GCF Wideband Switch Subassembly—Requirements and Design Concept

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Basic requirements and design approach for the wideband switch subassembly (WBSS) are presented. The WBSS is a part of the Ground Communication Facility's wideband subsystem located in the Central Communications Terminal at the Jet Propulsion Laboratory. It is used to support the Mariner-Venus-Mercury 1973 and Viking operations. The WBSS is a complex switching unit that provides for simple control by the operator for effecting the many interconnect configurations of various data sets, coded multiplexers/demultiplexers, and computer systems.

I. Introduction

Among other communications capabilities, the Ground Communications Facility provides for the interchange of wideband data between the Mission Control and Computing Center and deep space stations or Project locations. The hub of this activity is located within the Central Communications Terminal (CCT) at JPL.

The functional operations requirements established by the Deep Space Network for the necessary capabilities to support the Mariner-Venus-Mercury 1973 and Viking Flight Projects specify complete versatility in providing interchange configurations for wideband data.

This article discusses the basic requirements set forth as design criterion for that part of the wideband subsystem (WBS) which is to accomplish this multifaceted switching of wideband data and control signals—the wideband switch subassembly (WBSS).

II. Capabilities Requirements

The WBSS is required to provide real-time switching (interconnection) of equipments in the WBS with a minimum of operator actions. It is required to be capable of handling data rates of up to 250 kilobits/s in a high (electrical) noise environment without adding to that noise.

Its minimum switching capacity is that which is sufficient to interconnect 10 data sets (DSs), 3 coded multiplexers/demultiplexers (CMDs), and 6 local computer

systems, herein referred to as on-site computers (OSCs). These interconnections are further subdivided as to direction of data flow relative to OSCs.

III. Design Requirements

The WBSS is required to utilize no more than two full 61-cm (24-in.) equipment bays with each bay being fully connectorized at its external interfaces. Any individual rack-mounted assemblies must also be connectorized at their external interfaces.

To meet the frequency/noise specifications it is required to use coaxial cabling. This cabling is required to be so arranged as to prevent clock-to-data skew of greater than 1% of a bit period.

The WBSS is required to have a readout display which is continuous and allows easy interpretation of switched path configurations. It must have redundant power supplies with automatic cross-over in the event of power supply failure. It must have configuration-memory as a precaution against commercial power failure.

IV. Design Concept

The basic functions of the WBSS are depicted in Fig. 1. Superficially it appears as a fairly straightforward design. Challenges are then brought to the fore when the various types of interconnection are investigated and especially when the transmit/receive functions of each piece of equipment are to be controlled separately.

It is possible, for example, to route nonmultiplexed (uncoded) inbound data directly from DS No. 1 (receive) to OSC No. 3 (via the DS/OSC matrix) and simultaneously route outbound data from OSC No. 5 through CMD No. 2 (via the CMD/OSC and then the DS/CMD matrices) to DS No. 1 (transmit).

This is not a common operations configuration, but it does indicate how versatile the WBSS can be. Unique provisions are made for allowing the multiple connection of DSs to a single CMD. This permits outbound (only) data to be routed to more than one distant location from the same CMD.

Crossbar switches are utilized for two reasons. First, they have a high switch-contact density—about 37,500 contacts per cubic meter (1,250 per cubic foot). Secondly, they are capable of "latching" a crosspoint and thus retaining it through a power failure.

Integrated circuits are utilized to provide an uncomplicated interface for the operator at the control and display panels. All aspects must be considered to minimize those factors which could confuse an operator during a critical or busy period.

V. Conclusion

The requirements set forth describe a complex switching unit. A detailed calculation reveals a requirement of 626 specific configurations of from 3 to 6 signal lines per configuration. The human-factors requirements of the WBSS are nearly as involved as those of the configuration switching.

Reference

1. McClure, J. P., "Ground Communications Facility Functional Design for 1973–1974," Technical Report 32-1526, Vol. XI, pp. 124–131, Jet Propulsion Laboratory, Pasadena, Calif., Oct. 15, 1972.

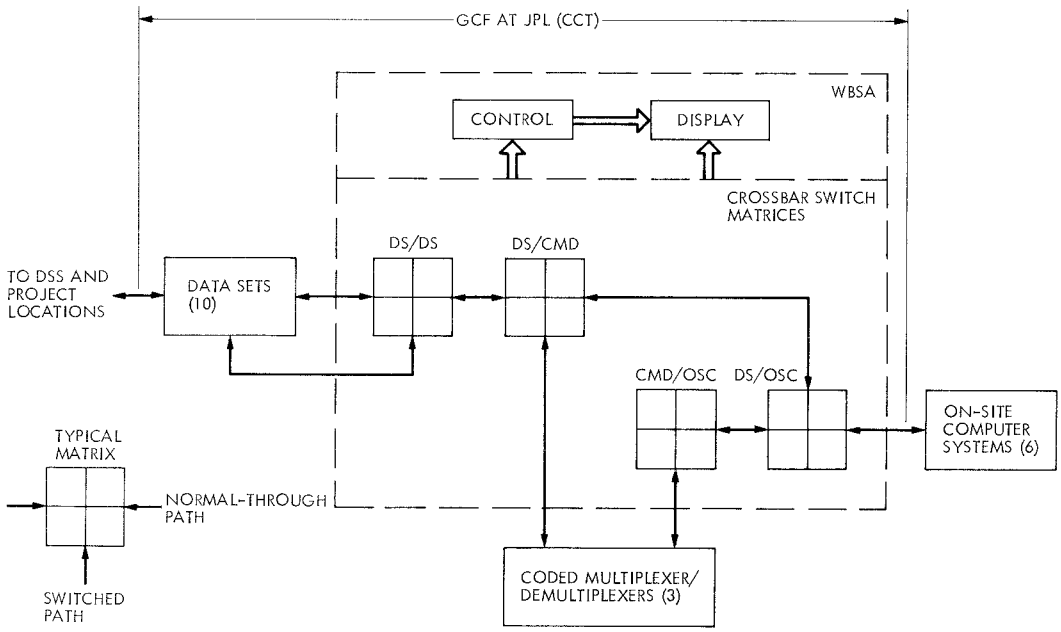

Fig. 1. GCF wideband switch subassembly