DSN Monitor Performance Program

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This report provides: (1) a general description of the programs used by DSN monitor analysts in the generation of the weekly and monthly performance summary reports, and (2) the format guide used by the DSN real-time analyst to assist in interpreting the formatted data.

I. Introduction

The DSN monitor system has the responsibility of reporting the performance of the DSN and to ensure that each element of the DSN is properly configured for anomaly-free data flow.

To assist the DSN monitor analysts in the performance of their duties, the Summary Performance Report and the Digital Television (DTV) Format Guide programs were developed and are used to supplement the manual collection of data for analysis and to make real-time determination of the DSN configuration status.

II. Summary Performance Report

Prior to March 1, 1972 the DSN Monitor Weekly and Monthly Performance Report was manually generated and consumed two man days per week for the output. The report contained a listing of the tracking time per deep space station, two-way lock time, number of commands transmitted to the spacecraft from each station, and graphs of the receiver's residual signal strength (AGC) and signal-to-noise ratio (SNR). Additionally, it contained the up time and down time of the 360/75 computer, the 3100 computer, and DSIF's digital instrumentation system (DIS).

To reduce the man hours involved in the generation of the Summary Performance Report, the function was computerized. The computerized version proved to be more reliable and more dynamic in response to new requirements. The net results were a more meaningful report to the users.

In real-time, the data are collected and coded for keypunching and become the data base for the Traceability and Reporting Program (TRP), which is a file management program providing user visibility in near real-time and/or in an archival mode of data generated by DSN system (Ref. 1).

The program operates on either the 360/75 or 370/155 system. The information is retained within the program and retrieved on command. Depending on the requirements, the data are collected, combined, computed, and

processed according to the pre-established algorithm within the program. The data can be organized into the format desired and extracted on an independent time base, e.g., weekly basis, daily, monthly or cumulative.

Presently the Summary Performance Report is DSN monitor-based, but the provision exists to include DSN tracking, DSN telemetry, and DSN command parameters. The next evaluation of the software program will include parameters from the above three systems and will contain DSN network data on both quantity and quality of data generated within the DSN.

Since the initiation of the automatic generation of the DSN Performance Summary Report, the report users state that they have a better understanding of the DSN, and that they have been able to increase the reliability of their individual system.

See Fig. 1 for an example of the summary performance report generated by the DSN monitor analyst.

Since the requirements for each project are different, the DSN Monitor Performance Summary Report must necessarily be dynamic. The intent is to continue to update the report so that it can serve the needs of each project and DSN management, and provide greater visibility of the DSN and the total support provided by the DSN to the various projects.

III. Format Guide

Within the DSN, the data available through DTV are processed by the DSN Monitor Program operating in the 360/75 Real-Time Software Programs.

The Monitor System is responsible for the output of the DSN DTV Software and the validity of the data extracted and displayed via DTV Formats. Therefore, a guide was generated showing the definition of the mnemonics used for each format, the High Speed Data (HSD) location, and the algorithm used to generate the displayed parameters.

A software program was generated with a dynamic data base to operate in the Univac 1108 computer. The program has the capability to be updated as changes to the formats are made and to include any new formats that are generated within the DSN systems. As updates are made to the software, a new publication of the "format guide" is made available to Monitor data users.

The "format guide" shows the contents of each format. Presently there are 39 operational formats in use by the DSN. Specifically, the guide shows mnemonic and mnemonic definition, display, data source, word and bit location within the HSD block of the displayed parameter.

With this information, each user can determine if the formats are being processed correctly. In the event that errors show up, the users are encouraged to generate a Discrepancy Report on the erroneous format or parameter within the formats. In this way changes can be initiated to correct format deficiencies.

The DTV format guide program allows the user to generate up to 20 copies of either a single DTV format definition or the entire DTV format catalog. This capability is available to anyone who is familiar with the program.

The program provides the user the ability to edit the DTV format catalog from an 1108 demand terminal. The editing capability includes the provision to add new formats, change parameters within an individual format, and change the algorithm that generates a particular parameter display. See Table 1 for an example of the program output.

