

Fire protection features	Stowage compartment interior volumes		
	Less than 25 ft ³	25 ft ³ to 57 ft ³	57 ft ³ to 200 ft ³
Detectors ²	No	Yes	Yes.
Liner ³	No	No	Yes.
Locating Device ⁴	No	Yes	Yes.

¹ Material: The material used to construct each enclosed stowage compartment must at least be fire resistant and must meet the flammability standards for interior components specified in §25.853. For compartments with an interior volume less than 25 cubic feet, the design must contain a fire likely to occur within the compartment under normal use.

² Detectors: Enclosed stowage compartments equal to or exceeding 25 cubic feet in interior volume must have a smoke- or fire-detection system to ensure that a fire can be detected within 1 minute. Flight tests must be conducted to show compliance with this requirement. Each system must provide the following:

- (a) A visual indication in the flight deck within 1 minute after the start of a fire;
- (b) An aural warning in the CRM; and
- (c) A warning in the main passenger compartment. This warning must be readily detectable by a flight attendant, taking into account the location of flight attendants throughout the main passenger compartment during various phases of flight.

³ Liner: If the material used to construct the stowage compartment meets the flammability requirements of a liner for a Class B cargo compartment, then no liner would be required for enclosed stowage compartments equal to or greater than 25 cubic but less than 57 cubic feet in interior volume. For those enclosed stowage compartments the interior volume of which is equal to or greater than 57 cubic feet, but less than or equal to 200 cubic feet, the liner must meet the requirements of §25.855 at Amendment 25-72 for a Class B cargo compartment.

⁴ Location Detector: Crew-rest areas that contain enclosed stowage compartments interior volumes of which exceed 25 cubic feet, and that are located away from one central location, such as the entry to the CRM or a common area within the CRM, would require additional fire-protection devices to assist the firefighter in determining the location of a fire.

Issued in Renton, Washington, on March 31, 2009.

Stephen P. Boyd,

Acting Manager, Transport Airplane Directorate, Aircraft Certification Service.
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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 25

[Docket No. NM395; Special Conditions No. 25-379-SC]

Special Conditions: Dassault Falcon 2000 Series Airplanes; Aircell Airborne Satcom Equipment Consisting of a Wireless Handset and Associated Base Station, With Lithium Battery Installations

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions.

SUMMARY: These special conditions are issued for the Dassault Falcon 2000 series airplanes. These airplanes, as modified by Aircell LLC, will have a novel or unusual design feature associated with the Aircell airborne satcom equipment (ASE) which use lithium battery technology. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature. These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

DATES: *Effective Date:* May 8, 2009.

FOR FURTHER INFORMATION CONTACT: Nazih Khaouly, FAA, Airplane and Flight Crew Interface Branch, ANM-111, Transport Airplane Directorate, Aircraft Certification Service, 1601 Lind Avenue, SW., Renton, Washington 98057-3356; telephone (425) 227-2432; facsimile (425) 227-1149.

SUPPLEMENTARY INFORMATION:

Background

On March 15, 2007, Aircell LLC, applied for a type design change to an existing STC (ST01388WI-D), to install additional equipment on Dassault Falcon 2000 series airplanes. This installation adds components to the existing airplane installation to include a low power Wi-Fi handset containing a single cell lithium polymer rechargeable battery. The battery identified for application in this design is a low capacity, single cell lithium polymer rechargeable battery, with a nominal capacity of 1400mAh and a nominal voltage of 3.7V. The battery has a weight of 26.5 grams. The battery has been Underwriters Laboratories, Inc. (UL) tested and qualified by DO-160E in the Aircell handset (P12857). The design is supported by a System Safety Assessment/Functional Hazard Assessment (SSA/FHA) analysis. The Aircell Wi-Fi handset, which is a component of the Aircell ASE, consists of a wireless handset and associated base station (cradle and charging unit), both with protective circuits and fuse devices which provide multiple levels of redundant protection from hazards, such as overcharging or discharging. The lithium battery is installed in the handset.

