TECHNOLOGY WHITE PAPER

# Optimally Utilizing Glass Cockpit Displays

CURTISS-WRIGHT

DEFENSE SOLUTIONS

### Read About

Glass Cockpit Displays

Early Avionic Systems

Air Data Computers

CVFDR Crash Survivable Recorders

Digital avionic integration

Upgrading to Glass Cockpit Displays

## Introduction

In contrast to mechanical displays, glass cockpit displays rely on computerized systems that integrate multiple data inputs and controls. They can present more information in the available space than conventional instrument panels. However, existing on board systems may not output data in the correct format to integrate directly into these displays. This white paper will discuss how glass cockpit displays can be optimally utilized and how Line Replaceable Units (LRU) such as Crash Recorders and Air Data Computers (ADC) integrate with these modern systems.

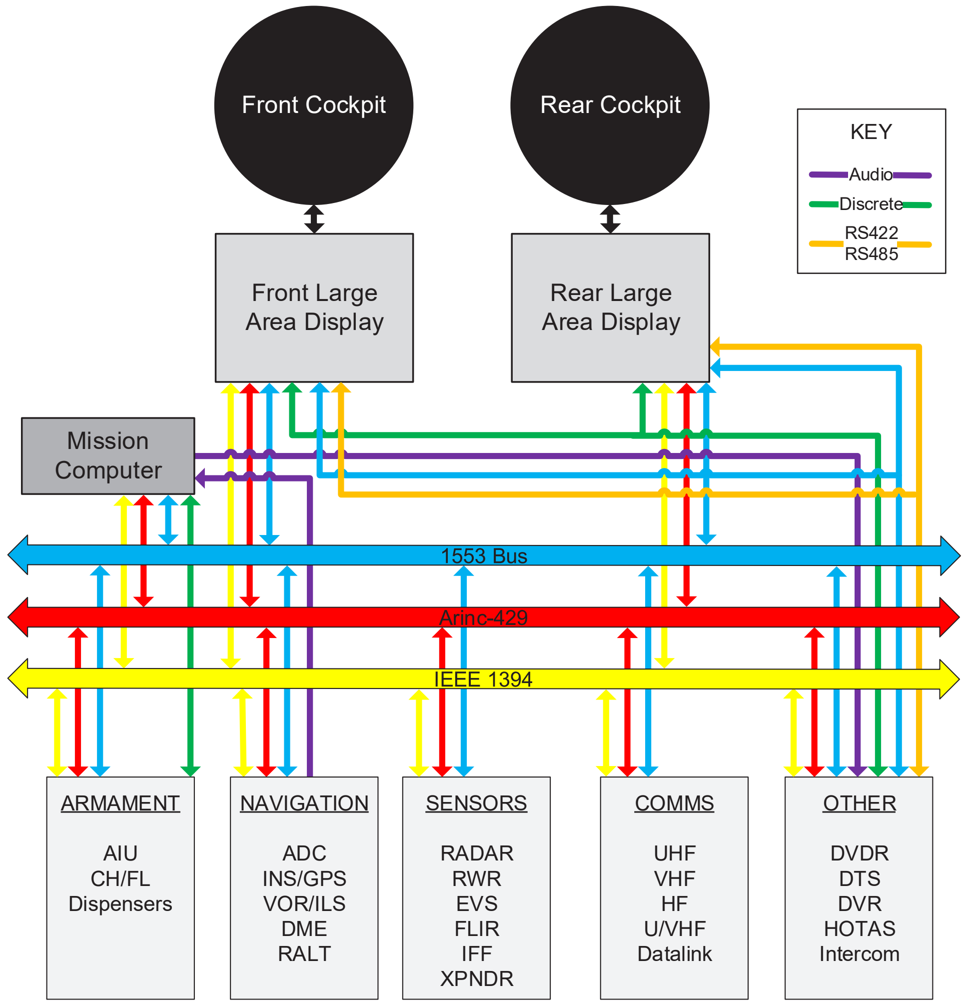


Figure 1: Glass cockpits receive data from multiple systems


### Info

curtisswrightds.com

### Email

ds@curtisswright.com

## Analog Systems

Each of the conventional round-dial instruments rely on electromechanical, pneumatic, or pressure-sensitive components to generate and display specific aircraft performance and control parameters, such as airspeed, altitude, heading, pitch and bank attitude, rate of climb, and rate of turn.

The average transport aircraft in the mid-1970s had more than one hundred cockpit instruments and controls, and the primary flight instruments were already crowded with indicators, crossbars, and symbols and the growing number of cockpit elements were competing for cockpit space and pilot attention. Analog components can suffer from temperature drift and represent data that is hard to store. In pneumatic systems, additional volumes and restrictors are often implemented to smooth out pressure pulses prior to reaching the instrument so that the air crew have a stable indication of a parameter.

These components operate in the analog world and can lack compatibility with modern avionic systems, meaning many OEMs and upgraders are now joining the digital avionics revolution.