Reference

1. Miccio, J. A., "DSN Traceability and Reporting Program: Micrographic Application," in *The Deep Space Network Progress Report*, Technical Report 32-1526, Vol. VII, pp. 185–187. Jet Propulsion Laboratory, Pasadena, Calif., Feb. 15, 1972.

Table 1. Example of program output

MNEMONIC	DEFINITION	DISPLAY	DATA SOURCE	WORD	BITS
OSS	STATION I.D.	NN			
SC	SPACECRAF NO.	NN	PERF/STAT	3	18-24
SD	STANDARD DEVIATION RECEIVER SIGNAL STRENGTH	+-.NNN			
	RECEIVER 1		PERF/STAT	26	16-24
	RECEIVER 2		PERF/STAT	27	16-24
SPE	RECEIVER STATIC PHASE ERROR	+-.NNN			
	RECEIVER 1		PERF/STAT	30	1-10
	RECEIVER 2		PERF/STAT	31	1-10
TMB/W	TELEMETRY BANDWIDTH- BIT CONFIG:				
	0111	4.5K	PERF/STAT	20	4-7
	1011	20K	PERF/STAT	20	4-7
	1101	420K	PERF/STAT	20	4-7
	1110	3.3M	PERF/STAT	20	4-7
ABW	RECEIVER AGC BANDWIDTH- RECEIVER 1				
	BIT CONFIG: 101	N	PERF/STAT	20	8-10
	110	M	PERF/STAT	20	8-10
	011	W	PERF/STAT	20	8-10
	RECEIVER 2				
	101	N	PERF/STAT	19	8-10
	110	M	PERF/STAT	19	8-1
	011	W	PERF/STAT	19	8-10
RFL	RECEIVER [R.F.] LOOP BANDWIDTH -RECEIVER 1				
	BIT CONFIG: 0111	NAR	PERF/STAT	20	11-14
	1101	MED	PERF/STAT	20	11-14
	1011	WID	PERF/STAT	20	11-14
	RCV1 ONLY: 1110	3	PERF/STAT	20	11-14
	0111 -RECEIVER 2	NAR	PERF/STAT	19	11-14
	1101	MED	PERF/STAT	19	11-14
	1011	WID	PERF/STAT	19	11-14
VC	RECEIVER VCO NUMBER:				
	RECEIVER 1	N	PERF/STAT	19	19-22
	RECEIVER 2	N	PERF/STAT	19	15-18
	RECEIVER LOCK STATUS	IN/OUT			
	RECEIVER 1		PERF/STAT	20	3
	RECEIVER 2		PERF/STAT	19	3
HA-ERR	HOUR ANGLE ERROR	+ OR -.NNNN	PERF/STAT	30	11-17
HA-RES	HOUR ANGLE RESIDUAL	+ OR -.NNNN	PERF/STAT	39-40	20-05
DECERR	DECLINATION ANGLE ERROR	+ OR -.NNNN	PERF/STAT	30	18-24
DECRES	DECLINATION ANGLE RESIDUAL	+ OR -.NNNN	PERF/STAT	40	6-15
DOP	DOPPLER MODE	1,2,OR 3	PERF/STAT	18	1-4
RNL	RANGE RECEIVER LOOP BANDWIDTH				
	BIT CONFIG: 011	NAR	PERF/STAT	20	15-17
	101	MED	PERF/STAT	20	15-17
	110	WID	PERF/STAT	20	15-17
MOD	TRANSMITTER MODULATION STATE		PERF/STAT	18	5,11,12,14
	BIT CONFIG: 1011	MOO	PERF/STAT	18	5,11,12,14
	1110	TMO	PERF/STAT	18	5,11,12,14
	1101	CMA	PERF/STAT	18	5,11,12,14
	1111	CMB	PERF/STAT	18	5,11,12,14
	0011	RMO	PERF/STAT	18	5,11,12,14
	0101	RCA	PERF/STAT	18	5,11,12,14
	0111	RCB	PERF/STAT	18	5,11,12,14

Table 1 (contd)

