



[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR part 25

Docket No. FAA-2015-1496; Special Conditions No. 25-601-SC

Special Conditions: Gulfstream Model GVII-G500 Airplanes, Side-Stick

Controllers; Controllability and Maneuverability

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions.

SUMMARY: These special conditions are issued for the Gulfstream Model GVII-G500 airplane.

This airplane will have a novel or unusual design feature when compared to the state of technology envisioned in the airworthiness standards for transport category airplanes. This design feature is side-stick controllers, instead of conventional-control wheel-and-column design, for pitch and roll control. 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.

DATES: Effective [INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

FOR FURTHER INFORMATION CONTACT: Joe Jacobsen, FAA, Airplane and Flight Crew Interface Branch, ANM-111, Transport Airplane Directorate, Aircraft Certification Service, 1601

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SUPPLEMENTARY INFORMATION:

Background

On March 29, 2012, Gulfstream Aerospace Corporation applied for a type certificate for their new Model GVII-G500 airplane. The Model GVII-G500 will be a large-cabin business jet with seating for 19 passengers. It will incorporate a low, swept-wing design with winglets and a T-tail. The powerplant will consist of two aft-fuselage-mounted Pratt & Whitney turbofan engines. The flight-control system is a three-axis, fly-by-wire (FBW) system incorporating active control/coupled side sticks.

The Model GVII-G500 will have a wingspan of approximately 87 ft. and a length of just over 91 ft. Maximum takeoff weight will be approximately 76,850 lbs and maximum takeoff thrust will be approximately 15,135 lbs. Maximum range will be approximately 5,000 nm and maximum operating altitude will be 51,000 ft.

The Model GVII-G500 airplane will incorporate a FBW flight-control system, through side-stick controllers, for pitch and roll control. Regulatory requirements, such as the pilot-control forces prescribed in the referenced regulations, are not applicable for the side-stick controller design. In addition, pilot-control authority may be uncertain because the side-stick controllers are not mechanically interconnected to flight controls as are conventional wheel-and-column controls.

Type Certification Basis

Under Title 14, Code of Federal Regulations (14 CFR) 21.17, Gulfstream must show that the Model GVII-G500 airplane meets the applicable provisions of 14 CFR part 25, effective

February 1, 1965, including Amendments 25-1 through 25-137; 14 CFR part 34, as amended by Amendments 34-1 through the most current amendment at time of design approval; and 14 CFR part 36, Amendment 36-29.

In addition, the certification basis includes other regulations, special conditions, and exemptions that are not relevant to these special conditions. Type Certificate no. TC-01-2010-0024 will be updated to include a complete description of the certification basis for this airplane model.

If the Administrator finds that the applicable airworthiness regulations (i.e., 14 CFR part 25) do not contain adequate or appropriate safety standards for the Gulfstream Model GVII-G500 airplane because of a novel or unusual design feature, special conditions are prescribed under § 21.16.

Special conditions are initially applicable to the model for which they are issued. Should the type certificate for that model be amended later to include any other model that incorporates the same or similar novel or unusual design feature, the special conditions would also apply to the other model under § 21.101.

In addition to the applicable airworthiness regulations and special conditions, Gulfstream Model GVII-G500 airplanes must comply with the fuel-vent and exhaust-emission requirements of 14 CFR part 34, and the noise-certification requirements of 14 CFR part 36.

The FAA issues special conditions, as defined in 14 CFR 11.19, under § 11.38, and they become part of the type certification basis under § 21.17(a)(2).

Novel or Unusual Design Features

Gulfstream Model GVII-G500 airplanes will incorporate the following novel or unusual design feature:

Side-stick controllers incorporating fly-by-wire technology for pitch and roll control, in place of conventional wheel-and-column controls.

Discussion

These special conditions for the Gulfstream Model GVII-G500 airplane address the unique features of the side-stick controllers. The Model GVII-G500 airplane will incorporate side-stick controllers controlling a FBW flight-control system. The FBW control laws are designed to provide conventional flying qualities such as positive static longitudinal and lateral stability as prescribed in part 25, subpart B. However, the pilot-control forces prescribed in the referenced regulations are not applicable for the side-stick controller design.

Because current FAA regulations do not specifically address the use of side-stick controllers for pitch and roll control, the unique features of the side stick therefore must be demonstrated, through flight and simulator tests, to have suitable handling and control characteristics when considering the following:

- The handling-qualities tasks and requirements of the Gulfstream Model GVII-G500 Special Conditions and other 14 CFR part 25 requirements for stability, control, and maneuverability, including the effects of turbulence.
- General ergonomics: Armrest comfort and support, local freedom of movement, displacement-angle suitability, and axis harmony.
- Inadvertent pilot input in turbulence.
- Inadvertent pitch and roll crosstalk from pilot inputs on the side-stick controller.

Discussion of Comments

Notice of proposed special conditions no. 25-15-07-SC for the Gulfstream Model GVII-G500 airplane was published in the Federal Register on August 18, 2015 [80 FR 49934]. No comments were received, and the special conditions are adopted as proposed.

Applicability

As discussed above, these special conditions apply to Gulfstream Model GVII-G500 airplanes. Should Gulfstream apply later for a change to the type certificate to include another model incorporating the same or similar novel or unusual design feature, the special conditions would apply to that model as well.

Conclusion

This action affects only certain novel or unusual design features on Gulfstream Model GVII-G500 airplanes. It is not a rule of general applicability.

List of Subjects in 14 CFR part 25

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

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 the Gulfstream Model GVII-G500 airplane, in lieu of §§ 25.143(d), 25.143(i)(2), 25.145(b), 25.173(c), 25.175(b), and 25.175(d):

Pilot strength: In lieu of the control-force limits shown in § 25.143(d) for pitch and roll, and in lieu of specific pitch-force requirements of §§ 25.143(i)(2), 25.145(b), 25.173(c),

25.175(b), and 25.175(d), Gulfstream must show that the temporary and maximum prolonged-force levels for the side-stick controllers are suitable for all expected operating conditions and configurations, whether normal or non-normal.

Pilot-control authority: The electronic side-stick-controller coupling design must provide for corrective and overriding control inputs by either pilot with no unsafe characteristics. Annunciation of the controller status must be provided, and must not be confusing to the flightcrew.

Pilot control: Gulfstream must show by flight tests that the use of side-stick controllers does not produce unsuitable pilot-in-the-loop control characteristics when considering precision path control and tasks, and turbulence. In addition, pitch and roll control force and displacement sensitivity must be compatible, so that normal pilot inputs on one control axis will not cause significant unintentional inputs (crossover) on the other.

Issued in Renton, Washington, September 25, 2015.

Michael Kaszycki
Acting Manager, Transport Airplane Directorate
Aircraft Certification Service
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