A lithium battery has certain failure, operational, and maintenance characteristics that differ significantly from those of the nickel-cadmium and lead-acid rechargeable batteries currently approved for installation on large transport category airplanes. The FAA is issuing these special conditions to require that (1) all characteristics of the lithium batteries and their installations that could affect safe operation of the Dassault Falcon 2000 are addressed, and (2) appropriate continued airworthiness instructions, which include maintenance requirements, are established to ensure the availability of electrical power from the batteries when needed. At present, there is limited experience with use of rechargeable lithium batteries in applications involving commercial aviation. However, other users of this technology, ranging from wireless telephone manufacturers to the electric vehicle industry, have noted safety problems with lithium batteries. These problems include overcharging, over-discharging, and flammability of cell components.

1. Overcharging

In general, lithium batteries are significantly more susceptible to internal failures that can result in self-sustaining increases in temperature and pressure (i.e., thermal runaway) than their nickel-cadmium or lead-acid counterparts. This is especially true for overcharging that causes heating and destabilization of the components of the cell, leading to the formation (by plating) of highly unstable metallic lithium. The metallic lithium can ignite, resulting in a self-sustaining fire or

explosion. Finally, the severity of thermal runaway due to overcharging increases with increasing battery capacity due to the higher amount of electrolyte in large batteries.

2. Over-Discharging

Discharge of some types of lithium batteries beyond a certain voltage (typically 2.4 volts) can cause corrosion of the electrodes of the cell, resulting in loss of battery capacity that cannot be reversed by recharging. This loss of capacity may not be detected by the simple voltage measurements commonly available to flightcrews as a means of checking battery status—a problem shared with nickel-cadmium batteries.

3. Flammability of Cell Components

Unlike nickel-cadmium and lead-acid batteries, some types of lithium batteries use liquid electrolytes that are flammable. The electrolyte can serve as a source of fuel for an external fire, if there is a breach of the battery container.

These problems experienced by users of lithium batteries raise concern about the use of these batteries in commercial aviation. Accordingly, the proposed use of lithium batteries in the Aircell ASE on Dassault Falcon 2000 series aircraft has prompted the FAA to review the adequacy of existing regulations in Title 14 Code of Federal Regulations (14 CFR) part 25. Our review indicates that the existing regulations do not adequately address several failure, operational, and maintenance characteristics of lithium batteries that could affect the safety and reliability of lithium battery installations.

The intent of these special conditions is to establish appropriate airworthiness standards for lithium batteries in Dassault Falcon 2000 series aircraft, modified Aircell LLC., and to ensure, as required by § 25.601, that these battery installations are not hazardous or unreliable. Accordingly, these special conditions include the following requirements:

- Those provisions of § 25.1353 which are applicable to lithium batteries.
- The flammable fluid fire protection provisions of § 25.863.

In the past, this regulation was not applied to batteries of transport category airplanes, since the electrolytes used in lead-acid and nickel-cadmium batteries are not flammable.

- New requirements to address the hazards of overcharging and over-discharging that are unique to lithium batteries.

- New Instructions for Continuous Airworthiness that include maintenance requirements to ensure that batteries used as spares are maintained in an appropriate state of charge.

Type Certification Basis

Under the provisions of 14 CFR 21.101, Aircell LLC, must show that the Dassault Falcon 2000 series airplanes, as changed, continues to meet the applicable provisions of the regulations incorporated by reference in Type Certificate No. Type Certificate A50NM, Revision 3, or the applicable regulations in effect on the date of application for the change. The regulations incorporated by reference in the type certificate are commonly referred to as the “original type certification basis.”

The certification basis for Dassault Falcon 2000, is listed in Type Certificate A50NM, Revision 3, dated September 21, 2004. In addition, the certification basis includes certain special conditions and exemptions that are not relevant to these special conditions. Also, if the regulations incorporated by reference do not provide adequate standards with respect to the change, the applicant must comply with certain regulations in effect on the date of application for the change.

