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**[4910-13]**

## **DEPARTMENT OF TRANSPORTATION**

### **Federal Aviation Administration**

#### **14 CFR Part 25**

#### **[Docket No. FAA-2014-0248; Special Conditions No. 25-553-SC]**

**Special Conditions:** Gulfstream Model GVI airplanes; airbag-equipped shoulder belt.

**AGENCY:** Federal Aviation Administration (FAA), DOT.

**ACTION:** Final special conditions; request for comments.

**SUMMARY:** These special conditions are issued for the Gulfstream Model GVI airplane. This airplane, as modified by Gulfstream, will have a novel or unusual design feature associated with airbag-equipped shoulder belts. 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:** The effective date of these special conditions is **[insert FR publication date]**. We must receive your comments by **[insert date 45 days after FR publication date]**.

**ADDRESSES:** Send comments identified by docket number FAA-2014-0248 using any of the following methods:

Federal eRegulations Portal: Go to <http://www.regulations.gov/> and follow the online instructions for sending your comments electronically.

Mail: Send comments to Docket Operations, M-30, U.S. Department of Transportation (DOT), 1200 New Jersey Avenue, SE, Room W12-140, West Building Ground Floor, Washington, D.C., 20590-0001.

Hand Delivery or Courier: Take comments to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE, Washington, D.C., between 9 a.m. and 5 p.m., Monday through Friday, except federal holidays.

Fax: Fax comments to Docket Operations at 202-493-2251.

Privacy: The FAA will post all comments it receives, without change, to <http://www.regulations.gov/>, including any personal information the commenter provides. Using the search function of the docket web site, anyone can find and read the electronic form of all comments received into any FAA docket, including the name of the individual sending the comment (or signing the comment for an association, business, labor union, etc.). DOT's complete Privacy Act Statement can be found in the Federal Register published on April 11, 2000 (65 FR 19477-19478), as well as at <http://DocketsInfo.dot.gov/>.

Docket: Background documents or comments received may be read at <http://www.regulations.gov/> at any time. Follow the online instructions for accessing the docket or go to the Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE, Washington, D.C., between 9 a.m. and 5 p.m., Monday through Friday, except federal holidays.

**FOR FURTHER INFORMATION CONTACT:** Dan Jacquet, Airframe and Cabin Safety, ANM-115, Transport Airplane Directorate, Aircraft Certification Service, 1601 Lind Avenue SW, Renton, Washington 98057-3356; telephone 425-227-2676; facsimile 425-227-1149.

**SUPPLEMENTARY INFORMATION:**

The FAA has determined that notice of, and opportunity for prior public comment on, these special conditions are impracticable because these procedures would significantly delay issuance of the design approval and thus delivery of the affected airplane. In addition, the

substance of these special conditions has been subject to the public-comment process in several prior instances with no substantive comments received. The FAA therefore finds that good cause exists for making these special conditions effective upon publication in the *Federal Register*.

### **Comments Invited**

We invite interested people to take part in this rulemaking by sending written comments, data, or views. The most helpful comments reference a specific portion of the special conditions, explain the reason for any recommended change, and include supporting data.

We will consider all comments we receive by the closing date for comments. We may change these special conditions based on the comments we receive.

### **Background**

On October 23, 2012, Gulfstream applied for a supplemental type certificate for airbag-equipped shoulder belts in the Gulfstream Model GVI airplane. The Gulfstream Model GVI is a two-engine jet transport airplane with an executive cabin interior. The maximum takeoff weight is 99,600 pounds, with a maximum passenger capacity of 19.

### **Type Certification Basis**

Under the provisions of § 21.101 Gulfstream must show that the GVI, as changed, continues to meet the applicable provisions of the regulations incorporated by reference in type certificate no. T00015AT 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 T00015AT are as follows:

The certification basis is 14 CFR part 25, Airworthiness Standards: Transport Category Airplanes, effective February 1, 1965, including Amendments 25-1 through 25-120 and 25-122, 25-124, and 25-132.

Amendment 25-118 was not published and therefore does not apply.

Optional Design Regulations:

- The Model GVI has been shown to comply with the requirements for ditching: § 25.801, 25.563, 25.807(e), and 25.1585(a). When the operating rules require emergency-ditching equipment, compliance with §§ 25.1411 and 25.1415 must be shown. Gulfstream Report GVI-GER-1709, titled “Design Requirements Document for Ditching Equipment,” provides an acceptable means for showing compliance with §§ 25.1411 and 25.1415.
- The Model GVI is approved for flight into known icing conditions and has demonstrated compliance to § 25.1419.

Exemption No. 9761, §§ 25.562(a) and 25.785(b) for side-facing divans also applies.

The certification basis includes certain special conditions, exemptions, and equivalent-safety findings that are not relevant to these proposed special conditions.

