

Press Release

Science and technology in aeronautical engineering – autonomous communicating sensor networks

The StrainWISE project acclaimed at the Mechatronics Awards 2013

Neuchatel, October 30, 2013 – The Clean Sky project StrainWISE has been awarded the “Research” prize of the “Mechatronics Awards 2013” at the European mechatronics meetings held in Toulouse on 25 and 26 September 2013. The consortium responsible for this success is made up of CSEM (coordinator), Imperial College London and Serma Ingénierie.

This particularly ambitious project resulted in the development of a high-performance and ultra-low-power wireless sensor network platform meeting the requirements of the aeronautical industry. Such wireless communication devices open up new possibilities for the preventive maintenance of aircrafts, for improving cabin supervision and passenger comfort, as well as for better monitoring the aircraft critical structures and equipment such as the engines or landing gears. The proposed solution allows the installation of a large number of sensors, without any restrictions on their location, hence providing additional or more precise data. The new information, provided without any additional wires, allows for an improved control of the aircraft and presents major advantages compared to traditional solutions, notably in terms of fuel consumption and maintenance costs. Owing to these achievements, the project won the top prize in the “Research” category at the *Mechatronics Awards 2013*.

The StrainWISE project, initiated by Airbus as part of the “Clean Sky” program, clearly demonstrates the wide range of use of wireless sensor networks in aeronautical applications. Each sensor is equipped with a radio transceiver and an independent power supply. Energy consumption, both during flight and while the aircraft is on the ground, has been reduced to a minimum by a combination of energy-efficient electronic components and by the optimisation of the communication protocol: using the right protocol is a key enabler, as radio transmissions represent by far the biggest power drain. The combination of the various selected techniques made it possible to solely power the sensor by harvesting from a thermoelectric energy recovery unit, therefore avoiding the need to change batteries throughout the sensor 35-year life. Thanks to this unlimited autonomy, a wide array of sensors can now be placed very close to the structures to be monitored, at places that would be very difficult to access for maintenance, such as in the fuselage, the wings and the stabilizer. Each sensing node allows the measurements to be timed with an accuracy of less than a millisecond, for sampling rates ranging from 120 to 500 Hz, and carries its information by radio to the plane computers. They do not interfere with the operation of the pre-existing devices, as the system successfully passed the qualification tests related to radio interferences – qualifications which are subject to extremely stringent criteria.

A demonstrator has been delivered to Airbus and is currently undergoing tests. The partners are pursuing their collaboration as part of a new Clean Sky project called “FLITE-WISE”, the objective of which is to create a new platform of high-speed autonomous sensors intended for use on the outside of the aircraft, both on fixed and moving parts.

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Image of a node in the sensor network. The metal plate is positioned against the interior of the aircraft's cabin. The red tank (thermal insulator) contains water, whose conversion to solid state is delayed when the aircraft climbs in order to create a temperature differential at the extremities of the TEG cell, which is converted into electrical current. The green circuit board controls energy flow and recharging of the battery. The blue board contains the sensor interface, the radio frequency circuit, the antennas, and the microcontroller, the heart of the system's intelligence.

Additional information

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About the Mechatronics Awards 2013

Launched in 2008, the Mechatronics Awards – awarded at the European Mechatronics Meetings, EMM, – have become a real institution for the mechatronics sector. While the term mechatronics has gradually become part of common technical language, mechatronics applications, although very numerous, rarely receive media attention because they are often integrated into large complex systems. For this reason the Mechatronics Awards were created, in order to showcase particularly innovative products, procedures, research and services. The theme of the 2013 competition was aeronautical engineering, automotive, space, and production tools for these sectors. Mechatronics is everywhere: in the design of aircraft, of vehicles, of satellites, or of industrial or service robots, in anything from the simple component to critical embedded systems.

To find out more, go to www.emm-mechatronics.eu

About the StrainWISE project

StrainWISE – a project from the European Clean Sky programme

The project, which lasted for two years, was allocated a total budget of EUR 795,000 shared between the partners and partially funded by them. CSEM was responsible for the smooth running of the project as its co-ordinator. It also developed the general architecture of the system and was responsible for the ultra-low-energy wireless communication protocols as well as their embedded deployment. Imperial College London designed and created the thermoelectric energy recovery device used to fuel the system nodes. Serma Engineering designed the hermetic housings for the nodes and carried out the multiple tests used to qualify the system for the aeronautical sector.

For more information about the Clean Sky programme, go to www.cleansky.eu

About CSEM SA

CSEM – an innovation center

CSEM SA, founded in 1984, is a private research and development center specializing in microtechnology, nanotechnology, microelectronics, system engineering, photovoltaics and communications technologies. Approximately 400 highly qualified and specialized employees from various scientific and technical disciplines work for CSEM in Neuchâtel, Zurich, Muttenz, Alpnach and Landquart.

Further information is available at www.csem.ch

About SERMA Group

SERMA GROUP offers an independent, international one-stop-shop for services in electronics. Specialised in electronic technologies for high stress environment, the group has developed around its culture of technical excellence and its in-house network of experts.

Throughout the electronics life cycle, SERMA GROUP provides global offers around 7 major themes: consultancy and technology auditing; physical expertise and electrical tests; critical systems evaluation and information security; development of embedded electronics; ASIC & FPGA design, ASIC production; microelectronic packaging; technical training.

750 engineers and technicians are the strength of the Group operating with 10 industrial sites, at the closest of multisectoral customers, aeronautic, automotive, industry, aerospace, military and medical.

The Group consists of the following subsidiaries: SERMA TECHNOLOGIES, SERMA INGENIERIE, IDMOS, PE GmbH, HCM.SYSTREL and SERMA GmbH.

About Imperial College London

Consistently rated amongst the world's best universities, Imperial College London is a science-based institution with a reputation for excellence in teaching and research that attracts 14,000 students and 6,000 staff of the highest international quality. Innovative research at the College explores the interface between science, medicine, engineering and business, delivering practical solutions that improve quality of life and the environment - underpinned by a dynamic enterprise culture.

Since its foundation in 1907, Imperial's contributions to society have included the discovery of penicillin, the development of holography and the foundations of fibre optics. This commitment to the application of research for the benefit of all continues today, with current focuses including interdisciplinary collaborations to improve global health, tackle climate change, develop sustainable sources of energy and address security challenges.

In 2007, Imperial College London and Imperial College Healthcare NHS Trust formed the UK's first Academic Health Science Centre. This unique partnership aims to improve the quality of life of patients and populations by taking new discoveries and translating them into new therapies as quickly as possible.]

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