SFOF Digital Television Computer Subassembly

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The SFOF digital television computer subassembly is part of the digital television assembly. It provides control functions and interfacing of two IBM 360/75's to 80 channels of television for real-time display of alphanumeric and graphic information.

The subassembly consists of a dual computer configuration which is utilized in a primary/alternate mode. This provides the capability for rapid detection and correction of failures in the mission operations environment.

I. Introduction

The Digital Television Assembly (DTV) is a part of the user terminal and display subsystem in the SFOF. The purpose of the DTV is to provide flight projects and DSN users with volatile real-time displays of spacecraft data and DSN equipment status.

This article supplements the SFOF digital television assembly description in Ref. 1. It provides details on the selection, configuration, application and interface characteristics of the computer subassembly. Future articles will also describe the display subassembly in greater detail.

II. Requirements for a Computer Subassembly

The selected proposal for a digital television assembly called for a display subassembly and a computer subassembly as shown in Fig. 1. Several factors influenced the selection of the Computer Subassembly:

(1) The computer subassembly was required to provide control functions for the modularized display subassembly. This control capability included accepting data input from dual SFOF processing computers and servicing of hard copy requests from the display subassembly.

(2) DSN requirements for rapid detection and correction of failures made it necessary to consider an

alternate path or backup capability for this critical display control function.

(3) Time constraints, in development of software for the *Mariner* Mars 1971 mission, made it necessary to design and check out the related SFOF data processing system (IBM 360/75's) software concurrent with development of the digital television assembly.

III. Design Approach

Two principal alternatives were considered in selecting a computer subassembly to meet the above requirements:

(1) Purchase the control computer proposed for the display subassembly.

(2) Utilize an existing JPL-owned dual computer (CDC 3100's) subassembly.

The second alternative was chosen because it offered the following advantages:

(1) The procurement cost was lowered.

(2) The existing computers were being totally decommitted from their current display control function.

(3) Major software design and checkout could be done before delivery of the display subassembly.

(4) The existing 3100 computer configurations would support future offline development activity concurrent with mission operations support.

The major problem incurred by this decision involved the definition of computer subassembly interfaces.

The display subassembly vendor was required to interface to a channel of each 3100. This interface became part of a special-purpose control unit which was necessary to communicate between the modular units of the display subassembly. It was designed to receive data from both 3100's on a sequential basis but would normally operate with a single 3100.

If the first alternative had been chosen, the display subassembly vendor would have interfaced to a specified channel of each 360/75. Since existing computers were to be used, an interface to the 360/75's was required from another source. The decision was to design and build this interface at JPL rather than buy from a vendor. Determining factors were time, cost, and unavailability of an existing design. Time was most important, since an operating 3100 and its input interface were required for early 360/75 software checkout.

IV. Computer Subassembly Configuration

As shown in Fig. 2, the major components of the DTV computer subassembly are two CDC 3100 computers which are designated A and B. Both 3100's are configured identically with the same complement of peripheral devices and processing capabilities. During normal operations, one 3100 will accept data from both 360/75's and output to the display subassembly. The alternate 3100 will either serve as a backup processor or support DTV development activity. Both 3100's can access the display subassembly sequentially under program control. However, each 360/75 input is routed via a configuration switch to one 3100 or the other.

The only new equipment in the computer subassembly is the two computer interface control (CIC) units. The design of these units and the selection of 3100 channel assignments were aimed at maximizing the data throughput capability. Channel 0, the highest priority channel, was assigned to service the display subassembly. This channel has the highest activity since it must output data received via channels 1 and 3, plus servicing hard copy requests from the display subassembly.

Each CIC provides its 360/75 with an independent path to either 3100 via a configuration switch. This allows the 3100 to utilize a separate channel for each 360/75 input. Channel 1 is configured to the corresponding 360/75 and the alternate 360/75 is configured to channel 3 which has the lowest priority. This assignment allows concurrent operation with both 360/75's. It also provides two independent CIC units which can be interchanged rapidly by swapping two cables from each 360/75. The CIC input comes from a selector subchannel on the multiplexer channel of each 360/75. This subchannel was chosen for most efficient transfer of large blocks of data, best choice of control features and the possibility of adding two-way data transfer in the future.

The shared disk is assigned to channel 2. Other peripherals share channel 3 with the alternate 360/75 input. These peripherals are only intended for use in development activities and for initializing or troubleshooting the

system. Therefore, they should not conflict with 360/75 activity during mission operations.

