

Live Round Table on PHOTONICS AND RELIABILITY

"Assessment of long-term Reliability, Prognostic and Health Management (P&HM) and Predictive Maintenance of Aerospace and Wind Power structures: Attributes, Challenges, Pitfalls, Roles, Significance."

To the benefits of ESREF attendees:

Thursday October 7th, 2021

2:40 PM

Organized by :



Live or face-to-face venue: University
of Bordeaux (France) IMS
Laboratory.

Register before: **October 1st deadline**

<https://esref2021.sciencesconf.org/>



Context:

The industrial automation ecosphere is going through a major transformation towards the actual industrial revolution, or Industry 5.0. New and mature critical **infrastructures such as Wind Power farms, Aeronautics transporters, Automotive, Nuclear Power stations**, but also concrete bridges, high rise buildings, large dams, offshore platforms and steel pipelines are continuously experiencing environmental corrosion, material aging, fatigue, natural disasters and very complex operational loading.



Prognostics and Health Management (P&HM) is

an enabling discipline consisting of technologies and methods to assess the reliability of a product in its actual life cycle conditions to determine the

risk of failure and mitigate system operation. However, the deployment of PHM capabilities presents multiple challenges to the PHM practitioner charged with retrofitting such systems. Issues include a lack of specific instrumentation needed to capture the signals of interest; insufficient data and sampling rates required for fault detection and diagnosis, and for detection of failure/degradation indicators; and difficulties in the identification of a system's nominal behavior as a result of age induced degradation.

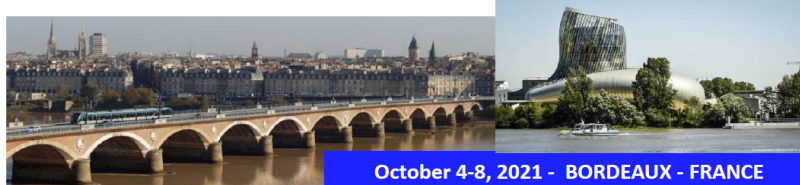
Advanced Diagnostics and Structure Health Management are applied separately or concurrently at device or component levels, as well as at subsystem, structure, system and/or total platform stages, sensor networks, protocols and agents, depend on the mission profiles stress conditions undergone by these vital systems. Checks and maintenance are periodically scheduled throughout their operational life.

Both PHM on systems and Structure Health Management on structures sustain operation cost and time reduction by optimizing maintenance planning when needed, manage equipment life time, impacting positively structural weight at design stage inducing energy savings.

The collateral **Structural Health Monitoring (SHM) network, one element of the global Structure Health Management, provides**

important advantages in Safety by constant monitoring to apply the most appropriate procedure and protocols. This methodology aims to deliver the best operation survey and benefit from recorded in-situ data of any component ageing induced by operation.





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Main topic

of the Round Table is **to focus on SHM fiber optical sensing solutions** as technologies to ensure the integrity of parts, components, materials, and structures without damaging them. They are used to monitor and make diagnosis related to predict ageing behavior during operation. They help to anticipate any possible failure of the structure/component. Therefore, their reliability assessment during all life cycle is key.

The aim of the virtual session

is to give system engineers, developers, users practitioners, and integrators a chance to discuss their capabilities and experiences at any or all of these application levels. This event is a chance to hear about the vision and the roadmap of several key industries, research laboratories and academics proposing low TRL innovative constructions as well as high TRL products leading the **mainstream market of MRO industries (Maintenance, Repair, and Operations)**. It is expected to give an overview of the needs, challenges, and roles within this ecosystem and to discuss pitfalls and significance of lessons learned from **System Manufacturers, Industry Services, Agencies, Academic Laboratories, Research Centers and End-users acting in the fields of Aeronautics, Wind Power Energy, Automotive and Ground Application Industries**.

Organization of the Round Table

Virtual session talk and discussion will focus on optical sensor technologies, techniques and services related to the integrity control of mechanical structures implemented in the Wind Power, Aeronautic or Automotive domains.

The virtual session feature internationally prominent researchers working on frontiers of science and engineering that may significantly impact the world we live in.

Panel speakers



Thijs Van Leest Ing-PhD, Team Lead Research & Innovation at PhotonFirst.

PhotonFirst provides state-of-the-art fiber sensing solutions for demanding environments and measurement tasks, using the enabling power of Integrated Photonics.

Title : Fiber sensing solutions for SHM practices on large infrastructures.

Abstract: What are the main reliability requirements of a complete measurement setup system?

What are the challenges that need to be overcome?



Rafik HADJRIA. Ing-PhD., is Senior Engineer on Integrated Vehicle Health Monitoring (IVHM) at **SAFRAN Sensing Systems Research Department-Safran Tech**. The company is specialist in integrated vehicle health monitoring technologies of aeronautical structural equipment's.

Title: SHM and on-board optical sensors in Aeronautic.

