CASE STUDY

IMMC: Integrated Mission Management Computer

CURTISS-WRIGHT

DEFENSE SOLUTIONS

Application

- IMMC is used as a flight computer in a dual-redundant configuration on the RQ-4 Global Hawk UAS
- It has been further developed for use on the MQ-4C Triton UAS for maritime surveillance
- Interfaces with all flight critical control subsystems, full avionics input/output (I/O) suite in a highly-equipped, rugged, PowerPC-based embedded system

System

- Flexible, deployed VPX open architecture system enables end-user to execute vehicle-tailored flight control law algorithms
- Rugged conduction-cooled design eliminates the need for cold plate
- Provides a complete flight control solution with full avionics I/O, optimized BSP running on PowerPC architecture

Results

- Triton IMMC features improved mounting/installation and reduced re-install times
- Improves Mean Time to Replace (MTTR) through better thermal management, reduced spare quantity requirements and extended product lifecycle
- Lowers total product cost and meets required program affordability targets

Application

Northrop Grumman's High Altitude, Long Endurance (HALE) unmanned aircraft systems (UASs) continue to establish new historic benchmarks. On May 22, 2001, an aviation milestone was set when the RQ-4 Global Hawk UAS reached the 1,000 flight hour mark. On June 5, 2006, Northrop Grumman made history with Global Hawk by setting a record of 10,000 flight hours. By the end of April 2015, the UAS had surpassed 150,000 flight hours, seventy-five percent of which were in combat/operational sorties.

Curtiss-Wright Defense Solutions has supplied Northrop Grumman with the dual Integrated Mission Management Computer (IMMC) computers that are used as the redundant flight control processors aboard the Global Hawk since the inception of the program in 2000.

Today, Curtiss-Wright also provides critical onboard flight systems for Northrop Grumman's next-generation MQ-4C Triton, a UAS designed and built to meet the U.S. Navy's maritime surveillance needs.

To support the Triton aircraft's flight controls requirements, Curtiss-Wright developed the latest variant of the IMMC. Through our expertise in designing SWaP-optimized systems, Curtiss-Wright redesigned the box with an alternate mounting technique, which resulted in significant improvements in thermal performance, system reliability and overall system performance.

Integrated Mission Management Computer

System

The IMMC features high-performance processing elements that execute elaborate flight control law algorithms. It also provides handshake controls for redundant architecture implementation. Its integrated I/O interfaces with the UAS's flight-critical subsystems which include: temperature and pressure sensors, engine, fuel systems, altimeter, power, bay doors, air speed sensors and ice detector. The IMMC can be used to complete the control loop for a myriad of functional system interfaces, such as weapons coordination, radar, communications, GPS navigation, brakes, telemetry, anti-jam module, crash recorder and fuel management systems.

Results

As an experienced supplier of commercial-off-the-shelf (COTS) subsystems for UASs, Curtiss-Wright has amassed unique insight into the challenges and best practices for developing optimal subsystem solutions, both for unmanned aircraft and the ground stations that support them. For HALE platforms, SWaP is a key design consideration; weight and power are usually the most critical.

Curtiss-Wright's knowledge of subsystem architecture optimization has led to significant improvement in the design of the latest generation of the IMMC and how it is mounted in the chassis. Collaborative discussions about the design of the previous generation IMMC revealed that as the UAS evolved, the installation and removal of the IMMC subsystem had become increasingly time-consuming. In addition, there were concerns about the thermal management of denser, hotter next-generation electronics in future upgrades.

This valuable input led Curtiss-Wright to evaluate the installation process and the subsystem's thermal management. The earlier version of the IMMC used a sliding/stacking approach. Installation and removal of the unit proved cumbersome and impeded cooling airflow. Provided with new insight into the platform's configuration that went beyond the details provided in the final specification, Curtiss-Wright leveraged its expertise in optimizing SWaP-constrained subsystems. As a result, the IMMC chassis was completely redesigned with an alternate mounting technique. The new design also features improved thermal performance that provides a greatly reduced MTTR while increasing the overall system reliability. Curtiss-Wright, working closely with Northrop Grumman, was able to deliver a lower cost of ownership and significantly decrease risk to the program.

The successful execution of the Triton IMMC is the result of collaborative and innovative efforts between Northrop Grumman's and Curtiss-Wright's engineering teams. Close communication between the COTS vendor and the system integrator plays a significant role in delivering optimized UAS solutions. Curtiss-Wright's rugged and deployed systems serve as scalable and flexible solutions, ranging in size and power, for use on-board unmanned aircraft, such as the Global Hawk and Triton.

RQ-4 Global Hawk UAS

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