HUMS TECHNOLOGY PRESENTATION

Synopses are invited for presentations on technologies in advanced stages of development related to Health (Condition) and Usage Monitoring. Applications can be across any of the HUMS fields of aerospace, land vehicles, marine vehicles, and data processing and/or management.

The technologies will be reviewed by the HUMS2017 Committee, for presentation in the "Application Technologies Steam" of the Congress, at the Avalon Airshow.

The Synopsis be submitted on the template as specified below

Brief Synopsis Template

Presentation Title: Live demonstration of Structural Health Monitoring and Damage Detection System
Presenter Name: Dr Thomas Melia
Company: Curtiss-Wright (Acra), Critical-Materials
Address: Unit 5, Richview Office Park, Clonskeagh, Dublin, D14 X981, IRELAND
Telephone: +353 1295 1264; **Email:** tmelia@curtisswright.com

Background (150 words)

Aircraft maintainers and operators who use Structural Health Monitoring (SHM) systems are able to determine if structural damage has occurred, when the damage event occurred and precisely where the damage is located. A SHM system feeds into a Condition Based Maintenance (CBM) regime, where aircraft maintainers can efficiently direct their resources towards the aircraft that actually require repair, the result is less overall maintenance effort and increased aircraft availability.

SHM systems aim to monitor aircraft components in near real-time and detect structural defects when they happen. Rather than just reporting loading cycles on structural components, a SHM system will report actual changes in structural components.

SHM techniques have been used for many years on the ground for aircraft inspection and overhaul. The terms NDT or NDI (non-destructive test or inspection) are typically used in this context. SHM is becoming important for new composite airframes where traditional metal fatigue models are not useful and where damage is often not apparent at the surface.

Design & Development (250 words)

There is a good awareness of the benefits of SHM within the aerospace community for many years, however it is only now that airborne solutions are being developed, driven in a large part by the introduction of composite structural components.

SHM solutions require

- High-fidelity data acquisition hardware
- Robust damage detection algorithms

Curtiss-Wright has partnered with Critical Materials to offer complete SHM solutions that combine Acra KAM-500 instrumentation units with Critical Materials tailored detection algorithms.

Our SHM solutions do not rely on bulky NDI equipment and techniques, but rather use a minimized number of low-cost sensors to guarantee a specified POD (probability of detection), e.g. 12 accelerometers optimally distributed on a wing-surface to guarantee detection of defects with surface area >1cm^2.

System Specifications (100 words)

This technology demonstration is a scaled down version of our airborne SHM (structural health monitoring) system that is currently flying on multiple platforms, including the Portuguese SAR fleet.

The system consists of the following off-the-shelf elements:

- SSR/CHS/001 - Airborne multi-role recorder with integrated data acquisition and CompactFlash drive
- KAD/ADC/126 - Accelerometer ADC (current excitation, programmable analog gain, 25kHz b/w) - 4ch at 100ksps
- Commercially sourced CompactFlash Card
- KAD/MAT/101 - Microcontroller-based module
- PRODDIA AERO software platform for Structural Health Monitoring, Operational Loads Monitoring and Damage Tolerance Analysis of in-service aircraft
- Mechanical jig consisting of representation of an aircraft panel, defect simulation and accelerometer sensors.

The demonstration will show how the various elements operate together to provide real-time damage detection and reporting.

Application Status on Platforms (250 words)

The demonstrated technology has been used in the aircraft test and monitoring community for 20+ years, and is currently flying on hundreds of platforms globally, including several RAAF health monitoring programs: RAAF F/A-18 OLM, RAAF PC-7 OLM, RAAF C-130 OLM (via Marshall Aerospace).

The combined hardware / software solution demonstrated is scaled version of a SHM system currently flying on the Portuguese SAR fleet.

Future Development Plans (150 words)

This system is being proposed into multiple SHM programs globally. Particular areas of improvement include:

- the ability to move portions of the Proddia algorithmic processing into the hardware embedded processors.
- the ability to scale to large fleet health management via the Proddia Cloud based services.