



# National Transportation Safety Board

Washington, D.C. 20594

## Aircraft Accident Brief

**Accident Number:** IAD05MA006  
**Aircraft and Registration:** Beech King Air 200, N501RH  
**Location:** Stuart, Virginia  
**Date:** October 24, 2004  
**Adopted on:** February 7, 2006

### HISTORY OF FLIGHT

On October 24, 2004, about 1235 eastern daylight time,<sup>1</sup> a Beech King Air 200, N501RH, operated by Hendrick Motorsports, Inc., crashed into mountainous terrain in Stuart, Virginia, during a missed approach to Martinsville/Blue Ridge Airport (MTV), Martinsville, Virginia. The flight was transporting Hendrick Motorsports employees and others to an automobile race in Martinsville, Virginia. The two flight crewmembers and eight passengers were killed, and the airplane was destroyed by impact forces and postcrash fire. The flight was operating under the provisions of 14 *Code of Federal Regulations* (CFR) Part 91 on an instrument flight rules (IFR) flight plan. Instrument meteorological conditions (IMC) prevailed at the time of the accident.

The flight departed from Concord Regional Airport (JQF), Concord, North Carolina, about 1156. An examination of radar data and voice communications from the Federal Aviation Administration (FAA) revealed that, during the en route portion of the flight, a radar target identified as the accident airplane maintained all assigned altitudes and headings.

As the airplane approached MTV, an air traffic controller advised the flight crew that the airplane was second in line for the localizer runway 30 approach. The controller instructed the pilots to hold "as published" on the localizer course at 4,000 feet mean sea level (msl)<sup>2</sup> and to expect a 28-minute delay in the holding pattern. The flight crew requested 5-mile legs in the holding pattern, and the controller approved 5- or 10-mile legs at the crew's discretion.

The localizer runway 30 approach procedure (see figure 1) included an inbound course with a magnetic heading of 305°. The minimum descent altitude for the intermediate section of the approach and the holding pattern southeast of the BALES locator outer marker (LOM) was 2,600 feet. The BALES LOM is located at 6 distance

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<sup>1</sup> All times in this brief are eastern daylight time based on a 24-hour clock.

<sup>2</sup> All altitudes and elevations in this brief are expressed as msl unless otherwise noted.

measuring equipment (DME)<sup>3</sup> on the approach course. After crossing the BALES LOM on the inbound course, the minimum descent altitude on the final segment of the approach, for an airplane equipped with DME, was 1,340 feet. The missed approach point (MAP) was at 1 DME and near the approach end of the runway. The distance from the BALES LOM to the MAP was 5 nautical miles (nm). The published missed approach procedure instructed the pilot to make a “climbing right turn to 2,600 feet and proceed direct to BALES LOM and hold.”

The accident airplane approached the BALES LOM from the south (see figure 2), crossed BALES at 4,000 feet, and turned right toward the outbound leg of the holding pattern. About that time, the flight crewmembers of the airplane that preceded the accident airplane on the approach announced that they were canceling their IFR clearance after breaking out of the clouds during the approach and then proceeded to land at MTV.

At 1224:19, while the accident airplane was still turning right to the outbound leg of the holding pattern, the controller asked the flight crew if the airplane was established in the holding pattern, and the crew confirmed, “we’re established.” At 1224:26, the controller cleared the airplane for the localizer runway 30 approach and requested that the flight crew advise him when the airplane was inbound on the approach. The airplane then completed a continuous right turn toward the inbound course and crossed the BALES LOM at an altitude of 3,900 feet.

At 1226:53, the flight crew advised the controller that the airplane was “established inbound” on the approach. At 1227:04, the controller cleared the airplane for the approach and approved a radio frequency change from the approach control frequency to the common traffic advisory frequency (CTAF).<sup>4</sup> At 4 DME, or 2 nm after crossing the BALES LOM on the inbound course, the airplane started to descend from 4,000 feet (see figure 3). The airplane leveled off at 2,600 feet as it passed the MAP. About 1 nm past the MAP and over the runway, the airplane began a descent to 1,400 feet and continued on an approximate heading of 305°.

The airplane leveled at 1,400 feet, about 4 nm beyond MTV and 5 nm beyond the MAP. The airplane maintained level flight between 1,400 and 1,500 feet for the next 1 minute 13 seconds. At 1232:13, about 8 nm beyond MTV, the airplane initiated a straight-ahead climb.

At 1233:08, the flight crew informed the controller, “we’re going missed at this time.” The controller asked the flight crew to repeat the radio transmission. The flight crew repeated the information, and the controller acknowledged the radio transmission. The controller received no further radio transmissions from the flight crew.

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<sup>3</sup> One DME equals 1 nautical mile.

<sup>4</sup> According to FAA Order 7110.65, “Air Traffic Control,” paragraph 5-1-13, after a controller issues a frequency change to the CTAF, radar services are automatically terminated.

