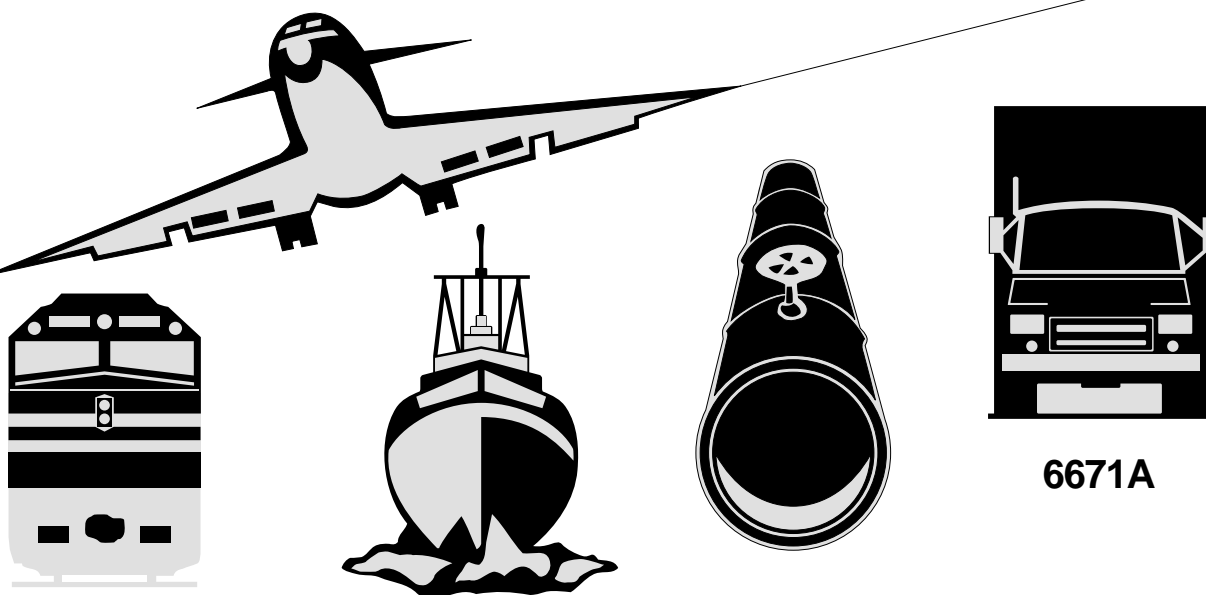


# NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

## AIRCRAFT ACCIDENT REPORT

RUNWAY DEPARTURE DURING ATTEMPTED TAKEOFF  
TOWER AIR FLIGHT 41  
BOEING 747-136, N605FF  
JFK INTERNATIONAL AIRPORT, NEW YORK  
DECEMBER 20, 1995



6671A

## EXECUTIVE SUMMARY

On December 20, 1995, at 1136, Tower Air flight 41, a Boeing B-747, veered off the left side of runway 4L during an attempted takeoff at John F. Kennedy International Airport (JFK), Jamaica, New York. The flight was a regularly scheduled passenger/cargo flight conducted under the provisions of Title 14 Code of Federal Regulations (CFR) Part 121. Of the 468 persons aboard (451 passengers, 12 cabin crewmembers, 3 flightcrew members, and 2 cockpit jumpseat occupants), 24 passengers sustained minor injuries, and a flight attendant received serious injuries. The airplane sustained substantial damage. The weather at the time of the accident was partially obscured, with a 700-foot broken cloud ceiling, 1 1/2 mile visibility, light snow, and fog.

The National Transportation Safety Board determines that the probable cause of this accident was the captain's failure to reject the takeoff in a timely manner when excessive nosewheel steering tiller inputs resulted in a loss of directional control on a slippery runway. Inadequate Boeing 747 slippery runway operating procedures developed by Tower Air, Inc., and the Boeing Commercial Airplane Group and the inadequate fidelity of B-747 flight training simulators for slippery runway operations contributed to the cause of this accident. The captain's reapplication of forward thrust before the airplane departed the left side of the runway contributed to the severity of the runway excursion and damage to the airplane.

