. Accept and act on enable/disable high speed messages	3-TCP
e. Transmit command at appropriate times to spacecraft	3-TCP
f. Bit-by-bit check for abort	3-TCP
g. Transmit to SFOF confirm or abort message via high speed	3-TCP
h. Local display of alarms and confirm/abort messages	3-TCP
i. Transmit alarms to SFOF	3-TCP
j. Command stack recall	3-TCP
k. Generate Original Data Record (ODR)	3-TCP
l. a through k at DSS 71	3-TCP
m. Local entry of command message and enable/disable message	3-TCP
n. Configuration and standards and limits recall to SFOF	3-TCP
o. Compare status with standards and limits and alarm/abort as specified	3-TCP
3. Analog recording of command modulation waveform	3
4. Command capability at Ascension MSFN using RWV	—

Launch/cruise capabilities	Figure reference
B. GCF	
1. High speed data (4800 bps) system between SFOF and DSSs 12, 41, and 51	3
2. Teletype between SFOF and DSSs 12, 41, 51, and ACN	3
3. Internal SFOF teletype distribution of 360/75 formatted data	1-TTY
4. Voice between SFOF and DSSs 12, 41, 51, and ACN	—
5. 1 through 4 at DSS 71	3
C. SFOF	
1. Hardware	
a. 360/75 computer and GCF interface	3-360
b. Digital TV and its 360/75 interface	3-DTV
c. 2260 (manual input, CRT display)	3-2260
d. 2501 (card readers)	3-2501
2. 360/75 command software	
a. Accept and transmit manually input commands—pseudo-octal	3-360
b. Accept and transmit manually input commands—alphanumeric	3-360
c. Accept and transmit files of commands from COMGEN or card entry	3-360
d. Display verification—TTY	3-360
e. Display verification—DTV	3-360
f. Automatic verification and enable	3-360
g. Accept and transmit enable/disable	3-360
h. Display confirm/abort—TTY	3-360
i. Display confirm/abort—DTV	3-360
j. Display alarms	3-360
k. TCP command stack recall and display	3-360
l. Recall DSS configuration and standards and limits, and display	3-360
m. Accept and transmit DSS configuration and standards and limits	3-360
n. Generate system data record (SDR)	3-360
3. Digital TV software	3-DTV

Table 3. Tracking system

Launch/cruise capabilities	Figure reference
A. DSIF	
1. Acquire doppler, angles, and (lunar distance) range data; format and transmit to SFOF from DSSs 12, 41, and 51 via teletype	4-TDH
2. Acquire doppler, (planetary distance) range, and DRVID data at DSS 14; format for teletype and transmit to SFOF	4-TDH
3. Provide 20 μsec inter-station time synchronization	—
B. GCF	
1. Teletype between SFOF and DSSs 12, 41, 51, 14	4-TTY
2. Teletype between SFOF and MSFN ACN	—
3. Closed circuit TV distribution of tracking DTV formats	4-CCTV
C. SFOF	
1. Hardware	
a. 360/75 computer and GCF teletype interfaces	4-360
b. Digital TV and its 360/75 interface	4-DTV
c. 1443 line printer	4-1443
2. 360/75 tracking software	
a. Acquire tracking data from DSIF via GCF and create SDR	5-(1)
b. Same as for MSFN data	5-(1)
c. Transfer SDR to 1108 via tape	5
d. Acquire spacecraft ephemeris from 1108 via tape	5
e. Generate predictions of DSS observables and format for high speed or TTY transmission to DSS for local printout, and for pseudo-residual use (predicts)	5-(3)
f. Difference predictions with actual data as it is received and displayed (pseudo-residuals)	5-(2)
g. Provide real-time accountability of received data	5-(1)
3. Digital TV software	4-DTV

