

# AIRCRAFT ACCIDENT REPORT

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**ADOPTED:** November 17, 1964

**RELEASED:** November 19, 1964

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PURDUE AERONAUTICS CORPORATION  
DOUGLAS DC-3, N386T  
MORGANTOWN, WEST VIRGINIA  
NOVEMBER 29, 1963

## SYNOPSIS

A Purdue Aeronautics Corporation Douglas DC-3, N386T crashed during an instrument approach to the Municipal Airport at Morgantown, West Virginia, at 1110 c.s.t., November 29, 1963.

The stewardess received fatal injuries in the accident. The pilot and copilot were injured and the aircraft was damaged beyond repair by the crash.

The aircraft was being ferried to Morgantown in preparation for a charter flight, and there were no passengers aboard.

The Board determines that the probable cause of this accident was the pilot's execution of an instrument approach in an aircraft not equipped with navigational instrumentation appropriate to the ground facilities being used.

## Accident

A Purdue Aeronautics Corporation, Douglas DC-3, N386T crashed while making an instrument approach to the Morgantown Municipal Airport, Morgantown, West Virginia. The accident occurred 2.5 nautical miles from the Morgantown VOR on the 340° radial at 1110 c.s.t. 1/November 29, 1963. The stewardess was fatally injured in the accident but the captain and first officer escaped with minor injuries. There were no other persons aboard the aircraft. The aircraft was damaged beyond repair by the impact and post impact fire. N386T was being ferried to Morgantown in preparation for a charter flight.

## History of Flight

The aircraft was given a preflight inspection by the Chief Inspector, Purdue Aeronautics Corporation, on the morning of the flight. No discrepancies were noted and no maintenance was required or performed. Additionally, the aircraft was given a visual inspection by the captain and the first officer before the flight and no discrepancies were noted. This latter inspection included a fuel check which showed 794 gallons of fuel aboard.

On the evening of November 28, 1963, the first officer inspected the contents of the navigation kits and prepared the flight plan. His flight plan was reviewed

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1/All times herein are central standard based on the 24-hour clock.

and approved by the captain on the morning of the flight. Both pilots checked the weather reports and forecasts, and the captain received a comprehensive briefing from the Federal Aviation Agency (FAA) personnel assigned to the Lafayette Flight Service Station.

The flight was a ferry mission to Morgantown, West Virginia, where the aircraft was scheduled to enplane passengers for a charter flight.

The weight and balance as well as the center of gravity (c.g.) were within the prescribed limits, and there were no passengers or cargo aboard the aircraft.

The aircraft departed Purdue University Airport, Lafayette, Indiana, at 0836 on an Instrument Flight Rules (IFR) flight plan to Morgantown via direct Dayton, Ohio, Victor 12 (Airway) to Appleton, Victor 144 to Morgantown with Canton and Youngstown, Ohio, as alternates, to cruise at 5,000 feet. The crew later requested and received a clearance to operate at 7,000 feet.

The aircraft operated on top of clouds until after passing Zanesville, Ohio, where the crew went on instruments in light rain which continued until the end of the flight. Twenty-five degrees of carburetor heat was applied when the rain was encountered. En route the captain detected a difference between the magnetic compass and the remote indicating compass of approximately 15 degrees. He stated that he was never able to determine which of the compasses was more nearly correct.

The captain reviewed the instrument approach plates for the Morgantown airport and selected the "VOR/DME"<sup>2/</sup> approach to use for his approach. He stated that he made this selection because he wanted to make a VOR approach so he could "tie down the radial" and that "with a difference of 15° between the two compasses (Magnetic) we could not be positive of our track making an ADF approach under these conditions. He further stated that he thought of "the VOR/DME plate as two approaches on one plate, similar to an ILS/ADF plate." Because the VOR/DME plate had a later date than the VOR plate he said he thought the VOR plate was obsolete. The captain also testified that he did not see the note indicating "if aircraft not equipped with operational VOR and DME equipment, procedure not authorized," which was printed on the chart.

He noted a position called "DECK"<sup>3/</sup> or 3.5 miles" on the depiction of the final approach course from the VOR station to the airfield. Because he felt it was important to determine this point, he took a cross bearing on this point from the Grantsville VOR<sup>4/</sup> and selected the 273° radial of this station to give him an indication of passing "Deck."

The captain testified that he had never had any formal training in the use of the type of approach plates he was using on this flight. He had used them,

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<sup>2/</sup> A ground transmitter receiver unit of distance measuring equipment (DME) which receives and replies to interrogation signals from an aircraft radio.

<sup>3/</sup> A fix along final approach course at Morgantown beyond which DME-equipped aircraft may descend to minimum instrument approach altitude.

<sup>4/</sup> VOR navigational facilities.

however, in the course of his duties for more than two years before this accident.