If the Administrator finds that the applicable airworthiness regulations (i.e., part 25, as amended) do not contain adequate or appropriate safety standards for Dassault Aviation Falcon 2000 series airplanes because of a novel or unusual design feature, special conditions are prescribed under the provisions of 14 CFR 21.16.

In addition to the applicable airworthiness regulations and special conditions, the Dassault Falcon 2000 series airplanes must comply with the fuel vent and exhaust emission requirements of 14 CFR part 34 and the noise certification requirements of 14 CFR part 36.

The FAA issues special conditions, as defined in 14 CFR 11.19, under § 11.38, and they become part of the type certification basis in accordance with § 21.101.

Special conditions are initially applicable to the models for which they are issued. Should Aircell LLC. apply for a supplemental type certificate to modify any other model included on Type Certificate No. A50NM to incorporate the same or similar novel or unusual design feature, these special conditions would also apply to the other model.

Novel or Unusual Design Features

The Dassault Aviation Falcon 2000 series airplanes, as modified by Aircell

LLC., to include the Aircell ASE which will use lithium battery technology, will incorporate a novel or unusual design feature. Because of rapid improvements in airplane technology, the applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature. These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

The Aircell Access system will include lithium battery installations. The application of a rechargeable lithium battery is a novel or unusual design feature in transport category airplanes. This type of battery has certain failure, operational, and maintenance characteristics that differ significantly from those of the nickel-cadmium and lead-acid rechargeable batteries currently approved for installation on large transport category airplanes. The FAA issues these special conditions to require that (1) all characteristics of the lithium battery and its installation that could affect safe operation of the satellite communication system are addressed, and (2) appropriate maintenance requirements are established to ensure that electrical power is available from the batteries when it is needed.

Discussion of Comments

Notice of proposed special conditions No. 25–08–07–SC for the Dassault Falcon 2000 series airplanes was published in the **Federal Register** on November 20, 2008 (73 FR 70286). One comment was received from Dassault Falcon Jet Corporation.

Comment: Dassault requested that an additional safety requirement be added to the text of the special conditions as follows: “Any equipment/system that embodies a lithium battery shall be designed so as to ensure that it can only be connected to its own dedicated charger which has been designed for such equipment/system. This is especially true when the equipment/system in question has a charger which is external to such equipment/system. In that case, the equipment/system must be designed in a way that it is not possible to connect it to a charger which is used for recharging other aircraft equipment and systems with a different battery type or brand or a different lithium technology.”

FAA Disposition: There are many ways to design equipment/systems that embody a lithium battery power storage system. The batteries could be either internal or external to the equipment/system. The charging system could be

built-in or external to the battery storage system. In addition to the equipment/system, the battery and the charging system could be self-contained and designed to comply with the special conditions. The FAA concurs that the system must be designed to ensure that the recharging function of the system ensures proper and safe recharging. However, the commenter's proposal is not practical. It would be onerous to require that no other system can be connected to the battery. The safety concern here is mitigated by the other requirements in the special conditions. In particular, the special conditions require that safe charging must be ensured (see Special Condition Nos. 1, 3, 7, and 9). Therefore, we believe the special conditions are adequate. Section 25.1301 also addresses this comment. The special conditions are issued as proposed.

Applicability

As discussed above, these special conditions are applicable to the Dassault Aviation 2000 series airplanes as modified by Aircell LLC. Should Aircell LLC apply at a later date for a supplemental type certificate to modify any other model included on Type Certificate No. A28NM to incorporate the same novel or unusual design feature, these special conditions would apply to that model as well.

Conclusion

This action affects only certain novel or unusual design features of the Dassault Aviation 2000 series airplanes as modified by Aircell LLC. It is not a rule of general applicability and affects only the applicant which applied to the FAA for approval of these features on the airplane.

