DSN Monitor and Control System

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The last major upgrade to the DSN Monitor and Control System was during preparation for support of the Mariner Mars 1971 (MM'71) mission. Since then, several improvements have been made, specifically: incremental improvements in the DSS Monitor and Control Subsystem, implementation by the Block I Network Control System (NCS) Project of the network operations control functions, and implementation by the Block II NCS Project of the design of the Network Control Monitor and Control Subsystem. These changes are described in this article.

I. Introduction

Changes to the DSN Monitor and Control System since the last major upgrade (in preparation for MM'71) fall into three areas: (1) new monitor functions in the Station Monitor and Control Subsystem (SMC), (2) monitor functions implemented by the Block I Network Control System (NCS) Project, and the Network Control (NC) Monitor and Control Subsystem (MCS) implemented by the Block II NCS Project.

II. Station Monitor and Control Subsystem

Although changes to the SMC software were extensive, the monitor functional capability was not significantly changed. However, several monitor operational improvements were made. Some non-SMC functions were added (e.g., formatting of radio metric data for output via high-speed data lines), but they are beyond the scope of the Monitor and Control Subsystem.

In the past, there has been a different SMC computer program for each station type; the new program is used at all stations, eliminating multiple programs. A second cathode-ray tube (CRT) display device has been added to each SMC, and the software provides two independent display outputs at the station manager's console. In the 64-m Deep Space Stations (DSSs), a third CRT was added as a slave to one of the SMC displays; it is called "SMC Junior" and is located in the data processing area. Monitoring of the Block IV receiver/exciter has been added.

A significant operational improvement is to give the station manager a wide range of display formats. A specific format is stored on punched paper tape, and changes to it are effected by keyboard. Thus, the station manager selects from an assortment of predefined formats.

III. Network Operations Control Function Implemented By the Block I NCS Project

Inbound high-speed data (HSD), not wideband data (WBD), are examined by a Sigma-5 located in the Network Data Processing Area (NDPA), and some data indicative of data flow conditions are displayed on CRTs, and some on the logging typewriter. The display devices are located both in the NDPA and in the Network Operations Control Area (NOCA).

For each DSS, or equivalent ground communications (GC) circuit, each user-dependent type (UDT) and data-dependent type (DDT) combination is treated as one stream. The streams are displayed on the CRT such that all streams for a given DSS are grouped. The display will accommodate 10 command streams per DSS plus 10 non-command streams. A normal activity overfills one CRT display, so the display is paged. Either a keyboard entry or a function button on the keyboard changes pages (see Fig. 1).

The status available for each stream is:

(1) DSS number.

(2) Percent good data to 1.0% resolution (based on GC error flags of the data blocks; filler blocks are excluded).

(3) User-dependent type.

(4) Data-dependent type.

(5) Block serial number of last block received before display update.

(6) Activity indicator (reads "NEW" for first minute a new stream exists).

(7) Cumulative count of block serial number (BSN) anomalies (i.e., occurrences of a block received not having BSN exactly one greater than the last block received).

The display updates every 5 seconds. If the error rate goes down to 98% or below, an entry is also made on the alarm logging typewriter in the NDPA and NOCA (see Fig. 2).

This capability was used operationally during Mariner Venus/Mercury 1973 (MVM'73) encounters.

IV. NC Monitor and Control Subsystem Functions Being Implemented by the Block II NCS Project

The NC MCS will contain a real-time monitor (RTM) computer dedicated to displaying DSS monitor data (see Fig. 3). The CRT/keyboards and slave CRTs in NOCA are the display devices.

The two CRT display devices are completely independent and will usually have different formats. Two formats have been designed for output. One is a single-DSS detailed format. The other is a two-DSS summary format. The strategy will be to display the two-DSS format on each CRT, thus displaying monitoring of four DSSs. (It would have been highly desirable to have multi-DSS display, not just two-DSS display, but CRT limitations on field size precluded this.) For troubleshooting, one CRT would have the single-DSS format called up instead. Format/DSS selection is from the CRT keyboard.

