NOCA Upgrade

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The Network Operations Control Area (NOCA) of the Space Flight Operations Facility (SFOF) is being upgraded in both hardware and software capabilities to provide the visibility and operability necessary for the operations control function to be performed within the present technological environment of the tracking network. This article addresses the hardware implementation currently in progress that provides a standard operating console with increased display capacity and improved ergonomics as a replacement for the existing, outmoded, circular consoles original to the SFOF.

I. Introduction

The Network Operations Control Area (NOCA) is located in the Space Flight Operations Facility (SFOF) of the Laboratory and occupies the west half of the main operations room of the SFOF. The SFOF, especially the main operations room, has traditionally been a showplace of the Laboratory and was designed to accommodate and impress visitors and spectators as well as to provide a functional facility for operational control activities of the Laboratory. The first operational use of the main operations room was in support of the Ranger VII mission in July of 1964. The nature of operations control at that time was people-intensive and lent itself to the additional purpose of the facility, to meet spectator expectations of a space center. Within a few years the functional capabilities of the main operations room became inadequate for the requirements of the larger, more complex JPL missions and, in 1968, the DSN Network Control task was moved into the main operations room. The present NOCA includes the principal function performed in the main operations room of the SFOF today. Advancements in the state-of-the-art to collect and communicate vast quantities of data by the Network, and the addition of several new distinct DSN Systems as well as increases in the sophistication and complexity of systems operations have far exceeded the capability of the 1964 design to provide a reasonably efficient operations control function to the Network with any degree of cost-effectiveness. The following sections of this article explain the hardware approach to meeting the requirements of functionalism, operability, and aesthetics.

II. Functional Description

The NOCA provides the environment for a central point of operational direction and control to the facilities of the DSN in real time and a single point of access to the DSN for Network users in real time. The major tasks accomplished in performing these functions are the coordination of Network activities, monitoring of Network performance, providing facilities with supporting information, resolving conflicts at the operational level, and allocating resources based on real-time priorities.

A. Coordination

The Network Operations Control Team (NOCT) operating within the NOCA coordinates Network activities and user requirements by voice communication with the Deep Space Stations, Mission Operations Centers, data processing facilities,

and the Ground Communications Facility in real time. The voice communication involved in the interfacility and intrafacility coordination performed by a single Operations Controller utilizes a total of twenty-eight dedicated circuits.

B. Monitoring

The NOCT insures the integrity of DSN performance by monitoring facility configuration and systems performance parameters of the various systems in real time. Performance and status data are provided to the NOCA by the Deep Space Station subsystems and by real-time system monitoring computers in the SFOF. The monitoring of status and performance by a single Operations Controller utilizes a total of thirty-five discrete display channels.

III. Hardware Improvements

A. Functionalism

The basic convex structure of the circular console (Fig. 1) limited the available viewing angle of an operator to an area that – when combined with the low profile – would permit the observation of only two nine-inch CRT displays. The first improvement was to reverse the structure (Fig. 2) to one of a concave presentation to the operator, which increased the operator viewing angle. The second improvement in functionalism was to increase the height of the console to accommodate vertical installation of more than one digital television (DTV) display. In addition to increasing single operator viewing from two to seven simultaneous displays, the new dimensions provided increased operator working area and enabled the colocation within the console racks of displays and associated selectors.

The integral construction of the original circular consoles would not permit horizontal expansion. The replacement console is modular in construction and allows for further expansion if required with no sacrifice to basic design.

The increased mounting surfaces of the replacement console permitted the installation, within operator attention zone, of equipment that was previously peripheral to the console; (i.e., GMT clock, special purpose telephones, and a warning timer).

B. Operability

In the design of the original circular console, operability was sacrificed for aesthetic appeal. This is understandable considering that human factors engineering has only recently become a popular consideration. The human factors guides and prior SFOF-peculiar studies applied to the development of the replacement console are given at the end of this article for reference. The entire approach to the replacement of the circular consoles was one of prototype development and, consequently, a period of three months was allowed for use and evaluation of the prototype by the operators that would eventually use it.

Improvements realized with the replacement console are most obvious when seated at the old, then moving to the new, but the ease of reading the new fourteen-inch displays as opposed to the previous nine-inch displays and being able to observe six or seven simultaneous displays as opposed to the previous two, are the most noticeable improvements. Improvements were made in the operator seating posture, reach requirements, button access, and speaker locations.

One compromise was made to appearance; the DTV tilt angle was increased slightly beyond optimum to reduce the height of the console slightly and provide a more appealing profile.

C. Aesthetics

The improvement of the aesthetic appeal of the main operations room of the SFOF to the general public as a space center facility was beyond the scope of the NOCA upgrade.

Although emphasis was placed on functionalism and operability in the design of the replacement console, the basic criterion was maintained that any resulting change to the appearance of the SFOF must conform to a general perception of a space center. The color chosen, for example, for the new console is slightly lighter in shade than the recommended optimum for DTV viewing enhancement, but blends well with the overall operations room and background displays. It was determined that this tradeoff was acceptable due to the normally reduced lighting in the room. The prototype console was assembled and installed for viewing in the main operations room for several days to collect a wide variety of observers' opinions on the aesthetic result, which proved highly favorable.

The arrangement of the individual consoles in the final configuration was determined to some extent by human factors considerations, but also by aesthetic appeal.

Since the permanent installation of the first replacement console in the NOCA, it has become a favorite backdrop for film crews and public relations photographers, which is probably a satisfactory endorsement.

IV. Summary

As of this reporting period, all hardware required for the replacement of the original SFOF circular consoles with the

NOCA upgrade standard operating consoles has been procured and is available to begin replacement immediately following Voyager 2 Saturn encounter critical activities. No direct cost savings are expected to be realized from the hardware replacement, but the improved operability of the NOCA should help to minimize any future costs that would result from the Networks Consolidation increased loading. The largest part of the NOCA upgrade is concerned with software implementation and has not been addressed in this article. It is currently planned that most of the NOCA upgrade software will be implemented as part of the Networks Consolidation Program schedule.

References

1. Vancott, H. P., and Kinkade, R. G., *Human Engineering Guide to Equipment Design*, McGraw-Hill, Revised Edition, 1972.
2. Woodson, W. E., and Conover, D. W., *Human Engineering Guide for Equipment Designers*, University of California Press, Berkeley, 1966.
3. *Some NASA Contributions to Human Factors Engineering*, SP-5117 Technology Utilization. National Aeronautics and Space Administration, Washington, D. C.
4. *NCS Operations Effectiveness Study, 3rd module, Technical Studies on Network Operations Performance Analysis*, Dosher Associates, 1972.

Fig. 1. Original circular consoles

Fig. 2. Replacement console