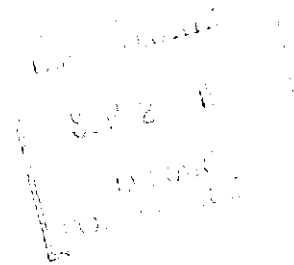
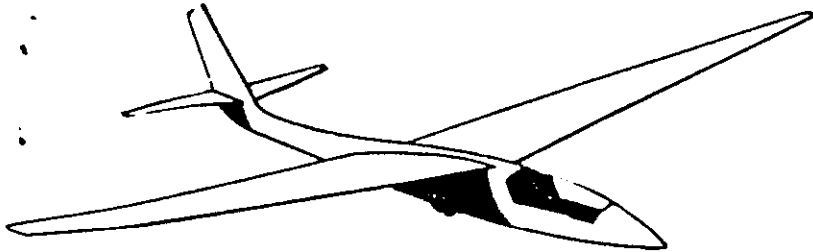




U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory Circular

21.17-2



**TYPE CERTIFICATION--
FIXED-WING GLIDERS (SAILPLANES)
INCLUDING
SELF-LAUNCHING (POWERED) GLIDERS**

July 13, 1989

Aircraft Certification Service



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

Advisory Circular

Subject: TYPE CERTIFICATION--FIXED-WING
GLIDERS (SAILPLANES), INCLUDING
SELF-LAUNCHING (POWERED) GLIDERS

Date: 7/13/89
Initiated by: AIR-110

AC No: 21.17-2
Change:

1. PURPOSE. This advisory circular (AC) describes three acceptable criteria, but not the only means, for the type certification of fixed-wing gliders (sailplanes) including self-launching (powered) gliders, that may be used by an applicant in showing compliance with new section 21.17(b) of Part 21 of the Federal Aviation Regulations (FAR). General guidance relative to glider type certification is also provided.

2. CANCELLATION. AC 21.23-1, Type Certification - Fixed-Wing Gliders (Sailplanes) dated January 12, 1981, is canceled.

3. RELATED FEDERAL AVIATION REGULATIONS.

- a. Section 21.5--Airplane or Rotorcraft Flight Manual.
- b. Section 21.17--Designation of applicable regulations.
- c. Part 23--Airworthiness Standards: Normal, Utility, and Acrobatic Category Airplanes.
- d. Part 33--Airworthiness Standards: Aircraft Engines.
- e. Part 35--Airworthiness Standards: Propellers.
- f. Part 45, Subpart C--Nationality and Registration Marks.
- g. Section 91.31--Civil aircraft flight manual, marking, and placard requirements.
- h. Section 91.33--Powered civil aircraft with standard category U.S. airworthiness certificates; instrument and equipment requirements.

4. BACKGROUND.

a. Part 21 of the FAR was amended effective April 13, 1987, to provide procedures for the type certification and airworthiness certification of special classes of aircraft. Special classes of aircraft include gliders (including self-launching gliders), airships, and other kinds of aircraft that would be eligible for a standard airworthiness certificate but for which no airworthiness standards have as yet been established as a separate part of

Chapter 1, Subchapter C of CFR 14. Airworthiness standards for these special classes of aircraft are designated in § 21.17(b). Section 21.23 was removed, and the glider requirements incorporated in § 21.17(b). Therefore the essence of AC 21.23-1 was included in this AC.

b. Provisions of § 21.23. Former § 21.23 provided that an applicant was entitled to a type certificate for a glider if the applicant submitted the type design, test reports, and computations necessary to show and the Administrator found that--

(1) The glider complied either with those airworthiness requirements of Part 23 or Part 27 of the FAR that the Administrator considered to be appropriate for gliders and applicable to the specific type design or with such other airworthiness criteria as the Administrator may have determined an equivalent level of safety to those parts; and

(2) There was no unsafe feature or characteristic of the glider.

c. General Nature of § 21.23. Reference to Part 27 of the FAR in § 21.23 was for the type certification of rotary-wing gliders which is outside the scope of this AC. The airworthiness standards for the type certification of gliders as defined by § 21.23 were very general and objective in nature, making it necessary for the applicant to develop comprehensive and detailed criteria to be used for the certification basis and for the FAA evaluation of the glider type design.

5. DISCUSSION. This AC contains a list of design criteria found acceptable to the Administrator for the type certification of fixed-wing gliders (sailplanes), including self-launching (powered) gliders. The following is a discussion of some of the acceptable means of showing compliance with § 21.17(b).

a. Basic Glider Criteria Handbook. In 1966, the FAA announced to the public the availability of the Basic Glider Criteria Handbook as an acceptable means, but not the only means, of showing compliance with § 21.23. Except for self-launching (powered) gliders, the FAA still considers the criteria in the handbook acceptable for showing compliance with new § 21.17(b). Criteria for self-launching (powered) gliders are addressed in paragraphs 6b, c, and g of this AC.

b. JAR-22. Joint Airworthiness Requirements for Sailplanes and Powered Sailplanes.

