Diagnostics for the Mark IIIA Central Processing System: IBM 360/75 Computer On-Line Test Routines

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A family of real-time on-line diagnostics was developed to check out all IBM 360/75-related components of the SFOF Mark IIIA Central Processing System. Diagnostic requests are entered from a cathode-ray-tube display station, initiating concurrent tests of assorted user devices and communications links. A supervisory software monitor program coordinates execution and, where necessary, draws on the facilities of the JPL Operating System in each IBM 360/75 computer.

I. Introduction

This article describes the *real-time, on-line* diagnostic routines which have been developed for IBM 360/75 computer-related hardware: channels, subchannels, control units, devices, input/output lines, attached processors, and special features. Reference 1 describes the independent or standalone diagnostics developed for JPL-unique subsystems and devices in the SFOF Central Processing System (CPS).

These real-time, on-line diagnostic routines are resident under the JPL Operating System (JPLOS) and execute under the control of the *Dia*gnostic *Mon*itor (DIAMON), which recognizes the requests and coordinates the test(s). DIAMON also generates the necessary test patterns, checks those which are returned, and issues error messages and statistics. If requested, DIAMON will also generate diagnostic summary displays and printouts.

II. Implementation

Figure 1 shows the current Mark IIIA SFOF CPS equipment configuration, all elements of which are supported by on-line test routines insofar as they relate to the IBM 360/75 processors. Reference 2 gives specific interconnection details, model numbers, and equipment complement for this configuration.

As presently implemented, the DIAMON system (when initialized) becomes the one and only real-time job step under JPLOS; no other concurrent real-time data processing is possible. (Work is underway to permit DIAMON to operate as one of several independent tasks under the real-time job step, allowing simultaneous testing and mission data processing on disparate parts of the system.)

