DEVELOPMENT OF A C3 GENERIC WORKSTATION: SYSTEM OVERVIEW

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The mission of the U.S. Air Force School of Aerospace Medicine (USAFSAM) is to support and enhance Air Force Capabilities and Operations through programs across the spectrum of aerospace medicine, education, and research and development. The Crew Performance Laboratory (CPL) of the Aerospace Research Branch, Crew Technology Division is responsible for developing, evaluating, and employing performance measures to allow the assessment of aircrew performance in a variety of environments. The measures include psychophysiological measures, workload assessment tasks, tests of cognitive performance and subjective questionnaires. The environments include chemical defense and performance-altering drugs, sustained operations and stressful situations (altitude, gravitation, hypoxia, disorientation).

One problem that has ramifications in all military services is the effect of selected drugs on human performance at tasks that require decision-making in complex environments and/or under sustained or continuous operations. In each of these situations a decrement in performance when optimal performance is demanded would have disastrous consequences. The CPL has worked closely with the Tri-Service Joint Working Group on Drug Dependent Degradation of Military Performance ($JWGD^3$ MIL PERF) to develop a facility for evaluating performance in aircrews subjected to chemical defense protection drugs and antihistamines in a complex decision-making command, control and communications (C3) environment. This C3 system is housed in the Aircrew Evaluation Sustained Operations Performance (AESOP) facility which was designed to accommodate sustained operations research.

The following systems, which are based on the proven simulation technology currently in use at the Naval Air Test Center (NATC), Patuxent, MD, will comprise the initial C3 environment and provide flexible, reconfigurable integration (Figures 1-3):

1. A cluster of two VAX 11/780 (Digital Equipment Corporation) computers and peripherals with shared multi-port memory that control scenario presentation and collect performance and physiology data.

2. Four C3 generic workstations configured to realistically simulate, both physically and functionally, the model selected for the simulations.

3. Two VTR-6050 (VOTAN Corporation) speech synthesis/recognition systems under computer control.

4. A state-of-the-art audio distribution communications system, including:

   a. A multi-channel audio recording system.
   b. A white-noise generator.
   c. Simulated radio frequency and intercom channels.

d. An experimenter's control console.

5. All software systems to accomplish the scenario presentations.

The C3 model chosen to investigate this question is the Weapons Director (WD) on an Airborne Warning and Control Systems (AWACS) aircraft. The WD is one of a team of individuals that provides command and control for friendly aircraft in a potentially hostile environment. Specifically the WD locates, identifies and tracks aircraft, controls weapons against targets, ensures expeditious recovery of aircraft, coordinates with internal and external agencies on mission matters and accomplishes tasks assigned by the Senior Director.

Since his function is primarily control the WD has the largest subset of crewstation displays and functions and a considerable communications workload. The simulations presented to subjects with the C3 generic workstations will be both graphics and communications intensive. A state-of-the-art Audio Distribution System Network (ADSN) is currently being developed to provide a realistic simulation of the AWACS communications environment.

Realistic graphic and tabular information will be presented using a CX1500 high resolution graphics subsystem (Chromatics, Inc.) under VAX control. Input to controlling software will be via console switches, trackball and keyboard as in the real-life environment. Switch actions will be recorded with 1 msec resolution. Other performance data will be collected as specified. A physiological data acquisition system with up to 44 channels will be completed and installed into one of the two VAX systems. All data will be time stamped for correlation with scenario events.

The generic workstations, computers, ADSN and speech synthesis units will be combined in a fully integrated network.

All systems must be fully compatible with those that oversee and present the scenarios. Computer control will be affected through the timed event blocks in the scenario data file. This will include transfer of digitized data between the VTR-6050 and the VAX. The difficulty of the operator's task will be changed through modifying the scenario.

In conclusion, the integrated C3 generic workstation facility will provide a powerful, flexible tool for the collection and analysis of data related to aircrew team performance. Complex decision-making environments simulating real situations can be generated for short-term studies or sustained/continuous operations. Performance, physiological and speech data will be collected and analyzed for individuals and teams of individuals.

