

DESIGN TOOLS FOR EMPIRICAL ANALYSIS OF CREW STATION UTILITIES

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ABSTRACT

Given the rapidly rising complexity of advanced-development aircraft and the diminishing experience pool of crewstation designers, a requirement exists for the implementation of crewstation development tools. These tools must support real-time simulation, advanced displays, and empirical data collection.

Northrops Advanced Crewstation Integration Cockpit (ACIC) introduces full and rapid reconfigurability to a comprehensive aero-dynamic, threat, sensor and weapons system simulation presented to the pilot on conventional or advanced design displays. All controls and displays are reprogrammable, relocatable, and reconfigurable in their size, type of action and graphical attributes. Development capability for expert systems, sensor fusion, and data collection requirements are provided for. This standalone system, operating in real time, is an industry first, unique in its ability to perform high utility simulation at low cost.

Customized, unique performance metrics are both generated and supported by the ACIC.

BACKGROUND

The ACIC is a natural outgrowth of the original Northrop Reconfigurable Cockpit developed in 1987. It is being developed by the Advanced Avionics Development organization at Northrop's Aircraft Division in Hawthorne California. The group is composed of software, avionics, computer hardware, and operational requirements specialists. The program is designed to support display hardware evaluation, symbol set and format evaluation, and human factors engineering studies. The ACIC (Figure 1) will support research and development programs in artificial intelligence/expert systems technologies, the ATF Program, sensor fusion studies, pilot vehicle interface (PVI) systems development, and other advanced programs.

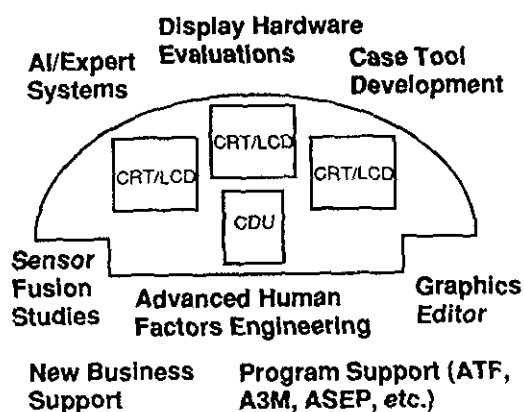


Figure 1: ACIC Support Areas

DESIGN HISTORY

In the past, PVI design philosophies were dependent on limited cockpit hardware and were geared more toward convention than towards facilitating or optimizing the chances for aircraft mission success. The pilot was always required to adapt to and overcome deficiencies of crew station hardware and design.

Typically, cockpits were designed by directive or committee rather than by the application of proven design methodologies. No single design methodology has ever been proven, accepted, or applied industry-wide to cockpit crewstation design. The design-by-directive approach generally resulted in a cockpit that is not mission optimized, and the committee approach tends to drive a design towards mediocrity as a result of continual compromise. The final product requires aircraft crew to overcome deficiencies in design. Aircraft hardware integration problems are often handled in the most expeditious and economical way rather than the most operationally effective way. Engineers and other scientists tend to do what they know how to do rather than what needs to be done.

What was needed was a sophisticated tool that would permit objective and iterative studies of what comprised an effective, mission-optimized cockpit for a given aircraft.

GENERATION 1 RECONFIGURABLE COCKPIT (RCP)

Northrop's answer to this problem was its original Pilot-Vehicle-Interface design tool, the Reconfigurable Cockpit (RCP), Figure 2. The RCP is a projected-display device capable of actualizing panoramic and conventional display and display-format cockpit designs. Other than the pilot's stick and throttle, all flight hardware was simulated by software. This permitted rapid evaluation of virtually any concept of cockpit design, since concepts were not limited by laboratory hardware considerations.

Reconfigurable Cockpit

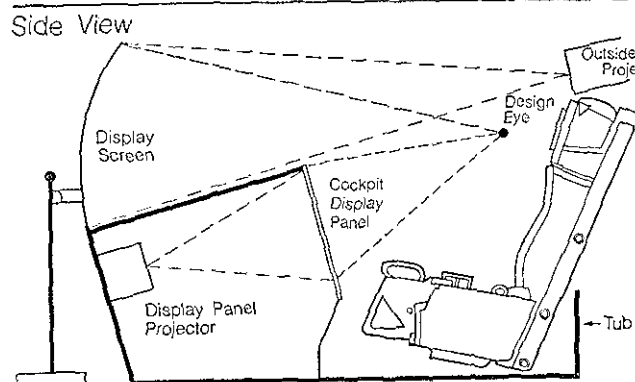


FIGURE 2: Original Reconfigurable Cockpit