(1) Origin. On April 1, 1980, certain European Civil Airworthiness Authorities agreed to Joint Airworthiness Requirements for Sailplanes and Powered Sailplanes (JAR-22). JAR-22 is based on the Federal Republic of Germany national airworthiness code (Lufttüchtigkeitsforderungen für

Segelflugzeuge and Motorsegler (LFSM) published by the Luftfahrt Bundesamt), and was developed through joint participation of the Civil Airworthiness Authorities of Belgium, the Federal Republic of Germany, France, Italy, the Netherlands, Sweden, and the United Kingdom. After the original issuance, JAR-22 was amended to add new Subparts H and J which set forth criteria for the type certification of glider engines and propellers, respectively.

(2) Acceptability of JAR-22. After reviewing JAR-22 as amended, the FAA has determined that, for fixed-wing gliders, including self-launching (powered) gliders, the criteria of JAR-22, plus the additional criteria specified herein, provide an equivalent level of safety to the appropriate and applicable requirements of Part 23 of the FAR. Moreover, the FAA has in the past, type certificated a number of gliders manufactured in the Federal Republic of Germany that were designed to the LFSM which was used as the basis for JAR-22. The highly satisfactory service experience gained with those gliders further supports the acceptability of JAR-22 as criteria for showing compliance with § 21.17(b) of the FAR.

c. Other Airworthiness Criteria. FAR § 21.17(b) establishes procedures for the development and application of airworthiness standards and criteria for special classes of aircraft for which appropriate airworthiness standards do not exist in the FAR. Special classes of aircraft include gliders (including self-launching gliders) that would be eligible for standard airworthiness certificates but for which no airworthiness standards have as yet been established as a separate part of Chapter 1, Subchapter C of the CFR. The use of these criteria for type certification of gliders is permitted providing the Administrator finds that they provide a level of safety equivalent to those standards.

d. Operational Provisions of Part 91. In addition to the type certification requirements of Part 21 of the FAR, gliders must also comply with certain operational provisions of Part 91 of the FAR. Applicants for type certification of gliders, particularly self-launching gliders, should ensure that these requirements are considered in their designs.

6. ACCEPTABLE CRITERIA.

a. Applicants may utilize one of the following means of showing compliance for the type certification of fixed-wing gliders, including self-launching (powered) gliders.

(1) FAA Basic Glider Criteria Handbook (1962 or later revision) plus the additional criteria specified in paragraphs 6(b)(2), (3), and 6(c)(7) below for self-launching (powered) gliders.

(2) JAR-22 as amended and accepted by the FAA at the date of application for type certification plus the additional criteria specified in paragraphs 6(c)(6) and (7) below.

(3) Other Airworthiness Criteria.

(1) In the event that the airworthiness criteria prescribed in (1) and (2) above are inadequate or otherwise inappropriate as a certification basis of a glider due to its unique design or design features, other criteria may be developed. FAA approval is required before the initial application of the airworthiness criteria as the certification basis of the glider. Guidance for preparation and approval of these criteria are outlined as follows:

(A) These criteria must provide for a level of safety equivalent to that prescribed in § 21.17(b). Any proposed airworthiness criteria submitted to the FAA should be comparable to Part 23 of the FAR in its thoroughness, conciseness, clarity, and amount of detail. It is envisaged by the FAA that, to achieve a feasible set of airworthiness criteria, an engineering staff experienced in glider design, in conducting certification programs, and with the development of procedures and standards will be necessary. If the Administrator finds that there is a need, the FAA may participate in the development of such criteria depending on the feasibility of completing the project and the availability of personnel.

(B) The applicant should submit its airworthiness criteria for approval to the certificating aircraft certification office, which will submit them, with recommendations, to the Small Airplane Directorate, ACE-100, for approval by the Manager, Small Airplane Directorate, Aircraft Certification Service. Upon receipt, ACE-100 will review the airworthiness criteria for applicability to the type design and for completeness. After the criteria are determined by ACE-100 to be acceptable, they will be announced in the Federal Register for public comment as a proposed revision to this AC. The disposition of public comments will be kept on file. Once approved, these criteria may be used as the certification basis for other gliders. The approved set of criteria will be listed in this AC, along with information on where they may be obtained. ACE-100 will maintain a file of these criteria.

(ii) The approval procedures for significant changes or additions to any previously approved airworthiness criteria proposed for a new project will follow the procedures outlined in (B) above established for a complete set of airworthiness criteria.

