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NATIONAL TRANSPORTATION SAFETY BOARD

# AIRCRAFT INCIDENT REPORT

NORTHEAST AIRLINES, INC.

McDonnell Douglas DC-9-31, N982NE

Martha's Vineyard, Massachusetts

June 22, 1971

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NORTHEAST AIRLINES, INC.  
McDONNELL DOUGLAS DC-9-31, N982NE  
MARTHA'S VINEYARD, MASSACHUSETTS  
JUNE 22, 1971

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## S P E C I A L   N O T I C E

This report contains the essential items of information **revelant** to the probable causes and safety messages to be derived from this accident. However, for those having a need for more detailed information, the original factual report on the accident is on file in the Washington office of the National Transportation Safety Board. Upon request the report will be reproduced commercially at an average cost of 150 per page for printed matter and 750 per page for photographs, plus postage. (Minimum Charge \$1.00.)

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NATIONAL TRANSPORTATION SAFETY BOARD  
Washington, D. C. 20591  
AIRCRAFT INCIDENT REPORT

Adopted: December 29, 1971

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NORTHEAST AIRLINES INC .  
McDONNELL DOUGLAS DC-9-31, N982NE  
MARTHA'S VINEYARD , MASSACHUSETTS  
JUNE 22, 1971

SYNOPSIS

Northeast Airlines , Inc. , Flight 938, a McDonnell Douglas, E-9-31, N982NE, was a regularly scheduled passenger flight operating from John F. Kennedy International Airport, New York, to Martha's Vineyard, Massachusetts, with an intermediate stop in New Bedford, Massachusetts. The flight from New York to New Bedford was without reported incident. Flight 938 departed from New Bedford at 0822 eastern daylight time and proceeded direct to Martha's Vineyard. While on a VOR final approach to the airport, in instrument flight conditions, the aircraft struck the water, received minor damage but remained airborne. The incident occurred at 0830 e.d.t. approximately 3 miles from the end of Runway 24 at Martha's Vineyard. The captain then flew the aircraft to Logan International Airport at Boston, Massachusetts, where he made a normal landing. None of the five crewmembers and three passengers were injured.

The National Transportation Safety Board determines that the probable cause of this incident was the lack of crew coordination in monitoring the altitude during the performance of a nonprecision instrument approach, the misreading of the altimeter by the captain, and a lack of altitude awareness on the part of both pilots.

The Board has previously made several recommendations following the investigation of similar accidents and incidents. Our most recent correspondence to the Administrator, Federal Aviation Administration, is attached as Appendix D.

The Board noted during this investigation that N982NE was not equipped with a radio or radar altimeter.

Therefore the Board recommends **that**:

1. The Administrator require all air carrier aircraft to be equipped with a ground proximity warning device, in addition to barometric altimeters.
2. The Administrator establish appropriate operating procedures for such equipment.

Conceptual  
movement  
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INVESTIGATION

Northeast Airlines, Inc., Flight 938, a McDonnell Douglas DC-9-31, N982NE was a scheduled domestic passenger flight from John F. Kennedy International Airport, New York, to Martha's Vineyard, Massachusetts, with an intermediate stop in New Bedford, Massachusetts.

Flight 938 departed from New Bedford at 0822 e.d.t. 1/ on an instrument flight rules clearance direct to the Martha's Vineyard VOR at 3,000 feet m.s.l. 3/ Approximately 2 minutes after takeoff, flight was advised by Otis Approach Control to turn to a heading of 110° and to descend to 1,700 feet. This was a radar vector for a straight-in VOR approach. 24.

The weather given by the controller for Martha's Vineyard was: indefinite ceiling 300 feet; sky obscured; visibility 1 mile and fog; 030 at 5 knots; and the Otis altimeter 29.81. The controller then instructed Flight 938 to turn right to 140° and then further right to 240°. Flight 938 was then advised that it was 8 miles northeast of the VOR. The controller again instructed the flight to turn right to a heading of 240° and cleared it for & VOR approach to the Martha's Vineyard Airport

The captain called for landing gear down and flaps 25°. The descent and the before-landing checklists were completed. The captain and first officer each cross-checked both altimeters and both instruments indicated the same altitude.

The captain checked the rate of descent as the aircraft was leaving 1,100 feet and intended to level off at 540 feet. He looked out the windshield shortly after this time and saw water directly below. He immediately applied full power and rotated the airplane to a climbing attitude; however, the aircraft continued to descend until it struck the water.

The captain then advised the passengers: "We have struck the water during our approach," and "... I may have misread my altimeter."

The first officer estimated that 40 seconds after the aircraft struck the water the altimeter indicated 900 feet and the aircraft was climbing. The aircraft was flown to Boston with the landing gear extended and landed without further incident.