V. Conclusion

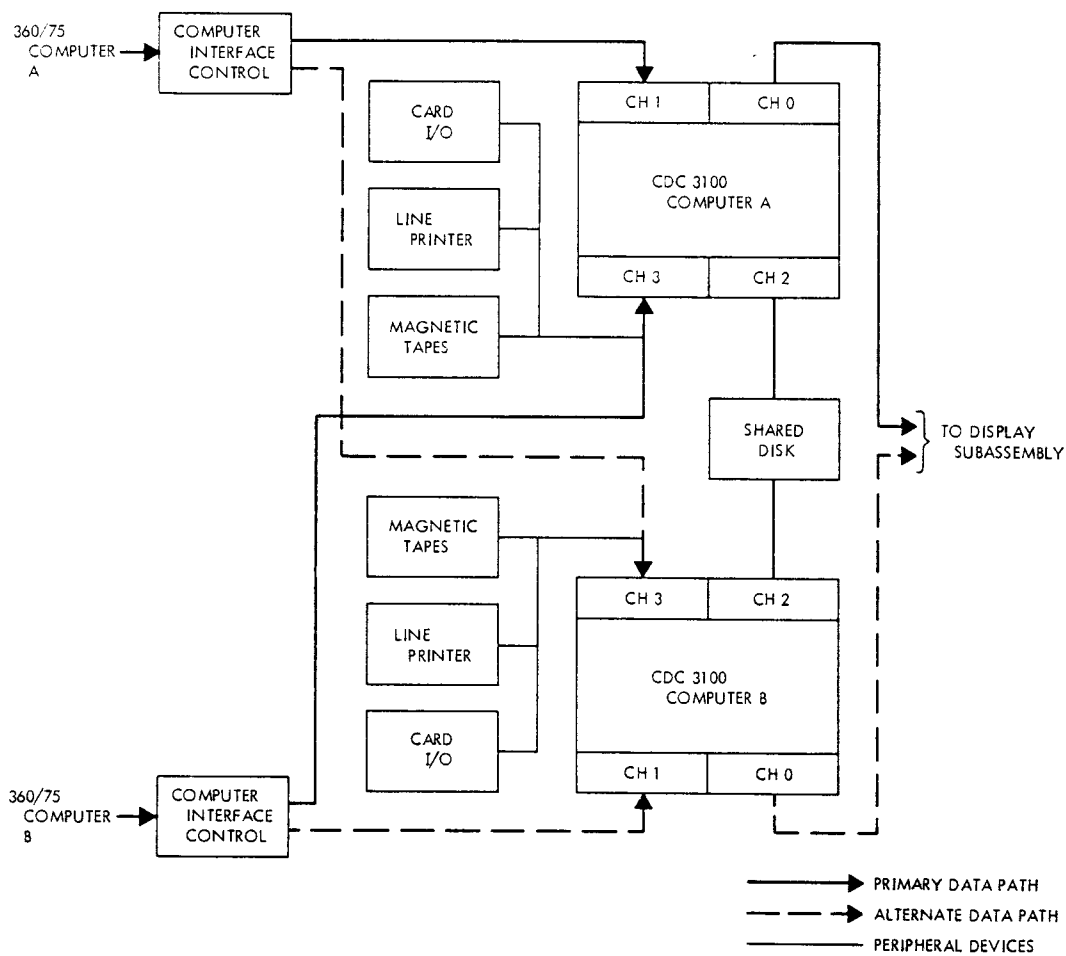The choice of an existing computer subassembly, with in-house design of its input interfaces, allowed software development to begin before display subassembly delivery. Significant delays in delivery of the display subassembly made this a very valuable development capability. The resultant hardware and software design has provided the DSN with a DTV computer subassembly which has a dual configuration that can be easily interchanged, for detection and correction of failures, without significant interruption to mission operations displays.

Reference

1. Singleton, F. L., "SFOF Digital Television Assembly," in *The Deep Space Network*, Space Programs Summary 37-65, Vol. II, pp. 86–91. Jet Propulsion Laboratory, Pasadena, Calif., Sept. 30, 1970.
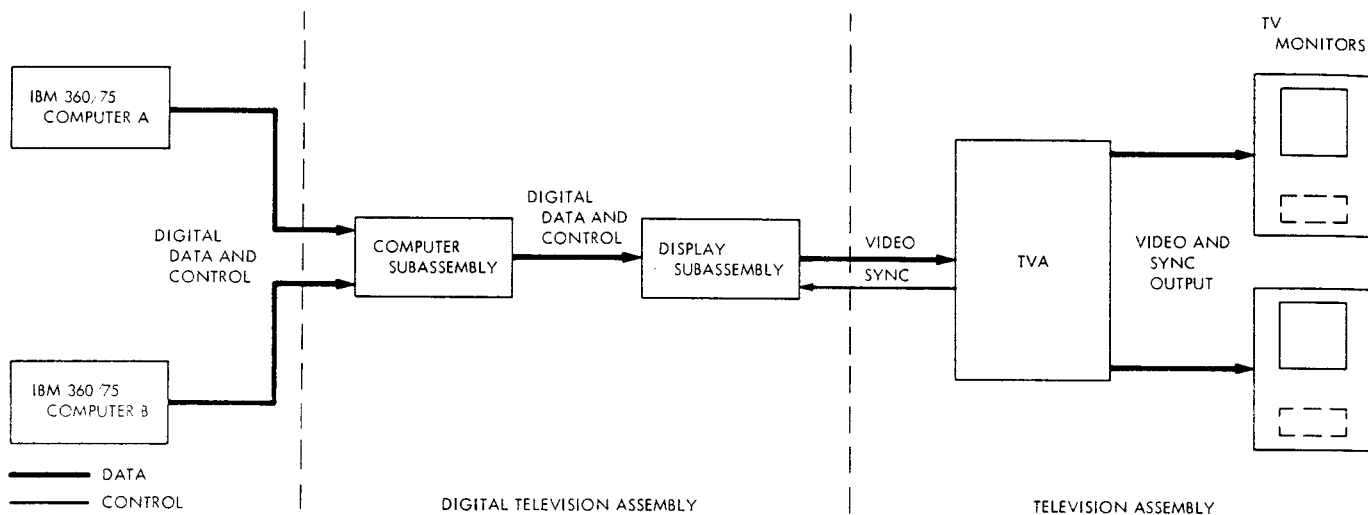
Fig. 1. DTV block diagram

Fig. 2. DTV computer subassembly configuration