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 GVI because of a novel or unusual design feature, special conditions are prescribed under the provisions of § 21.16.

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.

In addition to the applicable airworthiness regulations and special conditions, the GVI 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, in accordance with § 11.38, and they become part of the type-certification basis under § 21.101.

### **Novel or Unusual Design Features**

The Gulfstream model GVI will incorporate the following novel or unusual design feature:

Gulfstream Aerospace Corporation is proposing to install inflatable shoulder straps on side-facing divans to reduce the potential for head injury in the event of an accident. The inflatable shoulder strap works similarly to an automotive airbag except that the airbag is integrated with the shoulder strap of the restraint system.

Part 25 states the performance criteria for head injury protection in objective terms. However, none of these criteria are adequate to address the specific issues raised concerning seats with inflatable shoulder straps. The FAA has therefore determined that, in addition to the requirements of part 25, special conditions are needed to address requirements particular to installation of seats with inflatable shoulder straps.

Accordingly, in addition to the passenger-injury criteria specified in § 25.785, these special conditions are adopted for Gulfstream GVI airplanes equipped with inflatable shoulder straps.

### **Discussion**

From the standpoint of a passenger-safety system, the inflatable shoulder belt is unique in that it is both an active and entirely autonomous device. While the automotive industry has good

experience with airbags, the conditions of use and reliance on the inflatable shoulder belt as the sole means of injury protection are quite different. In automobile installations, the airbag is a supplemental system and works in conjunction with an upper torso restraint. In addition, the crash event is more definable and of typically shorter duration, which can simplify the activation logic. The airplane operating environment is also quite different from automobiles, and includes the potential for greater wear and tear and unanticipated abuse conditions (due to galley loading, passenger baggage, etc.). Airplanes also operate where exposure to high-intensity electromagnetic fields could affect the activation system.

The inflatable shoulder belt has two potential advantages over other means of head-impact protection. First, it can provide significantly greater protection than would be expected with energy-absorbing pads, and second, it can provide essentially equivalent protection for occupants of all stature. These are significant advantages from a safety standpoint, because such devices will likely provide a level of safety that exceeds the minimum standards of the federal aviation regulations. Conversely, inflatable shoulder belts in general are active systems and must be relied upon to activate properly when needed, as opposed to an energy-absorbing pad or upper-torso restraint that is passive and always available. Therefore, the potential advantages must be balanced against this and other potential disadvantages in developing standards for this design feature.

The FAA has considered the installation of inflatable shoulder belts to have two primary safety concerns: First, that they perform properly under foreseeable operating conditions, and second, that they do not perform in a manner or at such times as would constitute a hazard to the airplane or occupants. This latter point has the potential to be the more rigorous of the requirements, owing to the active nature of the system.

The inflatable shoulder belt will rely on electronic sensors for signaling, and a stored gas canister for inflation. These same devices could be susceptible to inadvertent activation, causing deployment in a potentially unsafe manner. The consequence of inadvertent deployment, as well as failure to deploy, must be considered in establishing the reliability of the system. Gulfstream Aerospace Corporation must substantiate that the effects of an inadvertent deployment in flight either would not cause injuries to occupants, or that such deployment(s) meet the requirement of § 25.1309(b). The effect of an inadvertent deployment on a passenger or crewmember that might be positioned close to the inflatable shoulder belt should also be considered. The person could be either standing or sitting. A minimum reliability level must be established for this case, depending upon the consequences, even if the effect on the airplane is negligible.

The potential for an inadvertent deployment could be increased as a result of condition in service. The installation must take into account wear and tear so that the likelihood of an inadvertent deployment is not increased to an unacceptable level. In this context, an appropriate inspection interval and self-test capability are considered necessary. Other outside influences are lightning and high-intensity radiated fields (HIRF). Existing HIRF special conditions for the model GVI are applicable.

Additionally, the inflatable shoulder-belt installation should be protected from the effects of fire, so that an additional hazard is not created by, for example, a rupture of the pyrotechnic squib.

To be an effective safety system, the inflatable shoulder belt must function properly and must not introduce any additional hazards to occupants as a result of its functioning. In several ways, the inflatable shoulder belt differs from traditional occupant-protection systems and requires special conditions to ensure adequate performance.

Because the inflatable shoulder belt is essentially a single-use device, this potentially could deploy under crash conditions that are not sufficiently so severe as to require head-injury protection from the inflatable shoulder belt. Because an actual crash is frequently composed of a series of impacts before the airplane comes to rest, this could render the inflatable shoulder belt useless if a larger impact follows the initial impact. The situation does not exist with energy-absorbing pads or upper-torso restraints, which tend to provide continuous protection regardless of severity or number of impacts in a crash event. Therefore, the inflatable shoulder-belt installation should provide protection, when it is required, by not expending its protection during a less-severe impact. It is also possible to have several large impact events during the course of a crash, but we will not require the inflatable shoulder belt to provide protection for multiple impacts.