MARTINSVILLE, VIRGINIA

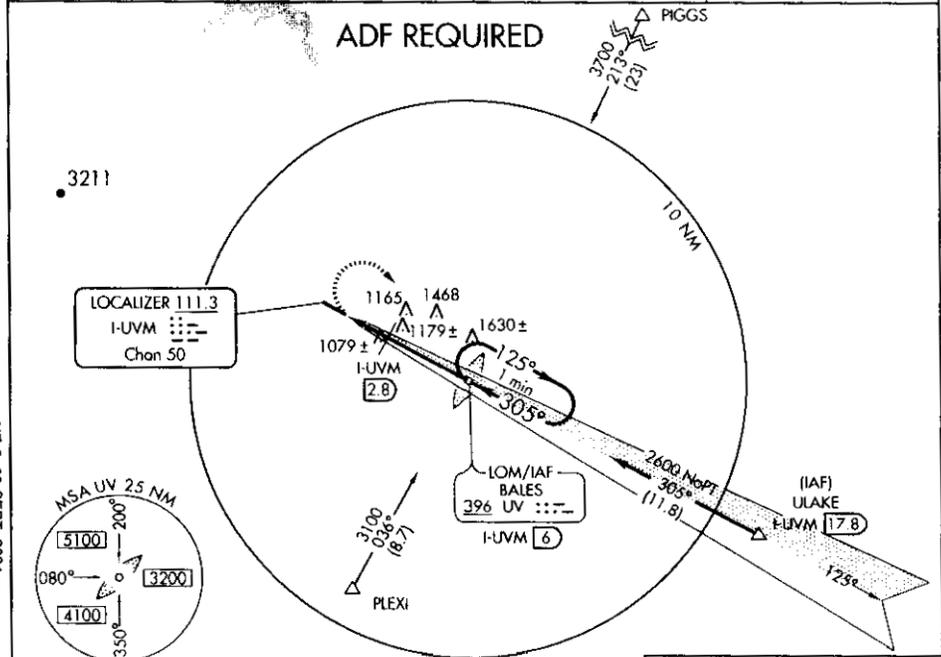
AL-5648 (FAA)

|                                      |                        |   |
|--------------------------------------|------------------------|---|
| LOC I-UVM<br><b>111.3</b><br>Chan 50 | APP CRS<br><b>305°</b> | Rwy Idg<br>5002<br>TDZE<br>925<br>Apt Elev<br>942 |
|--------------------------------------|------------------------|---|

**LOC RWY 30**

MARTINSVILLE/BLUE RIDGE (MTV)

|                         |   |                           |                               |
|-------------------------|---|---------------------------|-------------------------------|
| AWOS-3<br><b>118.45</b> | GREENSBORO APP CON<br><b>124.35 269.225</b> | CLNC DEL<br><b>124.85</b> | UNICOM<br><b>122.7 (CTAF)</b> |
|-------------------------|---|---------------------------|-------------------------------|



NE-3, 30 SEPT 2004

NE-3, 30 SEPT 2004

| ELEV 942   |  |                 |                      |                      |                   |         |                          |  |                      |                      |          |                    |  |                      |                    |   |              |  |      |   |          |  |
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| <table border="1"> <thead> <tr> <th>CATEGORY</th> <th>A</th> <th>B</th> <th>C</th> <th>D</th> </tr> </thead> <tbody> <tr> <td>S-30</td> <td>1520-1 595 (600-1)</td> <td></td> <td>1520-1½ 595 (600-1½)</td> <td>1520-1¾ 595 (600-1¾)</td> </tr> <tr> <td>CIRCLING</td> <td>1560-1 618 (700-1)</td> <td></td> <td>1560-1¾ 618 (700-1¾)</td> <td>1560-2 618 (700-2)</td> </tr> </tbody> </table> | CATEGORY   | A               | B                    | C                    | D                 | S-30    | 1520-1 595 (600-1)       |  | 1520-1½ 595 (600-1½) | 1520-1¾ 595 (600-1¾) | CIRCLING | 1560-1 618 (700-1) |  | 1560-1¾ 618 (700-1¾) | 1560-2 618 (700-2) | <table border="1"> <thead> <tr> <th colspan="2">DME MINIMUMS</th> </tr> </thead> <tbody> <tr> <td>S-30</td> <td>1340-1 415 (400-1) 1340-1½ 415 (400-1½)</td> </tr> <tr> <td>CIRCLING</td> <td>1560-1 618 (700-1) 1560-1¾ 618 (700-1¾) 1560-2 618 (700-2)</td> </tr> </tbody> </table> | DME MINIMUMS |  | S-30 | 1340-1 415 (400-1) 1340-1½ 415 (400-1½) | CIRCLING | 1560-1 618 (700-1) 1560-1¾ 618 (700-1¾) 1560-2 618 (700-2) |
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| DME MINIMUMS   |  |                 |                      |                      |                   |         |                          |  |                      |                      |          |                    |  |                      |                    |   |              |  |      |   |          |  |
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MARTINSVILLE, VIRGINIA

MARTINSVILLE/BLUE RIDGE (MTV)

Orig 03023

36°38'N-80°01'W

**LOC RWY 30**

Figure 1. Localizer runway 30 approach.