MNEMONIC	DEFINITION	DISPLAY	DATA SOURCE	WORD	BITS
	0110	RTM	PERF/STAT	18	5,11,12,14
DOPRESM	DOPPLER RESIDUAL MEAN	+-N.NNNN	PERF/STAT	36	1-17
DOP-SD	DOPPLER STANDARD DEVIATION	+-.NNNN	PERF/STAT	36	18-24
RNG-RESM	RANGE RESIDUAL MEAN	+-NN.NNNN	PERF/STAT	37	7-24
RNG-SD	RANGE STANDARD DEVIATION	+-.NNNN	PERF/STAT	38	1-13
TDHRT	TRACKING DATA SAMPLE RATE	NN	PERF/STAT	31	11-24
RNG/DOP	RANGE DOPPLER MEAN	+-N.NNNN	PERF/STAT	38-39	14-6
R/D-SD	RANGE DOPPLER STANDARD DEVIATION	+-.NNNN	PERF/STAT	39	7-19
TFREQ	TRANSMITTER VCO FREQUENCY	NNNN	PERF/STAT	35	1-14
TDH DCC	TRACKING DATA CONDITION CODE	NNNN	PERF/STAT	33	11-24
CMAB	COMMAND MODE SELECT	CALL	PERF/STAT	41	1-24
		CAL2	PERF/STAT	41	1-24
		IDL 1	PERF/STAT	41	1-24
		IDL2	PERF/STAT	41	1-24
		ACTV	PERF/STAT	41	1-24
		ABRT	PERF/STAT	41	1-24
TCP	TCP ACTIVE RECEIPT OF TRANSMISSION	TP1 OR TP2	PERF/STAT	42	19-21
C	COMMAND RECEIVED IN LAST 5 SECONDS	/ OR *	PERF/STAT	42	19
M	TCP ACTIVE FOR LAST COMMAND	M	PERF/STAT	41	3<15
A	ABORT DETECTED IN LAST 5 SECONDS	/ OR *	PERF/STAT	42	22-24
TCP1SN	TCP1 SIGNAL TO NOISE RATIO	+-NN.NN	PERF/STAT	43	13-24
TCP2SN	TCP2 SIGNAL TO NOISE RATIO	+-NN.NN	PERF/STAT	45	13-24
SSA1SN	SYMBOL SYNCHRONIZER 1 SIGNAL TO NOISE RATIO	+-NN.NN	PERF/STAT	44	1-12
SSA2SN	SSA2 SIGNAL TO NOISE RATIO	+-NN.NN	PERF/STAT	46	1-12
BDA1SN	BLOCK DECODER 1 SIGNAL TO NOISE RATIO	+-NN.NN	PERF/STAT	44	13-24
BDA2SN	BDA 2 SIGNAL TO NOISE RATIO	+-NN.NN	PERF/STAT	46	13-24
TCP-1					
R	CHANNEL 1 RECEIVER LOCK STATUS	/ OR *	PERF/STAT	43	5
D	CHANNEL 1 DEMOD LOCK STATUS	/ OR *	PERF/STAT	43	6
S	CHANNEL 1 BIT SYNC LOOP LOCK STATUS	/ OR *	PERF/STAT	43	7
R	CHANNEL 2 RECEIVER LOCK STATUS	/ OR *	PERF/STAT	43	8
D	CHANNEL 2 DEMOD LOCK STATUS	/ OR *	PERF/STAT	43	9
S	CHANNEL 2 BIT SYNC LOOP LOCK STATUS	/ OR *	PERF/STAT	43	10
Y	CHANNEL 2 SSA LOCK	/ OR *	PERF/STAT	43	11
B	CHANNEL 2 BDA LOCK STATUS	/ OR *	PERF/STAT	43	12
TCP-2	SAME AS TCP-1				
R		/ OR *	PERF/STAT	45	5
D		/ OR *	PERF/STAT	45	6
S		/ OR *	PERF/STAT	45	7
R		/ OR *	PERF/STAT	45	8
D		/ OR *	PERF/STAT	45	9
S		/ OR *	PERF/STAT	45	10
Y		/ OR *	PERF/STAT	45	11
B		/ OR *	PERF/STAT	45	12
TCP1					
T	TRANSMITTER STATUS	/ OR *	PERF/STAT	41	1
E	EXCITER FREQUENCY LIMIT	/ OR *	PERF/STAT	41	2
C	COMMAND MODULATION STATUS	/ OR *	PERF/STAT	41	3
P	PN MODULATION STATUS	/ OR *	PERF/STAT	41	4
TCP2	SAME AS TCP1				
T		/ OR *	PERF/STAT	41	13
E		/ OR *	PERF/STAT	41	14

