Aviation Investigation Final Report

Location:	Charleston, West Virginia	**Accident Number:**	DCA17FA109
Date & Time:	May 5, 2017, 06:51 Local	**Registration:**	N334AC
Aircraft:	SHORT BROS. & HARLAND SD3 30	**Aircraft Damage:**	Substantial
Defining Event:	Abnormal runway contact	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 135: Air taxi & commuter - Non-scheduled		

Analysis

The flight crew was conducting a cargo flight in instrument meteorological conditions. Takeoff from the departure airport and the en route portion of the flight were normal, with no reported weather or operational issues.

As the flight neared Charleston Yeager International Airport (CRW) at an altitude of 9,000 ft, the captain and first officer received the most recent automatic terminal information service (ATIS) report for the airport indicating wind from 080º at 11 knots, 10 miles visibility, scattered clouds at 700 ft above ground level (agl), and a broken ceiling at 1,300 ft agl. However, a special weather observation recorded about 7 minutes before the flight crew's initial contact with the CRW approach controller indicated that the wind conditions had changed to 170º at 4 knots and that cloud ceilings had dropped to 500 ft agl. The CRW approach controller did not provide the updated weather information to the flight crew and did not update the ATIS, as required by Federal Aviation Administration Order 7110.65X, paragraph 2-9-2.

The CRW approach controller advised the flight crew to expect the localizer 5 approach, which would have provided a straight-in final approach course aligned with runway 5. The first officer acknowledged the instruction but requested the VOR-A circling instrument approach, presumably because the approach procedure happened to line up with the flight crew's inbound flightpath and flying the localizer 5 approach would result in a slightly longer flight to the airport. However, because the localizer 5 approach was available, the flight crew's decision to fly the VOR-A circling approach was contrary to the operator's standard operating procedures (SOP).

The minimum descent altitude (MDA) for the localizer approach was 373 ft agl, and the MDA for the VOR-A approach was about 773 ft agl. With the special weather observation indicating cloud cover at 500 ft agl, it would be difficult for the pilots to see the airport while at the MDA for the VOR-A approach; yet, the flight crew did not have that information. The approach controller was required to provide the flight crew with the special weather report indicating that the ceiling at the arrival airport

had dropped below the MDA, which could have prompted the pilots to use the localizer approach; however, the pilots would not have been required to because the minimum visibility for the VOR-A approach was within acceptable limits.

The approach controller approved the first officer's request then cleared the flight direct to the first waypoint of the VOR-A approach and to descend to 4,000 ft. Radar data indicated that as the flight progressed along the VOR-A approach course, the airplane descended 120 feet below the prescribed minimum stepdown altitude of 1,720 ft two miles prior to FOGAG waypoint. The airplane remained level at or about 1,600 ft until about 0.5 mile from the displaced threshold of the landing runway. At this point, the airplane entered a 2,500 ft-per-minute, turning descent toward the runway in a steep left bank up to 42º in an apparent attempt to line up with the runway.

Performance analysis indicates that, just before the airplane impacted the runway, the descent rate decreased to about 600 fpm and pitch began to move in a nose-up direction, suggesting that the captain was pulling up as the airplane neared the pavement; however, it was too late to save the approach. Postaccident examination of the airplane did not identify any airplane or engine malfunctions or failures that would have precluded normal operation.

Video and witness information were not conclusive as to whether the captain descended below the MDA before exiting the cloud cover; however, the descent from the MDA was not in accordance with federal regulations, which required, in part, that pilots not leave the MDA until the "aircraft is continuously in a position from which a descent to a landing on the intended runway can be made at a normal descent rate using normal maneuvers." The accident airplane's descent rate was not in accordance with company guidance, which stated that "a constant rate of descent of about 500 ft./min. should be maintained." Rather than continue the VOR-A approach with an excessive descent rate and airplane maneuvering, the captain should have conducted a missed approach and executed the localizer 5 approach procedure.

No evidence was found to indicate why the captain chose to continue the approach; however, the captain's recent performance history, including an unsatisfactory checkride due to poor instrument flying, indicated that his instrument flight skills were marginal. It is possible that the captain felt more confident in his ability to perform an unstable approach to the runway compared to conducting the circling approach to land.

The first officer also could have called for a missed approach but, based on text messages she sent to friends and their interview statements, the first officer was not in the habit of speaking up. The difference in experience between the captain and first officer likely created a barrier to communication due to authority gradient.

ATC data of three VOR-A approaches to CRW flown by the captain over a period of 3 months before the accident and airport security footage of previous landings by the flight crew 1 month before the accident suggest that the captain's early descent below specified altitudes and excessive maneuvering during landing were not isolated to the accident flight. The evidence suggests that the flight crew consistently turned to final later and at a lower altitude than recommended by the operator's SOPs.

