



## National Transportation Safety Board

Washington, D.C. 20594

Office of Aviation Safety

### **U.S. Summary Comments on the Draft Final Report of the Aircraft Accident Involving PR-GTD and N600XL, 29 September 2006**

#### **INTRODUCTION**

This letter relates to the 29 September 2006 midair collision involving PR-GTD, a Boeing 737 operated as Gol Airlines flight 1907, and N600XL, an Embraer Legacy operated by Excelaire, near the NABOL navigation fix over the state of Mato Grosso, Brazil. As the State of Design and Manufacture of the 737 airplane and the State of Registry and Operator of the Legacy airplane,<sup>1</sup> a U.S. Accredited Representative and advisors<sup>2</sup> participated in the Brazilian Centro de Investigação e Prevenção de Acidentes Aeronáuticos (CENIPA) investigation. On 30 July 2008, the U.S. Accredited Representative received CENIPA's draft final report. The U.S. investigative team's comments are submitted to CENIPA pursuant to section 6.3 of Annex 13 to the Convention on International Civil Aviation.

#### **SUMMARY**

The U.S. Accredited Representative and advisors responded to the accident notification and traveled to Brazil. Additional advisors supported the team from the United States and participated in recorder readout in Canada. Followup work, including avionics examination, air traffic control (ATC) familiarization, operator personnel and pilot interviews, obtainment of records relevant to the operator, and cockpit voice recorder transcription was performed in the United States with CENIPA participation. This investigation was considered extremely complex with factors that would not likely be readily evident, as two virtually brand-new aircraft, with modern equipment, operating under instrument flight rules, collided in flight. The CENIPA accident investigation commission organized the investigative efforts into two broad categories—Operational, which included Human Factors and Material Factors, which comprised areas relating to airworthiness. Extensive examination of the material factors relative to both aircraft and their equipment revealed no preaccident failures or significant malfunctions. The material factors part of the investigation team provided input to the operational factors part of the team regarding how avionics components respond to certain inputs. The operational factors part of the investigation covered various topics related to the flight crew's preparation, training, familiarity with the aircraft, relevant flight rules and practices, company aspects, and situational

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<sup>1</sup> Additionally, the United States is the State of Manufacture of Honeywell and Aviation Communications & Surveillance Systems avionics components, which were considered significant major components in accordance with section 5.18 of Annex 13.

<sup>2</sup> Advisors to the U.S. Accredited Representative included representatives from the National Transportation Safety Board; Federal Aviation Administration; Boeing Commercial Airplanes; Excelaire Services, Inc.; Honeywell Aerospace Systems; and Aviation Communications & Surveillance Systems, Inc.

awareness. Operational factors also examined ATC issues, including the procedures used by controllers, equipment use, communications, and awareness. Additionally, investigation into human factors, including physiology and culture, was conducted.

The U.S. team's assistance focused primarily on aspects of the investigation that are relevant to U.S.-manufactured avionics components, the policies and procedures of the Legacy operator, and the background and actions of the Legacy flight crew. Additionally, the U.S. team examined most of the factual data and information regarding ATC, as well as the preparations for the Legacy's delivery.

The enclosed comments, which are based on the factual information gathered throughout the investigation, include analysis, findings and proposed causal factors by the U.S. Accredited Representative and advisors. In summary, the team has no substantial disagreement with the facts gathered and discussed in this report and generally concurs that the safety issues involved in this accident are related to ATC, operational factors, and the loss of in-flight collision avoidance technology. However, the interpretations, conclusions, and understandings of the relationship between certain factual items and the demonstrated risk differ in a number of respects. For example, the report states that the investigation was based on the following four focal points: functioning of equipment on board N600XL, preparation of the flight crew, ATC rules and procedures, and functioning of Brazilian airspace system.