Table 1 (contd)

MNEMONIC	DEFINITION	DISPLAY	DATA SOURCE	WORD	BITS
C		/ OR *	PERF/STAT	41	15
P		/ OR *	PERF/STAT	41	16
TM	TCP TELEMETRY STATUS	/ OR *	PERF/STAT	49	1-2
D	DIS DOPPLER PROCESSOR STATUS	/ OR *	PERF/STAT	49	4
A	DIS ANGLE DATA PROCESSOR STATUS	/ OR *	PERF/STAT	49	5
R	DIS RANGE DATA PROCESSOR STATUS	/ OR *	PERF/STAT	49	6
L	DIS LOG TAPE STATUS	/ OR *	PERF/STAT	49	7
H	DIS HIGH SPEED RECEIVER STATUS	/ OR *	PERF/STAT	49	8
C	TCP1 COMMAND DATA INDICATOR	/ OR *	PERF/STAT	49	10
D	TCP2 COMMAND DATA INDICATOR	/ OR *	PERF/STAT	49	11
MPO	SCM POLARIZATION	RCP/LCP	PERF/STAT	24	4-6
CS	RECEIVER INPUT CHANNEL SELECT	M1,M2,BP,NA	PERF/STAT	24	10-13
APO	SAA POLARIZATION	RCP/LCP	PERF/STAT	24	7-9
UR	MICROWAVE INPUT SELECT:				
	MASER 1, RCV 1	11	PERF/STAT	24	15-16
	MASER 1, RCV 2	12	PERF/STAT	24	15-16
	MASER 2, RCV 1	21	PERF/STAT	24	15-16
	MASER 2, RCV 2	22	PERF/STAT	24	15-16
SDA	SIGNAL DEMOD. ASSEMBLY HEADER				
INS	SDA INPUT SELECT				
	SDA 1 BIT CONFIG. 11	RX1	PERF/STAT	13	1-2
	01	RX2	PERF/STAT	13	1-2
	10	AIS	PERF/STAT	13	1-2
INS	SDA-2 BIT CONFIG. SAME AS SDA-1		PERF/STAT	13	19-20
INS	SDA-3 BIT CONFIG SAME AS SDA-1		PERF/STAT	14	13-14
INS	SDA-4 BIT CONFIG SAME AS SDA-1		PERF/STAT	15	7-8
OTS	SDA OUTPUT SELECT				
	SDA-1 BIT CONFIG: 01	RX1	PERF/STAT	13	3-4
	10	AIS	PERF/STAT	13	3-4
	11	MMT	PERF/STAT	13	3-4
OTS	SDA-2 SAME AS SDA-1		PERF/STAT	13	20-21
OTS	SDA-3 SAME AS SDA-1		PERF/STAT	14	23-24
OTS	SDA-4 SAME AS SDA-1		PERF/STAT	15	7-8
DB	SDA INPUT ATTENUATION				
	SDA-1 BIT CONFIG: 1111	0D	PERF/STAT	13	5-8
	1110	1D	PERF/STAT	13	5-8
	1101	2D	PERF/STAT	13	5-8
	1100	3D	PERF/STAT	13	5-8
	1011	4D	PERF/STAT	13	5-8
	1010	5D	PERF/STAT	13	5-8
	1001	6D	PERF/STAT	13	5-8
	1000	7D	PERF/STAT	13	5-8
	0111	8D	PERF/STAT	13	5-8
	0110	9D	PERF/STAT	13	5-8
	0101	10	PERF/STAT	13	5-8
	0100	11	PERF/STAT	13	5-8
	0011	12	PERF/STAT	13	5-8
DB	SDA-2 SAME AS SDA-1		PERF/STAT	13-14	23-2
DB	SDA-3 SAME AS SDA-1		PERF/STAT	14	17-20
DB	SDA-4 SAME AS SDA-1		PERF/STAT	15	11-14
BW	SDA BANDWIDTH SELECT				
	SDA-1 BIT CONFIG: 01	NAR	PERF/STAT	13	9-10