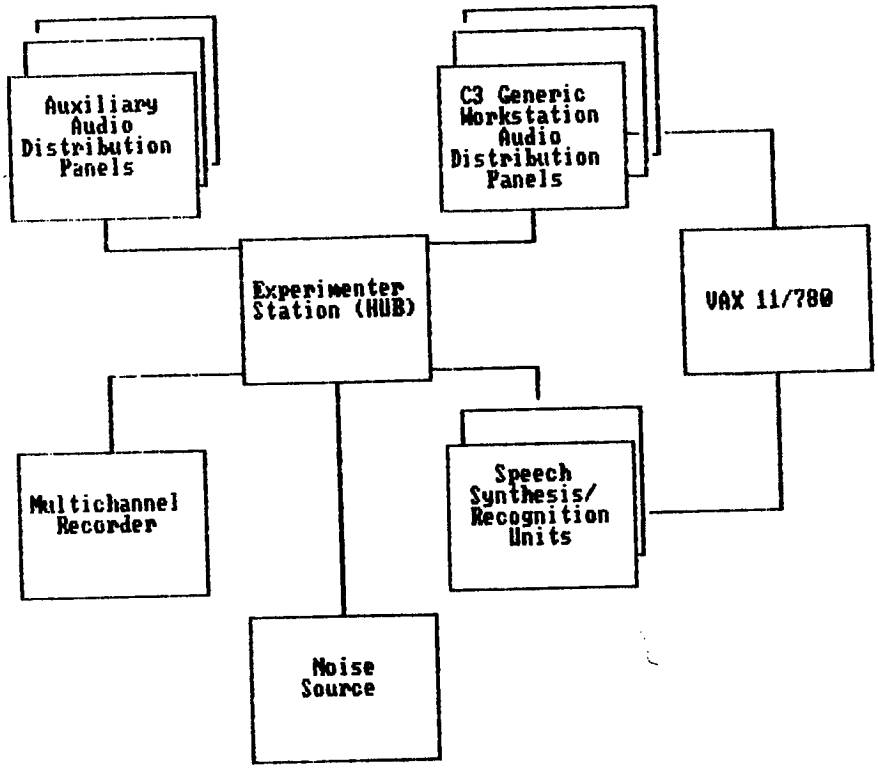

Figure 2. Audio Distribution System Network.