1/ All times herein are eastern daylight, based on the 24-hour clock.

2/ Very high frequency omnidirectional radio range.

3/ All altitudes expressed in feet, mean sea level, unless otherwise indicated.

Northeast Airlines Flight Operations Manual required that the following altitudes be called out during nonprecision instrument approaches:

1. "1,000 feet above MDA."
2. "500 feet above MDA"; "100 feet above MDA"; and "50 feet above MDA."
3. Callout, "Minimum altitude."

During the approach, the first officer did not make these required calls. At the time the calls should have been made, he was tuning in the low frequency radio beacon and, on the captain's instructions, attempting to contact the company on the radio to obtain the latest weather report from Martha's Vineyard.

The Jeppesen Approach Chart used by the captain for the Martha's Vineyard approach was dated February 26, 1971. The landing minima on this VOR approach to Runway 24 were three-quarters of a mile visibility and a minimum descent altitude of 540 feet when the radio beacon was inoperative and 460 feet when the beacon was operating. The beacon was operating during this approach and the MDA of 460 feet applied.

Both the flight data recorder (FDR) and the cockpit voice recorder (CVR) tapes were examined in the Board's Washington office.

The FDR data was plotted, and the graph showed an elapsed time of 9 minutes 48 seconds from takeoff at New Bedford to impact with the water. One minute 26 seconds after the altitude trace indicated a departure from 1,570 feet with a rate of descent of approximately 1,090 feet per minute, the trace moved rapidly from plus 125 feet to minus 250 feet. At the beginning of this descent, the heading was 174° magnetic. The trace showed a relatively continuous right turn until the aircraft struck the water on a heading of 272°. The indicated airspeed at the start of the descent was 135 knots, and it increased to 157 knots at impact, at which point, all four traces: acceleration; airspeed; heading; and altitude showed sudden large deviations for a period of about 7 seconds. The acceleration trace showed additional activity for another 5 seconds.

The Microdot CVR tape was found broken and wound around the takeup spool and no information was available regarding this incident.

The cowling of the lower segment of both engines was buckled, wrinkled, and torn, with a section of cowl skin and frame missing. The lower half of the No. 1 engine thrust reverser was pushed aft, and the

skin fairing was torn and missing. The lower half of the No. 2 engine thrust reverser was torn, buckled, and wrinkled.

The aircraft was certificated and registered as required by Federal regulations. (For details see Appendix C.) The aircraft records disclosed no maintenance discrepancies which could be related to this incident.

The Pitot static system was tested. No water or other foreign materials were found in the system and no air leaks were detected.

Both altimeters were tested in the aircraft with the static system intact. When the captain's altimeter was checked without an air data computer correction and with the instrument vibrator "off," a friction error of 50 feet was recorded. The altimeter was then removed and tested in an overhaul facility. It was reported to be operating within the established accuracy limits.

The copilot's altimeter is not connected to the air data computer so it was tested with the instrument vibrator "off" and a friction error of 50 feet was recorded. During the examination of this altimeter at the overhaul facility, a barometric setting error of 20 feet was found. This error would have resulted in the altimeter displaying an indicated altitude 20 feet lower than the aircraft's actual altitude.

~~The aircraft was not equipped with either radio altimeters or an altitude alerting system.~~

The air data computer had an error of 30 feet in the altitude reference synchro. This error also would have caused the altimeter to read lower than the actual altitude of the aircraft. The computer was approximately 15 feet out of tolerance at 1,000 feet, but all other outputs were normal.

Both pilots were properly certificated and had met the requirements of the Federal and company regulations to perform their duties. (See Appendix B.)

The captain received a first-class medical certificate after taking a physical examination on June 20, 1971. The findings of this examination were the same as his previous examination dated December 24, 1970. The near-vision portion of the most recent examination disclosed that his:

right eye tested to 20/60 corrected to 20/20 with corrective lenses;

left eye tested to 20/60 corrected to 20/20; and

both eyes tested to 20/60 corrected to 20/20.



The captain's medical certificate required **that** he possess corrective lenses for near vision while he **was** flying; however, he was not required to wear them. He had his glasses in his possession, but he **was** not wearing them during the **flight**.

At the Board's request the captain **was** reexamined on November 8, 1971, for near vision. The findings of this test (at 30 inches) were as follows:

Right Eye	20/60	corrected to 20/30
Left Eye	20/60	corrected to 20/30
Both Eyes	20/60	corrected to 20/30

In response to the Board's request, the captain submitted a statement regarding the lighting conditions during the accident flight. In part he stated:

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"Just prior to executing the approach while cruising at 3000' and on a heading of 110°, we were flying directly into the sun in a very bright haze approximately 1500' above the over cast. This condition existed until we entered the over cast during the descent phase of the approach. After entering the over cast I would estimate that there was a 50% reduction in outside light.