### N501RH Flight Path -- Plan View

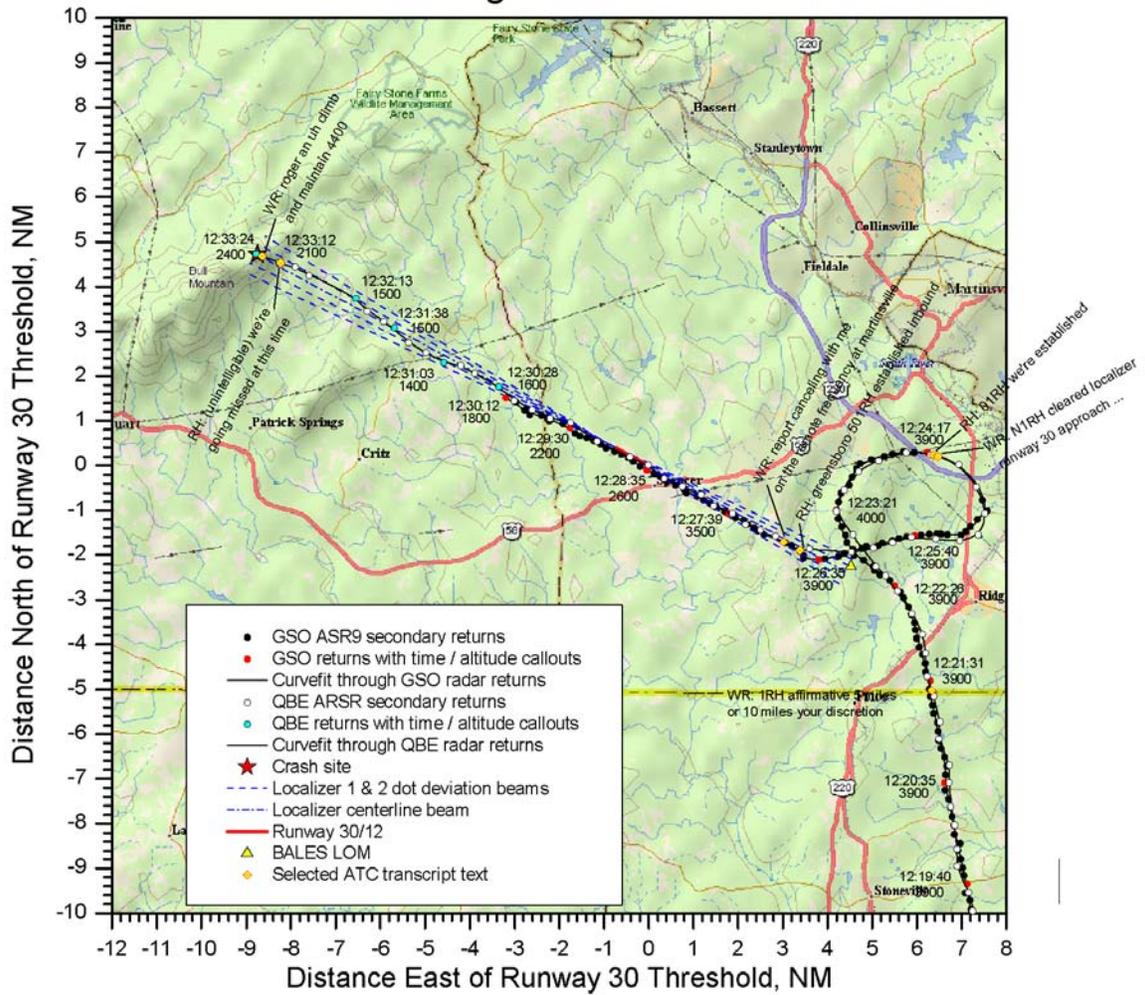


Figure 2. Accident airplane's flightpath.



evening), Bull Mountain was completely obscured by clouds and fog. The trooper stated that the visibility was between 0 and 0.25 mile.

## **PILOT INFORMATION**

### **The Captain**

The captain, age 51, held an airline transport pilot certificate with a rating for airplane multiengine land and a commercial pilot certificate with a rating for airplane single-engine land. The captain's most recent FAA first-class medical certificate was issued on December 15, 2003, with the limitation that he "must have corrective lenses for near vision." The captain was hired by Hendrick Motorsports on March 25, 2001.

A review of company training records revealed that the captain had accumulated 10,733 hours total flying time, including 8,600 hours in the Beech 1900. His total flying time in the Beech King Air 200 was 210 hours, with 152 hours as pilot-in-command (PIC). The captain had flown 67 hours in the last 90 days, 18 hours in the last 30 days, and about 30 minutes (the accident flight) in the last 24 hours.

On May 20, 2001, the captain attended SimuFlite's King Air 200 and King Air 1900 recurrent differences training, which included ground and flight simulator training. He received a PIC proficiency check in accordance with 14 CFR 61.56 and an instrument competency check in accordance with 14 CFR 61.57. On May 16, 2002, the captain attended SimuFlite's recurrent ground and flight simulator training for the King Air 300 and 350. He received a PIC proficiency check in accordance with 14 CFR 61.58. On May 22, 2003, the captain attended FlightSafety's Beech 1900 recurrent ground and flight simulator training. He received a PIC proficiency check in accordance with 14 CFR 61.58.

From January 19 to March 2, 2004, the captain attended FlightSafety's Saab 2000 initial second-in-command (SIC) training, which included ground and flight simulator training. He completed a SIC proficiency check in accordance with 14 CFR 61.55.

The captain's most recent flight review was on May 27, 2004. He completed Beech 1900 recurrent PIC ground and flight simulator training with FlightSafety and a PIC proficiency check in accordance with 14 CFR 61.58.

### **The First Officer**

The first officer, age 31, held a commercial pilot certificate with ratings for airplane single-engine land, multiengine land, and instrument airplane. Her most recent FAA first-class medical certificate was issued on April 1, 2004, with no limitations. She was hired by Hendrick Motorsports on November 19, 2001.

A review of company training records revealed that the first officer had accumulated 2,090 hours of total flying time, including 1,200 hours in single-engine airplanes and 860 hours in multiengine airplanes. Hendrick Motorsports reported that the

first officer had accumulated 640 hours of flying time since her date of hire, 121 hours of which were in the Beech King Air 200. The first officer had flown 67 hours in the last 90 days, 27 hours in the last 30 days, and about 30 minutes (the accident flight) in the last 24 hours.

On April 8, 2001 (before she was hired by Hendrick Motorsports), the first officer attended SIMCOM's initial training for the Beech 200. On May 16, 2002, the first officer attended SimuFlite's ground and flight training for the King Air 300 and 350 and received a SIC proficiency check in accordance with 14 CFR 61.55. On June 26, 2003, the first officer attended FlightSafety's Beech 1900 ground and flight recurrent training. She completed a proficiency check in accordance with 14 CFR 61.55.

