



U.S. Department  
of Transportation  
**Federal Aviation  
Administration**

# Memorandum

**Subject:** **ACTION:** Project No. TC1616SE-A -- Pacific Aviation Composites (PACUSA) Lancair LC40-550FG -- Requesting Review of and Concurrence with Equivalent Level of Safety (ELOS), FAR's 23.201, 23.203, and 23.221, Stalls and Spins.; ACE-98-1

**Date:**

**SEP 3 1998**

**From:** Manager, Seattle Aircraft Certification Office,  
ANM-100S

**Ref.**

**No.:** 98-190S-581

**To:** Manager, Small Airplane Directorate, ACE-100  
ATTN.: S. M. Nagarajan

**Reply to** J. Morfitt

**Attn. of:** (425) 227-2595

## Background:

PACUSA initially planned to show compliance with the spin resistant requirements of Federal Aviation Regulations (FAR) 23.221(a)(2) for the LC40-550FG. The airplane was not capable of meeting all requirements of spin resistance. As a result of company and Federal Aviation Administration (FAA) flight tests, PACUSA has asked that an equivalent level of safety finding be made. This equivalent level of safety finding was discussed in the F2 issue paper for this project.

## Applicable Regulations:

FAR's 23.201, 23.203, and 23.221, Stalls and Spins.

## Applicant Position:

PACUSA would like to submit the following Equivalent Level of Safety proposal.

The LC40-550FG was designed to meet the Spin Resistant criteria of FAR 23.221(a)(2). It is capable of demonstrating acceptable characteristics during the maneuvers required by FAR 23.221(a)(2)(ii) in all flap, weight and center of gravity configurations up to 75% power. Furthermore, it is capable of meeting all of the controllability requirements of FAR 23.221(a)(2)(i) for coordinated 30-degree roll reversals. It is also capable of meeting the controllability requirements of FAR 23.221(a)(2)(iii) for coordinated and one-ball-right wings-level stall characteristics. The airplane will not always meet FAR 23.221(a)(2)(iii) with one-ball-left, at 75% power and aft CG.

In retracting our claim of a completely "Spin Resistant" airplane, PACUSA would offer the following points for our proposal of Equivalent Level of Safety:

1. The airplane will not be marketed as a spin resistant airplane, and all references to such claims will be removed from the Airplane Flight Manual. The airplane will be treated as any other Utility Category Airplane “Not Approved for Spins”. All existing warnings against intentional spins will be retained.

2. Normal stall characteristics (ball centered) testing will be demonstrated per FAR’s 23.201 and 23.203. This will be done in lieu of FAR 23.221(a)(2)(iii).

3. Compliance with FAR 23.221(a)(2)(i) and (ii) will be demonstrated as follows.

(i) For compliance with FAR 23.221(a)(2)(i), the use of ailerons and rudder in the proper direction should be interpreted to mean coordinated use of ailerons and rudder such that the ball of the slip/skid indicator stays within one half ball width of centered. The FAA Pilot should verify that this degree of coordination does not require an exceptional level of pilot skill.

(ii) For the purpose of the application of FAR 23.221(a)(2)(ii), a 360 degree roll may be considered equivalent to a 360 degree heading change. This is only true provided the roll is due to the airplane responding to the rudder control in combination with wing dihedral and not due to a post stall departure. The airplane is not in a post stall departure (is in undeparted flight) if it exhibits no uncommanded motions and it responds immediately when recovery control inputs are made.

The intent of FAR 23.221(a)(2)(ii) is to demonstrate that the airplane is spin resistant and not to investigate regions beyond the airplane’s structural limits. If performing this maneuver results in a nose down attitude (i.e. via a rudder roll without a post stall departure) that results in a condition which approaches any structural limit ( $n_z$ ,  $V_{FE}$  or  $V_{NE}$ ), then the FAA pilot may discontinue the maneuver. As long as the FAA pilot finds that the airplane was approaching a limit in undeparted flight at the time that the maneuver was discontinued, then the FAA pilot may declare the airplane in compliance without continuing the maneuver for the full 7 seconds or 360 degrees. The roll and yaw rates encountered during a maneuver which is discontinued as described above must be such that 360 degrees of heading change or roll angle would not have occurred in less than 4 seconds. There is no intent to require instrumented measurements of yaw rate and roll rate; this will be a qualitative assessment by the FAA test pilot, as to whether the combined yaw and roll rates during any early recovery from the post-stall gyration is compatible with the 4 second requirement. Instrumented measurements would only be required only if PACUSA disagrees with the FAA pilot’s findings.

The test required by FAR 23.221(a)(2)(ii) must be accomplished using ailerons applied opposite the rudder direction as well as with the ailerons in a neutral position. Ailerons neutral means the control stick is held at the approximate center of its left to right travel.

4. The maneuvers, as described above, shall not require exceptional skill or any unique recovery technique. All flight controls should simply respond normally and effectively to fly the airplane out of the maneuver.

By successfully demonstrating compliance with the majority of FAR 23.221(a)(2), the LC40-550FG exhibits an exceptional level of safety in the stall/post stall regime. Focusing on spin resistance requirements, has produced an airplane with excellent low speed handling characteristics and an unusual tolerance to abused control inputs. The ability to fly away from an imminent stall, without entering a spin enhances the overall safety of the airplane.

FAA Position:

The proposal detailed above in the applicant position section of this memo provides a level of safety that is equivalent to or better than that provided by compliance with the one turn spin recovery option allowed under FAR 23.221(a)(1). Therefore, the FAA agrees that the this equivalent level of safety criteria may be used for showing compliance.

Compensating Features:

Stall characteristics meeting FAR's 23.201 and 23.203 combined with spin resistance characteristics meeting FAR's 23.221(a)(2)(i) and (ii).

Recommendation:

We concur that the PACUSA proposal detailed above in the applicant position section of this memo provides an equivalent level of safety as envisioned by the regulations and thus meets the requirements of FAR's 23.201, 23.203, and 23.221.

Concurred by:

  
 \_\_\_\_\_  
 Manager, Seattle Aircraft Certification Office, ANM-100S

9/3/98  
 Date

  
 \_\_\_\_\_  
 Manager, Standards Office, ACE-110

9/8/98  
 Date

  
 \_\_\_\_\_  
 Manager, Small Airplane Directorate,  
 Aircraft Certification Services, ACE-100

9/9/98  
 Date