CASE STUDY

Health Monitoring for Light Combat Aircraft

CURTISS-WRIGHT

DEFENSE SOLUTIONS

Challenge

- Scaling from lab to fleet-wide deployment
- Requirements capture
- Operator friendly

Solution

- Cloud-based fleet management
- "AviBlocks" avionics rapid prototyping
- Custom diagnostics

Results

- Modern CBM maintenance system
- Customer developed unit
- No NRE cost

Background

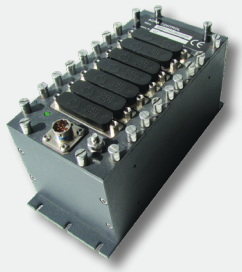
Over many decades, Air Force fleet managers have discovered that total cost of an aircraft asset can go far beyond the initial procurement costs. For many 20th century combat aircraft, the maintenance costs can reach $100M per aircraft over their lifetime, which places a huge burden on defense budgets. It is recognized that 21st century platforms must not only contain modern materials and modern systems, but also must be compatible with a modern condition based maintenance (CBM) approaches to aircraft maintenance which monitor key structural and performance parameters. This makes it possible to leave aircraft in service, returning for maintenance only when the monitoring system triggers a specific maintenance action. These health and usage monitoring systems (HUMS) play a crucial role for 21st century fleet managers, freeing up maintenance time and keeping assets flying for many decades in an economically feasible manner.

Challenge

Curtiss-Wright has supplied usage monitoring systems into many programs for over 20 years, and we have observed many HUMS implementation challenges up close, e.g. sensor selection, certification, integration and data analysis. In addition to these, the HUMS programs that are most successful tend to overcome the following principal challenges:

- Requirements capture (What to measure? How to measure?)
- Scaling from laboratory to fleet-wide deployment
- Creating an operationally robust system that doesn't require experts

Developers of a recent light combat aircraft (LCA) approached Curtiss-Wright describing just these challenges.



FDAU - Flight Data Management Unit

Solution

The modular nature of the Acra KAM-500 system allowed developers to overcome the challenge of requirements capture. With access to a prototype chassis and a selection of off-the-shelf interface modules, developers are able to iteratively test and validate their measurement specification with real hardware. This significantly fast-tracked requirements capture for the LCA HUMS development, so much so that the scope was expanded to include flight trials of the prototype HUMS units.

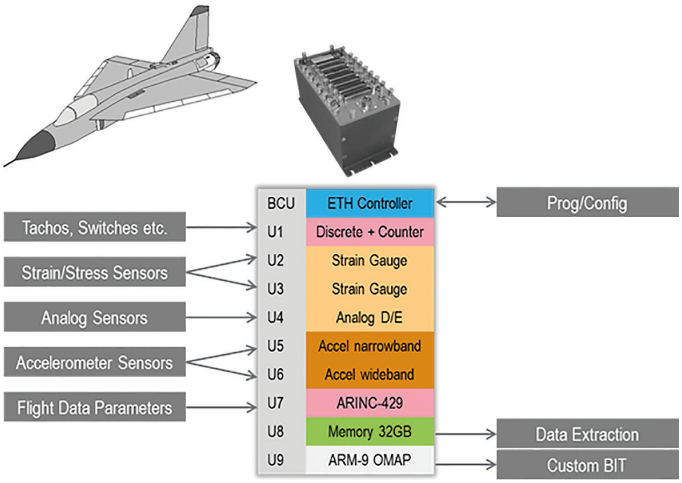


Figure 1: Example configurable measurement system created using standard Acra KAM-500 modules

To facilitate the move from laboratory trials to fleet deployment, Curtiss-Wright took the “frozen” measurement specification and created a custom line replaceable unit (LRU) with the LCA HUMS configuration specifically loaded. This particular LRU will be available to order for the life-time of the platform. Curtiss-Wright also provided the necessary documentation to support integration and certification of the new HUMS LRU, since the unit was based upon Acra KAM-500 technology these documents already existed and were delivered with minimal non-recurring cost.

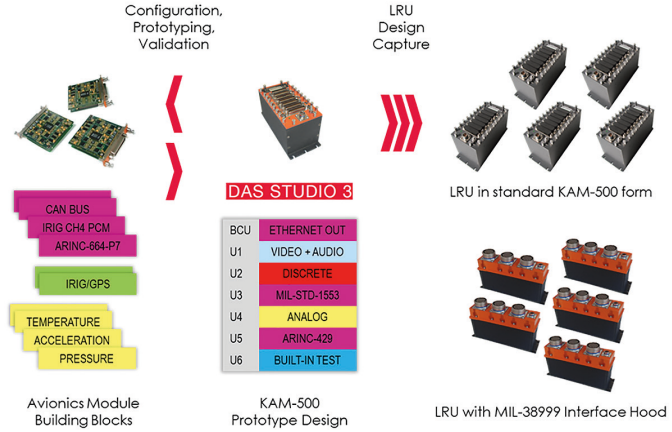


Figure 2: Moving from prototyping to production units using modular data acquisition systems

The LCA HUMS developers recognized that they would need to deliver a user-friendly LRU to their target fleet. This was essential since in the majority of cases non-specialist operators and installers would be handling the units. A microprocessor module (MAT/101 using an ARM9 processor) allowed them to develop their own customized built-in-test (BIT) routines facilitating remote field system check for integrators and system diagnostics for maintainers.

Results

The LCA operators are expecting the implementation of a CBM to reduce maintenance costs by about $70 million per aircraft, per year. The HUMS program has been greatly enhanced with a tailored monitoring unit and hosted application. Curtiss-Wright delivered this unit without a non-recurring engineering bill as might be expected for other technologies. The HUMS developers were impressed with the way KAM-500 technology can be seamlessly applied to prototyping and also fleet deployment. The time saved allowed for additional evaluation both in the laboratory and in the air.

The path to future upgrades and technology refreshes is clear thanks to the modular nature of the HUMS system. And because upgrades only involve module changes, the headaches associated with LRU removal and re-certification are largely avoided.

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