The first officer's most recent flight review was on May 27, 2004. She completed FlightSafety's Beech 1900 ground and flight recurrent SIC training, which satisfied the provisions of 14 CFR 61.55.

## **AIRPLANE INFORMATION**

The accident airplane, a Beech King Air 200, was manufactured in 1981 and had accumulated 8,140 total flight hours. The airplane was equipped with Pratt & Whitney Canada turbopropeller engines and Hartzell four-bladed, hydraulically operated, constant-speed, feathering-type propellers.

The airplane was being maintained in accordance with the manufacturer's inspection program. The airplane's most recent inspection was completed on June 25, 2004, at 8,079 flight hours.

The airplane was equipped with a Bendix/King KLN 90B global positioning system (GPS) receiver and a Mid-Continent Instruments MD-41 series GPS annunciation control unit. The GPS database was not current and therefore was not certified for IFR navigation. The airplane was not equipped with an enhanced ground proximity warning system (EGPWS).

The airplane had been for sale, so a decision had been made to "park" the airplane; upgrade another King Air 200, N502RH, with an EGPWS; and certify that airplane's GPS for IFR flight. The intended buyer for N501RH preferred N502RH and was allowed to purchase that airplane instead. As a result, the accident airplane was "put back out on the line" and was scheduled for a GPS upgrade and an EGPWS installation at the end of the 2004 racing season.

## **METEOROLOGICAL INFORMATION**

A National Transportation Safety Board meteorologist conducted a study of the weather conditions in southwestern Virginia and northern North Carolina on the day of the accident. The study depicted a warm front that produced overcast clouds, high relative humidity, patchy fog, and mist, which resulted in IMC across the region.

About 1140, the weather recorded at MTV included an overcast ceiling at 400 feet with 1 1/4 miles of visibility<sup>5</sup> and wind from 200° at 3 knots. The temperature was 55° Fahrenheit (F), and the dew point was 55° F. The altimeter setting was 29.99 inches of mercury (Hg).

About 1200, the weather recorded at MTV included an overcast ceiling at 600 feet with 5 miles of visibility and wind from 220° at 3 knots. The temperature was 57° F, and the dew point was 55° F. The altimeter setting was 29.98 inches of Hg.

About 1220, the weather recorded at MTV included an overcast ceiling at 600 feet with 5 miles of visibility and calm winds. The temperature was 57° F, and the dew point was 55° F. The altimeter setting was 29.98 inches of Hg.

The captain of the airplane that preceded the accident airplane on the approach stated that his airplane descended below the cloud layer about 150 feet above the published minimums. He also stated that the visibility below the clouds was “pretty clear” with about 2 miles visibility. The captain further stated that he did not recall the reported weather but did recall that the actual weather fluctuated as the airplane descended toward MTV and was “a little better” than reported.

## **AIDS TO NAVIGATION**

After the accident, FAA and State of Virginia personnel conducted a ground inspection of all navigational equipment at MTV. The inspection revealed that the equipment functioned satisfactorily. Also, the FAA conducted a flight check inspection of the equipment at MTV, and no problems were noted.

## **AIRPORT INFORMATION**

### **Air Traffic Control**

On October 25, 2004, a Safety Board air traffic control (ATC) specialist requested voice communication tapes, transcript information, and radar data from the FAA. Examination of voice communication tapes revealed that the air traffic controller issued the holding instructions, the approach clearance, and the frequency change in accordance with FAA Order 7110.65, “Air Traffic Control.” Radar data were derived from the Greensboro Airport Surveillance Radar-9 radar. Additional radar data were obtained from the U.S. Air Force 84th Radar Evaluation Squadron and the Roanoke Air Route Surveillance Radar.

The Safety Board’s ATC specialist conducted a postaccident interview with the certified professional controller who provided ATC services to the flight crew before the accident. At the time of the accident, the controller was working the west radar and final

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<sup>5</sup> In this section, cloud cover is expressed in feet above ground level, and visibility is expressed in statute miles.

radar positions at the Greensboro/Winston-Salem ATC tower. The controller was responsible for approach control services for the Greensboro/Winston-Salem airport and 11 satellite airports, including MTV. This area of responsibility extended about 30 nm north, 25 nm east, and 25 nm west of the Greensboro/Winston-Salem airport from the ground to 12,000 feet. MTV was located in the northern portion of the controller's area of responsibility. The controller stated that the MTV runway was shown on the ATC tower's radar display map. He also explained that controllers could select an additional map that depicted the final approach courses for the satellite airports (including MTV). In addition, the controller stated that, when an aircraft executed a localizer runway 30 approach to MTV according to the published descent profile, radar contact would normally be lost when the aircraft reached 2,000 feet, which occurred about 2 nm before the airport.

The controller stated that he observed the accident airplane's radar track when the airplane was about 3 nm southeast of MTV and was descending from 3,600 feet. He thought that the airplane was high for the approach but could not question the pilots because they had already been cleared to change to the CTAF and, as a result, the controller no longer had responsibility for the flight.

At 1230:07, when the airplane was 2.5 nm northwest of the airport and at an altitude of 1,800 feet, the controller's computer system generated a minimum safe altitude warning (MSAW) alert that lasted for 15 seconds. MSAW provides visual and aural alerts to controllers if a mode C-equipped aircraft is, or is projected to be, below an appropriate terrain clearance altitude. A review of the radar data indicated that an MSAW alert had sounded and was visually displayed on the controller's radar display as a flashing "LA" (low altitude) in the data block for the accident airplane. The controller stated that he did not observe or hear the MSAW alert.

