Transfer The Laboratory for Analysis and Architecture of Systems (LAAS) in Toulouse is a model example of how research, innovation, and industry can come together to create useful applications.

In-Flight Propeller Control

BY VAHÉ TER MINASSIAN

→ **A team of nano-engineering specialists at the LAAS**[1] has developed a device that can monitor the wear and tear on airplane propellers *in situ* and in real time. The so-called Structural Health Monitoring (SHM) system is based on microsensors that record the condition of mechanical devices while they are in use. Novel SHM technologies are in high demand by aircraft manufacturers, who are increasingly using composite materials in their planes (from doors to fuselage components). "Composites offer many advantages in terms of weight, but their defects are difficult to detect. As a result, a battery of expensive tests must be carried out periodically and, for safety purposes, certain components need to be oversized during the design phase," explains Jean-Yves Fourniols, who headed the project at the LAAS.

To overcome this problem for aircraft propellers, Fourniols and collaborators Christophe Escriba, Thierry Camps, and Jean-Louis Boizard, together with propeller manufacturer Ratier–Figeac,[2] developed a system based on intelligent microsensors (Microelectromechanical systems, or MEMS) that can measure in real time the speed, shock forces, and vibrations each propeller blade is subjected to in flight. Provided by accelerometers arranged in groups of one to three on each blade, the data is transmitted to the microcomputer (a few cubic centimeters large, installed in the propeller's hub) which can be monitored from the ground using a simple RFID receiver.

The system has been successfully tested on a drone, and will now be experimented by the French armed forces on a Transall military transport aircraft. The fact that no structural modifications to the planes are necessary makes this a viable option for existing fleets.

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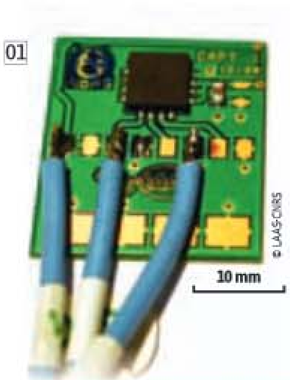

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01 The Structural Health Monitoring (SHM) system relies on data from accelerometers being transmitted to a microcomputer (pictured here). 02 The microcomputer installed on a Transall propeller blade.

Fast Vehicle Diagnostic System

BY BRETT KRAABEL

→ **Modern vehicles are packed with electronics,** making it increasingly difficult to diagnose maintenance faults. To make the task easier, a team led by Louise Travé-Massuyès from the LAAS[1] has developed a model-based-reasoning (MBR) diagnostic system that helps mechanics identify faulty components more quickly and cheaply.

The novelty of the MBR system lies in its approach. Rather than monitoring the static response of a single component and letting the mechanic sort out how it relates to others, the MBR system records the dynamic signals from a number of components over a period of time. It then generates a set of curves that it compares to reference curves from a database of existing fault models, and suggests a valid test for the mechanic. The MBR system was developed in Toulouse within a project of the Autodiag joint laboratory, which is the fruit of a financial and technological collaboration between the French electronics manufacturer Actia and the CNRS laboratories LAAS and IRIT.[2] It has already been granted a French patent and is awaiting a European one.

Although originally aimed at the car industry, this technology may find applications in virtually any market where electronic control units pilot mechanical devices (the burgeoning field of mechatronics), such as aeronautics, trains, and industrial machinery.

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03 The model-based-reasoning (MBR) diagnostic system is used to help mechanics identify the source of any given problem.