Table 1 (contd)

MNEMONIC	DEFINITION		DISPLAY	DATA SOURCE	WORD	BITS
		10	MED	PERF/STAT	13	9-10
		11	WID	PERF/STAT	13	9-10
	SDA-2 SAME AS SDA-1			PERF/STAT	14	3-4
	SDA-3 SAME AS SDA-1			PERF/STAT	14	21-22
	SDA-4 SAME AS SDA-1			PERF/STAT	15	15-16
SYMR	SDA SYMBOL RATE SELECT					
	SDA-1 BIT CONFIG:	0001	5.6	PERF/STAT	13	12-15
		0010	12	PERF/STAT	13	12-15
		0011	27	PERF/STAT	13	12-15
		0100	56	PERF/STAT	13	12-15
		0101	120	PERF/STAT	13	12-15
		0110	270	PERF/STAT	13	12-15
		0111	560	PERF/STAT	13	12-15
		1000	120n	PERF/STAT	13	12-15
		1001	2700	PERF/STAT	13	12-15
		1010	5600	PERF/STAT	13	12-15
		1011	12K	PERF/STAT	13	12-15
		1100	27K	PERF/STAT	13	12-15
		1101	56K	PERF/STAT	13	12-15
		1110	86K	PERF/STAT	13	12-15
	SDA-2 SAME AS SDA-1			PERF/STAT	14	6-9
	SDA-3 SAME AS SDA-1			PERF/STAT	14-15	24-3
	SDA-4 SAME AS SDA-1			PERF/STAT	15	18-21
RA	SYNTHESIZER RANGE					
	SDA-1		1X OR 10	PERF/STAT	13	16
	SDA-2		1X OR 10	PERF/STAT	14	10
	SDA-3		1X OR 10	PERF/STAT	15	4
	SDA-4		1X OR 10	PERF/STAT	15	22
SFQ	SYNTHESIZER FREQUENCY STANDARD					
	SDA-1		INT/EXT	PERF/STAT	13	17
	SDA-2		INT/EXT	PERF/STAT	14	11
	SDA-3		INT/EXT	PERF/STAT	15	5
	SDA-4		INT/EXT	PERF/STAT	15	23
L	SDA LOCK STATUS					
	SDA-1		/ OR *	PERF/STAT	13	18
	SDA-2		/ OR *	PERF/STAT	14	12
	SDA-3		/ OR *	PERF/STAT	15	6
	SDA-4		/ OR *	PERF/STAT	15	24

	Deep Space Station							
	11	12	14	41	42	51	61	62
MM actual track time, h	0.0	28.31	496.89	205.27	27.58	0.0	0.0	360.21
MM passes tracked	0	9	40	23	6	0	0	38
PN actual track time, h	118.95	102.27	16.39	54.15	247.92	263.02	49.50	0.0
PN passes tracked	17	14	3	6	24	30	8	0
MM scheduled track time, h	0.0	30.33	507.11	212.12	27.00	0.0	0.0	361.01
PN scheduled track time, h	121.07	105.17	16.18	57.50	251.70	262.70	50.07	0.0
DIS down time, h	N/A	0.55	26.69	0.55	N/A	0.0	N/A	0.24
Total DIS outages	N/A	2	8	2	N/A	0	N/A	2
Total LGWR	N/A	21,697	85,338	41,640	N/A	18,515	N/A	60,965
Total LGER	N/A	13	7372	274	N/A	35	N/A	78
%Scheduled track	98.2%	96.4%	98.0%	96.2%	98.9%	100%	98.9%	99.8%
% DIS support	N/A	96.0%	94.8%	99.7%	N/A	100%	N/A	99.9%
LGWR/hour	N/A	166.9	175.4	165.6	N/A	177.8	N/A	169.4
LGER/hour	N/A	0.1	15.2	1.1	N/A	0.34	N/A	0.22
Mean time between failures, failures, h	N/A	65.02	60.82	129.44	N/A	No failures	N/A	180.0
Average duration of each failure, h	N/A	0.28	3.34	0.28	N/A	-	N/A	0.12