At 1230:12, the last radar return from the airplane was received. The MSAW predicted the projected path of the airplane for another 10 seconds, and the alert ended at 1230:22. The airplane continued to fly beneath radar coverage for about 3 minutes before the flight crew declared the missed approach on the approach control radio frequency.

## **FLIGHT RECORDERS**

The airplane was not equipped with a cockpit voice recorder (CVR) or flight data recorder (FDR) and was not required by Federal regulations to be so equipped.

## **WRECKAGE AND IMPACT INFORMATION**

The airplane wreckage was found on October 25, 2004, and all major components were accounted for at the accident scene. The airplane came to rest on the southeast face of Bull Mountain at an elevation of about 2,450 feet. The initial impact point was in trees, and the treetops were cut off at an angle that was parallel to the horizon. The distance from the first tree strikes to the initial ground scar was about 105 feet. The tree strikes and the ground scar were both at an elevation of about 2,400 feet. The distance from the

initial ground scar to the main wreckage was about 95 feet. Several pieces of angularly cut wood were found along the debris path beneath the trees.

The main wreckage was found in an upright position. The cockpit and cabin were destroyed by impact forces and postcrash fire. The empennage and tail sections were still attached to the fuselage but were twisted and in an inverted position. The vertical fin and rudder were damaged by impact forces and postcrash fire. The left horizontal stabilizer was mostly intact with the elevator attached. The right horizontal stabilizer was damaged by impact forces, with the inboard section of the elevator still attached and pieces of the outboard section of the elevator scattered along the wreckage path.

Both wings were still attached to the fuselage at points just outside of the engine nacelle on each wing. The wings' outboard sections and their associated parts were scattered along the wreckage path. The inboard sections were essentially intact but were damaged by impact forces and postcrash fire. The left and right wing flaps were retracted, and the left and right main landing gear were retracted and in their respective wheel wells.

The left engine was in its nacelle and was still attached to the wing by cables and wires. The engine was damaged by impact forces and postcrash fire. The left propeller assembly had separated from the engine and was found beneath the fuselage and entangled with the wreckage. Each blade showed similar twisting and bending, leading edge gouging, and chordwise scratching. Two blades were bent over almost 180° at midspan. Another blade was fractured, and the outboard one-third had separated. Another blade had a blade tip that was wrinkled and torn. The propeller shaft was fractured with fracture surfaces that were consistent with impact forces and overload.

The right engine had separated from its wing and was found uphill from the main wreckage. The engine was damaged by impact forces and postcrash fire. The propeller shaft was fractured and had fracture surfaces that were consistent with impact forces and overload. The right propeller assembly was located adjacent to the initial impact crater in an upright position and with all four propeller blades attached. Three of the four blades displayed similar twisting, bending, leading edge gouging, and chordwise scratching. Two of these blades had blade tips that were fractured. One blade was bent aft.

Control cable continuity was established from the cockpit to the flight control surfaces, except for the ailerons. Aileron cable continuity was established from the cockpit to the point of left and right wing separation outside of the engine nacelles. The breaks in the aileron cables displayed evidence of overload.

## **MEDICAL AND PATHOLOGICAL INFORMATION**

The Office of the Chief Medical Examiner, Roanoke, Virginia, performed autopsies on the flight crew and passengers. The Chief Medical Examiner determined that the cause of death for the airplane occupants was blunt force trauma.

The FAA's Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma, performed toxicological testing on the captain and the first officer. According to the toxicological testing report for the captain, metoprolol (a prescription blood pressure medication that is also used to reduce the risk of a heart attack) was detected in his blood and liver. The captain had indicated his use of Toprol<sup>TM</sup> (metoprolol) on his most recent application for an FAA airman medical certificate.

According to the toxicological testing report for the first officer, diphenhydramine (a sedating, over-the-counter antihistamine that is often known as Benadryl<sup>TM</sup> and is typically used for allergy symptoms) was detected in her liver and kidney.

## **TESTS AND RESEARCH**

### **Propellers**

On December 1, 2004, the propellers were examined at an aircraft recovery facility in Clayton, Delaware. The propellers' hub and blades were made of aluminum, and the propellers rotated in a clockwise direction (when viewed from the back). Neither propeller was feathered, which was consistent with normal operation. All of the damage (significant twisting, bending, leading edge gouging, and tearing of the blades) was consistent with impact forces, and no evidence indicated a mechanical anomaly.

