



[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 23

[Docket No. FAA-2012-0485; Special Conditions No. 23-258-SC]

Special Conditions: Tamarack Aerospace Group, Cirrus Model SR22; Active Technology Load Alleviation System (ATLAS).

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions.

SUMMARY: These special conditions are issued for the Tamarack Aerospace Group's modification to the Cirrus SR22 airplane. This airplane as modified by Tamarack will have a novel or unusual design feature(s) associated with Tamarack Aerospace Group's modification. The design change will install winglets and an Active Technology Load Alleviation system (ATLAS). The addition of the ATLAS mitigates the negative effects of the winglets by effectively aerodynamically turning off the winglet under limit gust and maneuver loads. This is accomplished by measuring the aircraft loading and moving a small aileron-like device called a Tamarack Active Control Surface (TACS). The TACS movement reduces lift at the tip of the wing, resulting in the wing center of pressure moving inboard, thus reducing bending stresses along the wing span. 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.

EFFECTIVE DATE: July 13, 2013.

FOR FURTHER INFORMATION CONTACT: For sections 23.301 through 23.629 (structural requirements), contact Mr. Mike Reyer, telephone (816) 329-4131. For sections 23.672 through 23.701 (control system requirements), contact Mr. Ross Schaller, telephone (816) 329-4162. The address and facsimile for both Mr. Reyer and Mr. Schaller is: Small Airplane Directorate, Aircraft Certification Service, 901 Locust, Kansas City, Missouri 64106; facsimile (816) 329-4090.

SUPPLEMENTARY INFORMATION:

Background

On February 15, 2011, Tamarack Aerospace Group applied for a supplemental type certificate for installation of winglets and an Active Technology Load Alleviation System (ATLAS) on the Cirrus Model SR22 (serial numbers 0002 – 2333, 2335 - 2419, and 2421 – 2437). The Cirrus Model SR22 is a certified, single reciprocating engine, four-passenger, composite airplane.

The installation of winglets, as proposed by Tamarack, increases aerodynamic efficiency. However, the winglets by themselves also increase wing static loads and the wing fatigue stress ratio, which under limit gust and maneuver loads factors may exceed the certificated wing design limits. The addition of ATLAS mitigates the negative effects of the winglets by effectively aerodynamically turning off the winglet at elevated gust and maneuver loads factors.

The ATLAS functions as a load-relief system. This is accomplished by measuring aircraft loading via an accelerometer, and by moving a small aileron-like device called a Tamarack Active Control Surface (TACS) that reduces lift at the tip of the wing. Because the ATLAS compensates for the increased wing root bending at elevated load factors, the overall

effect of this modification is that the winglet can be added to the Cirrus wing without the traditionally required reinforcement of the existing structure. This is the first application of an active loads alleviation system on a part 23 aircraft and the applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature.

Type Certification Basis

Under the provisions of § 21.101, Tamarack Aerospace Group must show that the Cirrus Model SR22, as changed, continues to meet the applicable provisions of the regulations incorporated by reference in Type Certificate Data Sheet A00009CH 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 regulations incorporated by reference in Type Certificate Data Sheet A00009CH (Serial Numbers (S/Ns) 0002 through 2333, 2335 through 2419, and 2421 through 2437) are as follows:

14 CFR Part 23 of the Federal Aviation Regulations, effective February 1, 1965, as amended by 23-1 through 23-53, except as follows:

14 CFR 23.301 through Amendment 42

14 CFR 23.855, 23.1326, 23.1359 not applicable

14 CFR Part 36, dated December 1, 1969, as amended by 36-1 through 36-22

Except for:

Increase in amendment level from the cirrus Model SR22 certification basis for Regulation 14 CFR 23.301 through amendment 23-42 to: 14 CFR 23.301 through Amendment 23-48.

Addition of regulation 14 CFR 23.1306 through Amendment 23-61.

Addition of regulation 14 CFR 23.1308 through Amendment 23-57.

Change in Cirrus Model SR22 certification basis for regulation 14 CFR 23.1359 through Amendment 23-49 from: Not Applicable to : Applicable

Equivalent Level of Safety (ELOS) Findings

ACE-96-6 for 14 CFR Section 23.221 (Spinning); refer to FAA Memorandum, dated June 10, 1998, for Models SR20, SR22.