(iii) Previously approved airworthiness criteria, when proposed for a new project, should be evaluated for currency based upon advancement of the state-of-the-art glider design, service experience, and amendments to appropriate regulations such as Part 23 of the FAR.

(iv) Equivalent safety findings may be appropriate in lieu of changes to previously approved airworthiness criteria. In such cases, a showing of equivalent safety findings should be required of the applicant and approved by ACE-100. Such equivalent safety findings should be part of the type certification basis and noted on the type certificate data sheet.

(v) These criteria will need to provide for Instructions for Continued Airworthiness to show compliance with § 21.50.

b. Additional Criteria for Self-Launching (Powered) Gliders.

(1) Self-launching (powered), fixed-wing gliders may be type certificated under § 21.17(b) if--

(i) The total occupant capacity does not exceed two persons;

(ii) The maximum certificated weight does not exceed 2,000 lb;

and

(iii) Either of the following criteria is met:

(A) The value, w/b^2 , does not exceed 2 lb/ft² (3 kg/m²); or

(B) The minimum descent rates for the glider, power-off, at maximum weight and most unfavorable center of gravity position, does not exceed 3.3 ft/sec (1 m/sec) for single-seat gliders, or 4.0 ft/sec (1.2 m/sec) for two-seat gliders.

(2) The criteria of Chapter 6 of the FAA Basic Glider Criteria Handbook are no longer considered acceptable for self-launching (powered) gliders. Applicants wishing to type certificate self-launching gliders, that comply with the criteria of paragraph 6(b)(1) of this AC, may either use the criteria of JAR-22 for powered sailplanes or develop criteria using Part 23 of the FAR as a base. Prior to using these airworthiness criteria for the certification basis, they need to be approved by the Manager, Small Airplane Directorate, Aircraft Certification Service in the same manner described in 6(a)(3). Self-launching gliders that exceed the limitations in 6(b)(1) can only be type certificated as normal, utility, or acrobatic category airplanes under Part 23 of the FAR.

(3) Engines and propellers intended for use on self-launching (powered) gliders may be type certificated in accordance with Parts 33 and 35 of the FAR, respectively, or may be certificated as an integral part of the glider. If either the engine or the propeller is certificated as an integral part of the glider, the applicant will need to provide the appropriate airworthiness criteria for which Part 33 or 35 may be used as a guide. Prior to using these airworthiness criteria for the certification basis, they need to be approved by the Manager, Small Airplane Directorate, Aircraft Certification Service in the same manner described in 6(a)(3). Engines and/or propellers that are approved as an integral part of the glider will be certificated as a part of the glider and will be limited to installation on that specific glider. Separate type certificates will not be issued for these engines and propellers. The engine and propeller, including the accessory system, should not create a hazard to the safe operation of the glider.

(4) Part 36 of the FAR does not contain noise requirements for fixed-wing gliders (sailplanes), including self-launching (powered) gliders. A finding, under the Noise Control Act of 1972, however, is to be conducted by the FAA for all aircraft before a new type certificate can be issued. Amended type certificates do not require findings.

c. JAR-22. If JAR-22 is selected by the applicant--

(1) Unless otherwise specified in subparagraph (6) below, the national variants identified by individual countries need not be applied.

(2) The "ACJ (interpretive material)" is considered acceptable to the FAA.

(3) The maximum weight limit of JAR-22.1(a)(1) need not be applied for unpowered gliders.

(4) Engines that meet the criteria of JAR-22 subpart H, may be approved as an integral part of the glider. Engines so approved will be certificated as a part of the glider and will be limited to installation on that specific glider.

(5) Propellers that meet the criteria of JAR-22; subpart J, may be approved as an integral part of the glider. Propellers so approved will be certificated as a part of the glider and will be limited to installation on that specific glider.

(6) The following additional criteria are required to satisfy the associated JAR-22 sections--

(i) JAR-22.177(b)--

(A) Pitch and roll control may not be adversely affected at maximum rudder deflection in any flap or speed brake configuration.

(B) Any rudder control force reversal must not require immediate corrective action to prevent an unstable or unsafe flight condition.

(C) The temporary control force required to overcome rudder control force reversal may not be greater than 15 percent of the maximum unreversed force or 15 pounds force, whichever is greater.

(D) The flight must describe the slip characteristics of the glider, the speed range within which slips can be performed, the appropriate pilot action in response to a control force decrease or reversal condition, and the degradation, if any, in the airspeed system accuracy during slip maneuvers.

(ii) JAR 22.207(b)--The national variant specified by Belgium, France, and the United Kingdom applies; that is visual stall warning alone is not acceptable.

(iii) JAR 22.1545--If the never-exceed speed (V_{NE}) varies with altitude, a means is necessary to indicate to the pilot the appropriate limitations throughout the operating altitude range.