### **Engines**

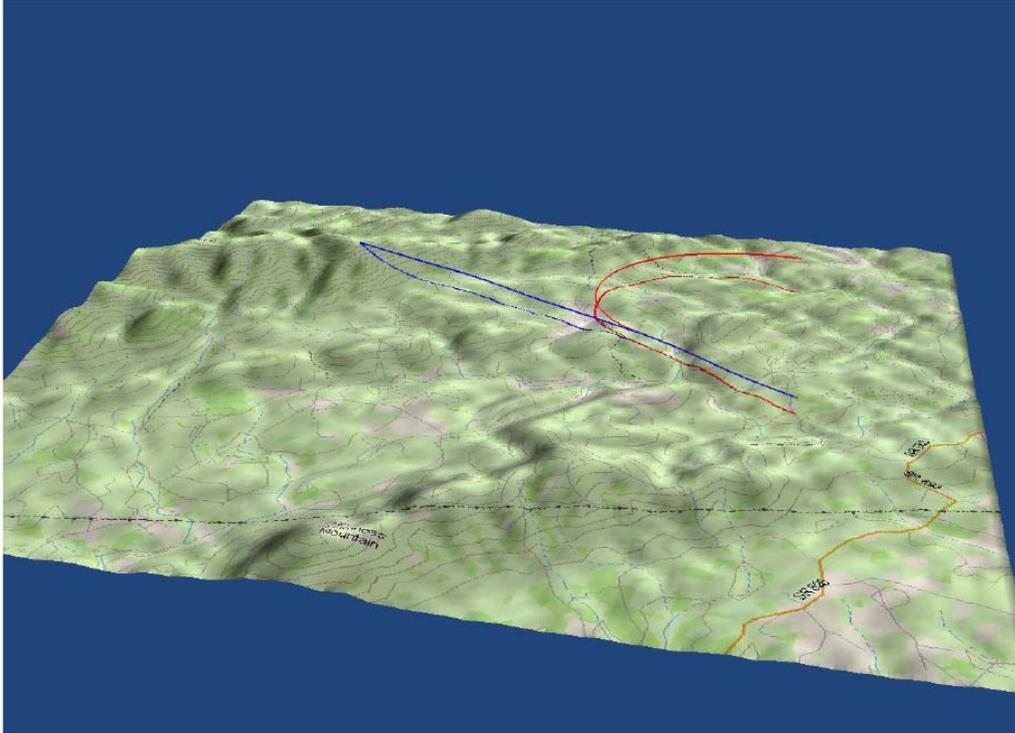
From January 26 to 28, 2005, the engines were examined at the Pratt & Whitney factory in Montreal, Canada, under the supervision of the Transportation Safety Board of Canada. No anomalies or mechanical deficiencies were found.

### **Aircraft Performance Study**

An aircraft performance study was conducted by a Safety Board aircraft performance specialist. The study used data from three separate radar facilities to depict the flightpath of the accident airplane from the en route phase of flight to the BALES LOM, throughout the approach, and beyond the airport to the crash site.

The published missed approach procedure called for a climbing right turn at the MAP, which is over the runway threshold. Radar data indicated that the flight crew initiated the missed approach 7.5 nm beyond the MAP. The airplane then entered a straight-ahead climb on the runway heading.

The aircraft performance study also presented the flightpath that the airplane would have flown if it had entered a climbing right turn at the point where the climb was initiated. Interpolation of nominal climb rates and a standard turn rate depicted a flightpath that would have kept the airplane clear of terrain. Figure 4 compares the airplane's flightpath (in blue) with the flightpath that would have resulted if the airplane had entered a standard-rate right turn during the climb (in red).



**Figure 4.** Depiction of the accident flightpath (blue) and the flightpath incorporating a climbing right turn (red) along with terrain elevations.

### **Demonstration Flight**

On January 7, 2005, the Operations Group Chairman participated in a demonstration flight in a Hendrick Motorsports Beech 1900 (N503RH) with two company pilots aboard. One purpose of the flight was to demonstrate the operation and functions of the Bendix/King KLN 90B GPS, the Mid-Continent Instruments MD-41 series GPS annunciation control unit, and other associated instrument displays. Another purpose of the flight was to observe the GPS runway 30 approach and the localizer runway 30 approach to MTV and other airplane navigation and system features that were available in the accident airplane.

If the database were current, the GPS unit would display the expiration date. If the database were expired, the GPS unit would indicate so, and the pilot would have to acknowledge the database's expiration. On powerup, the database displayed a date of September 3, 2003, with the message "non-current database." The database also displayed a message indicating that "all data must be confirmed before use," which was acknowledged by the pilot.

The pilots stated that they always used the "track up" feature versus the "north up" feature on the GPS. The track up feature showed the airplane flying to the top of the GPS screen, which provided better situational awareness than showing the airplane's relation to north at the top of the screen.

With the GPS selected on the GPS annunciation control unit, the horizontal situation indicators (HSI) displayed GPS information, including to/from indications, course needle steering, and distance to waypoint. However, when a localizer or instrument landing system frequency was tuned on the No. 1 NAV (navigation) radio, which is displayed on the captain's (left) side, the autoselect frequency feature automatically replaced the GPS information from the captain's HSI with information pertaining to the NAV mode. (According to the flight crew, the GPS features functioned identically in the accident airplane.)

On the demonstration airplane, the GPS was installed in the front instrument panel. As a result, the flight crew could easily view the GPS screen.<sup>6</sup>

After the demonstration airplane took off from Henderson Oxford Airport, Oxford, North Carolina, the pilots selected the Danville very high frequency omnidirectional range (VOR), BALES LOM, and MTV as waypoints. While the airplane was approaching the Danville VOR, a flashing waypoint light illuminated on the GPS annunciation control unit on the front instrument panel. The light flashed for about 1.5 nm until the airplane passed the Danville VOR. The GPS autosequenced to the next waypoint, which was the BALES LOM, and drew a course line from the Danville VOR to BALES, which was depicted on the GPS screen. A message light then illuminated on the annunciation control unit, and the message on the GPS screen instructed the pilot to set the course deviation indicator (CDI) on the course to the BALES LOM. Once the CDI was set, the message light extinguished.

The GPS autoscale feature automatically chose the smallest map scale that displayed the active waypoint and the waypoint after the active waypoint if one existed. At this point of the flight, the BALES LOM and MTV were depicted on the GPS screen.

When the airplane was about 1.5 nm from the BALES LOM, the flashing waypoint light illuminated on the GPS annunciator panel, and the waypoint identifier (BALES) flashed on the GPS screen. When the airplane was over the BALES LOM, the automatic direction finder (ADF), which was tuned to BALES, indicated a needle swing on both the captain's and the first officer's radio magnetic indicators. The needle swing confirmed that the airplane was passing directly over the BALES LOM. After the airplane crossed the BALES LOM, the flashing waypoint light went out. The GPS autosequenced to the MTV waypoint, and the HSI showed that the distance to the waypoint was 5.2 nm.