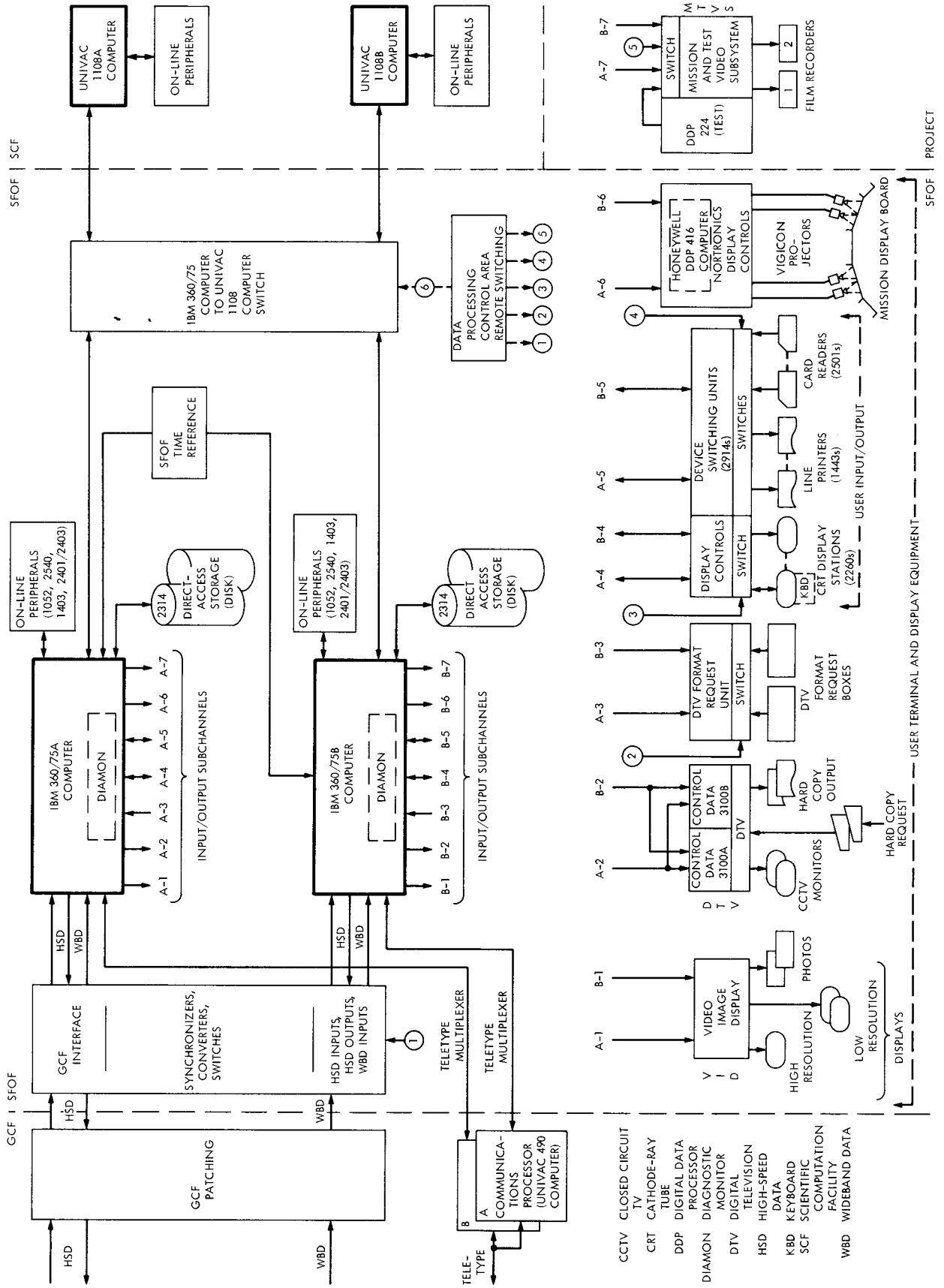

Fig. 1. SFOF Mark IIIA CPS diagnostic configuration

III. Operation

Equipment to be tested is identified at time of initialization so as to be reserved by JPLOS for the exclusive use of DIAMON, thus preventing the conflicts which would result from competition for the same resources.

Diagnostic requests are made from a cathode-ray-tube display station keyboard (Fig. 2) designated for this purpose. Test durations are variable at the discretion of the diagnostic operator. Runs on different devices and/or subchannels may be made concurrently and compatibly, with the sole exception of the diagnostic which tests the GMT (Greenwich Mean Time) register and the interval timer (IT) register in the central processing unit (CPU). The GMT/IT diagnostic must be run on a drained (empty) system so as not to jeopardize other programs which may attempt to access these registers. Diagnostic requests for the console-assigned peripherals (1052 typewriter, 2540 card read/punch, 1403 bulk printer) are accessed by DIAMON through the HASP[1] priority scheduler/queuer since these operator devices are reserved for system (JPLOS) usage.

Diagnostics which communicate with remotely situated processors in the SFOF (Univac 1108s, communications processors, control data 3100s, mission display board) are not automatically operable but require voice communication and coordination between operators to set up the desired test.

DIAMON has been so structured as to be extensible for the accommodation of future equipment additions. This

[1]HASP = Houston automatic spooling priority.