Table 4. Monitor system

Launch/cruise capabilities	Figure reference
A. DSIF (DSS 12, 41, 51)	
1. Acquire hardware/software status in real-time from other DSIF subsystems	6-DIS
2. Compare status with standards and limits, and alarm if necessary	6-DIS
3. Provide local display of DSS status and alarms	6-DIS
4. Transmit required subset of DSS status to SFOF	6-DIS
5. Encode accounting and status data from the GCF station communications terminal, and transmit to SFOF	6-DIS
6. Accept tracking predicts and generate pseudo-residuals as part of 2	6-DIS
7. 1 through 4 for DSS 71 and 1 through 5 for DSS 14	6-DIS
B. GCF	
1. High-speed data between SFOF and DSS 12, 41, 51	6-HSD_1
2. Transmit high-speed data blocks to 360/75 containing high-speed data accounting and status	6-HSD_2
3. 1 and 2 for DSS 71 and 14	6
4. Automatically display GCF accounting and status on closed-circuit TV	6
5. Provide 360/75 driven character printer for alarms	6-CP
C. SFOF	
1. Hardware	
a. 360/75 computer and GCF interface	6-360
b. Digital TV, its 360/75 interface, and format request boxes	6-DTV
c. 1443 Line printer	6-1443
d. 2260 (manual input, CRT display)	6-2260
2. 360/75 SFOF monitor software	
a. Accept status data from SFOF telemetry, command, and tracking software	6-360
3. 360/75 DSN monitor software	
a. Accept DSIF and GCF monitor data via high speed, and data from SFOF monitor software	6-360
b. Assemble monitor criteria data and use to generate alarms	6-360
c. Display alarms on digital TV and character printer	6-360
d. Provide real-time network status/configuration on digital TV	6-360
4. Digital TV software	6-DTV

Table 5. Operations control system

Launch/cruise capabilities	Figure reference
A. DSIF	
1. Display on line printer sequences of events, schedules, and predictions received from SFOF via high speed (DSSs 12, 41, 51)	7-DIS
2. Display on TTY character printer schedules and predictions received from SFOF via teletype (DSSs 12, 41, 51)	7
3. 1 and 2 for DSSs 71 and 14	7
B. GCF	
1. High-speed data between SFOF and DSS 12, 41, 51	7
2. Same for DSSs 71, 14	7
3. Teletype between SFOF and DSS 12, 41, 51	7
4. Same for DSSs 71, 14	7
C. SFOF	
1. Hardware	
a. 360/75 computer and GCF interface	7-360
2. 360/75 Operations Control software	
a. Sequence of events generation program, real-time (launch/cruise version with limited capabilities)	7-360
b. Control output routing of sequence of events, schedules, and predictions to DSS via high-speed data	7-360
c. Control output routing of schedules and predictions via teletype	7-360
3. Rapid recovery from failures	7-360

