National Transportation Safety Board
Aviation Accident Final Report

Location:	Macon, GA	**Accident Number:**	ERA12FA567
Date & Time:	09/18/2012, 1003 EDT	**Registration:**	N428JD
Aircraft:	BEECH 400	**Aircraft Damage:**	Substantial
Defining Event:	Landing area overshoot	**Injuries:**	2 Minor, 1 None
Flight Conducted Under:	Part 91: General Aviation - Executive/Corporate		

Analysis

The pilot was seated in the left seat and was the flying pilot. The pilots reported that prior to departure, there were no known mechanical malfunctions or abnormalities with the airplane, including the brakes, flaps, anti-skid, or thrust reversers. The copilot, who was the pilot monitoring, calculated a Vref speed of 108 knots for the landing weight. Postaccident analysis determined that a more precise Vref based on weight would have been 110 knots. Both pilots reported that they set their airspeed index bugs to 108 knots about 11 miles from the airport.

The pilot reported that the airplane touched down about 1,000 feet from the approach end of the runway. Both crewmembers reported that, although they used maximum thrust reversers, brakes, and ground spoilers, they could feel a "pulsation" in the brake system and that the airplane hydroplaned. The airplane overran the wet runway with standing water and came to rest 283 feet beyond the paved portion of the runway in a treed area off the airport.

Postaccident examination of the airspeed index bugs revealed that the pilot's was set to 115 knots and that the copilot's was set to 105 knots, which correlated with their calculated and reported V1 and V2 departure speeds. It is likely that they did not move the airspeed bugs during the approach to landing. Postaccident testing of the brake system components did not reveal any mechanical malfunctions or abnormalities that would have precluded normal operation.

Based on radar data, the airplane was likely 15 to 19 knots above the reference speed of 110 knots when it crossed the runway threshold. The data further revealed that the approach was flown with about a 4-degree glideslope approach angle instead of the recommended 3-degree glideslope angle. The pilots reported that the precision approach path indicator lights, which would have provided an approximate 3-degree approach, became inoperable shortly after activation. Although the touchdown location could not be accurately determined, given the approximate glideslope and the excessive speed, the airplane likely floated before touching down.

It is also likely that the pilots, familiar with landing at their home airport, which is configured

with a grooved runway that mitigates wet runway conditions more effectively, relied on their past wet runway experience and failed to calculate their landing distance using the appropriate performance chart for the contaminated runway. Based on the airplane's performance charts, on a contaminated runway, an airplane with a Vref of 110 knots would need a 4,800-foot runway; at Vref + 10 knots, the airplane would need 6,100 feet to land. The runway was 4,694 feet long. Hence, the lack of a clear understanding of the actual wet runway landing distance necessary to stop and the excessive approach speed resulted in the airplane crossing the approach end of the runway at a speed and flight profile unsuitable for the wet runway condition and without sufficient distance available to stop. Further, the pilots exhibited poor crew resource management by not using the appropriate chart for the contaminated runway, not recognizing the runway was too short based on the conditions, failing to reset their airspeed bugs before the approach, and not recognizing and addressing the excess approach speed.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's failure to maintain proper airspeed, which resulted in the airplane touching down too fast on the wet runway with inadequate runway remaining to stop and a subsequent runway overrun. Contributing to the landing overrun were the flight crewmembers' failure to correctly use the appropriate performance chart to calculate the runway required to stop on a contaminated runway and their general lack of proper crew resource management.

Findings

Aircraft	Surface speed/braking - Attain/maintain not possible (Cause)
	Airspeed - Not attained/maintained (Cause)
	Landing distance - Not attained/maintained (Cause)
Personnel issues	Performance calculations - Flight crew (Factor)
	CRM/MRM techniques - Flight crew (Factor)
Environmental issues	Wet surface - Effect on operation (Cause)
Organizational issues	Adequacy of policy/proc - Operator (Factor)

Factual Information

HISTORY OF FLIGHT

On September 18, 2012, about 1003 eastern daylight time (EDT), a Beech 400, N428JD, was substantially damaged when it overran runway 28 during landing at Macon Downtown Airport (MAC), Macon, Georgia. The airplane departed from Charleston Air Force Base/International Airport (CHS), Charleston, South Carolina, about 0930. Visual meteorological conditions prevailed and an instrument flight rules (IFR) flight plan was filed. Both Airline Transport Pilots (ATP) and one passenger sustained minor injuries. The airplane was owned by Dewberry, LLC and operated by The Aviation Department. The corporate flight was conducted under the provisions of Title 14 Code of Federal Regulations (CFR) Part 91.