ACE-00-09 for 14 CFR 23.1143(g) (Engine Controls) and 23.1147(b) (Mixture Controls) Refer to FAA Memorandum, dated September 11, 2000, for Model SR22.

ACE-01-01 for 14 CFR 23.1143(g) (Engine Controls) and 23.1147(b) (Mixture Controls); Refer to FAA Memorandum, dated February 14, 2001, for Model SR20.

Special Conditions

23-ACE-88 for ballistic parachute for Models SR20, SR22.

23-134-SC for protection of systems for High Intensity Radiated Fields continued: (HIRF), for Models SR20, SR22.

23-163-SC for inflatable restraint system. Addition to the certification basis Model SR20 effective S/N 1541 and subsequent; Model SR22 S/N 1500, 1520 and subsequent.

In addition, if the regulations incorporated by reference do not provide adequate standards regarding the change, the applicant must comply with certain regulations in effect on the date of application for the change. The FAA has determined that the Cirrus SR22 complies with the following sections of 14 CFR part 23, as amended by Amendments 23-1 through 23-61 for the areas affected by the change.

If the Administrator finds that the applicable airworthiness regulations (i.e., 14 CFR part 23) do not contain adequate or appropriate safety standards for the SR22 because of a novel or unusual design feature, special conditions are prescribed under the provisions of § 21.16.

In addition to the applicable airworthiness regulations and special conditions, the SR22 must comply with the fuel vent and exhaust emission requirements of 14 CFR part 35 and the noise certification requirements of 14 CFR part 36.

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

Special conditions are initially applicable to the model for which they are issued. Should the applicant apply for a supplemental type certificate to modify any other model included on the same type certificate to incorporate the same novel or unusual design feature, the special conditions would also apply to the other model under § 21.101.

Novel or Unusual Design Features

The SR22 will incorporate the following novel or unusual design features:

Winglets with an Active Technology Load Alleviation System (ATLAS) that incorporates a small aileron-like device called a Tamarack Active Control Surface (TACS).

Discussion

Tamarack has applied for a Supplemental Type Certificate to install a winglet and ATLAS. The ATLAS is not a primary flight control system, a trim device, or a wing flap. However, there is definite applicability to ATLAS for several regulations under part 23, Subpart D – Control Systems, which might otherwise be considered “Not Applicable” under a strict

interpretation of the regulations. Other conditions may be developed, as needed, based on further FAA review and discussions with the manufacturer.

Special conditions are also necessary for the effect of ATLAS on structural performance. These special conditions are intended to provide an equivalent level of safety for ATLAS as intended by part 23, Subpart C – Structure, and portions of part 23, Subpart D- Design and Construction.

Discussion of Comments

Notice of proposed special conditions No. 23-12-01-SC for the Cirrus SR22 airplanes was published on May 15, 2012 (77 FR 28530). No comments were received and the special conditions are adopted as proposed.

Applicability

As discussed above, these special conditions are applicable to the SR22 (S/NS 0002 thru 2333, 2335 thru 2419, and 2421 thru 2437). Should Tamarack Aerospace Group apply at a later date for a supplemental type certificate to modify any other model included on Type Certificate Data Sheet A00009CH to incorporate the same novel or unusual design feature, the special conditions would apply to that model as well.

Under standard practice, the effective date of final special conditions would be 30 days after the date of publication in the Federal Register; however, as the certification date for the Tamarack modified Cirrus SR22 is imminent, the FAA finds that good cause exists to make these special conditions effective upon issuance.

Conclusion

This action affects only certain novel or unusual design features on one model of airplane. It is not a rule of general applicability and it affects only the applicant who applied to the FAA for approval of these features on the airplane.

List of Subjects in 14 CFR Part 23

Aircraft, Aviation safety, Signs and symbols.

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 Cirrus Model SR22 airplanes (S/Ns 0002 through 2333, 2335 through 2419, and 2421 through 2437) modified by Tamarack Aerospace Group.

1. Active Load Alleviation Systems – Structural Requirements.

(A) The following special conditions apply to airplanes equipped with load alleviation systems that either directly, or as a result of failure or malfunction, affect structural performance. These special conditions address the direct structural consequences of the system responses and performances and cannot be considered in isolation but should be included in the overall safety evaluation of the airplane. Any statistical or probability terms used in the following special conditions apply to the structural requirements only and do not replace, remove, or supersede

other requirements, including those in part 23, subpart E. These criteria are only applicable to structure whose failure could prevent continued safe flight and landing.