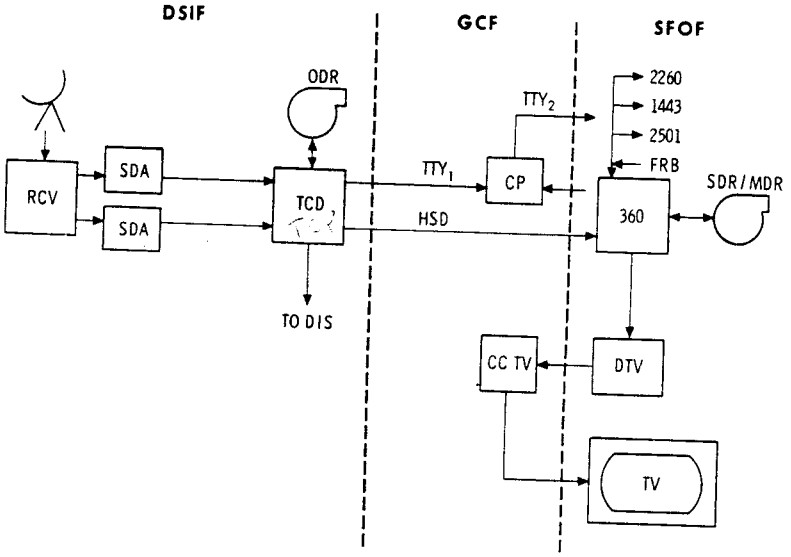

Fig. 1. Telemetry system

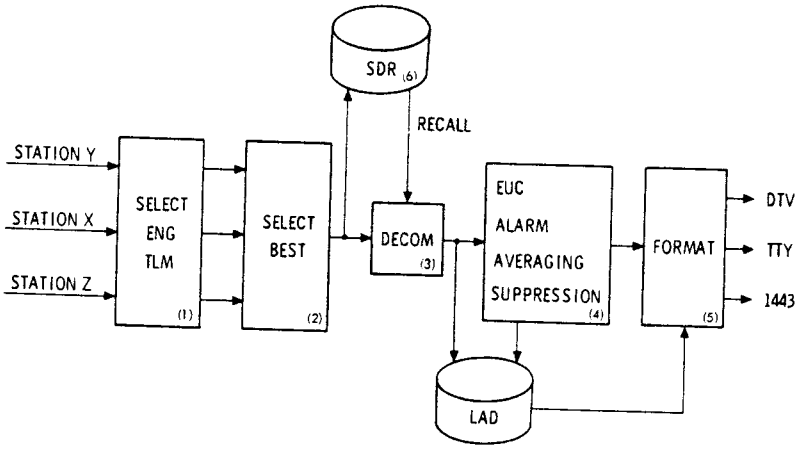

Fig. 2. Telemetry inside the 360 computer

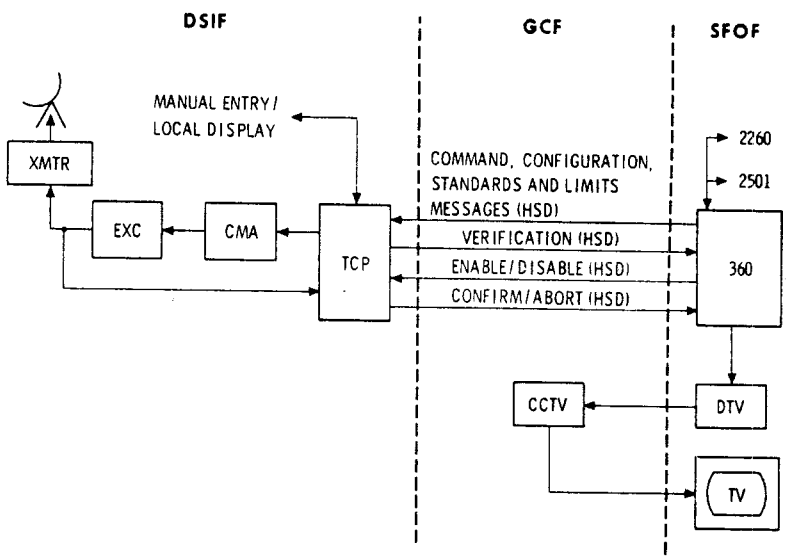

Fig. 3. Command system

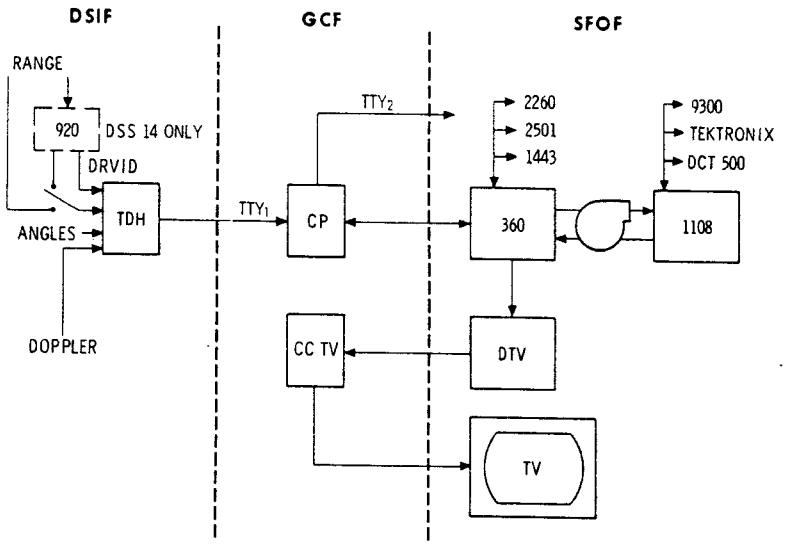