## The Introduction of Digital Avionics

The Information Age is generally understood to have arrived with the Internet as it was developed through the 1970s and rolled out throughout the 1980s, and continues evolving to this day. So too the adoption of digital techniques in aviation also arrived progressively at around the same time and continues today.

The first operational fully authoritative fly-by-wire system was developed for the General Dynamics F-16 Fighting Falcon and its introduction in 1978 heralded a revolution in taking over the task of ensuring stability in flight from the traditional aerodynamic stabilizers.

This use of “relaxed static stability” allowed aircraft to be made more maneuverable and to be given an artificial feel to aid pilots in their main task. Meanwhile, the glass cockpit was replacing the traditional analog electro-mechanical instrumentation with graphical digital displays which could display any information selected.

## Line Replaceable Units (LRU)

The avionics digital revolution has meant the introduction of a host of new displays, systems LRUs that can interact with each other more intimately that they have in the past. Some of the systems that interact directly with glass cockpit displays are; Attitude and Heading Reference Systems (AHRS), ADCs, Temperature Probes, Magnetometers and Crash Survivable Recorders to name but a few. Glass Cockpits have the capability to exchange electronic messages via interfaces such as ARINC 429 where message labels identify the source of the data from and to LRUs. This eradicates the requirement for separate data concentrators.

Crash survivable recorders, when handling Flight Data Recorder (FDR) data, have traditionally received an ARINC 717 stream of compiled data directly from a data concentrator or Data Acquisition Unit (DAU). Some modern recorders will accept ARINC 429 data directly from digital systems such as glass cockpit displays.

The ability of the display to receive multiple interfaces and process data from other avionics LRUs also allows the display to act as a data concentrator that is able to output information to the flight recorder. This makes them ideal for applications such as Flight Data Monitoring (FDM), where they remove the need for a separate data acquisition unit and recorder. So when upgrading to a glass cockpit or integrating them onto new platforms, these recorders can reduce LRU count and simplify systems integration.

ADCs are flight critical avionics components that are used in conjunction with modern glass cockpits. The data from these computers use pitot and static pressure along with total air temperature to calculate airspeed, outside air temperature and vertical speed, which is in turn fed to the glass cockpit display and used to feed data to autopilot systems.

## Operational Issues

Curtiss-Wrights has been designing flight recorders for 60 years and their latest offerings are fully compatible with modern glass cockpit display environments. The Fortress DAFR (Data Acquisition Flight Recorder) through utilization of ARINC 429 and 664 interfaces, will allow communication with glass cockpit displays where all pertinent information is fed via other avionics equipment. The Multi-Function Display (MFD) is then utilized as a Data Concentrator Unit (DCU) to provide concentrated data to the FDR eliminating the need for separate wiring and a DAU. Fortress DAFR is state of the art, incorporating 25-hour record times, 90-day underwater locator beacon, cockpit video and data link recording.

The ESCADU (Enhanced Software Configurable Air Data Computer) is already an integral part of the Rockwell Collins, Common Avionics Architecture System (CAAS) which was initially developed for the SOA MH-47G Chinook and MH-60L/M Black Hawk aircraft. It is also widely utilized on many other prolific military and commercial, rotary and fixed wing aircraft.

Our range of ADCs have been providing cockpit crew with flight critical air data parameters for over 20 years and has evolved alongside new and emerging technologies. Our customers feel safe with the knowledge that if they add new aircraft variants to their fleet, they need only a simple software upgrade and can continue using the same units they qualified their existing fleet with.

One ADC with one-part number can hold configurations for up to 15 different aircraft and individual configurations can hold different source error correction data and many other variations. They also eliminate the need for mechanical damping provided by mechanical volumes and restrictors in rotorcraft pitot static systems as it digitally eliminates the effects of rotor downwash thus providing the aircrew with a 'smooth' display of data rather than a rapidly changing digital display.

Figure 2: ESCADU
(Enhanced Software Configurable Air Data Computer)

Figure 3: Fortress DAFR
(Data Acquisition Flight Recorder)

# Authors

Nick Churchill BEng,
Product Manager Air Data Computers
Curtiss-Wright Defense Solutions

# Summary

Analog avionic systems are heavy, space consuming and becoming harder to repair due to obsolescence issues. When installing or upgrading to glass cockpit, it doesn't only eliminate these issues, it also presents the opportunity to use cutting edge, lightweight, highly functional LRUs that adhere to today's and all foreseeable upcoming regulations where the elimination of LRUs and mechanical damping systems will save through-life maintenance costs and real-time operational costs.

# Learn More

Video: Highly Configurable Air Data Unit Reduces Inventories and Costs

White Papers:

- Addressing Safety and Maintenance Concerns without Increasing LRU Count
- Air Data Parameter Accuracy
- Optimizing Air Data Computers for Rotorcraft Applications