According to an interview with the pilots, they arrived at DeKalb-Peachtree Airport (PDK), Atlanta, Georgia, which was their home base airport, about 0400, and then drove about 4 1/2 hours to CHS for the 0930 flight. The flight departed on time, the airspeed index bug was set on the co-pilot's airspeed for a decision takeoff speed (V1) of about 102 knots and a single-engine climb speed (V2) on the pilot's side of 115 knots. The flight climbed to 16,000 feet prior to beginning the descent into MAC. When the flight was about 11 miles from the airport the flight crew visually acquired the airport and cancelled their IFR clearance with the Macon Radar Approach controller and proceeded to the airport visually. The second-in-command activated the runway lights utilizing the common traffic advisory frequency for the airport. Both crewmembers reported that about 3 seconds following activation of the lights and the precision approach path indicator (PAPI) lights, the PAPI lights turned off and would not reactivate. During the approach, the calculated reference speed (Vref) was 108 knots and was set on both pilots' airspeed indicator utilizing the index bug that moved around the outside face of the airspeed instrument. The landing was within the first 1,000 feet of the runway and during the landing rollout the airplane began to "hydroplane" since there was visible standing water on the runway and the water was "funneling into the middle." Maximum reverse thrust, braking, and ground spoilers were deployed; however, both pilots reported a "pulsation" in the brake system. The airplane departed the end of the runway into the grass, went down an embankment, across a road, and into trees. They further added that the airplane "hit hard" at the bottom of the embankment. They also reported that there were no mechanical malfunctions with the airplane prior to the landing.

According to an eyewitness statement, a few minutes prior to the airplane landing, the airport experienced a rain shower with a "heavy downpour." The witness reported observing the airplane on approach, heard the engine thrust reverse, and then observed the airplane "engulfed in a large ball of water vapor." However, he did not observe the airplane as it departed the end of the runway. Another witness was located in a hangar on the west side of the airport and heard the airplane, looked outside and then saw the airplane with the reverse thrusters deployed. He watched it depart the end of the runway and travel into the nearby woods.

PERSONNEL INFORMATION

Pilot

According to Federal Aviation Administration (FAA) records and the operator, the pilot, age 43, held an ATP certificate with a rating for multiengine land airplane, a commercial pilot

certificate with a rating for airplane single-engine land, and held a type rating in the make and model of the accident airplane. He held a first class medical certificate, which was issued on August 21, 2012, that contained no waivers and no limitations. The pilot's most recent training in the accident make and model airplane was completed on December 7, 2012. The pilot reported that he had 7,350 total flight hours, of which 6,700 were as pilot in command. He reported having 4,600 total flight hours in the accident aircraft make and model, of which the entire amount was as pilot in command. He accrued 80 hours in the last 90 days of which 76 of those hours were in the accident airplane make and model, and 25 hours in the preceding 30 days.

The pilot reported during a postaccident interview that he was notified of the trip the day prior and that the flight was scheduled to depart CHS at 0930. The evening before he completed some preliminary work by obtaining weather information, notices to airman (NOTAMS) for both airports, and filed a flight plan for the flight. On the morning of the flight he woke up about 0330 and he and the copilot met each other at PDK at 0400 and drove to CHS. The pilot drove approximately 2 hours at which point they stopped, got some coffee, and then switched drivers. After arriving at the airplane, they performed their preflight inspections and about 0905 they received a text message from the passenger that he was about 5 minutes away. After loading up the passenger, his dog, and some golf clubs he had notified the passenger there was some weather in the Macon area over the airport; however, at the time of arrival, the "weather should be good." He was seated in the left front seat for the flight, which departed at 0930.

Co-Pilot

According to FAA records, the co-pilot held an ATP certificate with ratings for airplane single-engine land, multiengine land, and also held a type rating in the make and model of the accident airplane. He held a first class medical certificate, which was issued on November 2, 2011, and it contained no waivers and no limitations. He reported 2,536 total flight hours, of which 1,485 of those hours were as pilot in command. He reported having 425 total flight hours in the accident aircraft make and model and none as pilot in command. He accrued 31 hours in the preceding 90 days, 8 hours in the last 30 days, of which 6 were in the accident airplane make and model, and 1 hour in the preceding 24 hours.