+  
"During the entire approach the florescent lights under the glare shield were all on **full** bright. They were turned on by means of the thunder storm light switch on the overhead panel. These lights were on prior to leaving New Bedford Airport.

→  
"Neither the First Officer nor I were wearing sun-glasses during the approach."

The FAA-designated aviation medical examiner, who examined the captain, stated **that** under the external and internal lighting conditions, "... it would take the captain's eyes approximately one to two minutes to adjust to the change in lighting."

ANALYSIS AND FINDINGS

Investigation of the aircraft, engines, system, and aircraft records indicated **that** there were no mechanical malfunctions or failures of the aircraft **that** could be related to the cause of this incident.

**Air** Traffic Control functions were properly executed as they relate to Flight 938, and there **was** no evidence of equipment or navigational facility malfunction.

The reported visibility **was** 1 mile with fog. There **was** an indefinite ceiling of 300 feet with the sky obscured.

The tests of the static pressure system and the altimeters indicate **that** the probable altimeter error at sea level, air data computer on, during a slow descent, **was** no more than @nus =feet. This error would have been in favor of the pilot; i.e., the altimeter would have read 30 feet lower than the actual altitude of the aircraft.

During his announcement to the passengers and later during an interview, the captain stated **that** he may have misread the altimeter. The captain and the first officer both stated **that** they had cross-checked their altimeters during the flight and both instruments indicated the same altitude. The first officer estimated **that** 40 seconds elapsed from the time the aircraft struck the water **until** his altimeter read 900 feet which indicates a rate of climb of approximately 1,350 feet per minute.

The existing lighting conditions and the captain's reduced visual acuity could have been contributing factors in his misreading of the altimeter. Under the external and internal lighting in this case, **it** could have taken the captain's eyes approximately 1 to 2 minutes to adjust to the change in lighting when he descended into the fog.

This incident could have been prevented **if** the crew had followed the altitude callout and coordination procedures required by the Northeast Airlines' flight manual.

PROBABLE CAUSE

The National Transportation Safety Board determines **that** the probable cause of **this** incident **was** the lack of crew coordination in monitoring the altitude during the performance of a nonprecision instrument approach, the misreading of altimeter by the captain, and a lack of altitude awareness on the part of both pilots.

RECOMMENDATIONS

The Board has previously made several recommendations following the investigation of similar accidents and incidents. Our most recent correspondence to the Administrator, Federal Aviation Administration, is attached as Appendix D.

The Board noted during this investigation that N982NE was not equipped with a radio or radar altimeter.

Therefore the Board recommends that:

1. The Administrator require all air carrier aircraft to be equipped with a functional ground proximity warning device, in addition to barometric altimeters.
2. The Administrator establish appropriate operating procedures for such equipment.

The Board has been advised that the Federal Aviation Administration is presently examining the need for intermediate vision requirements for pilots. The Board encourages this program and, if additional vision requirements are identified, will provide its comments on any rulemaking the FAA may initiate.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD:

/s/ JOHN H. REED  
Chairman

/s/ OSCAR M. LAUREL  
Member

/s/ FRANCIS H. McADAMS  
Member

/s/ LOUIS M. THAYER  
Member

/s/ ISABEL A. BURGESS  
Member

December 29, 1971

INVESTIGATION AND HEARING

1. Investigation

The Board received notification of this incident about 0920 e.d.t. on June 22, 1971. The investigator in charge was dispatched immediately to the scene from the Safety Board's New York City Field Office at John F. Kennedy International Airport with technical assistance from Washington, D. C. Working groups were established for: Systems, Flight Recorder, Cockpit Voice Recorder, Human Factors, and a combined group consisting of Operations, Weather and Air Traffic Control.

Interested parties participating in the investigation included the Federal Aviation Administration, Northeast Airlines, McDonnell Douglas Aircraft Corporation, and the Air Line Pilots Association.

2. Hearing

There was no public hearing.

3. Preliminary Reports

An interim report of investigation summarizing the facts disclosed by the first phase of the investigation was published on August 4, 1971.

CREW INFORMATION

Captain Paul Donoghue, aged 46, holds Airline Transport Pilot Certificate No. 1030174. His latest Federal Aviation Administration first-class medical certificate was dated June 20, 1971, with the limitation **that** he shall have in his possession corrective glasses for near vision while exercising the privileges of his certificate. He holds aircraft type ratings for the E-3, 6, 7, and 9 -- FH 27/227. He successfully completed transition training and checkout as captain on the DC-9-type aircraft on June 12, 1967.

