



U.S. Department
of Transportation

**Federal Aviation
Administration**

Memorandum

Subject: **ACTION:** Review and Concurrence, Equivalent Level of Safety (ELOS) to 14 Code of Federal Regulations (CFR) 23.1353(h): Finding Number: ACE-05-15

Date: October 5, 2005

From: Manager, Airplane Certification Office, ASW-150

**Reply to
Attn. of:** Al Boutin
(817) 222-5157

To: Manager, Small Airplane Directorate, ACE-100

This memorandum requests that your office review and provide concurrence with the proposed finding of Equivalent Level of Safety (ELOS) in accordance with § 21.21(b)(1), to the requirements of § 23.1353(h) for the battery installation in the Sino Swearingen Aircraft Company (SSAC) Commuter Category airplane Model SJ30-2.

BACKGROUND:

The SJ30-2 is a 13,500-pound maximum take off weight, five-passenger airplane of conventional metal construction powered by two aft fuselage mounted Williams Rolls FJ44-2A medium bypass turbofan engines. Sino Swearingen Aircraft Corporation intends to obtain a Federal Aviation Administration (FAA) Type Certificate (TC), under 14 CFR Part 23 Commuter Category, for single pilot all weather operation of the SJ30-2. The airframe incorporates wing sweep and area ruling to reduce transonic drag, high lift devices for short field performance, and a cabin designed for a maximum pressurization differential of 12 psi. Maximum operating Mach number is 0.83 and maximum altitude is 49,000 feet.

The main electrical system operates on 28 VDC power, generated by a 325 Amp starter generator mounted on each engine. One sealed lead acid battery (42 AH) is installed to provide power to start engines (in the event that an electrical ground power unit is not available), while still providing at least 30-minutes of power to the critical electrical equipment (in the event that both starter-generators fail in flight).

APPLICABLE REGULATION:

The applicable regulation is 14 CFR § 23.1353(h) which states:

§ 23.1353 Storage battery design and installation.

(h) In the event of a complete loss of the primary electrical power generating system, the battery must be capable of providing at least

30-minutes of electrical power to those loads that are essential to continued safe flight and landing. The 30-minute time period includes the time needed for the pilots to recognize the loss of generated power and take appropriate load shedding action.

APPLICANT'S POSITION:

The FAA policy regarding compliance to 14 CFR § 23.1353(h) is published in the Advisory Circular (AC) 23-17B. This policy is that the battery, which is used to show compliance to § 23.1353(h), should not be the battery that is used to start the airplane engines. Additionally, if the applicant proposes a design that utilizes the battery which is used to start the airplane engines, an ELOS is required because there must be compensating features to ensure that while the airplane is in service, this battery will be able to supply the required electrical loads in the event of a failure of the primary electrical power generating system. Advisory material allows for single battery use and operation provided testing, monitoring procedures and periodic maintenance procedures are provided. SSAC has provided those requirements. Further, in service use and history on several different models of turbine aircraft reveals that the Concord RG-380E/44 battery will provide a reliable and dependable battery solution on the SSAC SJ30-2 airplane.

FAA POSITION:

Since the battery that is used to start the engines is considered a component of the “primary electrical power generating system”, literal compliance with § 23.1353(h) would not allow the battery that is used to start the airplane engines to be the battery used to show compliance with this rule. The FAA has further published information in AC 23-17B, listing the required compensating features that must be present in the proposed Type Design (TD) for an equivalent level of safety to compliance to § 23.1353(h). The criteria in the AC states: “If adequate monitoring and procedures are incorporated so the pilot knows the airplanes battery meets the 30-minute criteria after an engine start and during all other operations, an ELOS finding may be an acceptable method for using the airplanes starter battery”. SSAC has adequately shown that their design contains such compensating features.

COMPENSATING FEATURES:

1. The Sino Swearingen SJ30-2 incorporates a single 42-ampere hour sealed lead acid aircraft battery manufactured by Concord, P/N RG-380E/44. This battery is a valve regulated Recombinant Gas lead acid battery. This type of battery behaves in a very linear fashion, because it is a lead acid type. This represents the current technology for aircraft batteries. These batteries exhibit different failure characteristics from the conventional flooded (vented) lead acid batteries that evolved in the early 20th century and are still currently used for many aeronautical and automotive uses.

This battery does not behave like a NiCad with a constant voltage and a cascading current when loaded. It does not have a “memory”. It has over current protection within each cell and has protection against internal shorting, which characteristically causes complete failure typical of an automobile battery. It requires no temperature monitoring.

2. Testing of the 30 minute requirement (14 CFR § 23.1353(h)) on the SJ30-2 airplane will be performed I.A.W. SSAC, Report No. 30-2131 "Electrical Systems Generation and Operation Certification Plan". This plan provides for a flight test that incorporates (1) a 25% discharged battery (75% of full capacity) to simulate end of life, (2) dual engine start using only the battery, (3) testing immediately after takeoff (worst case scenario), and (4) verification of battery voltage and required systems operation during the 30-minute test.
3. The manufacturer of the battery, Concord, has established periodic testing procedures to ensure that the battery always has an 85% or better operating capacity. This capacity requirement is more conservative than that used for flight-testing. The interval and testing has been determined by the manufacturer through in service history, lab testing, and analysis (12 months or 600-hours initial and 3 months or 200-hours subsequent). This interval and the associated testing will be included as part of the SJ30-2 Instructions for Continued Airworthiness (ICA). The Concorde Battery Continued Airworthiness Instructions and Battery Operating Manual will be included in the ICA.
4. The airplane flight manual will contain Normal and Abnormal Procedures to allow the pilot to know that the battery can meet the 30-minute requirement, after engine starts and during all other operations, to power those electrical loads that are essential to continued safe flight and landing.

RECOMMENDATION:

Based on the SSAC showing of the compensating features of their design, per the AC, we recommend the issuance of this equivalent level of safety finding to § 23.1353(h), for the airplane Model SJ30-2.

CONCURRENCES:

Fred Stellar *10/6/05*

Manager, Airplane Certification Office, ASW-150 Date

John Colomy *10/21/05*

Manager, Standards Office, Small Airplane Directorate, ACE-110 Date

David R. Showers *10/28/05*

for Manager, Small Airplane Directorate, ACE-100 Date