The RTM software contains logic to process in a suppressed data mode. First, a canned-in station mask is used in the data processing. The mask tells the processor what equipments do not exist at each DSS, so that monitor parameters pertaining to equipment not at a given DSS are not processed. For example, the mask would exclude the data fields pertaining to a second transmitter from being processed for a 26-m DSS. Also, the mask instructs the processor to renumber some equipment. For example, it would cause subcarrier demodulator assembly 1 at a conjoint 26-m DSS to be displayed as SDA 7. Secondly, an initialization message, which is part of the monitor data stream, further instructs the processor on which of the station equipments are in use at a given time. Thus, status data on standby equipment are not displayed in NOCA. This has the effect of limiting the displayed data to only the most meaningful, thereby simplifying operator interpretation.

Computer hardware installation is complete, except for NOCA CRTs, and software is in test phase at this time. During the third quarter of 1974 there will be extensive network-level tests to validate NC MCS display against DSS SMC values. The NC MCS will be operational for Viking operational verification tests.

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FORMAT 1, PAGE 1  GMT:  116:05:11:39
  HIGH SPEED DATA STATUS       NUMBER = 4
 DSS  ERR  SC UDT/DDT   SEQ  BSN  GDD ACT
  12  100  95 107  75     0   155   0   C
  12  100  95  70  75     0   100   0   C
  12  100  95 107 167     0   152   0   C
  12  100  95  70 167     0    95   0   C
```

Fig. 1. Sample CRT display: real-time accountability

```
**  ACC DATA STREAM INACTIVE 014/076/026/104
**  ACC DATA STREAM INACTIVE 014/076/026/104
**  CMD ALM 18:27:25 DSS ALM BIT 11  14A 076
**  ACC DATA STREAM INACTIVE 014/076/026/104
**  ACC DATA STREAM INACTIVE 014/076/026/104
**  ACC DATA STREAM INACTIVE 014/076/026/104
```

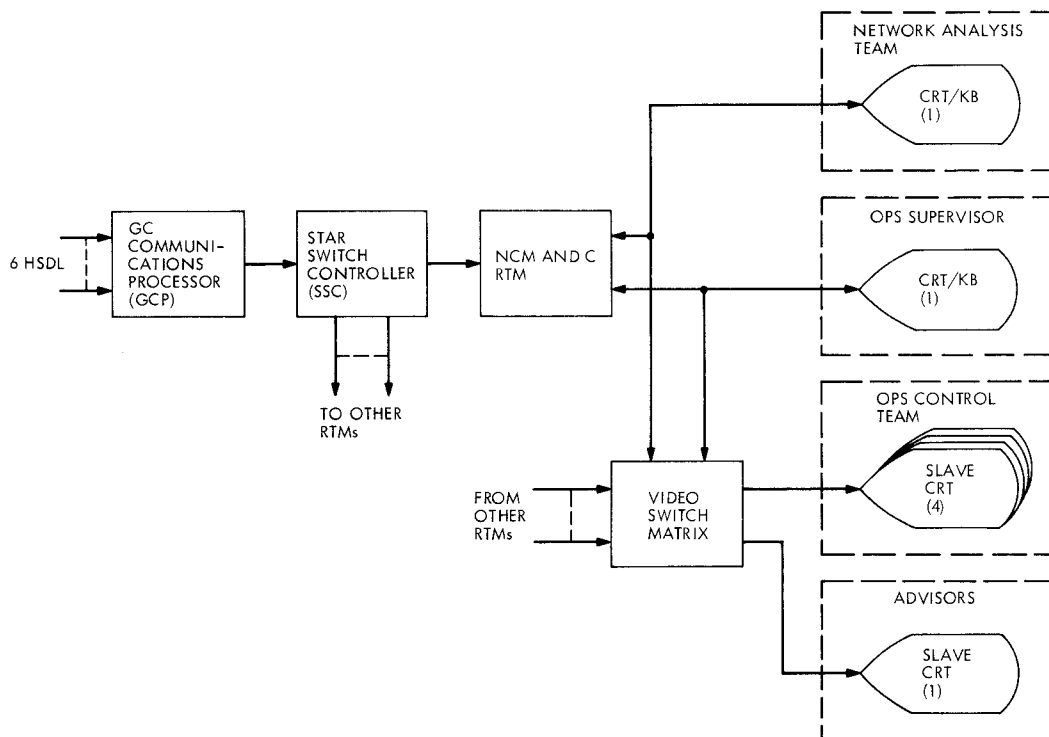Fig. 2. Sample alarm printer display: real-time
accountability alarms

Fig. 3.   The NC Monitor and Control Subsystem configuration (Block II NCS implementation)