Because each occupant's restraint system provides protection for that occupant only, the installation must address seats that are unoccupied. It will be necessary to show that the required protection is provided for each occupant regardless of the number of occupied seats, and considering that unoccupied seats may have shoulder belts that are active.

The inflatable shoulder belts should be effective for a wide range of occupants. The FAA has historically considered the range from the 5<sup>th</sup>-percentile female to the 95<sup>th</sup>-percentile male as the range of occupants that must be taken into account. In this case, the FAA is proposing consideration of a broader range of occupants, due to the nature of shoulder-belt installation and their close proximity to the occupant. In a similar vein, these persons could have assumed the brace position for those accidents where an impact is anticipated. Test data indicate that occupants in the brace position do not require supplemental protection, so it would not be necessary to show that the inflatable shoulder belts will enhance the brace position. However, the

inflatable shoulder belts must not introduce a hazard in the case of deploying into the seated, braced occupant.

Another area of concern is the use of seats, so equipped, by children, whether lap-held, in approved child safety seats, or occupying the seat directly. Similarly, if the seat is occupied by a pregnant woman, the installation should address such usage either by demonstrating that it will function properly, or by adding appropriate limitation on usage.

Because the inflatable shoulder belt will be electrically powered, there is the possibility that the system could fail due to a separation in the fuselage. And because this system is intended as a crash/post-crash protection means, failure to deploy due to fuselage separation is not acceptable. As with emergency lighting, the system should function properly if such a separation occurs at any point in the fuselage. As required by § 25.1353(a), operation of the existing airplane electrical equipment should not adversely impact the function of the inflatable lapbelt under all foreseeable conditions.

The inflatable lapbelt is likely to have a large volume displacement. Likewise, the inflated bag could potentially impede egress of passengers. The bag deflates to absorb energy, so it is likely that an inflatable lapbelt would be deflated at the time that persons would be trying to leave their seats. Nonetheless, we consider it appropriate to specify a time interval after which the inflatable lapbelt may not impede rapid exit (egress) from the airplane. Ten seconds has been deemed to be a reasonable time, as this corresponds to the maximum time allowed for an exit to be openable (§ 25.809).

In actuality, it is unlikely that an exit would be prepared this quickly in an accident severe enough to warrant deployment of the inflatable lapbelt, and the inflatable lapbelt will likely deflate much sooner than ten seconds.

This potential impediment to rapid egress is even more critical at the seats installed in the emergency-exit rows. Section 25.813 requires passenger access to the exit, from the main aisle, in the form of an unobstructed passageway, with no interference in opening the exit. The restraint system must not create an impediment to the access to, and the opening of, the exit. In some cases, the passenger, rather than a flightcrew member, opens an exit such as a Type III overwing hatch. These lap belts should be evaluated in the exit row under existing regulations (§§ 25.809 and 25.813) and guidance material. The inflatable lap belts must also be evaluated in post-crash conditions, and should be evaluated using representative restraint systems in the bag-deployed condition.

This evaluation would include reviewing the access to, and opening of, the exit, specifically for obstructions in the egress path, and any interference in opening the exit. Each unique interior configuration must be considered.

If the restraint creates any obstruction or interference, it is likely that it could impede the rapid egress from the airplane. Project-specific guidance is likely necessary if these restraint systems are installed at exit-door rows.

Part I of appendix F to part 25 specifies the flammability requirements for interior materials and components. Appendix F has no reference to inflatable restraint systems because such devices did not exist at the time the flammability requirements were written. The existing requirements are based on both material types and use, and have been specified in light of the state-of-the-art materials available to perform a given function. In the absence of a specific reference, the default requirement would be for the type of material used in constructing the inflatable restraint, which is a fabric in this case. However, in writing special conditions, the FAA must also consider the use of the material, and whether the default requirement is

appropriate. In this case, the specialized function of the inflatable shoulder belt means that highly specialized materials are needed. The standard normally applied to fabrics is a 12-second vertical ignition test. However, materials that meet this standard do not perform adequately as inflatable shoulder belts. Because the safety benefit of the inflatable shoulder belt is significant, the flammability standard appropriate for these devices should not screen out suitable materials, thereby effectively eliminating use of the inflatable shoulder belt based on its flammability performance. At this time, the 2.5-inch-per-minute horizontal test is considered to provide that balance. As the technology in materials progresses (which is expected), the FAA may change this standard in subsequent special conditions to account for improved materials.

The following special conditions can be characterized as addressing either the safety performance of the system or the system's integrity against inadvertent activation. Because a crash requiring use of the inflatable shoulder belt is a relatively rare event, and because the consequences of an inadvertent activation are potentially quite severe, these later requirements are probably more rigorous from a design standpoint.