Fig. 4. Tracking system

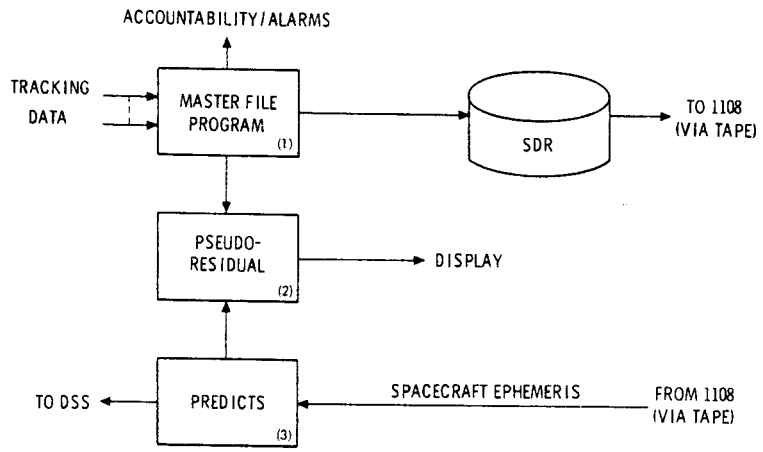

Fig. 5. Tracking inside the 360 computer

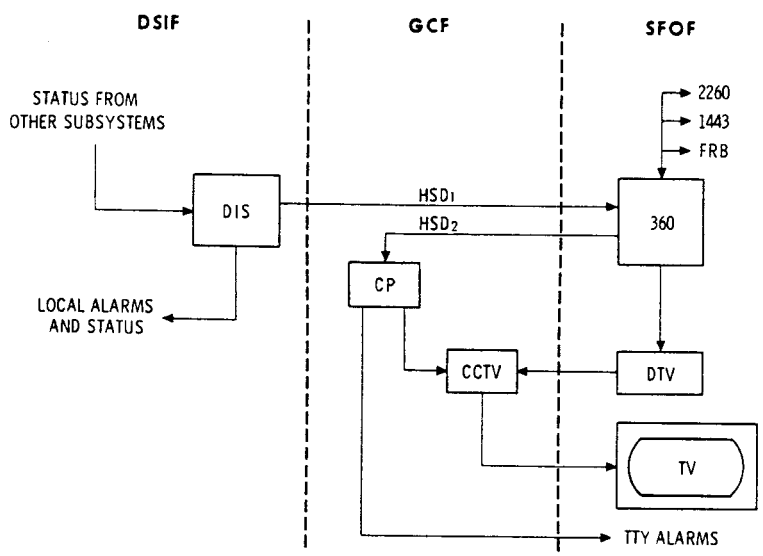

Fig. 6. Monitor system

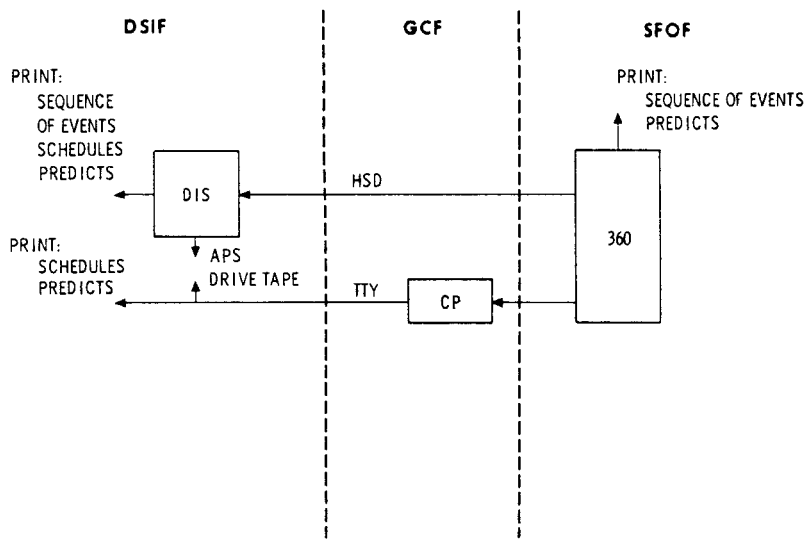

Fig. 7. Operations control system