Major Systems Providers and Smiths Connectors Tackle Lightning Strike Connector Threat

There's no doubt in anyone's mind that, in a heartbeat, lightning can be fatal. And while we all share a healthy respect for, and fear of, lightning, comprehending the awesome, split-second destructive power that lightning strikes unleash is all but incomprehensible to most of us. Actually being struck by lightning is something that rarely, if ever, enters the minds of the vast majority of air travelers. For the most part, people are pre-occupied with maters of getting to and from their destinations on time, and wondering if their luggage will arrive at the other end along with them.

However, looking at the phenomenon of lightning through the aviation reality lens, estimates from reliable sources indicate that virtually hundreds of aircraft are, in fact, struck by lightning every year. The very good news to be found in this unnerving scenario is the fact that modern aircraft are designed and built to withstand lightning strikes. Truth be told, very few aircraft ever sustain major damage as a result of taking a lightning hit.

For the most part, this has been the norm. This said, significant changes are now sweeping across the aviation landscape that are forcing designers to take a decidedly more sobering look at the very real need to take new comprehensive protective measures against lightning strikes as the construction materials used in modern aircraft continue to advance.

In fact, a new generation of *composite material aircraft* is being built by industry giants Boeing and Airbus that are, lighter in weight, more fuel-efficient, and more environmentally friendly. These planes are now being ushered-in as 21st century replacements for the worldwide fleet of traditional metal-skinned aircraft.

In the wake of transitioning to composite material aircraft, a daunting challenge facing design engineers today is one of addressing the problem of working with new materials that, in reality, offer substantially less protection against the potentially fatal effects of lightning strikes than their metal predecessors have provided in the past.

Where traditional metal-skinned aircraft act as a lightning rod, providing the lowest resistance for electrical discharges traveling from the sky to the ground, the same case simply does not hold true for the next generation of aircraft. There is a greater threat

present in carbon fiber materials due to the fact that they are more prone to electrical surges. The high intensity atmospheric discharge of lightning current moving through the fuselage, or across the wings, of an aircraft where the airframe is constructed of carbon-fiber reinforced plastics (CFRP) has the power to burn right through such materials like a hot knife through butter. Again, this is not the case with metal and aluminum-skinned aircraft.

Obviously, human safety will always stand alone as the single issue of paramount importance in air travel. However, if one can step aside from the human element just for a minute, one clearly sees that another critical challenge facing design engineers is one of ensuring that the proper protection is in place around the sensitive, sophisticated and vulnerable on-board electrical equipment that plays a pivotal role in keeping aircraft flying safely. Without the proper protection, such devices have a zero chance of surviving a lightning strike. Without proper protection, electrical systems could, in fact, be vaporized in an instant.

The most common approach employed by modern aircraft designers to reduce the damaging effects of electrical discharge on circuitry, has been "The Faraday Cage." Named after Michael Faraday, an 18th century British physicist noted for discovering electromagnetic induction, the Faraday Cage is essentially a shield around the body of the aircraft that is constructed of conducting material. Such an enclosure around a plane has the effect of canceling-out electrical fields outside the enclosure, and protecting people and equipment on the inside. An updated version of the Faraday Cage has been designed into the new composite material aircraft that are now being developed by Boeing and Airbus.

Additionally, the pressing need on the part of manufacturers to deal with the thorny issues of higher voltage and impedance, though not critical in metal-bodied aircraft, but potentially problematic in composite aircraft, is being addressed in the design process.

Today, a much greater degree of reliability, durability, immunity to shock and vibration, and the ability to address the threat of massive electrical surges, is required by the industry. Today, there is indeed a heightened sense of urgency around deploying on-board technology devices that will actually deliver and live-up to the claims that are made relevant to their capabilities. The demands and requirements from design engineers are changing as they develop the next generation of lighter-weight fuel-efficient aircraft.

A key technology element in the on-board equipment equation is that of electrical connectors, those small, unheralded components that are often taken for granted, but that

definitely play a very large role in meeting these unique and changing demands associated with doing business in the military and aerospace arena. A host of interconnect solutions providers are responding to the industry's call, and among them is Smiths Connectors, a leading supplier of application specific, high reliability electrical interconnect solutions from highly integrated assemblies to micro-miniature connectors and spring probe contacts.

Today's broad range of operating environments find many major systems providers manufacturing and marketing a wide array of solutions to the aerospace industry. In its role as a supplier to the aircraft design engineering community, one such major systems provider has forged a comprehensive technology alliance with Smiths Connectors that has proven to be very successful when deployed in extremely harsh operating environments such as those where lightning strikes, and the resulting surges that occur in their wake, are a very real threat.

Smiths Connectors unique "Basket of Wires" contact technology has been selected by one major systems provider as the interconnect solution of choice, and is playing a key role as an instrumental element in the suite of on-board technology that is carried in composite material aircraft. Smiths Connectors socket contacts are basically hyperboloid-shaped baskets of individual spring wires that are strung at an angle to the socket's axis. The wire basket inside the female contact mates to a male pin, which, when inserted into the sleeve, results in the wires stretching around it, creating a number of linear contact paths.

According to one lead design engineer, "For us, the decision to go with Smiths Connectors was really the only one to make. We feel that the unique and innovative design of the Hyperboloid wire basket socket is the only one that delivers the extended contact area completely around the pin that we require from connectors in this environment." Smiths Connectors has gained a reputation, across multiple application and industry disciplines, for being able to successfully stand-up to the most demanding environmental conditions. Gabriel Guglielmi, Vice-President of Business Development & Strategy, explains, "The basket of wires design guarantees an uninterrupted and continuous signal flow, and has delivered flawless performance in the most rigorous tests and real-world application environments." Guglielmi adds, "We are delighted to be collaborating with major systems providers and believe that we have unique strengths that work well with, and compliment these companies."