DCA11MA076

Human Performance Factual Report

Attachment 9

Letters Sent to the Gulfstream by the FAA's Atlanta Aircraft Certification Office

(7 pages)

U.S. Department
of Transportation
Federal Aviation
Administration

Atlanta Aircraft Certification Office
1701 Columbia Ave.
College Park, GA 30337

MAR - 9 2011

Mr. Anthony Beck
Manager, Airworthiness & Certification
Gulfstream Aerospace Corporation
P.O. Box 2206
Savannah, GA 31402-2206

Dear Mr. Beck:

On March 3, 2011, an apparent flight controls issue was identified during the conduct of a test flight for GVI Type Inspection Authorization 7A (Thrust Lapse and Engine Margins). The flight took place at Brunswick, GA with an FAA test pilot, and involved the conduct of both static takeoffs (power set before brake released), and rolling takeoffs (no stop on runway, full power set before 60 knots).

During the 14th takeoff (rolling), after no previous controllability issues, the test aircraft drifted right during its initial takeoff roll. The drift could not be controlled with left rudder pedal application up to full deflection, therefore the pilots applied brakes and aborted the takeoff. The test point was re-attempted and the drift condition was found to be repeatable.

A post-flight investigation by Gulfstream identified a feature of the fly-by-wire control system that collects yaw rate data below 65 KCAS, and then applies the correction to those yaw rates at or above 65 KCAS, washing out the initial rudder input over 8-10 seconds. During the rolling takeoff performed for the T1A 7A test flight, the crew had completed a 180 degree turn from taxiway to runway at approximately 10 knots taxi speed, thereby collecting a measurable amount of yaw rate. As the aircraft accelerated on takeoff roll, the collected yaw rate was apparently countered by the flight control system at 65 KCAS. The flight control system input a significant rudder deflection that could not be countered by pilot rudder pedal input during the washout period (i.e., the pilot's rudder pedal inputs had no effect on rudder deflection).

Gulfstream's initial investigation resulted in a Priority 1 Problem Report (PR), which has since been downgraded to Priority 2 based on the implementation of a new In-Flight Restriction (IFR) for monitoring residual yaw rate. However, the FAA remains very concerned with how this flight control system feature was apparently known to the Gulfstream flight control law engineers, but unknown to the Gulfstream pilots/flight test personnel. As currently understood, the FAA considers this feature to be highly undesirable, and assume that the Gulfstream pilots feel similarly. Therefore, in order to investigate this matter further the FAA would like Gulfstream to provide the following:

1. Time history data from S/N 6002, Flight 122, Card 4D - rejected takeoff, continued takeoff, and high speed taxi and Card 4E - continued takeoff. Parameters of interest

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include pilot control input (displacement and force), flight control surface positions. ADS #1 KCAS/KIAS and altitude, ground speed, basic engine data, brake pressures. relevant aircraft angles (α, θ, β, ψ, ϕ), angular rates. Nx. Ny. Nz. and DGPS ground roll distance/lateral deviation if available.

2. The severity 1 PR written in response to the flight control event that resulted in a rejected takeoff on Flight 122, Card 4D.
3. The meeting minutes from the Safety Review Board (SRB) held on March 4, 2011 to investigate item 2.
4. The justification developed to lower the PR severity classification to 2, including any associated IFR's or operating limitations.
5. A plan to fix or remove the flight control law function that caused the event in question. The schedule for implementing the fix, and any TIA tests that will require this fix, should be identified.

In addition to providing the items above, Gulfstream should accomplish the following:

6. Perform a complete review of the flight control law development and its implementation into the flight control software. Special emphasis should be placed on flight control law functions that automatically deflect the control surfaces without pilot input, or that limit control surface deflections commanded by the pilot. The possible unintended consequences of the implementation of these functions should be investigated. Examples of these include yaw damping, angle of attack protection, high speed protection, uncommanded roll protection, rudder load protection, and wing load alleviation. The FAA recommends that this review be performed by a multi-discipline team which would include flight control engineers, flight dynamics engineers, safety engineers, flight test engineers, and experimental test pilots.
7. Perform an internal review of the change approval process for the flight control system, and for any other system with direct pilot interface (e.g., avionics). Of particular interest is the personnel involved in the process (i.e., who can propose a change, who reviews the change, who approves the change, who implements the change, and who verifies the change), and how information pertaining to the change is communicated to all concerned parties. The FAA's expectation is that changes to flight control and avionics systems will be made with the full knowledge and consent of the Gulfstream pilots and flight test personnel.

Based on the seriousness of the FAA's concern, we will require the data outlined in items 1-5 prior to the issuance of the next TIA, along with adequate time for FAA review. We will then require Gulfstream to provide a full and detailed briefing of their company reviews (items 6 and 7), and details of the final flight control laws intended for type certification prior to the issuance of TIA 7 (Field Performance/Brakes/Nosewheel Steering Performance), TIA 11 (Flight Control System), or TIA 16 (Climb Performance/ Handling Qualities/Maneuver Margins), whichever comes first.

Finally, because the event on March 3rd was not directly associated with the Thrust Lapse and Engine Margins testing, and because Gulfstream has mitigated risk by conducting a Safety Review Board and incorporating the IFR discussed above, the FAA does not believe it is

necessary to discontinue TIA 7A at this time. However, Gulfstream should respond to this letter as soon as possible and let us know your plans and schedule for providing the information cited above.