(B) In addition to the requirements in 14 CFR part 23, § 23.301 Loads, comply with the following:

SC 23.301 Loads, probability of failure of load alleviation system

(a) Failures of the load alleviation system, including the annunciation system, must be immediately annunciated to the pilot or annunciated prior to the next flight. Failure of the load alleviation system, including the annunciation system, must be no greater than 1×10^{-5} per flight hour.

(b) If failure of the load alleviation system, including the annunciation system, is greater than 1×10^{-8} per flight hour, an independent system functional test must be accomplished at a periodic interval to limit time exposure to an undetected failed system. The time interval for the system functional test must be selected so that the product of the time interval in hours and the failure of the load alleviation system, including the annunciation system, is no greater than 1×10^{-5} per hour.

(c) Failures of the load alleviation system, including the annunciation system, must be reported to the FAA in a manner acceptable to the Administrator.

(C) In place of the requirements in 14 CFR part 23, § 23.303 Factor of Safety, comply with the following:

SC 23.303 Factor of safety, load alleviation systems

The airplane must be able to withstand the limit and ultimate loads resulting from the following scenarios:

(a) The loads resulting from 14 CFR part 23, §§ 23.321 through 23.537, as applicable, corresponding to a fully operative load alleviation system. A factor of safety of 1.5 must be applied to determine ultimate loads.

(b) If an independent system functional test is required by SC 23.301(b), the loads resulting from 14 CFR part 23, §§ 23.321 through 23.537, as applicable, corresponding to the system in the failed state without additional flight limitations or reconfiguration of the airplane. A factor of safety of 1.0 must be applied to determine ultimate loads.

(c) The loads corresponding to the time of occurrence of load alleviation system failure and immediately after the failure. These loads must be determined at any speed up to V_{NE} , starting from 1g level flight conditions, and considering realistic scenarios, including pilot corrective actions. A factor of safety of 1.5 must be applied to determine ultimate loads.

(d) For airplanes equipped with “before the next flight” failure annunciation systems, the loads resulting from 14 CFR part 23, §§ 23.321 through 23.537, as applicable, corresponding to the system in the failed state without additional flight limitations or reconfiguration of the airplane. A factor of safety of 1.25 must be applied to determine ultimate loads.

(e) For airplanes equipped with "immediate" failure annunciation systems, the loads resulting from 14 CFR part 23, §§ 23.321 through 23.537, as applicable, corresponding to the system in the failed state with additional flight limitations or reconfiguration of the airplane. A factor of safety of 1.0 must be applied to determine ultimate loads.

(D) In addition to the requirements in 14 CFR part 23, §§ 23.571 through 23.574, comply with the following:

SC 23.571 through SC 23.574 Fatigue and damage tolerance

If any system failure would have a significant effect on the fatigue or damage evaluations required in §§ 23.571 through 23.574, then these effects must be taken into account. If an independent system functional test is required by SC 23.301(b), the effect on fatigue and damage evaluations resulting from the selected inspection interval must be taken into account.

(E) In addition to the requirements in 14 CFR part 23, § 23.629 Flutter, comply with the following:

SC 23.629 Flutter

(a) With the load alleviation system fully operative, compliance to 14 CFR part 23, § 23.629 must be shown. Compliance with § 23.629(f) must include the ATLAS control system and control surface.

(b) At the time of occurrence of load alleviation system failure and immediately after the failure, compliance with 14 CFR part 23, § 23.629 (a) and (e) must be shown up to V_D/M_D without consideration of additional operating limitations or reconfiguration of the airplane.

(c) For airplanes equipped with "before the next flight" failure annunciation systems and the load alleviation system in the failed state, compliance to 14 CFR part 23, § 23.629 Flutter, paragraphs (a) and (e), must be shown up to V_D/M_D without consideration of additional operating limitations or reconfiguration of the airplane.

(d) For airplanes equipped with "immediate" failure annunciation systems and the load alleviation system in the failed state, compliance to 14 CFR part 23, § 23.629 Flutter, paragraphs (a) and (e), must be shown with consideration of additional operating limitations or

reconfiguration of the airplane at speeds up to $V_D = 1.4 \times$ maximum speed limitation selected by the applicant.