The message light on the annunciation control unit illuminated, and the message reminded the pilot to set the CDI on a course of 305° (the inbound course for the localizer runway 30 approach). The pilot set the CDI on a course of 305°.

After the airplane crossed the BALES LOM, the pilot initiated a right turn and continued that turn to the inbound course. Once the airplane was established on the

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<sup>6</sup> On the accident airplane, the GPS was installed between the cockpit seats below the level of the seat cushion. As a result, pilots in both seats were required to turn their heads 90° toward the center of the airplane and then downward to view the screen.

inbound course, the captain's HSI showed a 5.1 nm distance readout to the MTV waypoint, and the first officer's HSI showed a 5.6 DME distance readout to the localizer/DME station.

After the airplane had overflowed the airport, the distance readouts increased on the captain's and the first officer's HSIs. After the airplane had passed the departure end of the runway, the distance readouts showed a 0.5 nm difference (which was the same as the difference shown inbound). On the GPS screen, no course line was depicted beyond the airport; only the moving airplane symbol was displayed with a line drawn from the airplane symbol back to the airport. Because no additional waypoints had been entered into the GPS, no further waypoints were available for autosequencing.

During two approaches, when the airplane had overflowed the localizer antenna, some CDI needle movement occurred to the right and back to center. During all of the runway overflights, the NAV flags did not appear on the captain's or the first officer's HSIs when the airplane passed over the localizer antenna. The GPS steering on the captain's side remained steady at all times.

Interviews with pilots at Hendrick Motorsports, including the pilot of the company's identically equipped King Air 200, N502RH, revealed that the Bendix/King KLN 90B GPS was used for backup only and strictly for position awareness. Further, the pilots who had flown the accident airplane and N502RH to MTV on the localizer runway 30 approach had all used the GPS and had set up the BALES LOM and MTV as waypoints.

The KLN 90B GPS Pilot's Guide stated the following: "as you become proficient with using the KLN 90B, don't be tempted to rely on it as the sole means of navigation. A good pilot never relies on just one source of navigation for either VFR [visual flight rules] or IFR flying. Cross check your position using VOR, DME, ADF, or other navigational devices you may have in the cockpit – including your eyes!"

## **ORGANIZATIONAL AND MANAGEMENT INFORMATION**

Hendrick Motorsports, Inc., has operated under different names as the company grew and evolved. On February 1, 1980, the company hired its first pilot, who, at the time of the accident, was still employed by the company as a captain. At the time of the accident, the company employed 18 pilots (including the accident pilots): 15 were designated as captains, and 3 were designated as first officers. Over the years, Hendrick Motorsports bought and sold several airplanes, including the Piper Cheyenne II, Cessna 340, Challenger, Westwind, Falcon 20, Hawker 800, and Learjet 25 and 55. At the time of the accident, the company owned two King Air 200s, two Gulfstream IIs, two Beech 1900s, a Bell 407 helicopter, and three Saab 2000s. These aircraft were based at JQF.

During a postaccident interview, the captain who was hired as Hendrick Motorsports' first pilot stated that, before the accident flight, the company's flight department had never experienced any accidents, incidents, or violations. He also stated

that the company never pressured any pilots to fly in bad weather and that the pilots always made the final decision regarding whether to fly in such conditions. The captain further stated that the flight department's maintenance costs were never questioned and that the department's budget was not limited because senior company management "wanted it done right."

### **Postaccident Actions**

After the accident, Hendrick Motorsports made immediate, short-term, and long-term changes to the company's organization, practices, and equipment. Some of these changes had already been planned or were in progress at the time of the accident and were further enhanced as a result of the company's participation in the investigation.

Hendrick Motorsports installed an EGPWS on each aircraft. The EGPWS provides pilots with a pictorial view of terrain (displayed on the radar screen, the multifunction display, or the GPS screen) in addition to aural warnings (as provided by the EGPWS). The company also installed a traffic alert collision avoidance system in each aircraft. Further, the company installed new Garmin GPS 400 units (with EGPWS) in Beech 1900 airplanes. In addition, the company moved the terrain depiction on the Gulfstream II from the global navigation system screen, which is mounted on the center console, to the radar screen on the front instrument panel, which is directly in the pilot's view.

Hendrick Motorsports created three new positions: aviation director, safety program manager, and full-time dispatcher. (The company previously had a part-time dispatcher.) The company's chief pilot was selected as aviation director and was responsible for the oversight of the entire aviation department. (The most senior company pilot was then promoted to chief pilot.) The responsibilities of safety program manager were added to the duties of a newly hired pilot who had a background in safety for a major airline.

Along with the staffing changes, Hendrick Motorsports established a safety committee that comprised staff members from the company's operations, flight, and maintenance departments and hired an independent safety consulting firm to review the flight department's operations. Also, Hendrick Motorsports consolidated the company's standard operating procedures for all aircraft in its fleet and issued addendums to the procedures for each aircraft model. In addition, Hendrick Motorsports revised the company's training plan to include two training sessions per year for each pilot. One session consisted of recurrent training, with 1 week of academic and flight simulator training. The other session consisted of 1 day of academic training for special circumstances (for example, cold weather considerations and mountain flying) and 1 day of emergency procedures training in a flight simulator.