AIRCRAFT INFORMATION

The airplane, a Beech BE-400 model, serial number RJ-13, was a low-wing, twin-engine, tail-mounted jet aircraft certificated in the transport category. According to FAA records, the airplane was issued an airworthiness certificate on June 24, 1986, and was registered to the corporation on April 26, 2004, as N3113B and was changed to N428JD on November 23, 2004. It was equipped with two Pratt and Whitney JT15D-5 engines. According to maintenance records, both main tires were replaced on June 5, 2012 with a recorded Hobbs reading of 2155.7 hours and total cycles of 5747. Both left and right brake assemblies was overhauled and reinstalled on August 11, 2012, with a recorded time of 5387.6 total airframe hours and a Hobbs recording of 2177.6 hours, and at that time the airplane had 5771 total cycles. On June 15, 2011, a recorded "A" airframe inspection was accomplished with a reported total time of 5187 flight hours.

The airplane was equipped with electrically controlled hydraulically actuated fowler flaps that ran approximately the full span of each wing, and had 3 positions; 0, 10, and 30 degrees. Flap position transmitters located on the flap operating system sent a signal to the alternating

current (AC) powered flap position indicator, and also to a flap asymmetry detector to stop flap operation if a 5 to 7 degree discrepancy occurred between the left and right flaps. The flap on each wing consisted of a main and aft flap, which were hydraulically actuated with one actuator per side. The main flap drove the aft flap; the left and right side of the flaps were interconnected by a cable system to ensure symmetric flap extension.

The airplane was equipped with hydraulically actuated retractable tricycle landing gear; each main landing wheel was equipped with full powered multiple segmented brakes operated by toe action of the pilot or co-pilot's rudder pedals. Application of the brake pedals at either seat position delivered pressure to the directly connected master cylinder, which transferred it to a power brake valve through mixing valves. The power brake amplified the master cylinder pressure thereby increasing the pressure to the respective main landing gear brake. An electrically controlled anti-skid system was also incorporated in the power brake system. A stationary wheel speed transducer was mounted inside each main gear axle, and it electrically sensed any change in wheel rotation speed. By design, with the system on, as a skid is detected by the stationary wheel speed transducer, an electrical signal was supplied to the system which releases brake pressure. The system continued to operate as long as the brake pressure was sufficient to result in the skidding condition, but not below approximately 10 knots.

A ground safety system was also installed, which allowed for safe operation of several systems either in flight or on ground, including thrust reverser application for ground use only. Control was accomplished by the left and right squat switches that connected or removed an electrical ground from the coils of ground safety relays, which in turn enabled or disabled their respective systems according to the position of the safety switches.

METEOROLOGICAL INFORMATION

The 0953 recorded weather observation at Middle Georgia Regional Airport (MCN), located approximately 9 miles to the south southwest of the accident location, included wind from 180 degrees at 6 knots, visibility 7 miles due to light rain, broken clouds at 11,000 feet above ground level (agl), temperature 22 degrees C, dew point 21 degrees C and barometric altimeter 29.97 inches of mercury.

AIRPORT INFORMATION

The airport was a publically owned airport and at the time of the accident and it did not have an operating control tower. The airport was equipped with two runways designated as runway 10/28 and 15/33. Runway10/28 was reported as "in good condition" and runway 15/33 was reported as "in fair condition." Runway 10/28 was a 4,694-foot-long by 150-foot-wide non-grooved runway and runway 15/33 was a 2,614-foot-long by 75-foot-wide runway. The airport elevation was 437 feet above mean sea level. The airport was not equipped with an instrument landing system (ILS) approach but was serviced with 5 non-precision approaches.

In 2008, Runway 10/28 was resurfaced; the runway edge markings were painted at 50 feet from the centerline, which allowed an actual runway width of 100 feet with 25 feet on each side paved but not available for use during takeoff or landing. On June 10, 2011, the Georgia Department of Transportation conducted an airport inspection. During the inspection, Runway 28 was noted as meeting the minimum state licensing requirement but failed to meet federal requirements of a 34:1 obstruction-free non-precision approach surface. The obstructions were noted as trees 510 feet from the threshold and 200 feet to the left of the extended runway centerline. There were also trees and brush located about 250 feet from the centerline near the

approach and along the bank.

Runway 28 was equipped with a 4-light PAPI located on the left side of the runway. The PAPI system consisted of four identical light units, installed in a single row. Each unit produced a beam of light split horizontally, with aviation white light in the top sector of the beam and aviation red light in the bottom sector. The PAPI provided the pilot with glidepath information that could be used for day or night approaches. Maintaining the proper glidepath provides the pilot with adequate obstacle clearance and allowed the airplane to touchdown within a specified portion of the runway. At the time of the accident, the pilots reported to the NTSB Investigator in Charge that shortly after activation of the runway lights, the PAPI lights ceased operation. At the request of the NTSB, the Airport Authority investigated the PAPI lights and issued a notice to airman that the PAPI lights were not operational. Subsequent investigation of the lights revealed a blown circuit breaker. Four days following the accident the circuit breaker was repaired and the lights were considered operational.

