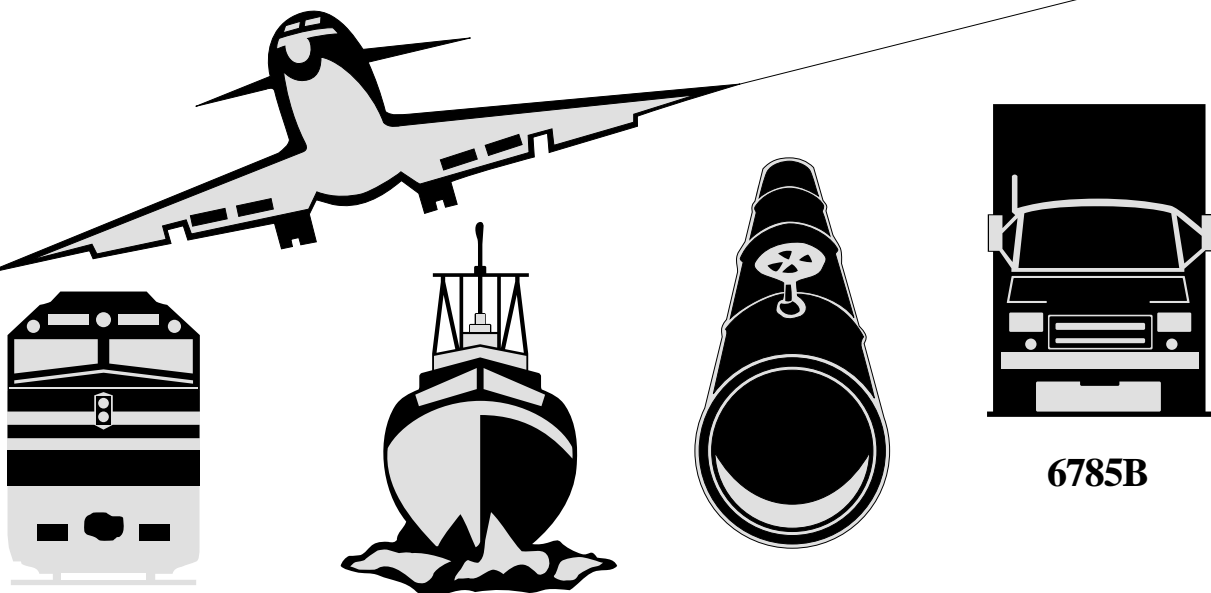


# NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

## AIRCRAFT ACCIDENT REPORT

DESCENT BELOW VISUAL GLIDEPATH  
AND COLLISION WITH TERRAIN  
DELTA AIR LINES FLIGHT 554  
MCDONNELL DOUGLAS MD-88, N914DL  
LAGUARDIA AIRPORT, NEW YORK  
OCTOBER 19, 1996



6785B

## EXECUTIVE SUMMARY

About 1638 eastern daylight time, on October 19, 1996, a McDonnell Douglas MD-88, N914DL, operated by Delta Air Lines, Inc., as flight 554, struck the approach light structure and the end of the runway deck during the approach to land on runway 13 at the LaGuardia Airport, in Flushing, New York. Flight 554 was being operated under the provisions of 14 CFR Part 121, as a scheduled, domestic passenger flight from Atlanta, Georgia, to Flushing. The flight departed the William B. Hartsfield International Airport at Atlanta, Georgia, about 1441, with two flightcrew members, three flight attendants, and 58 passengers on board. Three passengers reported minor injuries; no injuries were reported by the remaining 60 occupants. The airplane sustained substantial damage to the lower fuselage, wings (including slats and flaps), main landing gear, and both engines. Instrument meteorological conditions prevailed for the approach to runway 13; flight 554 was operating on an instrument flight rules flight plan.

The National Transportation Safety Board determines that the probable cause of this accident was the inability of the captain, because of his use of monovision contact lenses, to overcome his misperception of the airplane's position relative to the runway during the visual portion of the approach. This misperception occurred because of visual illusions produced by the approach over water in limited light conditions, the absence of visible ground features, the rain and fog, and the irregular spacing of the runway lights.

