CASE STUDY

Pre-integrated, Rugged COTS Computers Reduce AEW&C Program Costs and Time to Market

CURTISS-WRIGHT

DEFENSE SOLUTIONS

Challenge

- Power dissipation and cooling in a restricted environment
- Evolving thermal requirements
- High pin-count I/O requirement with low MTTR

Solution

- Thermal modeling and simulation
- Companion mounting tray with integral fans
- Flexible approach, attentive quick action on customer queries

Results

- 6U mission and radar processors
- Custom enclosure design with thermal management
- Easily removable for service despite high density I/O

Challenge

The technological advancements over the last three decades have outdated aerospace and defense systems built in the 1980's. As such, many of these systems need to be upgraded to remain effective and competitive in modern applications. When 30 year old airborne surveillance and control equipment mounted on the underside of an aging helicopter required replacement, the manufacturer needed a trusted, proven leader they could rely on to provide mission critical processing technology in harsh environments.

Having engaged with Curtiss-Wright in 2013, the customer identified the need for both a mission and radar processor with demanding power dissipation requirements, due to the heavy amount of signal processing required. Relatively large systems, the radar processor would directly interface with the radar system and the mission processor would provide a user interface to the radar system. Due to both the physical space available and environmental conditions, a custom enclosure developed around COTS boards provided the most cost effective solution while guaranteeing reliability in the challenging thermal environment the high power dissipation produced. Without suitable thermal management design, component temperatures could rise to levels that cause failure. The rate of failure increases as the operating temperatures increase, and early on in the program the top temperature that the systems needed to reliably operate in, increased, thus increasing the difficulty of the thermal design.

As with most programs of this size with numerous stakeholders tracking its milestones and achievements, keen attention to program management and effective customer support was important to keep it on time and within budget.

MPMC-9666-0001 - Mission Computer

Solution

The customer felt that Curtiss-Wright was in the best position to meet the program requirements based on previous experience with Curtiss-Wright products. Awarded in 2017, Curtiss-Wright recently delivered the first Early Access Units (EAU) to the customer: two rugged, pre-integrated COTS mission computers. The mission processor was integrated with an OpenVPX, Intel® Core™ i7 Single Board Computer (SBC) (VPX6-1957), two OpenVPX signal processing cards (CHAMP-AV8), and two mezzanine cards mounted on the SBC: a high performance graphics accelerator (XMC-715) and a third party XMC serial interface. A 24 port Ethernet switch was also provided as well as a safety certifiable SBC (VPX3-150) used to connect to systems sensitive to safety certification requirements (DO-254 and DO-178). The radar processor comprised of up to four signal processing cards (CHAMP-AV8), a slot for a customer supplied card, and a fibre optic XMC.

On-board, the mission processor was housed in a cabinet, restricting the airflow to the system. This posed an additional power dissipation challenge. Solving thermal management problems up front in the design phase created a more reliable product and prevented expensive changes later on, thus Curtiss-Wright made a significant investment in thermal modeling and simulation to achieve a tradeoff between fan design, configuration, and acoustic response that ensured reliability. Both systems were housed in ARINC 600 9MCU chassis with rear ARINC 600 connectors, which mate with a custom tray containing fans and mating connectors, enabling the customer to remove the system for maintenance. Using blind-mate ARINC 600 connectors met the I/O density, serviceability and Mean Time to Repair (MTTR) requirements of the system. The tray-mounted fans were also removable as field-replaceable units without removal of the tray and associated disconnection of fixed wiring.

Curtiss-Wright's agile design and development process enabled the flexibility necessary to swiftly address the evolving thermal requirements. The best in class program management and customer support teams provided attentive program management and customer queries servicing.

Results

The use of COTS boards to meet the signal processing requirements kept costs and development time down while the custom chassis design addressed the challenging heat dissipation requirements. A trusted, proven leader in COTS boards, custom enclosure design, and thermal management, Curtiss-Wright was uniquely positioned to develop the processing platforms for deployment onboard the helicopter, where optimal performance is critical in the harshest environments. Successful program management and customer support ensured the programs schedule and budget was met.