Home Base Airport

According to the flight crew, they departed and landed regularly at PDK. At the time of the accident PDK had 4 runways, one of the runways was designated 3R/21L and according to the pilot this was the primary runway they utilized. The runway was 6,001 feet-long and 100 feet-wide, was concrete, grooved, and considered in good conditions. The landing distance available (LDA) on runway 21L was 4,801 feet and the LDA on runway 3R was 5,411. According to a postaccident interview with the pilots, the normal stopping distance at PDK when the runways were wet was between 3,000 and 4,000 feet.

FLIGHT RECORDERS

The cockpit voice recorder (CVR) was forwarded to the NTSB Vehicle Recorders Laboratory in Washington, DC for readout. The CVR was a Fairchild GA-100, serial number 01572. The thirty-minute recording consisted of four channels of audio information. Good quality audio information was recorded from both pilots mircrophones. The unit was undamaged and audio content was extracted without difficulty. A CVR group was not convened.

The entire recording was not transcribed and in agreement with the investigator-in-charge, a summary of key events recorded on the CVR was transcribed. The transcription began at 09:37:37 (hh:mm:ss) and the recording contained events from cruise, descent, landing, and the accident sequence.

At 09:39:30, the pilot monitoring (PM) stated that he ran the approach/descent checklist down to engine syncs item.

About three minutes later, air traffic control (ATC) cleared the flight to descend to 11,000 feet followed five minutes later with a clearance to descend to 8,000 feet.

At 09:48:44, ATC informed the crew that rain was over the field and cleared the flight to descend to 4000 feet.

During the next, approximately 8 minutes, the flight was cleared to descend to 3,000 feet and then 2,200 feet.

At 09:59:52, the crew reported the airport in sight and was cleared for the visual approach.

At 10:00:10, an increase in background noise similar to the landing gear being extended was noted.

At 10:00:14, the crew canceled their IFR flight plan.

At 10:00:27, the pilot flying (PF) called for flaps 20.

At 10:00:37, the PM called three green, no red.

At 10:01:11, the PF called for flaps 30

At 10:01:38, the PM reported that winds at "other airport" were "220 at 4 knots."

From 10:01:50 to 10:02:20, there were three distinct recordings of several microphone "clicks."

At 10:02:41, a 500 foot automated call out was recorded.

At 10:03:11, the PM called "ref and 10."

At 10:03:19, a sound similar to touchdown on the runway was recorded.

At 10:03:20, the PF called for speedbrakes and the PM confirmed.

At 10:03:23, the PM called "hydroplaning."

At 10:03:26, a sound of increasing engine thrust similar to thrust reverser operation was recorded.

At 10:03:42, a sound similar to the airplane exiting the runway was recorded.

At 10:03:57, a power interruption was recorded.

One second after the power was restored the aircraft movement stopped and 14 seconds after the power restoration the sounds similar to an engine being shutdown was recorded.

The CVR stopped recording about 4:47 minutes after the power restoration.

For additional information on the CVR and its audio recording, refer to the "Cockpit Voice Recorder Specialist's Summary Report," located in the public docket for this accident investigation.

An examination of the Garmin GPS 500 reported that the battery was too depleted to record and save data.

The pilot had a Garmin 496 GPS, which was downloaded at the NTSB Vehicle Recorder Laboratory. The unit included a built-in Jeppesen database and was capable of receiving XM Satellite radio information. The unit was examined, power was applied, and the recorded point, route and tracklog data was successfully downloaded. The last recorded data point was about 5 minutes prior to the accident; at that point, the airplane was at a recorded altitude of 2,946 feet and approximately 16 nautical miles to the east of MAC. The XM radio subscription was current when the unit was tested and downloaded; however, no historical information was recorded.

WRECKAGE AND IMPACT INFORMATION

The airplane came to rest upright on a heading of 292 degrees, at the base of a tree that was approximately 7 inches in diameter, 283 feet from the paved portion of the runway. The wreckage was also located at 412 feet above mean sea level.

