

DSN System Performance Test Software

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The Deep Space Network Operations Software Support Group has developed an entirely new, fully automated means of testing the performance of the Deep Space Station Data Subsystems. The DSN System Performance Test Software was developed for the new DSN Mark-III '77 Data System (MDS).

I. Introduction

In April of 1975 the Deep Space Network Software Support Group was given the assignment of developing System Performance Test Software to run in the DSN Mark-III Data System Modcomp-II computers at the Deep Space Stations. The original idea was to basically recode existing software for the Modcomp. During the first few months of the software definition and design phase, new requirements were pointed out, structured programming concepts were stressed, and the capabilities of the Modcomp computer were becoming more obvious. It was then decided that it would be better to develop a totally new MDS software package. DSN management concurred, and the Software Support Group was given the go-ahead to start software implementation.

By January of 1976 the Software Support Group produced a new, totally automated DSN System Performance Test Software design for DSN management review and approval.

II. Description

The DSN System Performance Test (SPT) Software package is comprised of a Test Executive and several individual test programs. The Test Executive is the main program. It controls the input and output of the individual test programs by

routing data blocks and operator directives to those programs. It also processes data block dump requests from the operator.

The operation of the Test Executive is governed by the SPT Standard Operating System (SPTSOS), which contains the handlers and common software required by the Test Executive and the test programs. The SPT software package (Fig. 1) may be expanded vertically as well as horizontally as new requirements are defined and implemented. The expansion is limited only by the size of the disc. As new programs are developed, the disc configuration may be modified, if necessary, by the generation of a new Operating System (SYSGEN). A SYSGEN tailors an Operating System to the requirements of the project and allocates disc space as required.

III. System Performance Test Executive

The Test Executive routes all input directives, standard subsystem blocks (SSB's), and high-speed data (HSD) and wideband data (WBD) blocks to the proper test programs. It performs preliminary checks and error dumping on incoming data blocks. It routes HSD-WBD and SSB blocks as requested by the test programs and transmits acknowledge responses as required by the operational programs.

The Test Executive processes all directives routed to itself and activates such programs or routines as required. It also

handles operator messages and test log and test report output functions.

Probably the most important feature is the ability to read test procedures from disc. This capability allows the operator to perform semiautomatic testing. The procedure will output specific operator instructions to tell the operator how to configure the hardware, etc. In this manner, a test may be designed and tested prior to its required use. The operator does not have to sit at the console typewriter entering directives; the test may be performed at computer speed rather than at operator speed. Operator input errors are virtually eliminated and the computer and computer software are used in a very efficient manner.

IV. Monitor System Performance Test Software

The Monitor System Performance Test Software tests the DSS Monitor Subsystem by generating and transmitting simulated high-speed data blocks and standard subsystem blocks to the Monitor Operational Software which resides in the Digital Instrumentation Subsystem (DIS). It also has the ability to insert errors into the blocks and to generate text and backfeed blocks. The Monitor SPT Software also processes monitor blocks received from the DIS by performing header checks, verifying block timing, checking block serial number sequencing, testing for changes in selected block data fields, and by comparing received data to expected data.

V. Telemetry System Performance Test Software

The Telemetry System Performance Test Software is a table-driven multimission program capable of processing six telemetry channels simultaneously. In addition, it is capable of remotely controlling the Simulation Conversion Assembly (SCA) by generating text and control HSD blocks and transmitting them to the SCA. The outputs of the Telemetry Processor Assembly (TPA) are patched and become inputs to the Telemetry SPT Program, which accepts the inputs and performs header checks, time interval tests, and bit-word error rate tests and periodically reports errors and error summaries to the operator. An additional capability is also available which calculates Y-factor values given system parameters and calibration data.

VI. Tracking System Performance Test Program

The Tracking System Performance Test Software tests and evaluates the performance of the DSS doppler system by

verifying doppler data formats, calculating long-term drift and phase jitter, computing theoretical jitter, and reporting S-band Programmed Oscillator Control Assembly (POCA) ramp delay and noise characteristics. It also tests and evaluates the DSS Planetary Ranging Assembly (PRA) by verifying range data formats and by determining range and differenced range versus integrated doppler (DRVID) characteristics. It tests the antenna subsystem by creating and transmitting angle predicts.

The Tracking SPT Software consists of a primary program and transient test report generators. The primary program accepts directives (from the Test Executive) for configuration and control, validates received data formats from tracking high-speed data blocks, and records doppler and ranging data on disc. At the conclusion of an SPT, a test report generator is activated to evaluate system performance from the data recorded and produces a test report showing test configuration, test data, and test results. Criteria for noise characteristics based on DSN system requirements provide a pass-fail judgment which is included in the test results.