Abstract: Aeronautic structural components are required to be lifecycle managed under the damage tolerant principle and the safe-life, while the airworthiness is maintained through the process of scheduled inspection, and if needed repair or replacement.

How to reduce the inspection cost of aeronautic OEMs? What are the advantages of looking deeply to the concept of Structural Health Monitoring (SHM)?

How the basic concept of SHM is structured to acquire and analyze data from on-board sensors to determine the health of a structure?

Two complementary roles of sensor functions a) for operational monitoring, and b) for damage detection and monitoring.

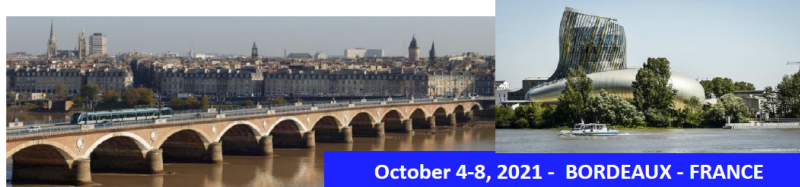
What about the potential of SHM technology to feed the advisory Circular AC 43-218 "Integrated Aircraft Health Management Systems"?



Thomas Geernaert Ing-PhD, is professor at the **Vrije Universiteit Brussel**. He is member of the Applied Physics and Photonics Department and of the photonics research group B-PHOT (Brussels Photonics). Within B-PHOT, T. Geernaert is leading the research team on optical fiber technologies.

Title: Fiber optic monitoring network - From time-based maintenance to condition-based maintenance

Abstract: A permanently installed fiber optic monitoring network of fibre Bragg gratings (FBGs) would allow a



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transition from time-based maintenance to condition-based maintenance.

What is needed to improve their technology readiness levels and to validate and qualify their compatibility with aerospace conditions?

What are the practical considerations for the use of FBG-based sensors?

How to deploy an in-flight compatible surface mounted OFS network?

Can we represent the health of a component in one Global Damage Index number?



Marie-Anne De Smet, Founder of **DFinder**, President of **ISROS**.

Marie-Anne De Smet joined in 1986 the Aeronautic world, civil and military aircraft applications. In 1994 she joined Airbus as Engineer in Material and Processes, with certifications in non-destructive testing (NDT) based on UK certification body processes. She contributed to development of certification supports on thermographic and shearographic technologies through COFREND, French certification Body. Since 2015 she is President of ISROS, International Society on Reliability of Optoelectronic Systems.

In 2021 she contributes to the development of reliable solutions for structure health management of wind turbine, one product of the Start-up company named DFinder. This company is specialized in Non-Destructive technics and SHM technologies dedicated to predictive maintenance of large infrastructures in Wind Power energy, Transport and Aeronautics.

Title: Reliable Structural Health Management solutions in large civil infrastructures.

Abstract: In civil structural applications (as for example Wind Power Energy farms or aeronautics infrastructures),



stakeholders are seeking guidance on the definition, development and certification of Structural Health Monitoring (SHM) technologies for health management applications.

What are the main focus of industrial and end user targets ? How SHM supports to optimize maintenance operation and reduce down time and maintenance costs ?

When design optimization and manufacturing for reliability and maintenance are key of challenges and benefits of feedback loop and lead time reduction through adequate logistics.

The introduction discussion will illustrate a use case on reliable solution based on SHM.

Panel list speakers and audience will give their views on some issues related to failure mode predictions characterization, ageing and remaining useful life, and reliability parameter drift modeling applied to optoelectronic systems including sensors and system health survey for large panel superstructures.

Alain Bensoussan, Ing. INSA, Dr-Ing, Dr Es-Science, has over 34 years of diversified experience at Thales Alenia Space where he acquires his main field of expertise on microelectronics reliability and Physics of Failure. His interest lie in several areas in applied research and space system equipment based on III-V compounds MMIC (monolithic microwave integrated circuits) devices, microwave hybrid modules, Si and GaN transistors, IC's and Deep-Sub-Micron technologies, MEMS and MOEMS, active and passive optoelectronic devices and modules. He is EEE Component Senior Expert at Thales Alenia Space, Toulouse, France.

Moderators:

Marie-Anne De Smet (Founder of DFinder, France – President of ISROS, formerly NDT Expert at AIRBUS. ma.desmet@dfinder.eu)

Alain Bensoussan, Ing. INSA, Dr-Ing, Dr Es-Science, formerly EEE Component Senior Expert at Thales Alenia Space, Toulouse, France – member of ISROS, and co-founder of DFinder a.bensoussan@dfinder.eu

Sponsorship: This round table is technically sponsored by the ISROS Society (International Society on Reliability of Optoelectronics for Systems) with the objective to promote scientific fundamental and applied research primarily in the fields of materials, components and sub-systems based on optoelectronics in high reliability applications.