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September 18, 2008

Howard Plagens
Air Safety Investigator
Office of Aviation Safety
National Transportation Safety Board

Re: JetBlue Flight 292 Incident on 09/21/2005 in Los Angeles, CA
NTSB Identification: LAX05IA312
Aircraft: Airbus Industrie A320 (N536JB)

Dear Howard

In accordance with 49 CFR Part 831.14, JetBlue Airways Corp. hereby submits to the National Transportation Safety Board ("the Board") its proposed findings, proposed probable cause, and proposed safety recommendations to prevent future similar accident. Given the nature of the Flight 292 event, the resulting investigation, and the format of the NTSB's recently published Factual Report, we have opted not to submit a full ICAO-style submission. Rather, we have chosen to provide our input to the NTSB in a very concise and simple letter format. If you should desire a more traditional ICAO-style submission, please let us know as soon as possible. We sincerely hope the Board finds this submission useful.

I. Analysis

A. General

The captain and the first officer were both properly certificated and qualified under Federal regulations. No evidence indicates any preexisting medical or physical conditions that might have adversely affected the crew's performance during the incident flight.

The aircraft was properly operated, certificated, equipped, and maintained in accordance with Federal regulations and approved company procedures. There were no open MEL items at the time of the incident flight. The aircraft was loaded in accordance with approved company weight and balance procedures. The weight and balance of the aircraft were within limits during all phases of the flight.

The emergency response was timely and appropriate. The passengers and crewmembers were safely deplaned from the aircraft.

B. Failure of NLG Upper Support Due to Fatigue

The aircraft had EMM/COMMOM BSCU software standard L4.5 (P/N E21327003) installed, which features a pre-landing dynamic steering test. Once the EMM BSCU L4.5 receives a signal indicating that the NLG is down and locked, the following five pre-land tests are performed: (1) Flight Gears Down; (2) Normal Braking Tests; (3) Steering Test – Step 1; (4) Steering Test – Step 2; (5) Toggle Tests. After the Flight Gears Down and Normal Braking Tests have been completed and hydraulic system power is available to the steering servo valve (nose gear down and locked and all gear doors are commanded closed), the BSCU starts the Steering Tests. After the two-step Steering Test is completed, the EMM BSCU L4-5 begins its Toggle Test. The Toggle Test is an "Active Mode" test in which the swivel selector valve is open and green hydraulic pressure is available. The Toggle Test electrically commands the NLG wheel assembly to rotate 2.5 degrees left from center, back to center, 2.5 degrees right, and then back to center. This cycle takes approximately 5.0 seconds to complete, and is continuously performed until touchdown of the main gear assembly. According to information provided by Airbus representatives, the NLG completes the left and right cycle an average of 57 times per flight (285 seconds). The EMM BSCU L4.5 Toggle Test put loads on the NLG cams, upper support, and cylinder that have been determined to cause early failure of the anti-rotating device. Specifically, in this aircraft two of the four anti-rotation lugs on the NLG upper support assembly had fractured from the upper support assembly and the other two lugs contained cracks as a result of fatigue induced over time by the EMM BSCU L4.5 Toggle Test. Failure of the NLG supper support anti-rotation lugs can allow NLG rotation while inside the NLG bay (triggering a L/G SHOCK ABSORBER FAULT), although the failure has no effect on the functionality of the shock absorber.

According to Airbus, the loads put on the upper support and anti-rotation lugs increase as shock absorber inflation increases, therefore increasing the possibility of upper support fatigue failure. Airbus has stated that with up to 15% over inflation of the shock absorber, full life flight cycles should occur prior to failure. However, Airbus data suggests that above 20% over inflation, failure of the anti-rotation lugs can occur well before the full life flight cycles. The shock absorber pressure in the incident aircraft was not documented as part of the investigation, and in many of the other known cases of anti-rotation lug failure the shock absorber inflation pressure similarly was not recorded.