Examination of runway 28 revealed evidence of tire tracks, beginning approximately 1,000 feet from the departure end of the runway. The tire tracks were lighter in color than the surrounding pavement. The tire track associated with the right main landing gear tire was

located 10 feet, 8 inches to the left of centerline and subsequently located to right of centerline, consistent with the inability to maintain directional control associated with hydroplaning. The tire tracks that crossed over white painted runway markings were white in color, consistent with the "steam cleaning" phenomenon associated with various types of hydroplaning. Subsequently, the tracks exited the end of the runway into the grass, continued 76 feet to the crest of an approximate 25 foot embankment, across a two-lane paved highway, which exhibited a gouge across the entire width of the road, through some brush, and came to rest in a wooded area. In total, the airplane traveled 123 feet, 6 inches past the end of the pavement, prior to coming to rest. The tire tracks were measured at 9 feet 5 inches from the center of the left tire track to the center of the right tire track. From the center of the right tire track to the center of the middle tire track was 4 feet 9 inches, which correlates to the dimensions of the accident airplane's tire tracks.

Nose Section

The nose of the airplane exhibited impact damage, which resulted in a breach of the avionics compartment. The nose gear was impact damaged and remained attached by an electrical bundle and two hydraulic lines. The nose gear tire pressure was tested and was noted as 110 psi. The nose strut oleo exhibited a slight bend to the right approximately 4 inches from the base of the strut.

Right Wing

The right wing exhibited minimal impact damage. The main flap exhibited deformation in the positive direction on the outboard approximately 2 feet. The flap was extended to the approximate full flap position, which was verified by the flap actuator. The right main landing gear was extended, was locked, and secure in the down position. The right main landing gear oleo strut was extended 3.75 inches. The right main tire pressure was noted at 104.5 psi and had a tread depth of 0.08 inches.

Empennage

The empennage exhibited crush damage on the underside aft of Station 251.09. Both engines remained attached to their respective nacelles, and were free of debris. One N1 fan blade on the No. 2 engine exhibited soft damage; however, all other N1 fan blades exhibited no damage and rotated freely at the compressor. The thrust reversers were in the stowed position. The crush damage exposed the rudder control cables and associated pulleys. The cable was routed properly over the pulleys; however, due to the binding of the cables it could not be actuated. The cables aft of the pulleys were actuated and continuity was confirmed to the rudder. The cargo door was in the open position and the floor to the cargo bay was deformed in the positive direction, which correlated to the crush damage on the underneath side of the empennage. The hydraulic level was visually checked after repositioning the airplane to a level surface and a slight nose down attitude revealed the hydraulic fluid was slightly over half full quantity. The hydraulic shut off valves were in the closed position.

The horizontal stabilizer trim actuator was examined and 27 threads were exposed on the upper portion of the drive and 5 or 6 threads were exposed on the lower portion of the drive, which correlated to a negative 9.88 degree leading edge angle or almost a full nose up trim.

Left Wing

The left wing exhibited minimal impact damage to the leading edge, with slight dents similar in

dimension to the brush and small sapling trees located in the vicinity of the accident site. The flap actuator was measured at 3.55 inches which correlated to a 30 degree or full flap position. The left main landing gear was extended, was locked, and secure in the down position. The main landing gear oleo strut was extended 1.5 inches. The left main landing gear had 109.5 psi in the tires and a tread depth of 0.09 inches.

Fuselage

The fuselage remained intact with breech deformation located at Station 251.09 and buckling continued aft of that breech to the empennage. The right side emergency exit was opened and the door was located on the ground, forward of the right wing. The door pins were operated and serviceable. The main cabin door was found opened, remained attached at the hinge, and operated smoothly. The locking mechanism was operational. The main cabin door was utilized as the point of egress for the occupants.

Cabin

The cabin appeared to be unbreeched and consisted of 9 passenger seats and 2 tray tables. The tray table on the right side, as viewed from the tail looking forward, remained extended and secured to the side of the cabin wall. The forward facing seat on the right side was utilized by the passenger, it remained attached, the seat belt was unbuckled and a water bottle was located in the associated bottle holder. No seats exhibited signs of the deformation and no seat belts exhibited signs of webstreching.

Cockpit

The cockpit remained intact; however, the floor was buckled in the positive and aft direction and the instrument panel was bowed inward toward the cockpit. Both seats remained intact, no deformation was noted, and the four-point, seat belt and shoulder harness, were unbuckled with no evidence of webstreching. Roll control continuity was confirmed from the control yoke to the left and right wing spoiler-speed brakes. It was noted that there was full roll authority to the right with normal travel and the left side had full down authority but only was able to maintain about one-half up authority due to binding. The left throttle lever was free to move in normal operation; however, continuity could not be confirmed to the hydro mechanical unit (HMU). The right throttle lever was jammed and could not be moved due to impact damage. Both airspeed indicators remained intact and the index bug on each instrument remained attached. The airspeed index bug on the pilot side indicated 115 knots and the index bug on the co-pilot side indicated 105 knots.