### **ADDITIONAL INFORMATION**

The FAA's Aeronautical Information Manual (AIM) chapter 5, "Air Traffic Control Procedures," section 5, "Pilot/Controller Roles and Responsibilities,"

paragraph 5-5-7, “Safety Alert,” states that pilots should initiate appropriate action if they receive a safety alert<sup>7</sup> from ATC and that they should “be aware that this service is not always available, and that many factors affect the ability of the controller to be aware of a situation in which unsafe proximity to terrain, obstructions, or proximity to other aircraft may be developing.”

AIM chapter 5, section 4, “Arrival Procedures,” paragraph 5-4-20, “Missed Approach,” states, in part, the following standard guidance for pilots:

- a. When a landing cannot be accomplished, advise ATC and, upon reaching the missed approach point defined on the approach procedure chart, the pilot must comply with the missed approach instructions for the procedure being used or with an alternate procedure specified by ATC.
- b. Protected obstacle clearance areas for missed approach are predicated on the assumption that the missed approach is initiated at...the missed approach point and not lower than the minimum descent altitude.
- f. Pilots must ensure that they have climbed to a safe altitude prior to proceeding off the published missed approach, especially in non-radar environments.

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<sup>7</sup> According to the AIM, controllers are to issue a safety alert if they become aware that an aircraft under their control is at an altitude that, in their judgment, places the aircraft in unsafe proximity to terrain, obstructions, or other aircraft.

## ANALYSIS

The corporate Beech King Air 200 approached the nontowered destination airport on an IFR flight plan in IMC. The flight crew was instructed to hold at the BALES LOM on the localizer course at an altitude of 4,000 feet and was then cleared for the approach during the initial right turn over the LOM. The airplane continued the turn until it was established on the localizer course inside the LOM at an altitude of about 3,900 feet. The airplane would have been expected to initially cross the BALES LOM at 4,000 feet; turn outbound on an extended leg; then, after being cleared for the approach, turn to the inbound course with sufficient distance from the BALES LOM to descend to an altitude of 2,600 feet before crossing the BALES LOM. Once the airplane was established on the localizer course, ATC issued a radio frequency change to the CTAF, and ATC radar services were automatically terminated. Two nm after crossing the BALES LOM, the airplane descended from 4,000 to 2,600 feet near the MAP. During this flight segment, the airplane would have been expected to descend from 2,600 feet at the BALES LOM to 1,340 feet at the MAP. However, an examination of the radar data showed that the airplane flew an approach that was displaced by about 5 nm compared with the published approach.

The published missed approach procedure instructed pilots, at the MAP, to make a climbing right turn directly to the BALES LOM and hold at 2,600 feet. Radar data showed that the accident airplane did not make a climbing right turn, as required in the published missed approach procedure. Instead, after passing the MAP, the airplane continued to descend from 2,600 feet on a course of 305° and leveled off at 1,400 feet, which was again consistent with a 5-nm displacement. About 8 nm beyond the airport, the airplane initiated a straight-ahead climb and climbed about 700 feet over the next 2 nm before the flight crew declared a missed approach on the approach control frequency. ATC acknowledged the call, and, about 3 seconds later, the airplane's radar target was lost near the location of the crash site. The accident occurred in mountainous terrain at an elevation of about 2,400 feet. Examination of the airplane revealed no mechanical anomalies. The airplane was not equipped with an EGPWS.

When the airplane was 2.5 nm northwest of the airport and at an altitude of 1,800 feet, the controller's computer system generated an MSAW alert, which lasted 15 seconds. The controller stated that he did not observe or hear the MSAW alert. However, the MSAW alert was not a factor in this accident because, at the time of the alert, radar services had already been terminated, and the airplane was not under the control of ATC. In addition, the airplane continued to fly for about another 7 miles before the accident occurred. During this time, no further MSAW alerts were generated because the airplane was flying beneath radar coverage.

Two distinct differences exist between the published approach procedure and the manner in which the accident pilots flew the approach. First, once the accident airplane was established on the inbound course, the descents to 2,600 and 1,400 feet appeared to be keyed to the MAP or MTV rather than to the BALES LOM. Second, the missed approach was initiated 7 to 8 nm past the MAP and was not properly executed.

An airplane performance study presented the flightpath that the airplane would have flown if it had entered a climbing right turn at the point that the straight-ahead climb was initiated. Interpolation of nominal climb rates and standard turn rates depicted a flightpath that was clear of terrain.

The airplane was not equipped with a CVR or an FDR, which prevented the Safety Board from determining the events that occurred in the cockpit during the approach. However, the accident approach profile is consistent with the pilots using the GPS data to navigate to the BALES LOM and then failing to notice that the GPS had autosequenced to MTV after the airplane passed BALES. Once the airplane was inbound, the pilots might have mistakenly believed that the airplane was showing distance data to the BALES LOM when, in fact, the airplane was showing distance data to MTV.

The airplane was equipped with an IFR-capable GPS receiver, but the database was not current, and the GPS was not certified for IFR navigation. GPS course guidance would be displayed on the pilots' HSIs unless a localizer frequency was tuned on the No. 1 NAV radio. Postaccident interviews with company pilots revealed that the GPS was used for backup navigation and position awareness only. Pilots would typically program the LOM and the airport as waypoints, and the GPS would autosequence to the airport as the airplane passed the LOM and provide distance and navigation information to the airport. For approaches that required crossing the LOM twice, first to define the turn to the outbound leg and then to define the final approach fix on the inbound leg, the GPS would autosequence to the airport at the initial LOM crossing.

## **PROBABLE CAUSE**

The National Transportation Safety Board determines that the probable cause of this accident was the flight crew's failure to properly execute the published instrument approach procedure, including the published missed approach procedure, which resulted in controlled flight into terrain. Contributing to the cause of the accident was the flight crew's failure to use all available navigational aids to confirm and monitor the airplane's position during the approach.