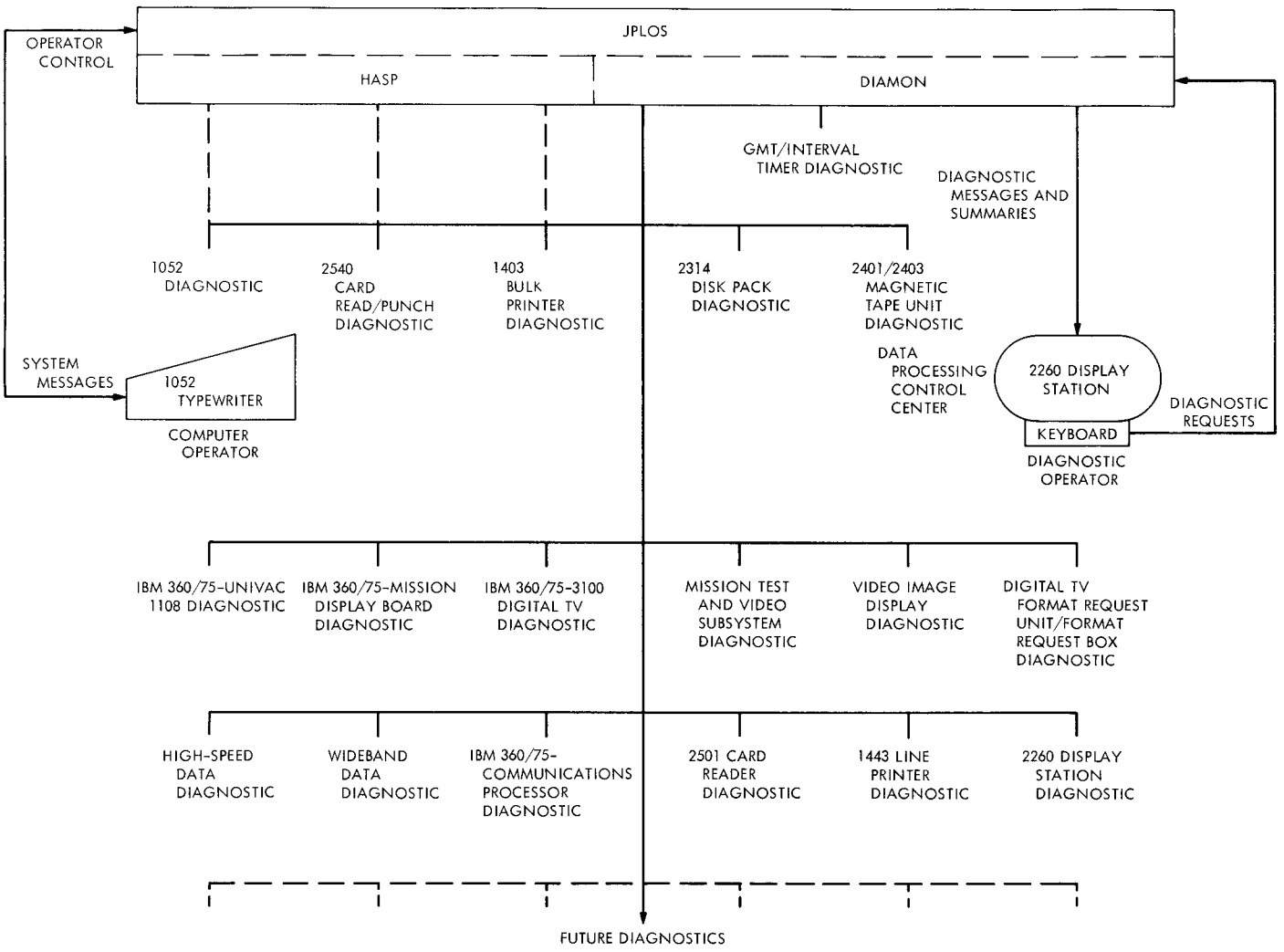

Fig. 2. SFOF CPS on-line diagnostics for the IBM 360/75 computer

open-ended modular approach also simplifies documentation, maintenance, and modifications.

IV. Conclusion

All of the DIAMON diagnostics referenced in this article have been fully developed and documented, and are in daily use to verify the operational integrity and performance of the various hardware components. Periodic full-scale facility-level tests are conducted using a preestablished script to assess and attest the current performance of all IBM-360/75-related equipments, in order that the continuing demands of spaceflight data processing may be satisfied.

References

1. Wells, R. A., "Diagnostics for the SFOF Mark IIIA Central Processing System: Standalone Acceptance and Maintenance Routines," in *The Deep Space Network*, Space Programs Summary 37-65, Vol. II, pp. 97–99. Jet Propulsion Laboratory, Pasadena, Calif., Sep. 30, 1970.
2. Stiver, R. A., "Mark IIIA IBM 360/75 Computer Configuration," in *The Deep Space Network*, Space Programs Summary 37-66, Vol. II, pp. 71–75. Jet Propulsion Laboratory, Pasadena, Calif., Nov. 30, 1970.