Note that, although these special conditions are applicable to the inflatable shoulder belts as installed, compliance with these special conditions is not an installation approval. While these special conditions relate to each such system installed, the overall installation approval is a separate finding and must consider the combined effects of all such systems installed.

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.

## **Applicability**

As discussed above, these special conditions are applicable to the Gulfstream Model GVI airplane. Should Gulfstream apply at a later date for a supplemental type certificate to modify any other model included on type certificate no. T00015AT to incorporate the same 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 one model of airplane. It is not a rule of general applicability and affects only the applicant who applied to the FAA for approval of these features on the airplane.

The substance of these special conditions has been subjected to the notice-and-comment period in several prior instances and has been derived without substantive change from those previously issued. It is unlikely that prior public comment would result in a significant change from the substance contained herein. Therefore, because a delay would significantly affect the certification of the airplane, which is imminent, the FAA has determined that prior public notice and comment are unnecessary and impracticable, and good cause exists for adopting these special conditions upon publication in the Federal Register. The FAA is requesting comments to allow interested persons to submit views that may not have been submitted in response to the prior opportunities for comment described above.

## **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 Gulfstream Model GVI airplanes modified by Gulfstream.

In addition to the requirements specified in exemption no. 9761, the following special conditions are proposed as part of the type certification basis for Gulfstream Model GVI airplanes equipped with an airbag system in the shoulder belt.

1. For seats with an airbag system in the shoulder belt, show that the airbag system in the shoulder belt will deploy and provide protection under crash conditions where it is necessary to prevent serious injury. The means of protection must take into consideration a range of stature from a 2-year-old child to a 95<sup>th</sup>-percentile male. The airbag system in the shoulder belt must provide a consistent approach to energy absorption throughout that range of occupants. When the seat system includes an airbag system, that system must be included in each of the certification tests as it would be installed in the airplane. In addition, the following situations must be considered, wherein the seat occupant is:
  - a. holding an infant
  - b. a pregnant woman
  - c. a child in a child-restraint device
  - d. a child not using a child-restraint device
2. The airbag system in the shoulder belt must provide adequate protection for each occupant regardless of the number of occupants of the seat assembly, considering that unoccupied seats may have an active airbag system in the shoulder belt.

3. The design must prevent the airbag system in the shoulder belt from being either incorrectly buckled or incorrectly installed, such that the airbag system in the shoulder belt would not properly deploy. Alternatively, it must be shown that such deployment is not hazardous to the occupant, and will provide the required injury protection.
4. It must be shown that the airbag system in the shoulder belt is not susceptible to inadvertent deployment as a result of wear and tear, or inertial loads resulting from in-flight or ground maneuvers (including gusts and hard landings), and other operating and environmental conditions (vibrations, moisture, etc.) likely to occur in service.
5. Deployment of the airbag system in the shoulder belt must not injure the seated occupant, including injuries that could impede rapid egress. This assessment should include an occupant whose belt is loosely fastened.
6. It must be shown that inadvertent deployment of the airbag system in the shoulder belt, during the most critical part of the flight, will either meet the requirement of § 25.1309(b) or not cause a hazard to the airplane or its occupants.
7. It must be shown that the airbag system in the shoulder belt will not impede rapid egress of occupants 10 seconds after airbag deployment.
8. The airbag system must be protected from lightning and high-intensity radiated fields (HIRF). The threats to the airplane specified in existing regulations regarding lightning, § 25.1316, and HIRF, § 25.1317, are incorporated by reference for the purpose of measuring lightning and HIRF protection.
9. The airbag system in the shoulder belt must function properly after loss of normal airplane electrical power, and after a transverse separation of the fuselage at the most critical location.

A separation at the location of the airbag system in the shoulder belt does not have to be considered.

10. It must be shown that the airbag system in the shoulder belt will not release hazardous quantities of gas or particulate matter into the cabin.
11. The airbag system in the shoulder-belt installation must be protected from the effects of fire such that no hazard to occupants will result.
12. A means must be available for a crewmember to verify the integrity of the airbag system in the shoulder-belt activation system prior to each flight, or it must be demonstrated to reliably operate between inspection intervals. The FAA considers that the loss of the airbag-system deployment function alone (i.e., independent of the conditional event that requires the airbag-system deployment) is a major-failure condition.
13. The inflatable material may not have an average burn rate of greater than 2.5 inches per minute when tested, using the horizontal flammability test defined in part 25, appendix F, part I, paragraph (b)(5).
14. The airbag system in the shoulder belt, once deployed, must not adversely affect the emergency-lighting system (i.e., block floor proximity lights to the extent that the lights no longer meet their intended function).

Issued in Renton, Washington, on May 12, 2014.

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