



# Federal Aviation Administration

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## Memorandum

Date: March 7, 2006

From: Manager, Airplane Certification Office, ASW-150

To: Manager, Small Airplane Directorate, ACE-100

Prepared by: Al Boutin, Aerospace Engineer, ASW-170

Subject: ACTION: Review and Concurrence, Equivalent Level of Safety (ELOS) to 14 Code of Federal Regulations (CFR) § 23.807(e)(1): Finding Number: ACE-05-25

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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 § 23.807(e)(1) for the Emergency Exits for ditching of 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, six-passenger pressurized airplane of conventional metal construction powered by two aft fuselage mounted Williams Rolls FJ44-2A medium bypass turbofan engines. FAA previously issued Type Certificate (TC) A0001AC, under 14 CFR part 23 Commuter Category, for single-pilot all-weather operation of the SJ30-2.

Sino Swearingen has not previously requested approval for ditching for the SJ30-2 and therefore, was restricted from flights over water. The SJ30-2 has two emergency exits, one on each side of the aircraft. The emergency exit on the right hand side of the SJ30-2 aircraft is an over wing exit which is in full compliance with § 23.807(d). However, the left hand emergency exit, the cabin entry door (design approved through ELOS ACE-98-3), is expected to have its lower sill below the waterline based on flotation analysis. A water dam is provided for insertion prior to a ditching such that a freeboard is achieved from the projected flotation waterline, which will leave an opening above the waterline that complies with the minimum dimensions of the requirements as contained in § 23.807(e)(1).

### **APPLICABLE REGULATION:**

The applicable regulation is 14CFR 23.807(e)(1), which states:

Section 23.807 Emergency Exits

- (e) For multiengine airplanes, ditching emergency exits must be provided in accordance with the following requirements, unless the emergency exits required by paragraph (a) or (b) of this section already comply with them:
- (1) One exit above the waterline on each side of the airplane having the dimensions specified in paragraph (b) or (d) of this section, as applicable; and
  - (2) If side exits cannot be above the waterline, there must be a readily accessible overhead hatch emergency exit that has a rectangular opening measuring not less than 20 inches wide by 36 inches long, with corner radii not greater than one-third the width of the exit.

### **APPLICANT'S POSITION:**

Compensating factors, which SSAC believes provide an equivalent level of safety to the requirements of § 23.807 (e)(1), as required by § 21.21 (b)(1) for the Model SJ30-2, are summarized in the following paragraphs. Rationale is presented to address the egress capabilities of the over wing emergency exit on the right hand side of the fuselage, and the compensating factors the SSAC believes that it provides an equivalent level of safety to the requirement of § 23.807 (e)(1), through the use of a water dam installed at the main cabin entry door.

The Model SJ30-2 aircraft is configured with two exit routes and openings, which are available in case of passenger and crew evacuation in water. The primary escape route is the over wing emergency escape hatch on the right side of the aircraft. The emergency hatch on the right side of the aircraft can be removed, with the buoyancy waterline being below the lower edge of the hatch opening. The buoyancy waterline derivation used in establishing the water float line is determined based on a maximum gross weight aircraft at the critical float depth in salt water. These conditions represent the worst possible flotation condition. This exit is readily accessible.

The second escape route is the main cabin entry door, which may be used for evacuation by installing a water dam prior to opening the exit. A pre-flight check to confirm that the water dam is on-board the aircraft and stowed in its designated location is required. Actual installation of the water dam panel across the door opening is required prior to a planned ditching and subsequent opening of the main cabin entry door. For an unplanned ditching, the FAA requires a demonstration showing that the water dam could be retrieved, and easily installed by a crewmember or a passenger. Ease of installation of the water dam is a specific design objective such that no special training or experience is required. Installation would normally be a crew function but design simplicity would allow any occupant to complete the installation. Complete installation instructions will be contained on passenger briefing cards and placarded on the water dam.

To assist the passengers in exiting the aircraft, the refreshment center is to be used. It is located immediately to the left of the main cabin door. It has a large open area that makes it possible for passengers or crew to be able to secure a handgrip to aid their opening of the cabin door, as well as exiting over the water dam. Further, as passengers step over the water dam, there are door cables on either side of the door to aid in their continued evacuation.