TEST AND RESEARCH

Systems Group Report

The condition of the braking system was documented on scene. In addition, the power brake valve, wheel speed transducers, antiskid control box, and brakes were removed for further examination. Examination of the removed items did not reveal any abnormalities or malfunctions that would have precluded normal operation. For further information on the examination of the braking system, see the "Systems Group Chairman Report" located in the docket associated with this accident.

Performance Study

Airplane performance information provided by the manufacturer in the Airplane Flight Manual

(AFM) and its supplements were utilized to determine landing distance. The landing distances published in the AFM supplement assumed the airplane was 50 ft. high and at Vref when it crossed the runway threshold. Higher heights above the runway, or speeds faster than Vref, could result in a "long" landing and longer landing distances. A steep approach (flight path above PAPI 3° glide slope) could result in excessive height over the threshold, faster than nominal approach speeds, or both. Radar data indicated that the landing was long and the airplane may have been 15 to 19 knots fast relative to a reference speed of 110 knots. About 1.25 nm from the runway threshold radar data indicated that the airplane was aligned with the runway, and flew an approximate 4° glide slope approach angle. Although radar data indicated that the ground speed was decreasing, the approximate speed while crossing the runway threshold was about 125 knots. However, due to uncertainty in the wind direction and speed, an exact speed could not be ascertained.

According to the performance chart titled "LANDING DISTANCE WET OR COMPACTED SNOW," which was located in the AFM in the section titled "Non-FAA Approved," the correlated approach reference speed for a 13,500 pound airplane would have been 110 knots. That chart revealed that the required landing distance at an approach speed of Vref would have been about 4,800 feet and a landing distance of about 6,100 feet if the approach speed was flown at Vref+10 knots.

ADDITIONAL INFORMATION

Weight and Balance

According to numbers obtained from the airplane, pilots, and the FAA, the landing weight of the airplane was 13,683 pounds and the center of gravity (CG) was located 20.91 inches aft of the datum. At the time of the accident the airplane was considered to be within the CG envelope.

CFR Part 91.103

CFR Part 91.103 stated in part, "Preflight Action Each pilot in command shall, before beginning a flight, become familiar with all available information concerning that flight. This information must include –

For a flight under IFR or a flight not in the vicinity of an airport, weather reports and forecasts, fuel requirements, alternatives available if the planned flight cannot be completed, and any known traffic delays of which the pilot in command has been advised by ATC:

For any flight, runway lengths at airports of intended use, and the following takeoff and landing distance information:

For a civil aircraft for which an approved Airplane or Rotorcraft Flight Manual containing takeoff and landing distance data is required, the takeoff and landing data contained therein"

FAA-H-8083-3A

FAA publication FAA-H-8083-3A, "Airplane Flying Handbook" defined hydroplaning as "A condition that exists when landing on a surface with standing water deeper than the tread depth of the tires. When the brakes are applied, there is a possibility that the brake will lock up and the tire will ride on the surface of the water, much like a water ski. When the tires are hydroplaning directional and braking action are virtually impossible. An effective anti-skid system can minimize the effects of hydroplaning."

In Chapter 8, "Approaches and Landings, " it stated in part, "...The three basic types of hydroplaning are dynamic hydroplaning, reverted rubber hydroplaning, and viscous hydroplaning...Dynamic hydroplaning is a relatively high-speed phenomenon that occurs when there is a film of water on the runway that is at least one-tenth inch deep. As the speed of the airplane and the depth of the water increase, the water layer builds up an increasing resistance to displacement, resulting in the formation of a wedge of water beneath the tire. At some speed, termed the hydroplaning speed (Vp), the water pressure equals the weight of the airplane and the tire is lifted off the runway surface. In this condition, the tires no longer contribute to direction control and braking action is nil. Dynamic hydroplaning is related to tire inflation pressure. Data obtained during hydroplaning test have shown the minimum dynamic hydroplaning speed (Vp) of a tire to be 8.6 times the square root of the tire pressure in pounds per square inch (PSI)...It is important to note that the calculated speed referred to above is for the start of dynamic hydroplaning...Reverted rubber (steam) hydroplaning occurs during heavy braking that results in a prolonged lock-wheel skid. Only a thin film of water on the runway is required to facilitate this type of hydroplaning. The tire skidding generates enough heat to cause the rubber in contact with the runway to revert to its original uncured stated. The reverted rubber acts as seal between the tire and the runway, and delays water exit from the tire footprint area. The water heats and is converted to steam which supports the tire off the runway. Reverted rubber hydroplaning frequently follows an encounter with dynamic hydroplaning...Viscous hydroplaning is due to the viscous properties of water. A thin film of fluid no more than one thousandths of an inch in depth is all that is needed. The tire cannot penetrate the fluid and the tire rolls on top of the film. This can occur at a much lower speed than dynamic hydroplane, but requires a smooth or smooth acting surface such as asphalt of a touchdown area coated with the accumulated rubber of past landings. Such a surface can have the same friction coefficient as wet ice. When confronted with the possibility of hydroplaning, it is best to land on a grooved runway (if available). Touchdown speed should be as slow as possible consistent with safety..."