As the flight approached the Morgantown area it was given the Morgantown 1035 weather observation by the Cleveland Air Route Traffic Control Center (ARTCC). The ceiling was estimated as 600 feet, broken clouds, visibility 1-1/2 miles in light rain and fog, and the wind from the north at 10 knots. The crew acknowledged receipt of this information.

The applicable published daytime minimums for the various instrument approaches to the Morgantown Airport are:

ADF, 600 feet ceiling and one mile visibility  
VOR/DME, 600 feet ceiling and one mile visibility  
VOR, 1,400 feet ceiling and one mile visibility

Immediately after giving the crew the 1035 weather, ARTCC cleared the flight for an ADF approach. A short time later the captain told the copilot to request a VOR approach, clearance for which was immediately granted by the ARTCC Controller. The Morgantown Flight Service Station was contacted at 1052 and gave the crew the same weather they had received from the ARTCC plus the latest altimeter setting of 29.43. The flight departed the VOR, outbound to the procedure turn, at 5,000 feet descending to 4,000 feet which was maintained until the procedure turn had been completed and the aircraft was inbound to the VOR, at which time the flight descended to 3,000 feet. As the first officer flew the aircraft, the captain (with the approach plate in his lap) was monitoring his flying technique. Carburetor heat was still on.

The first officer's VOR receiver was tuned to the Morgantown VOR with the 337° radial selected and the captain's VOR receiver was tuned to the Grantsville VOR with the 273° radial selected.

After passing the VOR inbound the captain instructed the first officer to descend to 2,400 feet. The altitude was maintained between 2,450 to 2,500 feet and, because of a cross wind from the right, a heading of 345-350° was required to maintain a track of 337°.

Approximately 2:35 minutes after passing the VOR inbound the captain's VOR indicator centered. He then told the copilot to "ease it down" and turned on the windshield wipers. He advised the copilot that the minimum altitude was 1,856 feet. The last altitude the captain recalls on the altimeter was 2,200 feet, however, he stated it could have been 2,150 or 2,175. When trees suddenly appeared the captain pulled the yoke back but the aircraft struck the trees nose-high and the aircraft crashed.

The flight crew searched the wreckage of the aircraft and found the stewardess's body in the aft cabin.

The copilot's testimony indicates the flight was essentially as described by the captain.

### Investigation

The wreckage was located 2.5 nautical miles from the Morgantown VOR on the 340° radial oriented along a line 340° magnetic.

The initial impact with trees was determined to be at an altitude of 2,040 feet m.s.l. by use of an altimeter which had been checked against the Morgantown field pressure before use. The aircraft proceeded 230 feet and struck several more trees at approximately 2,050 m.s.l. The first ground impact occurred 320 feet further along the wreckage path and the fuselage came to rest 550 feet from the first trees struck.

Investigation of the instrumentation in the wreckage showed that the VOR receivers were tuned to Morgantown (first officer's) and Grantsville (captain's) and the Omni bearing selectors set on 337° (first officer's) and 273° (captain's). The captain's altimeter was set at 29.43, the first officer's at 29.44. The altimeter setting at the time of the accident was 29.43 at Morgantown Airport. No discrepancies were noted in examination of the aircraft and engine controls.

The crew advised investigators that the powerplants and aircraft were operating normally until impact.

The crew's testimony and examination of the wreckage revealed no evidence of instrument difficulties except the 15-degree difference between the magnetic compass and the remote indicating compass. The altimeters and vertical speed indicator were removed, bench checked, and operated within prescribed limits. Crew tests and bench checks indicated that the installed VOR receivers were serviceable and operated satisfactorily. The radio equipment consisted of VOR and ADF navigational receivers and VHF communication transceivers. No DME equipment was installed on the aircraft.

A flight check of the facilities at Morgantown was performed within 24 hours after the accident. This flight check revealed no discrepancies. There was no attempt to ascertain the position of "Deck" by radial presentment from the Grantsville VOR as it was not a suggested or approved procedure.

A few days later a flight check consisting of three VOR approaches was made using an FAA DC-3 aircraft. These approaches were conducted utilizing the 337° radial of the Morgantown VOR and the 273° radial of Grantsville VOR. After passing Morgantown VOR at 3,000 feet m.s.l. inbound to Morgantown Airport on the 337° radial, a descent to 2,400 feet m.s.l. was begun. Immediately the Grantsville VOR signal strength dropped below tolerance causing unreliable course indications. A second approach was made maintaining 3,100 feet m.s.l. from the Morgantown VOR to the Morgantown Airport along the 337° radial. The Grantsville VOR signal strength was satisfactory throughout the approach and the 273° radial of Grantsville crossed the 337° radial of the Morgantown VOR at a point four nautical miles from the Morgantown VOR transmitter. The four nautical mile point was an average due to slight roughness of the Grantsville signal. It is noted that one degree at 3 nautical miles (the distance from "Deck" to Grantsville) is approximately 0.47 nautical mile in width.

