



Progress and constraints of structural health monitoring in aviation

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Abstract: Structural health monitoring (SHM) has now been discussed and explored for aeronautical applications for more than 25 years. What people had expected to be beneficial has still not been truly proven yet. The reasons for this are various and are certainly a result from the fact of the interdisciplinary role that SHM has. SHM is neither a part of structural design, non-destructive testing (NDT) and evaluation (NDE) or inspection and maintenance only but rather part of all of those and possibly more. It also includes systems design as well as a variety of signal and data processing and not to forget all the elements regarding prognostics or logistics. SHM is therefore a system that needs to be integrated into an established damage tolerance design process on the one side and into a maintenance logistic process on the other. In excess, it has to meet the high reliability standards modern aviation requires today. The presentation will start from the traditional structural design process applied in aviation nowadays and will gradually elaborate on how the benefits of SHM could be identified. It will further discuss the issues, requirements and differences between classical NDT/NDE based inspection and automated inspection in the sense of SHM. Finally, the necessity of a systems approach will be addressed as the fundamental basis from a mechanics point of view and the highly essential role simulation has in that regard. A summary of the achievements in SHM development will be given in the very end.

Biosketch: Prof. Dr.-Ing. Christian Boller studied civil engineering at the Technical University of Darmstadt (Germany) and received an engineering doctoral degree in the field of *material mechanics and fatigue life evaluation* from the same institution in 1987. Having been active in the field of *materials technology* at Battelle-Europe in Frankfurt (Germany) for a few years, he moved into the aircraft development division of MBB Military Aircraft (today Airbus) in 1990, where he became the chief engineer aero-structures in 1998. In 2003, he was appointed the chair of '*Smart Structural Design*' at the University of Sheffield (UK). Since 2008, he holds the chair for *Non-Destructive Testing and Quality Assurance* (LZfPQ) at Saarland University and a directorship at Fraunhofer Institute for *Nondestructive Testing* (IZFP). He is also the director of the NDT master course programme at Dresden International University (DIU) since 2013. In 2014, he was appointed a visiting professorship at the School of Aeronautics of Nanjing University of Aeronautics and Astronautics (NUAA) in Nanjing (China). He is the author and coauthor of around 250 publications including '*Materials Data for Cyclic Loading*' (1987) and '*Encyclopedia on Structural Health Monitoring*' (2008) both a 5-volume compendium each. He is also one of the central organizers of the 'European Workshop on *Structural Health Monitoring*' and the 'Symposium on *NDT in Aerospace*'.