AFM Section VI Performance

According to the definitions located at the beginning of the section, "landing field length" was defined as "the distance from a point 50 feet above the runway surface to the point at which the airplane can come to a full stop under the existing conditions. Assumes a dry, hard-surfaced runway." During the postaccident interview, with the pilot, co-pilot, and a representative of the operator, the pilot stated there "is not an FAA approved wet runway chart." The representative for the operator stated that "Hawker Beech put out a contaminated runway performance chart but it was never FAA approved... and not one that you can legally use." Review of Federal Regulations revealed that the FAA does not require nor restrict the use of wet and contaminated runway performance data. However, the manufacturer developed and approved the data for international operators who have a regulatory requirement to utilize that data. That data is supplied as manufacturer approved performance data.

Advisory Circular (AC) 91-79, "Runway Overrun Prevention"

According to AC 91-79, its purpose was to "provide ways for pilots and operators of turbine-powered airplanes to identify, understand, and mitigate risks associated with runway overruns during the landing phase of flight. It also provides operators with detailed information that may be used to develop company standard operating procedures (SOP's) to mitigate those risks." Item 6, "Hazards Associated with Runway Overruns" references a study of FAA and

NTSB data associated with runway overruns and indicated that in part "...that the following hazards may increase the risk of a runway overrun:

• nonstabilized approach

• excess airspeed

• landing beyond the intended touchdown point

• failure to assess required landing distance to account for slippery or contaminated runway conditions or any changed conditions existing at the time of landing."

In Appendix 1 of AC 91-79, Item 4, "Landing Performance and Standard Operating Procedures" stated in part "...Landing performance is influenced by a multitude of variable. Airplane weight and configuration, use of deceleration devices, airport elevation, atmospheric temperature, wind, runway length, runway slope, and runway surface condition (i.e. dry, wet, contaminated, improved, unimproved, grass, etc.) are all factors in determining landing performance... landing distances determined during certification tests are aimed at demonstrating the shortest landing distances for a given airplane weight with a test pilot at the controls and are established with full awareness that operational rules for normal operations require the addition of factors to determine minimum operational field length...Therefore, the landing distances determined under § 23.75 and 25.125 are much shorter than the landing distances achieved in normal operations..."

Table 2, "Rule of Thumb" on Landing Distance Calculations of the AC 91-79 indicated in part that "a Non-stabilized approach is unpredictable on determining the landing distance...that for every 10 knots of excessive airspeed add 500 feet of landing distance for a wet runway... to add an additional 2,500 feet per 10 knots of excessive airspeed to account for floating during an extended flare."

Advisory Circular (AC) 120-51E "Crew Resource Management Training"

According to AC 120-51E, "CRM [Crew Resource Management] training focuses on situation awareness, communication skills, teamwork, task allocation, and decision making within a comprehensive framework of standard operating procedures (SOP)." Paragraph 7 "Background" stated in part that "investigations into the causes of air carrier accidents have shown that human error is a contributing factor in 60 to 80 percent of all air carrier accidents and incidents. Many problems encountered by flightcrews had very little to do with the technical aspect of operating in a multi-person cockpit, rather, problems are associated with poor group decision making, ineffective communication, inadequate leadership, and poor task or resource management." Paragraph 16(a) "Crew Monitoring and Cross-Checking" stated in part "Several studies of crew performance, incidents, and accidents have identified inadequate flightcrew monitoring and cross-checking as a problem for aviation safety. Therefore to ensure the highest levels of safety, each flight crewmember must carefully monitor the aircraft's flight path and systems and actively cross-check the actions of other crewmembers. Effective monitoring and cross-checking can be the last line of defense that prevents an accident because detecting an error or unsafe situation may break the chain of events leading to an accident. This monitoring function is always essential, and particularly so during approach and landing...."

