

## Electromagnetic Test and Analysis

*“The protection of civil aircraft electrical and electronic systems from the hazardous effects of lightning and high-intensity radiated fields (HIRF).”*

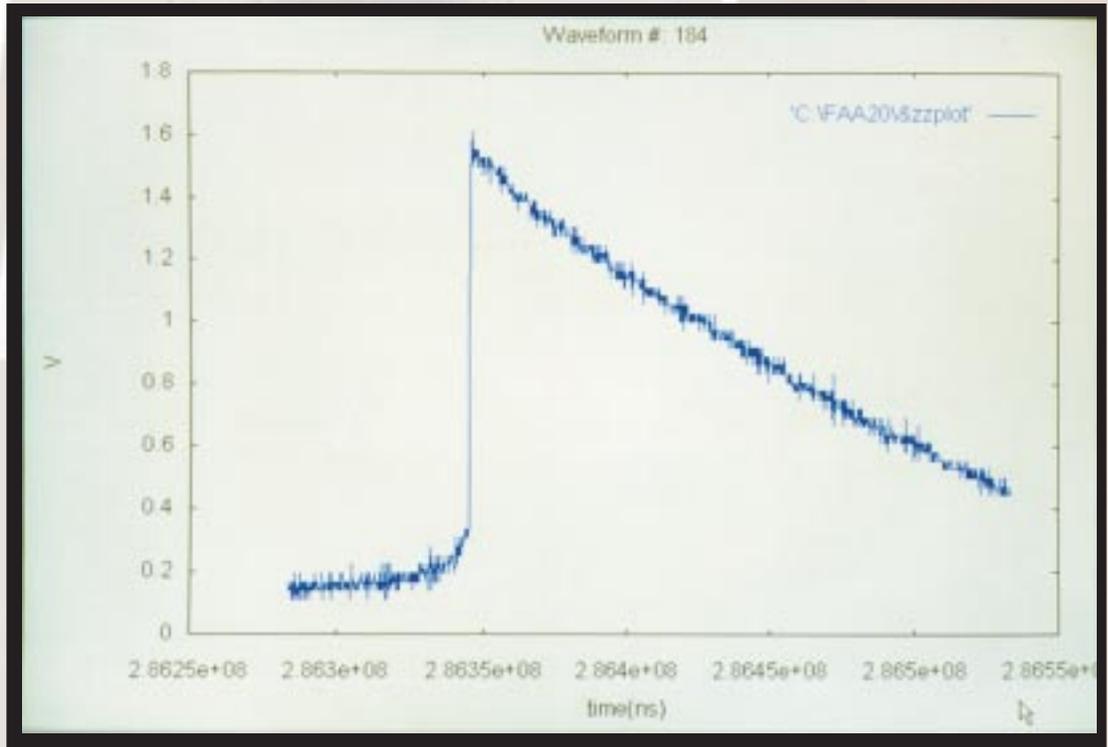
Though there has not been any recent aircraft accidents attributable to lightning or HIRF, the FAA maintains a proactive Electromagnetic Test and Analysis R&D Program.

The reason for this is made up of a combination of factors. New civil aircraft designs and retrofit aircraft are increasingly relying on electrical and electronic systems to perform functions which may be necessary for the continued safe flight and landing of the aircraft. In addition, there is a reduction of the operating power levels of electronic devices used in electrical and electronic systems which may cause circuits to be more susceptible to induced lightning and radio frequency (RF) voltages and currents leading to malfunction or failure. More passengers are carrying onboard a wide array of portable electronic devices (PEDs), such as laptop computers, CD players, and electronic games, which radiate RF energy into aircraft avionics systems. Finally, there has been an increased percentage of composite materials used in aircraft construction. Because of their decreased conductivity, these materials may result in less inherent shielding by the aircraft structure than is usually afforded by aluminum.



The characteristics of lightning have been fairly well understood for many years but recent incidents involving damage to aircraft structures and avionics systems have caught the attention of lightning researchers. In particular, a number of lightning strikes to protected aircraft radomes have resulted in damage that was not predicted or tested for. It is believed that the lightning tests that were performed in the past on radomes on the ground may not be truly representative of actual lightning strikes in flight. One approach to solving this problem is a closer examination of the in-flight characteristics, i.e., voltage, current, rate of rise, etc., of actual lightning strikes to aircraft.

The FAA Electromagnetic Research Database (FRED) is an electronic, interactive, CD-ROM-based database that runs on a PC and currently contains the data for hundreds of lightning strikes to aircraft in-flight. A typical screen plot is shown on the back page. FRED was updated in 1997 and is the culmination of years of research which involved flying instrumented aircraft into thunderstorms in order to be struck by lightning. The strike parameters were then recorded on magnetic tapes which have



since been digitized onto hard disks. Three separate lightning strike programs are now included: the FAA Convair 580 Program, the NASA F-106 Program, and the Transall C-160 Program.

Continued study of the characteristics of lightning strikes to aircraft will uncover more information about the effects of lightning on the aircraft structure and electrical systems. This information may then be used to design better protection techniques for all types of aircraft. This information may also be used to develop better testing and certification methodologies so that aircraft structures and systems which pass lightning tests on the ground will not fail in actual

lightning conditions in flight.

To find out more about the Electromagnetic Test and Analysis Program, contact:

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