	SFOF Systems	
	360/75	3100/DTV
Scheduled support, h	978.84	960.00
Duration of scheduled outages, h	8.31	0.00
Number of scheduled outages	27	0
Duration of unscheduled outages, h	17.71	2.52
Number of unscheduled outages	99	15
% Scheduled support	98.1%	99.7%
Mean time between failures, h	9.71	63.88
Average duration of each failure, h	0.18	0.17

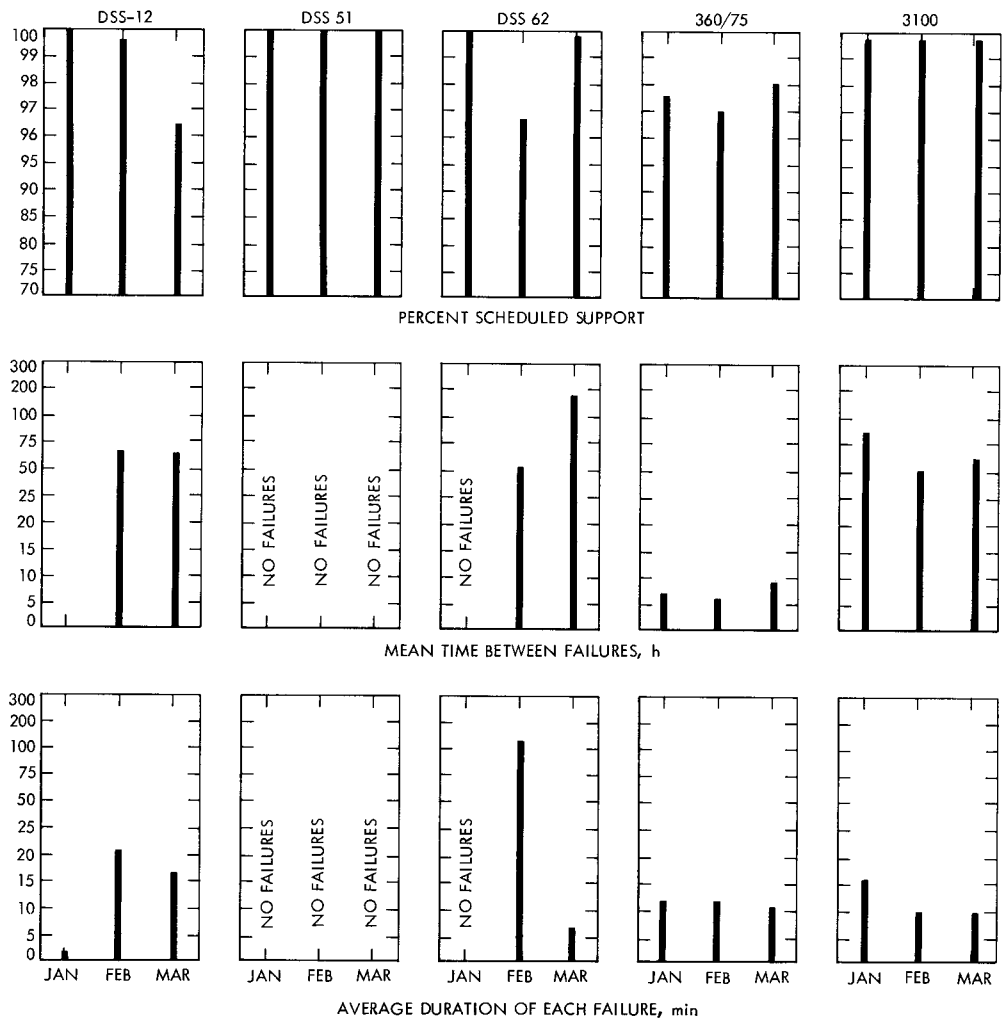

Fig. 1. DSN system performance summary