Advisory Circular 150/5300-13A "Airport Design," provides guidance and specific standards for airport geometric and design criteria. Some of the specific standards required traverse

grades. However, the 10/28 runway rehabilitation project that was accomplished, was funded with state and local funding, therefore the airport was not required to use the guidance set forth for the runway paving segment.

On February 25, 2013, runway laser scan data was collected by a private company commissioned by the airport authority. Noted from the survey was that the contour for runway 10/28 had no crown section, most of the transverse grades on the 100-foot-wide runway sloped in one direction, and several areas indicated little to no slope. It was further noted in the FAA advisory circular standards that transverse slopes should be adequate to prevent the accumulation of water on the surface. Water will pond in flat areas and in some areas with transverse grades of less than 1.0%.

History of Flight

Landing	Landing area overshoot (Defining event)
Landing-landing roll	Runway excursion Collision with terr/obj (non-CFIT)

Pilot Information

Certificate:	Airline Transport; Commercial	**Age:**	43
Airplane Rating(s):	Multi-engine Land; Single-engine Land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 1 Without Waivers/Limitations	**Last FAA Medical Exam:**	08/21/2012
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	7000 hours (Total, all aircraft), 4000 hours (Total, this make and model)		

Co-Pilot Information

Certificate:	Airline Transport	**Age:**	39
Airplane Rating(s):	Multi-engine Land; Single-engine Land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	None	**Restraint Used:**	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 1 None	**Last FAA Medical Exam:**	11/02/2011
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	2500 hours (Total, all aircraft), 450 hours (Total, this make and model)		

Aircraft and Owner/Operator Information

Aircraft Make:	BEECH	**Registration:**	N428JD
Model/Series:	400	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Transport	**Serial Number:**	RJ-13
Landing Gear Type:	Retractable - Tricycle	**Seats:**	11
Date/Type of Last Inspection:	06/15/2011, Continuous Airworthiness	**Certified Max Gross Wt.:**	15780 lbs
Time Since Last Inspection:	239 Hours	**Engines:**	2 Turbo Fan
Airframe Total Time:	5416 Hours at time of accident	**Engine Manufacturer:**	P&W CANADA
ELT:	C126 installed, not activated	**Engine Model/Series:**	JT15D 5 SER
Registered Owner:	DEWBERRY AIR LLC	**Rated Power:**	2900 lbs
Operator:	DEWBERRY AIR LLC	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	**Condition of Light:**	Day
Observation Facility, Elevation:	MCN, 354 ft msl	**Distance from Accident Site:**	9 Nautical Miles
Observation Time:	0953 EDT	**Direction from Accident Site:**	215°
Lowest Cloud Condition:	Thin Broken / 11000 ft agl	**Visibility**	7 Miles
Lowest Ceiling:	Broken / 11000 ft agl	**Visibility (RVR):**	
Wind Speed/Gusts:	6 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	180°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.78 inches Hg	**Temperature/Dew Point:**	22°C / 21°C
Precipitation and Obscuration:	Light - Showers - No Obscuration; Light - Showers - Rain		
Departure Point:	Charleston, SC (CHS)	**Type of Flight Plan Filed:**	IFR
Destination:	Macon, GA (MAC)	**Type of Clearance:**	IFR
Departure Time:	0930 EDT	**Type of Airspace:**	

Airport Information

Airport:	Macon Downtown Airport (MAC)	**Runway Surface Type:**	Asphalt
Airport Elevation:	437 ft	**Runway Surface Condition:**	Rubber Deposits; Wet
Runway Used:	28	**IFR Approach:**	Visual
Runway Length/Width:	4694 ft / 150 ft	**VFR Approach/Landing:**	Full Stop; Straight-in

Wreckage and Impact Information

Crew Injuries:	2 Minor	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Minor, 1 None	**Latitude, Longitude:**	32.824722, -83.571944

Administrative Information

Investigator In Charge (IIC):	Shawn Etcher	**Report Date:**	06/23/2014
Additional Participating Persons:	Micahel A Pupek; FAA FSDO; Atlanta, GA Kris Wetheral; Beech Aircrfat; Wichita, KS		
Publish Date:	06/23/2014		
Investigation Docket:	http://dms.ntsb.gov/pubdms/search/dockList.cfm?mKey=85070		