Captain Donoghue had accumulated 17,344 hours as of May 31, 1971, of which 3,050 hours were as captain in the E-9. He had flown 1.33 hours during this flight with a 4-day rest period before the flight. His last en route check was conducted on September 28, 1970, and his last proficiency check was conducted on April 19, 1971.

, First Officer Rudolph C. Milhalik, aged 31, holds Commercial Pilot Certificate No. 1609095 for single-engine land with an instrument certificate. His latest Federal Aviation Administration first-class medical certificate was dated November 18, 1970, with no limitation. He had accumulated a total of 2,933 hours as of May 31, 1971, of which 2,001 hours were in the DC-9. He had flown 1.33 hours during this flight with a 4-day rest period before the flight. His initial first-officer proficiency check was conducted on November 26, 1967, with his latest proficiency check on November 23, 1970.

AIRCRAFT HISTORY

N982NE was a McDonnell Douglas E-9-31 model aircraft. Manufacture was completed in January 1968.

The aircraft had been flown a total of 8,907:15 hours since manufacture and had flown 1,046:20 hours since the last inspection.

N982NE was equipped with two Pratt & Whitney JT8D-7 engines.

	Engine No. 1	Engine No. 2
Date of Manufacture	8/16/67	10/12/67
Serial Number	654614	654707
Total Time (hours)	7720:21	8169:20
Hours Since Last Overhaul.	7720:21	8169:20

EXTRACT FROM AIRCRAFT ACCIDENT REPORT

SOUTHERN AIRWAYS, INC.  
DOUGLAS DC-9-15, N92S  
GULFPORT, MISSISSIPPI  
FEBRUARY 17, 1971

REPORT NUMBER: NTSB-AAR-71-14

RECOMMENDATIONS

The Board finds that altitude alerting equipment now installed on air carrier aircraft is not used as a ground proximity warning device which has been previously recommended and, therefore, the Board recommends that the Federal Aviation Administration:

1. Develop a ground proximity warning system for use in the approach and landing phases of operation which will warn flightcrews of excessive rates of descent, unwanted/inadvertent descent below Minimum Descent Altitudes, or descent through Decision Height. It would be desirable if the equipment now installed could meet this need; and
2. Develop and implement appropriate operational procedures to provide this type of warning to flightcrews for use during the approach and landing phase of flight.

DEPARTMENT OF TRANSPORTATION  
FEDERAL AVIATION ADMINISTRATION

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WASHINGTON, D.C. 20590



OFFICE OF  
THE ADMINISTRATOR

15 NOV 1971

Honorable John H. Reed  
Chairman, National Transportation  
Safety Board  
Department of Transportation  
Washington, D C 20591

Dear **Mr.** Chairman:

This is in response to the recommendations contained in Report Number NTSB-AAR-71-14, an aircraft accident report concerning a Southern Airways DC-9 at Gulfport, Mississippi, on 17 February 1971 and referred to in your letter dated 3 November 1971.

With respect to the recommendation to develop a ground proximity warning system for use during approach and landing, we believe the present instrumentation and procedures are safe and adequate. This presupposes proper cockpit disciplines are maintained. On this flight the Captain stated that during the approach he read the altimeter at 300 feet. The voice recorder transcript shows the Captain called 150 feet and advised the copilot who was flying the aircraft to "bring it up." The report brings out that the radar altimeter was set for 400 feet and the yellow warning light was observed by the pilot. We believe the pilot was well aware that he was below the Minimum Descent Altitude (MDA). We fail to see how a ground proximity warning could have contributed further to what we believe was already known.

We are, however, reassessing our system requirements for nonprecision straight-in-approach systems with a view to providing additional assistance to the pilot in the form of accurate position information which will make his evaluation of the visual approach segment less susceptible to human error.

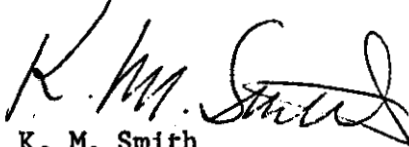
With respect to the recommendation to have operational procedures to provide ground proximity warning, the agency has, for many years, had an altitude awareness program. Operators develop and publish in their manuals company procedures to insure altitude awareness during approaches. Southern Airways did have such a procedure, but it was not followed during the approach in question. Additionally, as the nonprecision straight-in-approach system is revised we will consider new or additional procedures to implement the system.



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With respect to the recommendation to commission the full ILS at Gulfport, grading needed to solve the siting problem is being accomplished by the sponsor. We expect the system to be commissioned in early 1972.

Sincerely,



K. M. Smith  
Acting Administrator

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