The weather reported at Morgantown at 1036 was

Special, estimated 600 feet broken, 800 feet overcast,  
visibility 1-1/2 miles, light rain, fog, wind north  
12 knots, altimeter 29.44, ceiling ragged.

At 1057 the weather was the same except the altimeter setting was reported to be 29.43 inches. The temperature and dewpoint were 40°F. At 1118, approximately

eight minutes after the accident, another special observation was taken which indicated:

Special, balloon ceiling, 600 feet broken, 800 feet overcast, visibility 2 miles, light rain, fog, wind north 12 knots, gusts 20 knots, altimeter setting 29.42, ceiling ragged.

This reported weather was essentially as forecast by the U. S. Weather Bureau and given to the pilot by the Flight Service Station personnel before his departure. According to the transcript of the ARTCC communication recordings, the 1036 Morgantown weather was correctly passed to the pilot with the additional comment that "ceiling is higher to the north."

A review of the then current instrument approach procedure charts revealed that straight-in approaches from the VOR to runway 36 were not authorized. ADF approaches made from the non-directional radio beacon north of the airport could be made straight-in to runway 18, or circling to any runway. However, the ADF approach minima were the same for straight-in or circling approaches.

The air traffic control procedures utilized by the ARTCC controller were compared with those outlined in the FAA's then current Air Traffic Control Procedures manual, ATP7110.1A. Paragraph 265.4 of that manual states:

"When an official weather report is made available to the controller which indicates that weather conditions are below the minima published for the particular approach . . . to be executed the controller shall:

- A. Issue the weather report to all arriving aircraft.
- B. Advise the pilot of other than military or scheduled air carrier aircraft that the reported weather is below the published minima and request such pilots to advise their intentions; and
- C. Issue approach clearance, landing clearances and/or instructions, as appropriate, in accordance with the pilot's stated intentions and the traffic situation."

A review of the transcript of the radio communication between ARTCC and the crew indicates that this procedure was not followed. The controller testified that when he received the request for the VOR approach from the crew he checked his sector binder, saw a U. S. Coast and Geodetic Survey (C&GS) approach plate with a southeast procedure turn, and read the minimums of 600 feet and one mile. He believed this was the VOR approach plate. The controller identified the VOR/DME plate as the one which he had used to determine the minimums. The controller further testified that after the accident a card was prepared for each sector position at the ARTCC which depicts the minimums for each instrument approach procedure in the sector.

During flight checks of the navigational facilities at Morgantown it was found that the terrain clearance between the VOR and the airport did not conform to the criteria established by the United States Manual of Criteria for Standard Instrument Approach Procedures. As a result of this finding the minimum altitude between the

VOR station and the "Deck" fix was raised from 2,400 to 2,700 feet m.s.l. An FAA witness testified that the terrain altitude information used to prepare the original VOR/DME approach plate was taken from a U. S. Geological Survey quadrangle chart dated 1931. During the investigation of this accident the FAA became aware that more recent charts depicted higher terrain elevations in the approach area at Morgantown. As a result of this information and the observation of higher than reported terrain in the area between the VOR and the airport, the minimum altitudes were corrected to their present values.

FAA witnesses further testified that the minimum crossing altitude at the VOR station was increased from 3,000 feet to 3,300 feet m.s.l. under the provision of Civil Air Regulations (CAR) amendment 60.21/29. CAR 60.21/29 was promulgated by the Administrator to provide an additional 500 feet of VFR air space below the floor of controlled airspaces for use by VFR flights.

Following this accident the C&GS VOR/DME approach plate for Morgantown was changed to reflect the higher minimum altitudes. Additionally, "VOR/DME" was printed on the face of the chart above the note that indicates the ". . . approach authorized only for aircraft with installed operational VOR and DME equipment." The approach plate used by the carrier had, and still has, a "Note 1. If aircraft not equipped with operational VOR and DME equipment procedure not authorized. The captain stated that he did not see this note until after the accident occurred.

The crew testified that they had adequate rest before the flight and that neither of them had taken any medications or been under a doctor's care before takeoff.

### Analysis

There was no malfunction of the aircraft, powerplants, or aircraft systems that contributed to the cause of this accident. The weight and balance of the aircraft was within limits. The navigational equipment, both on the ground and in the aircraft was operational without malfunctions. The crew was current and properly certificated for the flight and their physical condition was not considered a factor.

The weather services provided the crew and controller were timely and adequate. At the time the approach was attempted the weather was satisfactory for either an ADF or a VOR/DME approach; however, it was below minimums for a VOR approach.