List of Subjects in 14 CFR Part 25

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

■ The authority citation for these special conditions is as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701, 44702, 44704.

The Special Conditions

■ Accordingly, pursuant to the authority delegated to me by the Administrator, the following special conditions are issued as part of the type certification basis for the Dassault Aviation 2000 series airplanes, modified by Aircell LLC, in lieu of the requirements of § 25.1353(c)(1) through (c)(4), Amendment 25-113.

Lithium batteries and battery installations on Dassault Aviation 2000 series airplanes must be designed and installed as follows:

1. Safe cell temperatures and pressures must be maintained during any foreseeable charging or discharging condition and during any failure of the charging or battery monitoring system not shown to be extremely remote. The lithium battery installation must preclude explosion in the event of those failures.

2. Design of the lithium batteries must preclude the occurrence of self-sustaining, uncontrolled increases in temperature or pressure.

3. No explosive or toxic gases emitted by any lithium battery in normal operation or as the result of any failure of the battery charging system, monitoring system, or battery installation which is not shown to be extremely remote may accumulate in hazardous quantities within the airplane.

4. Installations of lithium batteries must meet the requirements of § 25.863(a) through (d).

5. No corrosive fluids or gases that may escape from any lithium battery may damage surrounding structure or any adjacent systems, equipment, or electrical wiring of the airplane in such a way as to cause a major or more severe failure condition, in accordance with § 25.1309(b) and applicable regulatory guidance.

6. Each lithium battery installation must have provisions to prevent any hazardous effect on structure or essential systems caused by the maximum amount of heat the battery can generate during a short circuit of the battery or of its individual cells.

7. Lithium battery installations must have a system to control the charging rate of the battery automatically, so as to prevent battery overheating or overcharging, and,

(a) A battery temperature sensing and over-temperature warning system with a means for automatically disconnecting the battery from its charging source in the event of an over-temperature condition, or

(b) A battery failure sensing and warning system with a means for automatically disconnecting the battery from its charging source in the event of battery failure.

8. Any lithium battery installation whose function is required for safe operation of the airplane must incorporate a monitoring and warning feature that will provide an indication to the appropriate flight crewmembers whenever the state-of-charge of the batteries has fallen below levels considered acceptable for dispatch of the airplane.

9. The Instructions for Continued Airworthiness required by § 25.1529

must contain maintenance requirements to assure that the lithium battery is sufficiently charged at appropriate intervals specified by the battery manufacturer. The Instructions for Continued Airworthiness must also contain procedures for the maintenance of lithium batteries in spares storage to prevent the replacement of batteries whose function is required for safe operation of the airplane with batteries that have experienced degraded charge retention ability or other damage due to prolonged storage at a low state of charge. Precautions should be included in the Instructions for Continued Airworthiness maintenance instructions to prevent mishandling of the lithium battery which could result in short-circuit or other unintentional damage that could result in personal injury or property damage.

Note 1: The term "sufficiently charged" means that the battery will retain enough of a charge, expressed in ampere-hours, to ensure that the battery cells will not be damaged. A battery cell may be damaged by lowering the charge below a point where there is a reduction in the ability to charge and retain a full charge. This reduction would be greater than the reduction that may result from normal operational degradation.

Note 2: These special conditions are not intended to replace § 25.1353(c), Amendment 25-113 in the certification basis of the Aircell LLC supplemental type certificate. These special conditions apply only to lithium batteries and their installations. The requirements of § 25.1353(c), Amendment 25-113 remain in effect for batteries and battery installations on the Aircell LLC supplemental type certificate that do not use lithium batteries.

Compliance with the requirements of these special conditions must be shown by test or analysis, with the concurrence of the Fort Worth Special Certification Office.

Issued in Renton, Washington, on March 4, 2009.

Linda Navarro,

Acting Manager, Transport Airplane Directorate, Aircraft Certification Service.

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