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# Case Study:

## AIRPLANE DATA

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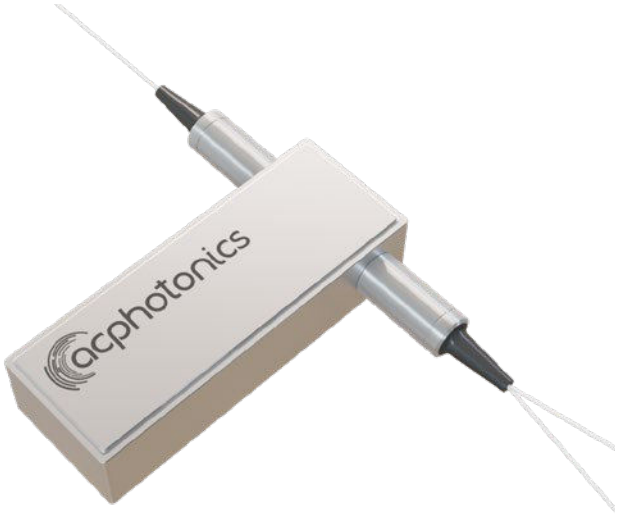
# Introduction

Legendary airplanes like the B-52, and Boeing 747 were designed decades before the arrival of the personal computers and sophisticated 5 and 6 axis CNC machines. The bulk of the work on these legendary vehicles was done with hand drawn mylar drawings, slide rules and primitive (by today's standards) milling machines. The fact that these planes are still flying and carrying people and cargo many decades later, is a testament to the incredible talent and capability of engineers and master machinists of that era. Real time sensing of stresses on commercial and military applications was unheard of in that period. Such testing was only accomplished during the development phase and on occasional inspections.

As optical sensing capability was developing some insightful engineers used optics to measure stresses at various locations within the plane during development phase. With time, engineers started asking "What If" questions such as "what if we could measure stresses in real time, all the time, at every critical location?".

# Where does AC fit into this




Optical sensing is a truly enabling technology of such real time sensing applications. Optical sensors are particularly applicable because they are lightweight, extremely small, and can measure many things simultaneously at the speed of light. Another added advantage is that the detection system is single ended. An optical laser pulse is sent from one end of the fiber and the signals are detected from the same end. Typically, an ACP optical circulator will allow the same fiber to be used to send the outbound signal as well as measure the return signal without interference.

That same single fiber can be used to measure stress/strain at various desired locations along the same fiber. In fact the same fiber can be used to measure various desired parameters including stress/strain, temperature, pressure, etc. What's even more powerful is the ability to incorporate an ACP opto-mechanical 1xn switch to make the system even more capable. Utilizing a 1xn switch a single laser pulse emitting assembly can be used to query several such fibers each trans-versing a different critical path such as: several along each of the wing spans and several longitudinal paths along the fuselage and other structural areas. Of course each path can have many sensors at various locations and measure different parameters. Likewise, on the detector side, an nx1 switch can be incorporated to allow a single detecting system to measure responses from many paths, thereby saving weight, size and cost associated with employing several laser assemblies and several detector systems, one for each of the fiber paths. The switches can also be used to add redundancy in the system. ACP also offers solid state switches that switch in the sub microsecond. A redundant laser can be utilized to take over immediately should an issue arise with the main system. Likewise, a backup detector system can take over instantly should any issues occur with the primary system. These solid-state switches have no moving parts and have a lifespan measured in billions of cycles.

# Conclusion

Real time optical sensing systems can proactively and continuously provide data on the status of the plane's health and operating conditions continuously. The implications of such readily available data on predictive failures, proactive maintenance, safety and avoiding mishaps can be profound. ACP is one of the leading optical component manufacturers in the US. ACP provides highly reliable optical components and fibers to many industries including Defense and Commercial Aerospace. ACP provides the optical components or more integrated solutions. The technical team at ACP works closely with customers to develop custom optics where off the shelf solutions do not exist.

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