Confusion in the captain's mind as to the meaning of the designation VOR/DME on the chart, coupled with his lack of familiarity with the type of charts furnished for his use, led him to select an approach procedure for which the aircraft was not instrumented. He did not recall ever receiving any instructions in the use of this particular type of approach chart and had apparently limited experience in their use. The approach plates had been authorized for use by the FAA. All the required information, including a note that operational DME equipment was required in the aircraft, was displayed on the face of the chart. However, either due to the location or format of the note the captain did not see it. It is noted that the FAA controller made the same type of error when he selected the C&GS VOR/DME chart to verify the minimums for the VOR approach prior to issuing the crew a clearance for a VOR approach. The Board believes that had the controller noted this dis-

crepancy and used the VOR approach plate to check the minimums he would have advised the crew that the weather was not suitable for a VOR approach.

The captain's attempt to use a radial from the Grantsville VOR to establish the location of "Deck" shows a lack of understanding, on his part, of the display of navigational information on the approach plate he was using, as well as the inherent limitations on the use of a VOR station. He took no cognizance of the effect of distance and terrain on the emissions of very high frequency radio transmitters which broadcast essentially on a line of sight basis. His inability to differentiate between instrument centering brought about by weak signals, as opposed to a course interception, coupled with an inaccurate estimate of his ground speed to give him an erroneous position indication.

The apparent passing of the Deck fix was compounded by the captain's lack of knowledge regarding the head wind in the approach area. At the time he believed he was at the Deck fix, 3.5 nautical miles from the VOR, he had actually traveled only 2.5 nautical miles. He stated that he had begun his timing after passing the cone of ambiguity over the VOR.

The aircraft wreckage was found to have crashed on the 340° radial of the VOR rather than the 337° radial which put it about 1/2 nautical mile right of the centerline of the approach radial. Had the aircraft been on track it would have cleared all terrain between the VOR and the airfield. Furthermore, had the minimum altitude for the approach been established as it is now the aircraft would have cleared the terrain en route to the airport, even though it was not exactly on track.

#### Probable Cause

The Board determines that the probable cause of this accident was the pilot's execution of an instrument approach in an aircraft not equipped with navigational instrumentation appropriate to the ground facilities being used.

BY THE CIVIL AERONAUTICS BOARD:

/s/ ALAN S. BOYD  
Chairman

/s/ ROBERT T. MURPHY  
Vice Chairman

/s/ G. JOSEPH MINETTI  
Member

/s/ WHITNEY GILLILLAND  
Member

GURNEY, Member, did not take part in the adoption of this report.

# S U P P L E M E N T A L D A T A

## Investigation

The Civil Aeronautics Board was notified of this accident November 29, 1963, and an investigation was initiated under the provisions of Title VII of the Federal Aviation Act of 1958, as amended. Depositions were taken in this matter at Oberlin, Ohio, February 11, 1964, Lafayette, Indiana, February 12, 1964, and Washington, D. C., March 27, 1964.

## Air Carrier

Purdue Aeronautics Corporation is an affiliate of Purdue University, Lafayette, Indiana, where the corporation maintains its headquarters. The company operates as a nonscheduled air carrier under the provisions of Part 42 of the Civil Air Regulations. Purdue Aeronautics has interim authority for supplemental air service from the Civil Aeronautics Board, and an operating certificate issued by the Federal Aviation Agency.

## Flight Personnel

Captain William G. Cook, age 50, possessed an air transport pilot certificate issued December 5, 1962, with airplane multiengine land, Lockheed Constellation, and Douglas DC-3 ratings. He was current and qualified in the DC-3. He had a current first-class medical certificate with the limitation that he wear corrective glasses while exercising the privileges of his airman certificate. He had a total of 23,553 hours with 3,899 hours in the DC-3.

First Officer David H. Sewell, age 21, possessed a commercial pilot certificate with an instrument and Douglas DC-3 ratings. He had a current second-class medical certificate with no limitations or waivers. He had a total of 966 hours flying time with 207 hours in the DC-3. He was current and qualified in the DC-3.

Stewardess Alice V. Hawkins, age 19, was a student at Purdue University. She qualified as a DC-3 stewardess November 1, 1963.

## The Aircraft

The aircraft, a Douglas DC-3, N386T, manufacturer's serial No. 20144, was owned and operated by the Purdue Aeronautics Corporation, Lafayette, Indiana. It had a total of 12,241 hours and had flown 126 hours since the last major inspection.

## The Powerplants

The aircraft was equipped with two Wright R-1800-G202A engines and Hamilton Standard 23E50 propellers.

<u>Engine No.</u>	<u>Total Time</u>	<u>Time Since Overhaul</u>
1	29,607 hrs.	948 hrs
2	25,430 hrs.	203 hrs.
<u>Propellers</u>		
1	4,328 hrs.	528 hrs.
2	3,985 hrs.	422 hrs.