Gulfstream's Response to NTSB

Questions Regarding Certification

ERA14MA271

Certification Related Action Items

NTSB AI 64

"Requirement 25.679(a)(2): Understand Gulfstream's interpretation (or understanding) of requirement."

NTSB AI 65

"Requirement 25.679(a)(2): Gulfstream's method of compliance to this requirement and how the findings of compliance was made and by who? How does the gust lock on the GIV limit the operation of the airplane so that the pilot receives unmistakable warning at the start of takeoff?"

NTSB AI 66

"Six degree TQ movement with gust lock engaged: History of this requirement. What was the original purpose of this requirement on the GII (how about GI?)?"

NTSB AI 67

"Six degree TQ movement with gust lock engaged: On the GII, did restricting the throttle lever movement to 6 degrees prevent the aircraft from achieving takeoff EPR?"

NTSB AI 68

"Six degree TQ movement with gust lock engaged: During the GIV certification, was this requirement reviewed to determine if it was still adequate?"

NTSB AI 69

"Six degree TQ movement with gust lock engaged: Is the six degree requirement still adequate for the GIV? How was it validated and verified for the GIV?"

NTSB AI 77

"Can Gulfstream provide a formal explanation for the intent (and interpretation) of this 6 degree req?"

NTSB AI 78

"(follow on from NTSB AI#77) What is the original basis for this requirement?"

NTSB AI 79

"(follow on from NTSB AI#77) Was the intent of the requirement to limit the power lever movement to 6 degrees with the GL engaged taking into account the tolerances (freeplay) with the GL handle to interlock linkages OR."

NTSB AI 80

"(follow on from NTSB AI#79) Was the intent of the requirement to limit the power lever movement to 6 degrees for initial rigging and adjustment of the power lever control rods and sectors?"

NTSB AI 82

"How was the 6 degree requirement validated for the GIV aircraft?"

NTSB AI 83

"How was the 6 degree requirement verified on the GIV aircraft?"

GAC Response

The GIV model airplane was certified in 1987. The applicable gust lock system certification documentation includes: 1159C-GER-107 ("Gulfstream IV Compliance Checklist for FAR Part 25"), 1159C20005 ("Control Instl-Flight Controls Gust Lock Drawing"), 1159SCF450 ("Control Pedestal Assy-Crew and Equipment-Cockpit, Gulfstream IV Drawing"), and 1159SCF451 ("Control Sectors and Support Assembly-Power Plant-Cockpit Floor, Gulfstream IV Drawing").

Compliance with 14 CFR 25.679 (b)(2), which requires that the gust lock system limit the operation of the airplane so that the pilot receives unmistakable warning at the start of takeoff, was found by review of the drawings. Per the drawings listed in the compliance checklist, when engaged the gust lock system design:

- Restricts the operation of the pilot controls (i.e. yoke, column, rudder pedals)
- Limits the operation of the throttle levers
- As an additional warning feature, the gust lock handle is painted red and located prominently adjacent to the flap handle such that there is physical contact with the pilot's hand during the selecting of flap position

These features limit operation of the airplane and would provide unmistakable warning to the crew.

A Gulfstream-employed FAA designated engineering representative, who retired approximately 20 years ago, found compliance with 14 CFR 25.679 as documented on the applicable FAA 8110-3 form, as previously provided to the NTSB.

According to the requirements in these specification documents, the GIV pedestal design requires a 6° maximum movement of the throttle sectors from "idle" with gust lock "ON" (see 1159SCF450). The interlock is intended to limit throttle movement to less than 6° +/- 1° from the idle position during operation with gust lock engaged, including tolerances (see 1159SCF451 section 3.2.1.3).

Further historical documentation has not been located to confirm any additional validation and verification of the 6° requirement beyond the compliance finding. Based on current 2014 analysis and demonstrations (during the A/C 1399 investigation), GAC has validated that restricting throttle movement to 6° prevents the GIV aircraft from achieving takeoff EPR. This testing verified that the current detailed pedestal design does not meet the 6 degree throttle interlock specification requirement.

The 6° throttle interlock specification requirement was originally established on the GII model airplane in 1967 in order to limit throttle movement with the gust lock engaged, thereby restricting available engine power. This limits aircraft operation and provides unmistakable warning to the pilot. This requirement was defined on 1159SCP005 ("Power Plant-Control Sectors & Support Assy, Floor") and remained the same for GIII and GIV aircraft.

The GII gust lock system was certified to CAR 4b.326 and was verified by test as documented in FT1159-0-Ve.83.

A recent demonstration on a GIII aircraft (which uses the identical gust lock, throttle and engine system as the GII) was performed as a part of the A/C 1399 investigation. The demonstration verified that the gust lock throttle interlock does not meet the 6 degree throttle interlock specification requirement. However, it also verified that the as-built throttle interlock prevents the Rolls Royce Spey engine-powered GII and GIII aircraft from achieving takeoff EPR with the gust lock ON, providing sufficient margin to be unmistakable to the crew.

The GI, GIV-X, GV, GV-SP, and GVI do not use the GII-GIV gust lock and throttle interlock designs and are not pertinent to these discussions.