The U.S. team believes that these points all stem from the basic investigative question, namely, how the primary mission of ATC to separate aircraft within positive controlled airspace was unsuccessful. This investigation has identified many safety issues for ATC operations, but these issues need to be further highlighted. Even though the body of the report acknowledges safety deficiencies with ATC, these deficiencies are not sufficiently supported with analysis or reflected in the conclusions or cause of the accident. These deficiencies include a lack of timely ATC action after the loss of N600XL's transponder and two-way radio communication, and features of the ATC software that may have aggravated deficiencies in altitude clearance awareness for N600XL. The U.S. team's additional ATC findings, which are provided in accordance with International Civil Aviation Organization Document 9756, Part IV, are central to understanding this accident and supplement the findings and contributing factors already cited in the draft report.

The flight crew of N600XL, although not in violation of any regulations, was not aware of the loss of transponder and collision avoidance functionality, lack of ATC communication, and the flight's progress reference altitude convention. The team agrees that safety lessons in these areas can be determined to better prepare flight crews for international operations.

Finally, the U.S. team has worked closely with CENIPA as a result of this accident to improve collision avoidance technology. Along with CENIPA, the U.S. team drafted a Safety Board recommendation, A-07-35, which asked the Federal Aviation Administration to require an enhanced aural and visual warning requiring pilot acknowledgment in the event of an airborne loss of collision avoidance system functionality for any reason. ACAS systems are an integral component of current air space safety, and this accident highlights the need for upgraded cockpit warnings whenever ACAS functionality is compromised. The U.S. team also believes there are

safety issues uncovered in the course of this investigation concerning the guarding or relocating of important cockpit controls from inadvertent activation.

The U.S. team appreciates the opportunity to comment on this report and contribute to this important investigation and its effect on worldwide air safety.

## **FINDINGS**

1. The Sector 5 controller initiated the handoff of N600XL to Sector 7 at an unusually early point, prior to a navigational fix at which a level change should have been assigned.
2. ATC did not issue a level change instruction to N600XL at or prior to crossing Brasilia.
3. The controllers at Sector 5 and Sector 7 were unaware of the status of N600XL's altitude clearance, and did not take positive action to provide an amended clearance, confirmation, or appropriate coordination.
4. The automatic change of the datablock field from "cleared altitude" to "requested altitude" without any indication to, or action by, the ATCOs, led to the misunderstanding by the Sector 7 controller about what altitude clearance was issued to N600XL.
5. The collision avoidance technology aboard the aircraft did not function, likely due to inadvertent inactivation of the transponder on N600XL.
6. The flight crew of N600XL did not notice the inactive status of the transponder.
7. ATC did not take appropriate action in response to the loss of N600XL's transponder.
8. The automatic display of an altitude value ("3D") which is invalid for ATC use reinforced the incorrect assumptions that N600XL was descending.
9. ATC continued to apply RVSM separation standards despite a lack of mode C transponder altitude information.
10. Neither ATC nor the flight crew recognized the significance of the long time period without two-way communication to N600XL.
11. The flight crew of N600XL did not recognize the significance of the long time period spent at a non-standard cruise altitude for the flight direction.
12. ATC did not take adequate action to timely correct a known lost communication situation with N600XL.
13. Incorrect frequency utilization and ATC sector configuration within the CINDACTA contributed to the breakdown in communication with N600XL and the accident sequence of events.

14. The Sector 07 controller did not inform Amazonic ACC of the lost communication and non-transponder status of N600XL.
15. DECEA did not provide adequate training and supervision to develop effective skills for the ATCOs to appropriately handle this situation.
16. The evidence does not fully support the conclusion that the crew of N600XL's flight planning, or amount of time spent planning, contributed directly to the accident.

### **PROBABLE CAUSE**

The evidence collected during this investigation strongly supports the conclusion that this accident was caused by N600XL and GLO1907 following ATC clearances which directed them to operate in opposite directions on the same airway at the same altitude resulting in a midair collision.

The loss of effective air traffic control was not the result of a single error, but of a combination of numerous individual and institutional ATC factors, which reflected systemic shortcomings in emphasis on positive air traffic control concepts.

Contributing to this accident was the undetected loss of functionality of the airborne collision avoidance system technology as a result of the inadvertent inactivation of the transponder on board N600XL.

Further contributing to the accident was inadequate communication between ATC and the N600XL flight crew.