

SHERLOC: Structural Health Monitoring, Manufacturing and Repair Technologies for Life Management Of Composite Fuselage

Description

Design and maintenance of future pressurized fuselage composite structures is mainly influenced by the requirement to cope with accidental impact damages. Current aerospace certification process for composite structures is derived from deterministic approaches used for metallic airframe design. But within this concept, the stochastic nature of impact damages in composite structures impedes an appropriate relation to fixed safety margins. SHERLOC supports the philosophy of risk and failure probabilities with the goal to guarantee a certain level of safety.

SHERLOC aims for a Condition Based Maintenance (CBM) concept for composite fuselage enabled by Structure Health Monitoring (SHM) techniques. SHERLOC's main focus is: sensor technology, system validation and integration, global systems and regulatory guidance. The key components of the SHERLOC SHM prototype system are: Diagnosis, Prognosis and Life Extension and Predictive Maintenance. SHERLOC will develop a SHM system based on Piezoelectric (wired and wireless), Fibre Optics, Hybrid and Magnetostrictive technologies for damage detection and repair. The system is verified and validated through the building block approach at three levels of coupon, element (skin/stringer, aft, window frames, floor structures) and subcomponent (real scale flat and curved composite panels). The operational conditions are taken into account to demonstrate the SHM technology operating in industrially relevant conditions (TRL6).

SHERLOC pays particular attention to SHM system installation and manufacturing (automatic placement of pre-preg technique, RMT and thermoplastic forming). SHERLOC will develop a novel Bayesian based Dynamic Data Driven Application System (DDDAS) that will allow the characterization of uncertainty and conditional probabilities to be determined in terms of what is known about the structure from the model and what is measured during the inspection.

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Source URL (retrieved on 13 ago 2024 - 11:06): <https://www.bsc.es/ca/research-and-development/projects/sherloc-structural-health-monitoring-manufacturing-and-repair>