The water pressure due to head and the force necessary to push the entry door open against the water pressure is estimated to be a minimal amount in order to “crack” the door seal; a sufficiently small force that is well within normal passengers capabilities. The water dam consists of a panel that is designed to extend across the door opening and be retained by quick attach fittings.

The water dam panel is estimated to provide approximately 2.0 inches of freeboard from the most critical float depth while only requiring a maximum step-over height of approximately 14.5 inches. With the cabin entry door open and the water dam installed, the clear opening of the left side of the aircraft will be at least 32 inches wide by approximately 32 inches high, well in excess of the required 19 inches by 26 inches ellipse.

The use of the water barrier described in the previous paragraphs will permit the use of the main cabin entry door as a ditching emergency exit on the left side of the aircraft. The over wing emergency escape hatch serves as the required exit on the right side of the aircraft and is unaffected by the use of the water dam. Therefore, the use of the water barrier at the main cabin entry door provides a configuration, which complies with the ditching emergency exit requirements of § 23.807(e)(1), by providing one emergency exit on each side of the aircraft.

#### **Explanation of how design features or alternative standards provide an equivalent level of safety intended by the regulation**

Sino Swearingen design of the left main entry door is qualified as a ditching exit by an equivalent level of safety, i.e., by the installation of a water dam. Sino Swearingen agrees to a demonstration that the barrier can, in the airplane’s analyzed flotation time after a water landing, be removed from its stowed position, be installed at the main entry door by the passengers and flight crew members with ease and rapidity, and the aircraft evacuated.

Sino Swearingen will include on the passenger safety briefing cards that:

1. The water dam is required to be installed prior to opening the door and subsequent to a ditching;
2. The stowed location of the water dam.

The flight crew will also brief the stowed location of the water dam as well as brief how the water dam is to be installed.

Sino Swearingen will also provide for:

1. A demonstration that an “ordinary” passenger (no aviation related experiences) can install the water dam after receiving a standard passenger briefing and flight crew demonstration on how to retrieve and install the water dam.
2. A timed evacuation test wherein the occupants & crew will demonstrate water dam installation and exiting the aircraft with all the necessary water survival equipment (life rafts, life vests, etc.).

3. Revising Airplane Flight Manual (AFM) accordingly.

In addition, Sino Swearingen will placard the installation instructions on the water dam itself. Finally, when appropriate, installation instructions will be briefed by the flight crew to the passengers, as to when and the manner in which the water dam is to be installed. This equivalent safety finding, which is based on the installation of a dam and the associated placarding, covers Sino's maximum six-occupant configuration. Note is made that passenger seating configurations are as determined with reference to the Maximum Passengers allowed on the Type Certificate Data Sheet, and not by any customer configuration featuring fewer passengers.

**FAA POSITION:**

In a review of the FAR § 23.807 files, it has become apparent that similar equivalent levels of safety alternatives have been incorporated into previous similar aircraft configurations and have been FAA accepted. The ELOS Memo #: TC2548WI-T-AG-1 granted for the Cessna Model 860 is very similar to the configuration proposed by SSAC.

The adequacy of the installation and functionality of a water dam must be verified to support this equivalent level of safety with the following demonstrations acceptable to the FAA.

1. SSAC will demonstrate the barrier can be removed from its stowed position, be installed at the main entry door by the passengers and flight crew members with ease and rapidity, and the aircraft evacuated.
2. SSAC will provide verification that the dam, as installed, can support the anticipated hydrostatic loads.
3. SSAC will provide FAA approved placarding located on or immediately adjacent to the main cabin door indicating that a water dam is required to be installed prior to opening the door and subsequent to a ditching and identify the location of the water barrier as well as installation instructions on the dam itself
4. SSAC will demonstrate that the aircraft can be safely evacuated even with the dam in place.
5. Instructions will be briefed by the flight crew to the passengers, when appropriate, as to when and the manner in which the dam is to be installed.

**RECOMMENDATION:**

Based on the SSAC showing of the compensating features of their design and their agreement to perform the FAA requested demonstrations, we recommend the issuance of this equivalent level of safety finding to 14 CFR 23.807(e)(1), for the airplane Model SJ30-2.

**CONCURRENCES:**

Michele M. Owsley	3-7-06
Manager, Airplane Certification Office, ASW-150	Date

John Colomy	4-4-06
Manager, Standards Office, ACE-110	Date

James E. Jackson	4-5-06
Acting Manager, Small Airplane Directorate, ACE-100	Date