Contributing to the accident was the lack of instantaneous vertical speed information available to the pilot not flying, and the incomplete guidance available to optometrists, aviation medical examiners, and pilots regarding the prescription of unapproved monovision contact lenses for use by pilots.

The safety issues in this report focused on the possible hazards of monovision contact lenses, visual illusions encountered during the approach, non-instantaneous vertical speed information, the weather conditions encountered during the approach, the guidance in air carrier's manuals regarding flightcrew member duties, the stabilized approach criteria in air carrier's manuals, emergency evacuation procedures, special airport criteria and designation, and LaGuardia Airport issues/runway light spacing.

Safety recommendations concerning these issues were addressed to the Federal Aviation Administration and to optometric associations.

### **3.1 Findings**

1. The pilots held appropriate flight and medical certificates; they were trained and qualified for the flight, and were in compliance with the Federal regulations on flight and duty time. However, the captain was using monovision contact lenses, which were not approved by the FAA for use by pilots while flying.
2. The flight attendants had completed Delta's Federal Aviation Administration-approved flight attendant training program.
3. The airplane was properly certificated, and there was no evidence that airplane maintenance was a factor in the accident.
4. No air traffic control factors contributed to the cause of the accident.
5. Although the pilots did not receive several pieces of weather information, Delta Air Lines provided the pilots with sufficient preflight, en route, and arrival weather information to allow them to conduct the flight safely; however, because of rapidly changing surface conditions, the conditions they encountered differed from what was forecast.
6. Although the weather conditions encountered by the pilots during the approach differed from the forecast conditions, these conditions should not have affected the pilots' ability to conduct a safe approach and landing.
7. Delta flight 554 did not encounter windshear during its approach to runway 13 at LaGuardia.
8. Because the airplane was in stable flight and the captain had taken actions to correct for a glideslope deviation, the captain's continuation of the approach after he established visual contact with the approach lights was not inappropriate.
9. The captain gradually reduced the engine power because he perceived a need to slightly increase the airplane's rate of descent; however, the descent rate increased beyond what the captain likely intended to command.
10. Irregular and shortened runway edge light spacing and degraded weather conditions can result in a pilot making an unnecessarily rapid descent and possibly descending too soon, especially in the absence of other visual references or cues.
11. The captain's use of monovision contact lenses resulted in his (unrecognized) degraded depth perception, and thus increased his dependence on monocular cues (instead of normal three dimensional vision) to perceive distance.
12. Because of the captain's use of monovision contact lenses, he was unable to overcome the visual illusions resulting from the approach over water in limited light conditions (absence of visible ground features), the irregular spacing of the runway edge lights at shorter-than-usual intervals, the rain, and the fog, and that these illusions led the captain to perceive that the airplane was higher than it was during the visual portion of the approach, and thus, to his unnecessarily steepening the approach during the final 10 seconds before impact
13. During the visual portion of the approach, when the captain was primarily relying on visual cues, the first officer, who was primarily monitoring cockpit instrumentation to gauge the airplane's position

with regard to the runway, provided input to the captain that surpassed what was set forth in the guidance available to the pilots at that time.

14. The Delta manuals were not sufficiently specific regarding pilot-not-flying duties during Category I instrument landing system approaches after the pilot flying establishes ground contact.
15. Although Delta's manuals did not adequately specify operational criteria for a stabilized approach, the lack of guidance in this area did not contribute to the accident.
16. Aviation medical examiners (AMEs) need to know if pilot examinees are using contact lenses, and currently no process is in place to ensure that AMEs are provided with that information.
17. Information concerning the possible hazards of monovision contact lens use is not well disseminated among optometrists and the pilot population.
18. The lag time in the display of vertical speed information in the vertical speed indicator installed in the accident airplane limited the first officer's ability to provide the captain with precise vertical speed information during the critical final seconds of the approach, and therefore contributed to the accident.
19. Pilots need to be aware of the type of vertical speed information provided by the vertical speed indicator installed in their airplane, and to understand the possible ramifications of that information.
20. The Federal Aviation Administration's (FAA) current guidance on special airports contained in Advisory Circular 121.445-1D is not sufficiently specific about criteria and procedures for designation of special airports; therefore, the FAA's current guidance might not always be useful to air carriers operating in and out of (existing or potential) special airports.
21. The current requirements for special airport pilot qualifications might not be sufficient to ensure that pilots who are so qualified have been exposed to the runways and/or approaches at those airports that make the airport "special."
22. The flightcrew coordination appeared adequate, and the decision to evacuate the airplane was appropriate and timely.
23. The flight attendant in charge, who began shouting evacuation commands within 2 seconds of the evacuation order, reacted to the evacuation command promptly and assertively, in accordance with Delta's flight attendant manuals and training.
24. The two aft flight attendants did not react promptly or demonstrate assertive leadership, as specified in Delta's flight attendant manuals and training.
25. The quality of the crew resource management was not a factor in this accident.
26. The atypical installation and use of runway visual range transmissometer equipment at LaGuardia did not adversely affect the validity of the runway visual range values reported at the time of the accident.
27. The low level windshear alert system equipment anomalies were not a factor in this accident.