C. Manifestation of the 90 deg. Rotation of the NLG

After take-off when all gears were up and locked, the BSCU detected a 6 degree rotation of the NLG (centered and mechanically locked under normal conditions) due to the sheared anti-rotation lugs. The NLG was flagged to the pilot with the ECAM error message L/G SHOCK ABSORBER FAULT, upon which the pilot followed the appropriate FCOM/ECAM procedure by putting the landing gear down. The nose gear

became down and locked (assisted by aerodynamic loads) while the main gears were still in their extension cycle. At this point the BSCU commanded green system hydraulic pressure to the NLG steering servo valve to correct the gear off-centered position caused by the rotation of the NLG due to the failure of upper support. However, the hydraulic pressure was not available to the steering servo due to the landing gear doors being commanded open. Green hydraulic pressure to the steering system is physically tapped through the landing gear door closed line, i.e. landing gear doors commanded to close. However the doors remain commanded open until both nose and main gears are down and locked. On detecting the inability of the steering servo valve to correct the residual angular movement, the BSCU transmitted the ECAM message WHEEL N/W STRG FAULT and faulted the steering electro-hydraulic module (6GC). The BSCU then removed itself from control of the steering system. With this, both the mechanical and hydraulic centering on the nose gear was lost and the NLG was able to freely castor. Therefore, aerodynamic loads put on the NLG caused the NLG to move to a 90 degree left position and remain there for the duration of the flight.

II. Conclusions

A. Findings

1. The captain and the first officer were both properly certificated and qualified under Federal regulations.

2. The aircraft was properly operated, certificated, equipped, and maintained in accordance with Federal regulations and approved company procedures.

3. The weight and balance of the aircraft were within limits during all phases of the flight.

4. Once the EMM BSCU L4.5 receives a signal indicating that the NLG is down and locked, the following five pre-land tests are performed: (1) Flight Gears Down; (2) Normal Braking Tests; (3) Steering Test – Step 1; (4) Steering Test – Step 2; (5) Toggle Tests.

5. The Toggle Test electrically commands the NLG wheel assembly to rotate 2.5 degrees left from center, back to center, 2.5 degrees right, and then back to center. This cycle takes approximately 5.0 seconds to complete, and is continuously performed until touchdown of the main gear assembly.

6. The EMM BSCU L4.5 Toggle Test put loads on the NLG cams, upper support, and cylinder that have been determined to cause early failure of the anti-rotating device.

7. In this aircraft, two of the four anti-rotation lugs on the NLG upper support assembly had fractured from the upper support assembly and the other two lugs contained cracks as a result of fatigue induced over time by the EMM BSCU L4.5 Toggle Test.

8. Failure of the NLG supper support anti-rotation lugs can allow NLG rotation while inside the NLG bay (triggering a L/G SHOCK ABSORBER FAULT).

9. If the Main Landing Gear (MLG) are not down and locked and the gear doors are being commanded open, then green hydraulic pressure is not present in the steering system; so even if the EMM BSCU L.4.5 commands that the NLG be centered the steering system will not have hydraulic pressure available to center the NLG. If the NLG has turned (e.g. 6 deg), then the NWS is not able to drive back to centered and causing the BSCU to detect an error and resulting in the NLG to freely castor.

10. At 170 kts, aerodynamic loads are sufficient to move the NLG to 90 degrees from the centered position.

B. Probable Cause

Based on the information and evidence gathered during the course of this investigation, JetBlue believes that the probable cause of this incident was (1) the failure of the NLG upper support anti-rotation lugs due to fatigue induced by the pre-land steering test of EMM BSCU L.4.5 that allowed the NLG to rotate while in the NLG bay combined with (2) hydraulic pressure not being available to center the NLG after the NLG was down and locked but while the landing gear doors were still being commanded open. This allowed the NLG to freely castor and be driven by aerodynamic loads to a 90 degree left position.

Sincerely,

[redacted]

Michael Borer
Director - Flight Safety
JetBlue Airways Corp.

cc: TBD

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