The safety issues discussed in this report include the adequacy of Boeing and air carrier procedures for B-747 operations on slippery runways; adequacy of flight simulators for training B-747 pilots in slippery runway operations; security of galley equipment installed on transport category aircraft; role of communications among flight attendants and between the cabin crew and the flightcrew; adequacy of Tower Air galley security training; compliance of Tower Air's maintenance department with its established procedures; failure of the FDR system to function during the accident; adequacy of the Tower Air operational management structure; adequacy of FAA surveillance and workload imposed on POIs; adequacy of runway friction measurement requirements, including correlation of runway friction measurements with aircraft braking and ground handling performance.

### 3. CONCLUSIONS

#### 3.1 Findings

1. The flightcrew was properly certificated and qualified in accordance with applicable regulations and company requirements.
2. The air traffic control personnel involved with the flight were all properly certificated and qualified.
3. The airplane was properly certificated, equipped, and maintained (with the exception of the flight data recorder system) in accordance with approved regulations. The weight and balance were within allowable limits.
4. The captain's decision to attempt the takeoff on runway 4L was appropriate.
5. Asymmetric thrust was not a factor in the loss of directional control.
6. The captain's failure to correct the airplane's deviation from the centerline resulted from his overcontrolling the nosewheel steering through the tiller.
7. The captain of flight 41 first relied on right tiller inputs as the airplane continued to veer left, then applied insufficient or untimely right rudder inputs to effect a recovery.
8. Current Boeing 747 operating procedures provide inadequate guidance to flightcrews regarding the potential for loss of directional control at low speeds on slippery runways with the use of the tiller.
9. The procedural change by Tower Air to reevaluate and eliminate its standard procedure of guarding

the tiller during the takeoff roll through 80 knots will make overcontrol of the tiller less likely for its own operations; however, other air carrier operators of the Boeing 747 may need to make similar changes to their procedures.

10. Current Boeing 747 flight manual guidance is inadequate about when a pilot should reject a takeoff following some indication of a lack of directional control response.

11. Improvements in the slippery runway handling fidelity of flight simulators used for Boeing 747 pilot training are both needed and feasible.

12. The captain's failure to reject the takeoff in a timely manner was causal to the accident.

13. The inadequate Boeing 747 slippery runway operating procedures developed by Tower Air and the Boeing Commercial Airplane Group, and the inadequate fidelity of B-747 flight training simulators for slippery runway operations, contributed to the cause of this accident.

14. The captain abandoned his attempt to reject the takeoff, at least temporarily, by restoring forward thrust before the airplane departed the left side of the runway; this contributed to the severity of the runway excursion and damage to the airplane.

15. The material or installation of secondary latches in the galleys of N605FF was inadequate.

16. Despite some ambiguity about the situation, there were ample indications in most parts of the passenger cabin to have caused a greater number of flight attendants to shout brace commands before the airplane came to a stop.

17. The existing Tower Air flight attendant procedures provided inadequate guidance to flight attendants on how to communicate to coordinate their actions during and after the impact sequence.

18. Tower Air flight attendant galley security training was inadequate because flight attendants had not received "hands on" training with all the galley equipment that they were required to operate.

19. Based on the limited amount of time between the rental of the test equipment and the movements of the airplane, Tower Air did not perform the flight data recorder (FDR) functional test; this resulted in the loss of FDR data related to the accident flight that were of critical importance to the Safety Board's investigation.

20. The Tower Air maintenance program deviated in significant ways from the procedures established in the company's general maintenance manual.

21. The continuing airworthiness surveillance and reliability programs in the maintenance department of Tower Air were performing inadequately at the time of the accident.

22. Tower Air was operating with an inadequate management structure at the time of the accident.

23. The principal operations inspector (POI) and assistant POI assigned to Tower Air were overburdened, and the Federal Aviation Administration program for routine surveillance of the operational functions of Tower Air was inadequate.

24. The failure of the Port Authority of NY & NJ or Federal Aviation Administration air traffic control tower personnel to provide friction measurement data to the pilots of flight 41 did not contribute to this accident.

25. The circumstances of this accident indicate that the issue of correlating airplane stopping performance with runway friction measurements should be revisited by the Government and the air transportation industry.

### **3.2 Probable Cause**

The National Transportation Safety Board determines that the probable cause of this accident was the captain's failure to reject the takeoff in a timely manner when excessive nosewheel steering tiller inputs resulted in a loss of directional control on a slippery runway.

