

## Discussion

The FAA may issue and amend special conditions, as necessary, as part of the type certification basis if the Administrator finds that the airworthiness standards, designated according to § 21.101(b), do not contain adequate or appropriate safety standards because of novel or unusual design features of an airplane. Special conditions are prescribed under the provisions of § 21.16 to establish a level of safety equivalent to that established in the regulations. Special conditions are normally issued according to § 11.49, after public notice, as required by §§ 11.28 and 11.29(b), effective October 14, 1980, and become a part of the type certification basis in accordance with § 21.101(b)(2).

Elliott Aviation Technical Products Development, Inc., plans to incorporate certain novel and unusual design features into an airplane for which the airworthiness standards do not contain adequate or appropriate safety standards for protection from the effects of HIRF. These features include electronic systems, which are susceptible to the HIRF environment, that were not envisaged by the existing regulations for this type of airplane.

*Protection of Systems from High Intensity Radiated Fields (HIRF):* Recent advances in technology have given rise to the application in aircraft designs of advanced electrical and electronic systems that perform functions required for continued safe flight and landing. Due to the use of sensitive solid state advanced components in analog and digital electronics circuits, these advanced systems are readily responsive to the transient effects of induced electrical current and voltage caused by the HIRF. The HIRF can degrade electronic systems performance by damaging components or upsetting system functions.

Furthermore, the HIRF environment has undergone a transformation that was not foreseen when the current requirements were developed. Higher energy levels are radiated from transmitters that are used for radar, radio, and television. Also, the number of transmitters has increased significantly. There is also uncertainty concerning the effectiveness of airframe shielding for HIRF. Furthermore, coupling to cockpit-installed equipment through the cockpit window apertures is undefined.

The combined effect of the technological advances in airplane design and the changing environment has resulted in an increased level of vulnerability of electrical and electronic

systems required for the continued safe flight and landing of the airplane. Effective measures against the effects of exposure to HIRF must be provided by the design and installation of these systems. The accepted maximum energy levels in which civilian airplane system installations must be capable of operating safely are based on surveys and analysis of existing radio frequency emitters. These special conditions required that the airplane be evaluated under these energy levels for the protection of the electronic system and its associated wiring harness. These external threat levels, which are lower than previous required values, are believed to represent the worst case to which an airplane would be exposed in the operating environment.

These special conditions require qualification of systems that perform critical functions, as installed in aircraft, to the defined HIRF environment in paragraph 1 or, as an option to a fixed value using laboratory tests, in paragraph 2, as follows:

(1) The applicant may demonstrate that the operation and operational capability of the installed electrical and electronic systems that perform critical functions are not adversely affected when the aircraft is exposed to the HIRF environment defined below:

FIELD STRENGTH VOLTS/METER

Frequency	Peak	Average
10–100 KHz .....	50	50
100–500 .....	60	60
500–2000 .....	70	70
2–30 MHz .....	200	200
30–70 .....	30	30
70–100 .....	30	30
100–200 .....	150	33
200–400 .....	70	70
400–700 .....	4020	935
700–1000 .....	1700	170
1–2 GHz .....	5000	990
2–4 .....	6680	840
4–6 .....	6850	310
6–8 .....	3600	670
8–12 .....	3500	1270
12–18 .....	3500	360
18–40 .....	2100	750

or,

(2) The applicant may demonstrate by a system test and analysis that the electrical and electronic systems that perform critical functions can withstand a minimum threat of 100 volts per meter, peak electrical field strength, from 10 KHz to 18 GHz. When using this test to show compliance with the HIRF requirements, no credit is given for signal attenuation due to installation. A preliminary hazard analysis must be performed by the applicant, for approval by the FAA, to

identify electrical and/or electronic systems that perform critical functions. The term "critical" means those functions whose failure would contribute to, or cause, a failure condition that would prevent the continued safe flight and landing of the airplane. The systems identified by the hazard analysis that perform critical functions are candidates for the application of HIRF requirements. A system may perform both critical and non-critical functions. Primary electronic flight display systems, and their associated components, perform critical functions such as attitude, altitude, and airspeed indication. The HIRF requirements apply only to critical functions.

Compliance with HIRF requirements may be demonstrated by tests, analysis, models, similarity with existing systems, or any combination of these. Service experience alone is not acceptable since normal flight operations may not include an exposure to the HIRF environment. Reliance on a system with similar design features for redundancy as a means of protection against the effects of external HIRF is generally insufficient since all elements of a redundant system are likely to be exposed to the fields concurrently.

## Conclusion

In view of the design features discussed for the Beech Models 200, 200C, 200CT, 200T, B200, B200C, B200CT, B200T, 300, 300LW, B300, and B300C airplanes, the following special conditions are issued. This action is not a rule of general applicability and affects only those applicants who apply to the FAA for approval of these features on these airplanes.

The substance of these special conditions has been subject to the notice and public comment procedure in several prior rulemaking actions. For example, the Dornier 228–200 (53 FR 14782, April 26, 1988), the Cessna Model 525 (56 FR 49396, September 30, 1991), and the Beech Models 200, A200, and B200 airplanes (57 FR 1220, January 13, 1992). It is unlikely that additional public comment would result in any significant change from those special conditions already issued. For these reasons, and because a delay would significantly affect the applicant's installation of the system and certification of the airplane, which is imminent, the FAA has determined that prior public notice and comment are unnecessary and impracticable, and good cause exists for adopting these special conditions without notice. Therefore, these special conditions are being made effective upon publication