Wireless Intelligent Sensing Devices for helicopters

Helicopter operators usually schedule maintenance after a defined number of hours flying, but with varied aircraft usage some components might be over-serviced, while others may require earlier attention. For example, a helicopter used for search and rescue may be far more taxing on its components than one used for a television crew. Components may work harder in a climb than they do when cruising.

By monitoring the structural health of key components, major maintenance cost savings for helicopter operators can be achieved by reducing the need for invasive inspection processes and unplanned maintenance.

Sensors can be fitted to key structural components to monitor stresses and enable the remaining component lifetime to be estimated, but as many of the key components on a helicopter are rotating, making the connections to the sensors is difficult.

The collaborative research project "Wireless Intelligent Sensing Devices" (WISD) developed wireless (radio) technology to overcome these sensor connection problems and transmit the data back to a monitoring system.

The 3-year WISD project partnered TRW Conekt, University of Bristol and Systems Engineering & Assessment Ltd (SEA) together with lead partner AgustaWestland. The project, part funded by the Technology Strategy Board, drove a progressive approach to the development of the wireless sensing devices and demonstration of the technology on a flying AgustaWestland Lynx helicopter.

Strain and vibration sensing modules are mounted on key helicopter components such as the rotor blades to quantify accurately the used life and predict the life remaining. The sensing modules are self-contained and contain local signal processing to run sophisticated life prediction algorithms – this is the "intelligent" part. The modules transmit information over a wireless link only when the structural health changes and requires attention or maintenance. This provides an efficient alternative to the traditional approach of streaming raw data back to a central monitoring unit.

image courtesy AugustaWestland

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The Conekt Approach

When a traditional mechanical automotive system, such as ignition switch and key, is being replaced by an electronic equivalent, a number of safety considerations need to be made. TRW Conekt was approached by a Tier 1 automotive supplier to support the redesign activity of an electronic replacement for a mechanical ignition switch and key.

Conekt assessed and managed the safety risk posed by this new system at the design stage by adopting a "Safety Case" approach. By using bespoke analysis tools and industry best practices including Hazard Analysis, Fault Tree Analysis (FTA) and Failure Modes and Effects Analysis (FMEA), the risk posed by the design was assessed.

Benefits

By carrying out a preliminary hazard analysis, Conekt was able to report on the likelihood of occurrence of each of the principal hazards during vehicle use. Hazards during maintenance, non-operational periods and disposal were also considered.

The safety analysis identified 15 improvements that were successfully integrated into the production process, culminating in the successful commercial launch of the product, which has now seen a number of years of service without incident. Close client collaboration brought about a number of improvements in the client's own processes, which allowed them to address and rectify a further five potential safety issues.

Applications

Safety analysis has been applied to a number of systems including the following:

- Electric Steering
- Automated Parking System
- Electric Parking Brake
- Lane Departure Warning
- Adaptive Cruise Control
- Fuel Cell System and Electric Drive System for Fuel Cell Taxi

For more information on Systems and Safety, contact:

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