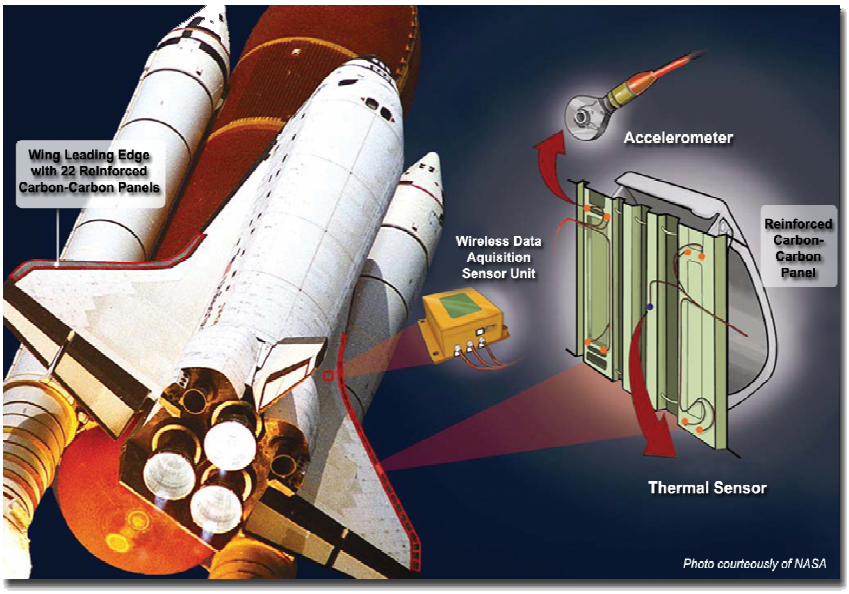
INVOCON, INC.

APPLICATION SPOTLIGHT
ENHANCED WIDE-BAND MICROTAU

In September 2006, NASA used Invocon's Enhanced Wide-Band Micro-Miniature Tri-Axial Accelerometer Unit to monitor impacts on the wing leading edge of the Orbiter. This was the third flight of this system. The use of an impact detection system during ascent was specified by the Columbia Accident Investigation Board (CAIB) as a step in making the orbiters ready for flight.

After the loss of Columbia during the STS-107 mission in February 2003, NASA contracted Invocon to develop a system to detect the vibrations of foam impacts on the Reinforced Carbon-Carbon (RCC) panels of the wing's leading edge. The system was designed to acquire data during the ascent phase of the mission. As a follow on task, the system also monitors for micro-meteor and orbital debris (MM/OD) impacts once the shuttle reaches orbit.



The Enhanced Wide-Band MicroTAU system was launched for the first time on July 26, 2005, aboard the STS-114 mission of the orbiter Discovery. Data acquired by the system during the ascent indicated some non-damaging impacts. These impacts were confirmed by the imagery systems present on the mission. The system proved to perform well during this mission and in subsequent missions.

During each mission, the Enhanced Wide-Band MicroTAU system is configured to monitor the launch event and record the acceleration data for values above a preprogrammed threshold. Once triggered, the units acquire 10 minutes of 20kHz data. After the 10 minute acquisition is complete, post-processing algorithms are executed to provide a limited analysis of the acquired data. The data can then be used to request 0.5 second portions of the raw data for in-depth inspection and analysis. This technique, using processed data for selecting data for viewing, reduced the necessary communication bandwidth required to determine when the leading edge was impacted and the magnitude of the impacts.

The Enhanced Wide-Band MicroTAU system flown during STS-114, STS-121, and STS-115 consists of 44 sensor units and two pairs of relay units. Each of the 22 units per wing is interfaced to three of the accelerometers distributed across the inside of the port and starboard wing spars. In addition to monitoring vibrations associated with impacts, the units acquire temperature data collected by 22 Resistive Thermal Device (RTD) transducers located in each wing. This temperature is used to compensate for thermal drift of the electronics during the temperature extremes of each mission. It also provides additional feedback to NASA regarding the environment inside the wings.

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