If you have any questions regarding this subject, please contact the Atlanta ACO's Mr. Neil Berryman at (404) 474-5526

Sincerely,

[redacted]

Melvin D. Taylor, Manager
Atlanta Aircraft Certification Office

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

Atlanta Aircraft Certification Office
1701 Columbia Ave.
College Park, GA 30337

MAR 31 2011

Mr. Anthony Beck
Manager, Airworthiness & Certification
Gulfstream Aerospace Corporation
P.O. Box 2206
Savannah, GA 31402-2206

Dear Mr. Beck:

During our weekly GVI Flight Test teleconference on March 25, 2010, Gulfstream put forth a proposal to initiate a portion of Type Inspection Authorization (TIA) 15A for stall speed testing using flight control computer (FCC) software that is not representative of the final TC configuration. The request was to begin TIA 15A in early April using FCC Load 5.15 for the flaps deployed stall speed conditions, and then complete the TIA (for the zero flap conditions) in May when the final FCC Load 5.2x is available. The rationale for this is to prevent a slippage in the schedule for field performance testing (TIA 7).

The FAA has considered your request and does not agree with the idea of dividing TIA 15A. We believe that a two-phased approach would require a certain amount of stall speed regression testing that would otherwise be unnecessary, and is therefore not an effective use of Gulfstream or FAA resources. Aside from this, we are even more concerned with the idea of using FCC Load 5.15 for TIA 7, since the changes introduced in Load 5.2x could affect the field performance flight test results given the complex nature of the flight control law design. For example, the takeoff and landing performance tests, including abused and out of trim test points, are used to substantiate compliance with 14 CFR part 25.101(f) and (h), and 25.143(a)(1)(5), and could certainly be affected by changes between Loads 5.15 and 5.2x. Therefore, since these test are only conducted once during a program the FAA feels strongly that the final FCC load should be installed on the test aircraft for the TIA 7 field performance evaluations.

Further to the discussion above, please recall that the FAA is expecting Gulfstream to provide a full and detailed briefing on the GVI flight control laws/control law development and change approval process reviews (items 6 and 7 from FAA letter correspondence dated March 9, 2011) prior to the issuance of TIA 7, TIA 11 (Flight Control System), or TIA 16 (Climb Performance/ Handling Qualities/Maneuver Margins).

Over the next few weeks the FAA will continue to support the GVI program with other TIA's that don't require FCC Load 5.2x, and we are also willing to consider moving some of these TIA's forward if Gulfstream desires and is ready to proceed.

If you have any questions regarding this subject, please contact the Atlanta ACO's Mr. Neil Berryman at (404) 474-5526.

Sincerely,

[redacted]

Melvin D. Taylor, Manager
Atlanta Aircraft Certification Office

U.S. Department
of Transportation
Federal Aviation
Administration

Atlanta Aircraft Certification Office
1701 Columbia Ave.
College Park, GA 30337

MAR 3 1 2011

Mr. Kurt Erbacher
Vice President, GVI Program
Gulfstream Aerospace Corporation
P.O. Box 2206
Savannah, GA 31402-2206

Dear Mr. Erbacher:

We wanted you to be aware of a letter that the FAA has just prepared for Mr. Tony Beck of Gulfstream's Airworthiness & Certification Department, and some potential implications of the same. In that letter we have denied a request to deviate from the planned/agreed approach for GVI Type Inspection Authorization (TIA) 15A (Stall Speeds), which Gulfstream proposed as a way to avoid impacting the schedule for TIA 7 (Field Performance).

We realize that a delay to TIA 7 is not what the company desires at this point, but we are reluctant to do too many flight test "work-arounds" while the GVI flight controls (and avionics) continue to be developed. Our hope is that Gulfstream will use any delay in TIA 15 A and TIA 7 to move closer to completing all systems development, such that when the FAA performs TIA 7, 11, 16, 18, 20, etc., we are evaluating hardware, software, and functionality that is well wrung-out and ready for certification. We also hope that our decision will serve as the impetus for other changes to the schedule that are needed to reflect the true status of the GVI program. For some time now the FAA has expressed our concerns about the overly aggressive schedule, and for some time now you have acknowledged "unofficially" that things are slipping; however, the company TIA schedule continues to reflect a pace that has proven to be unrealistic.

Finally, given the number of schedule slippages to date, and the number of company and certification tests that have yet to be performed, we feel it would be prudent for Gulfstream to be ready in case there is a need to file for an extension of the original TC application, which will be necessary if the GVI can not be certified within 5 years of its September 28, 2006 date of application. Although we do still believe it is possible for the GVI to receive a TC before the current deadline of September 28, 2011, we also believe it would be wise for Gulfstream to review the requirements of 14 CFR 21.17(d)(2) and have a contingency plan prepared.

As always, we remain willing to work with Gulfstream to complete all certification requirements as expeditiously as possible; however, this is always with the understanding that the regulatory requirements and the integrity of the certification process will be our first priority.

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If you have any questions on the contents of this letter, please contact me directly at 404-474-5501.

Sincerely,

[redacted]

Melvin D. Taylor, Manager
Atlanta Aircraft Certification Office

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