### **3.2 Probable Cause**

The National Transportation Safety Board determines that the probable cause of this accident was the inability of the captain, because of his use of monovision contact lenses, to overcome his misperception of the airplane's position relative to the runway during the visual portion of the approach. This misperception occurred because of visual illusions produced by the approach over water in limited light conditions, the absence of visible ground features, the rain and fog, and the irregular spacing of the runway lights.

Contributing to the accident was the lack of instantaneous vertical speed information available to the pilot not flying, and the incomplete guidance available to optometrists, aviation medical examiners, and pilots regarding the prescription of unapproved monovision contact lenses for use by pilots.

## **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:

Identify Part 139 airports that have irregular runway light spacing, evaluate the potential hazards of such irregular spacing, and determine if standardizing runway light spacing is warranted. (A-97-84)

Require all 14 CFR Part 121 and 135 operators to review and revise their company operations manuals to more clearly delineate flightcrew member (pilot flying/pilot not flying) duties and responsibilities for various phases of flight, and to more clearly define terms that are critical for safety of flight decisionmaking such as "stabilized approach." (A-97-85)

Revise FAA Form 8500-8, "Application for Airman Medical Certificate," to elicit information regarding contact lens use by the pilot/applicant. (A-97-86)

Require the Civil Aeromedical Institute to publish and disseminate a brochure containing information about vision correction options, to include information about the potential hazards of monovision (MV) contact lens use by pilots while performing flying duties and to emphasize that MV contact lenses are not approved for use while flying. (A-97-87)

Require all 14 CFR Part 121 and 135 operators to notify their pilots and medical personnel of the circumstances of this accident, and to alert them to the hazards of monovision contact lens use by flightcrew members. (A-97-88)

Require all flight standards district office air safety inspectors and accident prevention specialists to inform general aviation pilots of the circumstances of this accident and to alert them to the hazards of monovision contact lens use by pilots while flying. (A-97-89)

Require all 14 CFR Part 121 and 135 air carriers to make their pilots aware (through specific training, placards, or other means) of the type of vertical speed information (instantaneous/non-instantaneous) provided by the vertical speed indicators installed in their airplanes, and to make them aware of the ramifications that type of information could have on their perception of their flight situation. (A-97-90)

Require all 14 CFR Part 121 and 135 operators to convert, where practical, the non-instantaneous vertical speed instrumentation on airplanes that have inertial reference units installed to provide flightcrews with instantaneous vertical speed information. (A-97-91)

Expedite the development and publication of specific criteria and conditions for the classification of special airports; the resultant publication should include specific remarks detailing the reason(s) an airport is determined to be a special airport, and procedures for adding and removing airports from special airport classification. (A-97-92)

Develop criteria for special runways and/or special approaches giving consideration to the circumstances of this accident and any unique characteristics and special conditions at airports (such as those that exist for the approaches to runways 31 and 13 at LaGuardia Airport) and include detailed pilot qualification requirements for designated special runways or approaches. (A-97-93)

Once criteria for designating special airports and special runways and/or special approaches have been developed as recommended in Safety Recommendations A-97-92 and -93, evaluate all airports against that criteria and update special airport publications accordingly. (A-97-94)

Require all 14 CFR Part 121 and 135 operators to review their flight attendant training programs and emphasize the need for flight attendants to aggressively initiate their evacuation procedures when an evacuation order has been given. (A-97-95)