VII. Command System Performance Test Program

The Command System Performance Test Program tests the operational integrity of the DSS Command Subsystem by simulating the functions of the Mission Control and Computing Center (MCCC) or other control center. The program receives operator directives and simulates high-speed data blocks, which are routed by the Test Executive to the Command Processor Assembly (CPA). The CPA returns standard subsystem blocks or high-speed data blocks in response to the blocks received from the test program. The test program then processes the incoming blocks by performing header checks and verifying that the received block contains the appropriate response. The test program expects the CPA to transmit blocks within certain time tolerances. If a block is not received on time an appropriate error message is output to the operator.

VIII. Mission-Independent Original Data Record (ODR) Validation Program

The Mission-Independent ODR Validation Program provides a means for validating an Original Data Record (ODR) tape generated by the Communications Monitor and Formatter Assembly (CMFA) during a System Performance Test. It also has the ability to validate the Referenced Original Data Record (RODR) tape generated by the System Performance Test Executive. Validation consists of performing simple header checks on the recorded blocks or by comparing two tapes for consistency. The ODR program can also be used to dump the ODR tapes.

IX. Conclusion

The System Performance Test Software is currently being modified to include additional capabilities and enhancements. Additional software programs are currently being developed for the Command Store and Forward System and the Automatic Total Recall System (ATRS). Additional projects which will be supported by future capabilities are the Network Sys-

tem Performance Tests, Mission Configuration Tests (MCT's) and the 26-Meter S-X Band Conversion Project.

The software is currently being used for Mission Prepass Readiness Tests (PRT's or countdowns), but future plans include modifying the software so that the command, tracking and telemetry programs may run simultaneously, thereby reducing required test time considerably.

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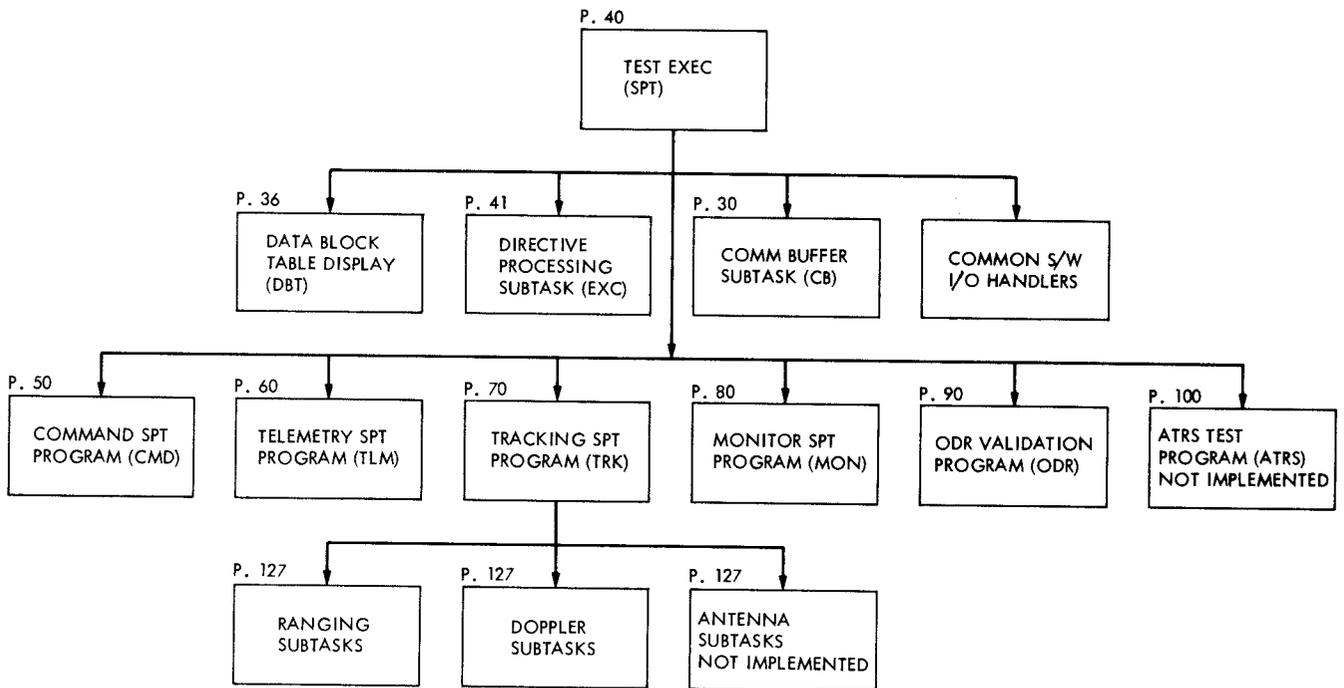


Fig. 1. SPT Software block diagram