2. **Active Load Alleviation Systems – Control System Requirements.**

(A) In place of 14 CFR part 23, § 23.672 Stability augmentation and automatic and power-operated systems requirement, comply with the following:

SC 23.672 Load Alleviation Systems

The load alleviation system must comply with the following:

(a) A warning, which is clearly distinguishable to the pilot under expected flight conditions without requiring the pilot's attention, must be provided for any failure in the load alleviation system or in any other automatic system that could result in an unsafe condition if the pilot was not aware of the failure. Warning systems must not activate the control system.

(b) The design of the load alleviation system or of any other automatic system must permit initial counteraction of failures without requiring exceptional pilot skill or strength, by either the deactivation of the system or a failed portion thereof, or by overriding the failure by movement of the flight controls in the normal sense.

(c) It must be shown that, while the system is active or after any single failure of the load alleviation system—

(1) The airplane is safely controllable when the failure or malfunction occurs at any speed or altitude within the approved operating limitations that is critical for the type of failure being considered;

(2) The controllability and maneuverability requirements of this part are met within a practical operational flight envelope (for example, speed, altitude, normal acceleration, and airplane configuration) that is described in the Airplane Flight Manual (AFM); and

(3) The trim, stability, and stall characteristics are not impaired below a level needed to permit continued safe flight and landing.

(B) In place of 14 CFR part 23, § 23.677 Trim systems requirement, comply with the following:

SC 23.677 Load Alleviation Active Control Surface

(a) Proper precautions must be taken to prevent inadvertent, improper, or abrupt Tamarack Active Control Surface (TACS) operation.

(b) The load alleviation system must be designed so that, when any one connecting or transmitting element in the primary flight control system fails, adequate longitudinal control for safe flight and landing is available.

(c) The load alleviation system must be irreversible unless the TACS is properly balanced and has no unsafe flutter characteristics. The system must have adequate rigidity and reliability in the portion of the system from the tab to the attachment of the irreversible unit to the airplane structure.

(d) It must be demonstrated that the airplane is safely controllable and that the pilot can perform all maneuvers and operations necessary to effect a safe landing following any probable powered system runaway that reasonably might be expected in service, allowing for appropriate time delay after pilot recognition of the system runaway. The demonstration must be conducted at critical airplane weights and center of gravity positions.

(C) In place of 14 CFR part 23, § 23.683 Operation tests requirement, comply with the following:

SC 23.683 Operation tests

(a) It must be shown by operation tests that, when the load alleviation system is active and operational and loaded as prescribed in paragraph (b) of this section, the system is free from—

- (1) Jamming;
- (2) Excessive friction; and
- (3) Excessive deflection.

(b) The prescribed test loads are, for the entire system, loads corresponding to the limit airloads on the appropriate surface.

(D) In place of 14 CFR part 23, § 23.685 Control system details requirement, comply with the following:

SC 23.685 Control system details

(a) Each detail of the Tamarack Active Control Surface (TACS) must be designed and installed to prevent jamming, chafing, and interference from cargo, passengers, loose objects, or the freezing of moisture.

(b) There must be means in the cockpit to prevent the entry of foreign objects into places where they would jam any one connecting or transmitting element of the system.

(c) Each element of the load alleviation system must have design features, or must be distinctively and permanently marked, to minimize the possibility of incorrect assembly that could result in malfunctioning of the control system.

(E) In place of 14 CFR part 23, § 23.697 Wing flap controls requirement, comply with the following:

SC 23.697 Load Alleviation System Controls

(a) The Tamarack Active Control Surface (TACS) must be designed so that, when the surface has been placed in any position, it will not move from that position unless the control is adjusted or is moved by the automatic operation of a load alleviation system.

(b) The rate of movement of the TACS in response to the automatic device must give satisfactory flight and performance characteristics under steady or changing conditions of airspeed, engine power, and attitude.

(F) In place of 14 CFR part 23, § 23.701 Flap interconnection requirement, comply with the following:

SC 23.701 Load Alleviation System Interconnection

(a) The load alleviation system and related movable surfaces as a system must—

(1) Be synchronized by a mechanical interconnection between the movable surfaces; or by an approved equivalent means; or

(2) Be designed so that the occurrence of any failure of the system that would result in an unsafe flight characteristic of the airplane is extremely improbable; or

(b) The airplane must be shown to have safe flight characteristics with any combination of extreme positions of individual movable surfaces.

Issued in Kansas City, Missouri, on July 13, 2013.

Earl Lawrence
Manager, Small Airplane Directorate

Aircraft Certification Service

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