Inadequate Boeing 747 slippery runway operating procedures developed by Tower Air, Inc., and the Boeing Commercial Airplane Group and the inadequate fidelity of B-747 flight training simulators for slippery runway operations contributed to the cause of this accident.

The captain's reapplication of forward thrust before the airplane departed the left side of the runway contributed to the severity of the runway excursion and damage to the airplane.

### **4 Recommendations**

As a result of the investigation of this accident, the National Transportation Safety Board makes the following recommendations:

—to the Federal Aviation Administration:

Require modification of applicable operating procedures published by the Boeing Commercial Airplane Group and air carrier operators of the B-747 to further caution flightcrews against use of the tiller during slippery runway operations, including low-speed operations (for airplanes equipped with rudder pedal steering) and to provide appropriate limitations on tiller use during these operations (for airplanes not equipped with rudder pedal steering). (A-96-150)

Issue a flight standards information bulletin to principal operations inspectors assigned to air carriers operating the B-747, informing them of the circumstances of this accident and requesting a review and modification, as required, of each air carrier's takeoff procedure regarding pilot hand position with respect to the tiller. (A-96-151)

Require the Boeing Commercial Airplane Group to develop operationally useful criteria for making a rapid and accurate decision to reject a takeoff under slippery runway conditions; then require that B-747 aircraft flight manuals, operating manuals, and training manuals be revised accordingly. (A-96-152)

Evaluate Boeing 747 simulator ground handling models and obtain additional ground handling data, as required, to ensure that B-747 flight simulators used for air carrier flightcrew training accurately simulate the slippery runway handling characteristics of the airplane. (A-96-153)

After completing this evaluation, issue a flight standards information bulletin urging principal operations inspectors assigned to air carrier operators of the Boeing 747 to enhance simulator training for slippery runway operations, including limitations on tiller use and instructions for rudder use during the takeoff roll. (A-96-154)

Develop certification standards for the installation of secondary galley latches; then use those standards to conduct an engineering review of secondary galley latches on all transport-category aircraft. Require changes to existing installations as necessary to ensure that the strength of secondary latches and their installation are sufficient to adequately restrain carts. (A-96-155)

Issue a flight standards information bulletin to principal operations inspectors of 14 CFR Part 121 air carriers to ensure that flight attendant training programs stress the importance of shouting the appropriate protective instructions at the first indication of a potential accident, even when flight attendants are uncertain of the precise nature of the situation. (A-96-156)

Issue a flight standards information bulletin requiring principal operations inspectors of 14 CFR Part 121 air carriers to ensure that their air carriers have adequate procedures for flight attendant

communications, including those for coordinating emergency commands to passengers, transmitting information to flightcrews and other flight attendants, and handling postaccident environments in which normal communications systems have been disrupted.(A-96-157)

Issue a flight standards information bulletin that encourages the use of this accident as a case study for crew resource management training. (A-96-158)

Review the structure and performance of the continuing airworthiness surveillance and reliability programs in the Tower Air maintenance department. (A-96-159)

Reassess inspectors' methods of evaluating maintenance work, focusing on the possibility of false entries through selective detailed analysis of records and unannounced work site inspections. (A-96-160)

Revise 14 CFR Part 119 to specify that the chief pilot and all operational functions under that position report through the director of operations. (A-96-161)

Immediately implement the plan to assign the Tower Air certificate to a principal operations inspector (POI) and assistant POI who do not have oversight responsibility for any other carriers. (A-96-162)

Develop, by December 31, 1997, standards for enhanced surveillance of air carriers based on rapid growth, change, complexity, and accident/incident history; then revise national flight standards surveillance methods, work programs, staffing standards, and inspector staffing to accomplish the enhanced surveillance that is identified by the new standards. (A-96-163)

Require the appropriate Aviation Rulemaking and Advisory Committee to establish runway friction measurements that are operationally meaningful to pilots and air carriers for their slippery runway operations (including a table correlating friction values measured by various types of industry equipment), and minimum coefficient of friction levels for specific airplane types below which airplane operations will be suspended. (A-96-164)

—to Tower Air, Inc.:

Revise Tower Air's initial flight attendant training program to include "hands-on" training for securing each type of galley and cart included in its Boeing 747 fleet. (A-96-165)

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