(7) For self-launching (powered) sailplanes the following additional criteria are required to satisfy the associated JAR-22 sections--

(i) JAR 22.777 cockpit controls

(A) Each cockpit control must be identified to prevent confusion and inadvertent operation.

(B) In powered sailplanes with dual controls, it must be possible to operate the following secondary controls from each of the two pilot seats--

(1) Propeller control;

(2) Mixture control; and

(3) Carburetor air heat control (if required).

(C) In powered sailplanes with side-by-side pilot seats, powerplant controls must be located at or near the center of the cockpit, on the pedestal, instrument panel, or overhead.

(D) The control location order from left to right must be power, propeller, and mixture control.

(E) Carburetor heat or alternate air control must be to the left of the throttle.

(ii) JAR 22.779 Motion and effect of cockpit controls--

<u>Controls</u>	<u>Motion and effect</u>
Carburetor, air heat or alternate air	Forward or upward for cold

(iii) JAR 22.903(b)--Engine operation must be evaluated after prolonged engine shut down at maximum altitude and after prolonged flight idle (soaring).

(iv) JAR 22.1093--The induction system icing protection must be evaluated for adequacy at reduced powers. Flight manual procedures for

recognition of carburetor ice symptoms and proper application of carburetor heat will be developed.

(v) Reference § 23.1147, Mixture controls (There is no comparable JAR section.)--If there is a mixture control, it must be guarded or must be shaped or arranged to prevent confusion by feel with other controls, and must require a separate and distinct operation to move the control toward the lean or shut-off position.

(vi) Reference § 23.1153, Propeller feathering controls (There is no comparable JAR section.)--If there is a propeller feathering control, it must have a means to prevent inadvertent operation.

(vii) JAR 22.1555 Control markings--A blade position indicating means for each controllable pitch propeller without constant speed controls is required.

d. FAK § 21.5. The Airplane Flight Manual requirements of § 21.5 are applicable to fixed-wing gliders. In addition, compliance with the civil aircraft operating limitations and marking requirements of § 91.31 is necessary.

e. FAR § 21.21(b)(2). Gliders may be designed for quick removal and installation of the wing and tail surfaces by the pilot. Regardless of the criteria selected under paragraph 6(a), it is necessary to provide a means for direct visual inspection of the connections for placement and security of the wing and tail attachments. If the flight controls are not automatically connected upon wing and tail assembly, it is necessary to provide a readily accessible means for manually connecting the control systems and direct visual inspection of the control connections for placement and security. The lack of a visual inspection means is considered an unsafe feature and is prohibited by § 21.21(b)(2).

f. Part 45, Subpart C of the FAR. Nationality registration marking requirements for U.S.-registered gliders are provided by Part 45 of the FAR, subpart C.

g. FAR § 91.33. Self-launching (powered) gliders are considered to be powered aircraft for the purpose of complying with § 91.33.

7. OTHER INFORMATION.

a. Compliance to JAR-22. United States designers and manufacturers of fixed-wing gliders (sailplanes), including self-launching (powered) gliders, should be advised that strict compliance with JAR-22, including adherence to the national variants, probably will be required by participating countries of the JAR group for import airworthiness acceptance. Accordingly, unless specifically notified to the contrary by the authority of the importing country on a particular case basis, the FAA will consider strict compliance

with JAR-22 required for issuance of a U.S. Class I Export Certificate of Airworthiness for export to a JAR participating country.

b. Certification Basis. An FAA letter may be used by the certificating aircraft certification office to inform the applicant of the airworthiness criteria selected in accordance with paragraph 6 that were found to be acceptable to the Administrator for showing compliance with § 21.17(b) of the FAR. These airworthiness criteria should be identified by title, number, revision, and date of approval.

c. Type Certificate Data Sheet (TCDS). Section 21.17(b) of the FAR will be cited as the certification basis for fixed-wing gliders (sailplanes), including self-launching (powered) gliders. The TCDS will list, as the certification basis, § 21.17(b) and the airworthiness criteria established in paragraph b. above. These criteria need to be identified by title, number, revision, and date of approval.

8. HOW TO ORDER.

a. SN 050-011-00004-6--FAA Basic Glider Criteria Handbook may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

b. JAR-22--Joint Airworthiness Requirements Sailplanes and Powered Sailplanes, may be purchased from the Civil Aviation Authority, Printing and Publication Services, Greville House, 37 Gratton Road, Cheltenham Glos. GL50 2BN, England.

c. AC 21.17-2--Type Certification--Fixed-Wing Gliders (Sailplanes), Including Self-Launching (Powered) Gliders, may be obtained from the U.S. Department of Transportation, Utilization and Storage Section, M-443.2, Room 2314, Nassif Building, Washington, DC 20590.



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