

## Experimental stress analysis

## The HBM optical measurement chain

# Optical sensors for lightweights

Modern lightweight materials are increasingly being used in aerospace applications and in other branches, such as traffic and construction engineering, mechanical engineering and the energy business. Fiber composite technology in particular is resulting in huge weight savings.

There are increased attempts to implement sensor technology, either for evaluating ongoing mechanical stresses/temperatures or for damage detection, to meet increased safety and warranty standards.

As the number of measurement points to be monitored in an airplane is very high, sensor concepts are needed that are capable of dealing appropriately with information transmission and data handling. Due to its small dimensions, material conformity and immunity against electromagnetic interference, fiber-optic measurement technology is of particular significance in this area.

The complexity of the entire measurement system can be reduced by transmitting the data for all connected measurement points at the same time through one thin waveguide, resulting in increased stability and availability.

### Fraunhofer Institute uses optical sensors on composite material

Figures 1 and 2 show a bearing surface section for feasibility testing of a prototype test carrier (VLA – Very Light Aircraft) at the Fraunhofer Institute for structural durability and system reliability LBF in Darmstadt, Germany. The monitoring in this case is of the mechanical stress of the structure, but the automatic acquisition of weight and center of gravity are equally important.



Fig. 2-5:  
Wing cover made of  
composite material with  
embedded sensors.  
Fraunhofer Institute LBF,  
Germany

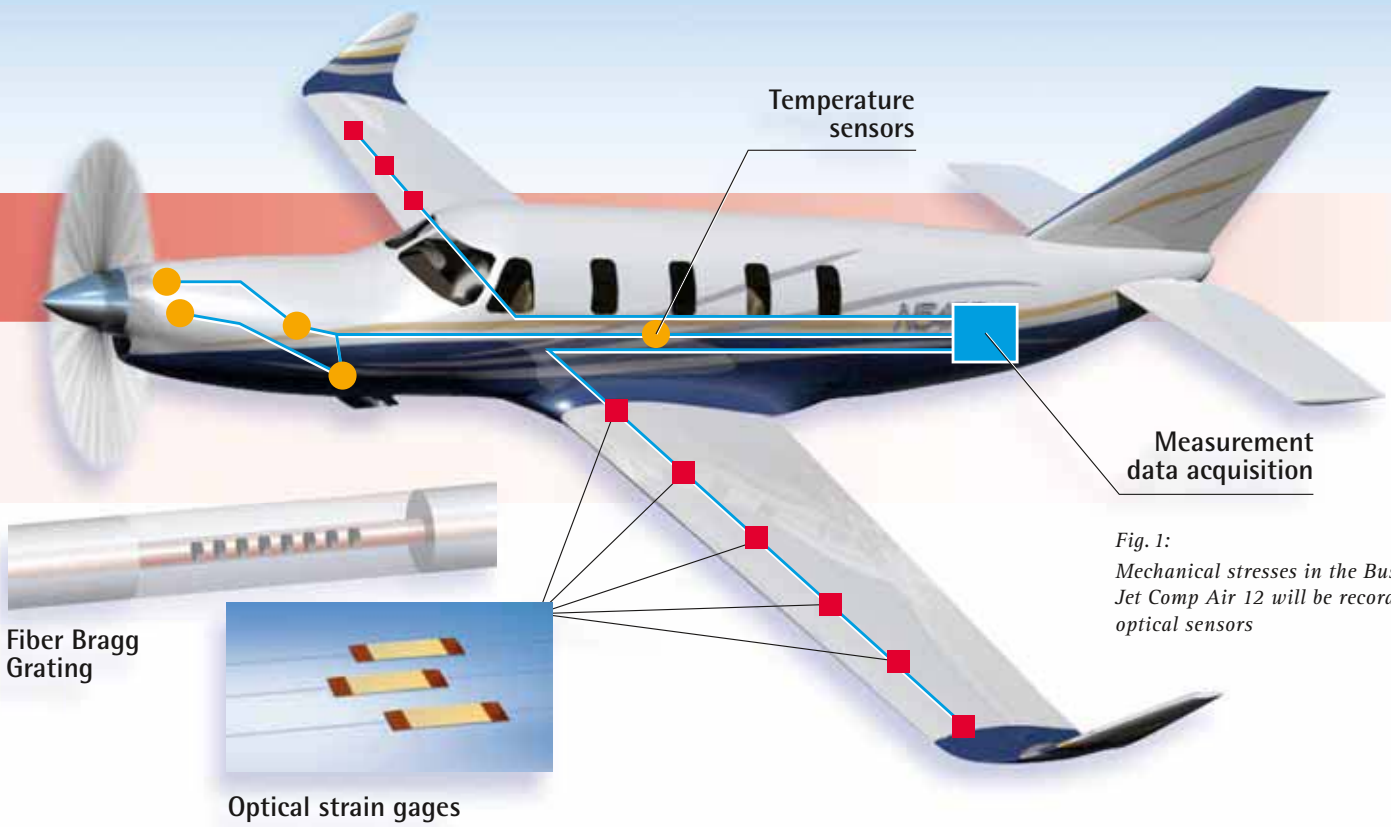


Figure: James Hausman

Fig. 1: Mechanical stresses in the Business Jet Comp Air 12 will be recorded with optical sensors

**First fiber-optic monitoring system for composite materials in aircraft construction**

Fiber-optic Bragg sensors and interrogators are also being used in the new Business Jet Comp Air CA-12. The US company Comp Air commissioned Chandler Monitoring Systems Inc. (CMS) with the system development, using interrogators, strain and temperature sensors from the company Micron Optics Inc. and optical transducers of the company Cleveland Electric Laboratories for the fire protection zone of the engine compartment. This 10-person turboprop aircraft is the first aircraft in the world to be built completely of composite

materials. A prototype with installed strain and temperature sensors was tested in 2007, the necessary FAA certification of the aircraft should be assigned just 30 months later. Comp Air Aviation will once again be fulfilling a trendsetter role in aircraft construction as this is the first time a fiber-optic monitoring system will be used.

■ Dr. Karl-Heinz Haase, HBM

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Fig. 6: Unmanned aircraft IAS Archimede UAV with mobile ground station Hummer GCS from International Aviation Supply S.r.l.