

Eclipse 500 Special condition

RELATED REQUIREMENTS

CS 23.903 Engines and auxiliary power units

CS 23.995(a) Fuel valves and controls

CS23.1141 (e) Power plant controls

STATEMENT OF ISSUE

The Eclipse 500 has an unusual design feature with respect to engine control. The engines FADEC's are electrically powered by the aircraft electrical system instead of a dedicated and independent electrical source on each engine. This means that in case of total electrical failure the engines will maintain the power setting that was present at the moment of the failure. This also leads to the loss of shut-off capability.

DISCUSSION

Historically, engine control did not rely on electrical power from the aircraft's electrical system.

As it is proposed now, the Eclipse 500 will deviate from this established standard which affects the redundancy in engine control related to power supply.

The Eclipse 500 design is, with regard to the failure of generated electrical power and viewed in combination with the subsequent condition, not comparable to existing designs (compared to an aircraft with totally independent, not time limited, engine control, mechanical shut-off means and independent, sometimes pneumatic, standby instruments). With virtually the same reliability of two electrical generators as on conventional designs, the Eclipse 500 has, in contrast to conventional designs, no dedicated and independent FADEC power supply. The aircraft is thus considered lost after 30 minutes of being on battery power, because:

- a. Engine control is lost
- b. Engine shut-off capability is lost
- c. All instruments are lost

The 30-minute requirement is considered to be applicable to a conventional design and not to a design where these three services are totally dependant on ship's electrical power

Also it is not considered reasonably possible to safely land the aircraft within 30 minutes from 41000 ft on battery supply, taking into account the time needed to perform the failure procedure, general pilot capability, lost services and ATC environment.

Thirty minutes after loss of generated electrical power the availability of the means to shut off the fuel supply is not assured. This system design is not in compliance with 23.995(a) where a shut-off means is required regardless of failure probability of other systems or time constraints. Furthermore, the fail fixed failure mode of the FADEC in this condition is useless if it is not possible to control and shut down the engine after landing.

Therefore there should be a new required standard being defined for an aircraft with a novel design like the Eclipse 500 in order to make sure that the safety level is not reduced. Alternatively, Eclipse Aviation could opt for a design that is similar to existing designs (time unlimited and dedicated FADEC power supply and a mechanical fuel shut-off means).

SPECIAL CONDITION

Eclipse Aviation is required to show that the cited requirements with regard to electrical power supply to the engine controls are complied with and that the redundancy and isolation standards are at least equal to those developed in the past based on these requirements.

Furthermore, Eclipse Aviation must ensure that the essential services (excluding engines), that remain available, allow for flight in IMC for a minimum of 30 minutes and in VMC for a subsequent minimum of 30 minutes more.

If the aircraft is going to be operated commercially, it must be shown that destination and alternate distances are compatible with the provided capacity of emergency electrical power with regard to engine, systems and instrument availability.