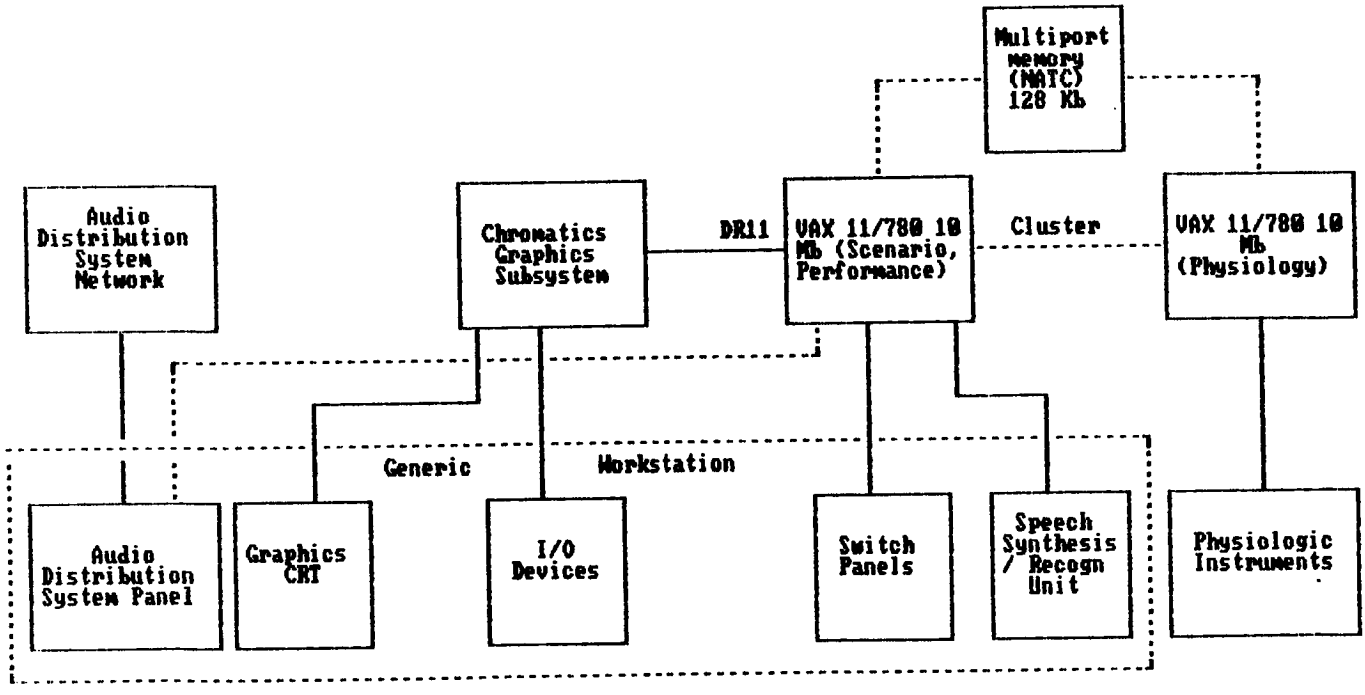

Figure 3. The Integrated C3 Network.

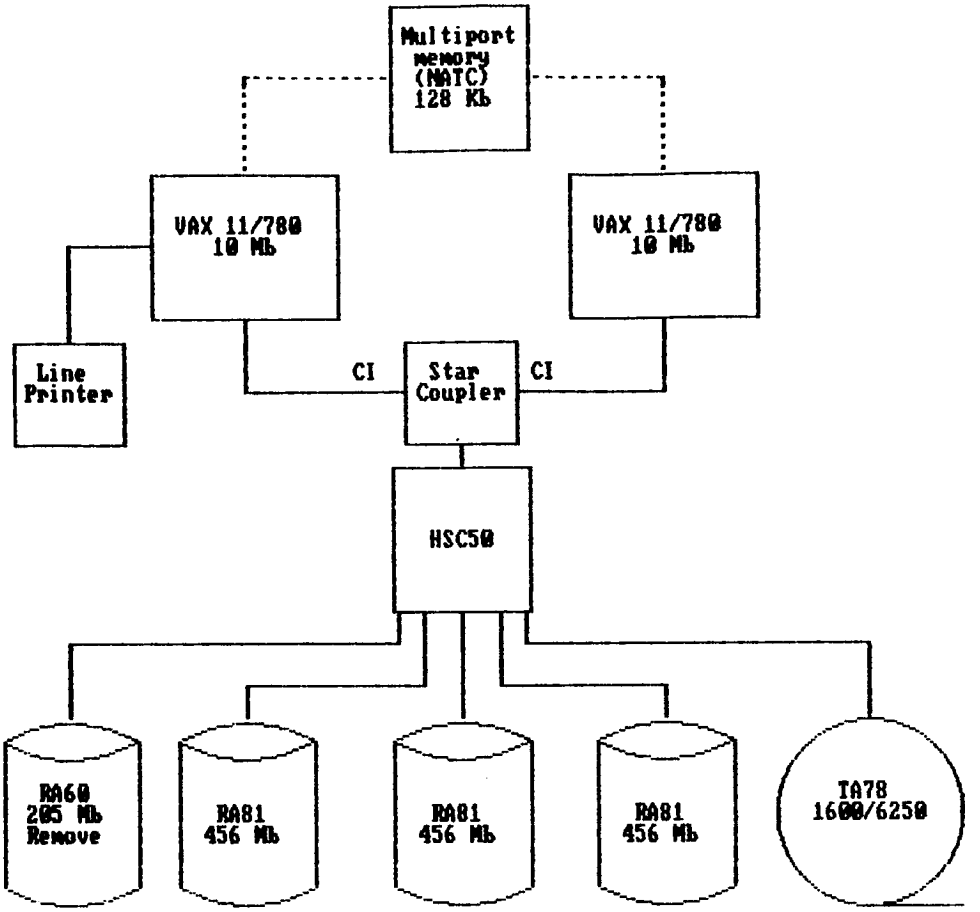

Figure 1. The USAFSAM Crew Performance Laboratory Computer System.