The flight crew's performance on the accident flight was consistent with procedural intentional noncompliance, which—as a longstanding concern of the NTSB—was highlighted on the NTSB's 2015

Most Wanted List. The operator stands as the first line of defense against procedural intentional noncompliance by setting a positive safety attitude for personnel to follow and establishing organizational protections. However, the operator had no formal safety and oversight program to assess compliance with SOPs or monitor pilots, such as the captain, with previous performance issues.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: the flight crew's improper decision to conduct a circling approach contrary to the operator's standard operating procedures (SOP) and the captain's excessive descent rate and maneuvering during the approach, which led to inadvertent, uncontrolled contact with the ground. Contributing to the accident was the operator's lack of a formal safety and oversight program to assess hazards and compliance with SOPs and to monitor pilots with previous performance issues.

Findings

Aircraft	Descent rate - Not attained/maintained
Personnel issues	Decision making/judgment - Flight crew
Personnel issues	Aircraft control - Pilot
Organizational issues	Oversight of personnel - Operator
Organizational issues	Availability of safety program - Operator

Factual Information

History of Flight

Landing-flare/touchdown	Loss of control in flight
Landing-flare/touchdown	Abnormal runway contact (Defining event)

HISTORY OF FLIGHT

On May 5, 2017, about 0651 eastern daylight time (EDT), Air Cargo Carriers (ACC) flight 1260, a Shorts SD3-30, N334AC, crashed during an attempt to land on runway 5 at Charleston Yeager International Airport (CRW), Charleston, West Virginia. The captain and first officer died, and the airplane was destroyed. The flight was operating under the provisions of 14 *Code of Federal Regulations* (*CFR*) Part 135 as a scheduled cargo flight from Louisville International Airport (SDF), Louisville, Kentucky. Instrument meteorological conditions prevailed at the time of the accident.

The accident flight departed SDF about 0541 on an instrument flight rules (IFR) flight plan and climbed to the assigned en route altitude of 9,000 ft. No irregularities or operational issues were reported during the takeoff and en route portion of the flight. The flight crew had received automatic terminal information service (ATIS) information "November," which broadcast the 0554 weather observation for CRW, indicating a wind from 080° at 11 knots, 10 miles visibility, scattered clouds at 700 ft above ground level (agl), and a broken ceiling at 1,300 ft agl. A special weather observation was issued about 0630 indicating, among other information, an overcast layer at 500 ft and a remark of valley fog; however, the ATIS wasn't updated to include the new weather observation, and the CRW approach controller did not provide the 0630 special weather observation to the flight crew after the first officer made initial contact about 0637 (see Meteorological Information for more information about the weather observations).

About 0637, the first officer contacted the CRW approach controller who provided the altimeter setting and told the flight crew to expect the localizer approach to runway 5 (which has a minimum descent altitude [MDA] of 1,320 ft mean sea level [msl] or about 373 ft above airport elevation with a minimum visibility of 5,500 ft runway visual range). The first officer acknowledged the instruction and requested the VOR-A circling instrument approach (which has an MDA of 1,600 ft msl and minimum visibility of 1 mile). The approach controller approved the first officer's request. The approach controller then cleared the flight direct to the first waypoint (HVQ) of CRW's very-high frequency omnidirectional radio range/distance measuring equipment (VOR/DME) navigation aid and to descend to 4,000 ft. At this time, the airplane was at 9,000 ft about 38 miles west of CRW and approximately aligned with the VOR-A approach course.

About 0642, the approach controller advised the flight crew that the airplane was 12 miles from HVQ and issued an instruction to cross the VOR at or above 3,000 ft (the minimum crossing altitude), then stated "cleared VOR-A approach runway 5." The first officer acknowledged this instruction. About

0646, the approach controller instructed the flight crew to contact the CRW tower controller, which the first officer acknowledged.

About 0646, the first officer contacted the CRW tower, initially stating that the flight was on a visual approach then corrected herself to indicate the VOR-A approach. The CRW tower controller acknowledged this transmission and provided wind information based on his direct readout display, indicating wind from 200º and speed of 5 knots, then cleared the flight to land on runway 5. At 0646:55, the airplane crossed HVQ at an altitude of 2,900 feet msl and continued to descend.

At 0647:29, when the airplane was at 2,200 ft and about 11 miles from the runway, the CRW tower controller issued a low-altitude alert to the flight crew in response to an automated visual and aural alarm in the tower. The first officer responded that the airplane's altitude was showing 2,200 ft and that they were "getting down" to 1,600 ft, which was consistent with radar information (aircraft equipped with DME, such as the accident airplane, can descend to an MDA of 1,600 ft msl after crossing the second waypoint of the VOR-A approach, FOGAG; the airplane had not yet reached FOGAG at this time). The CRW tower controller responded that the alarm may have been falsely triggered by the airplane's descent rate, which the National Transportation Safety Board's (NTSB) radar performance study suggests was between 1,300 and 2,000 fpm. No further communications occurred between ATC and the accident flight crew.

At 0648:25, radar data indicated the airplane reached an altitude of 1,600 feet msl and leveled off about 2 miles before FOGAG. At 0650:18, radar data indicated the airplane began a descent from 1,600 ft at a calibrated airspeed of 124 knots about 0.5 mile west of the runway 5 displaced threshold. The NTSB's radar performance study of the accident flight calculated the airplane's descent rate about 2,500 ft per minute during the final approach to the runway. Nearby security cameras captured the airplane's final approach and descent to runway 5 as it emerged from the cloud bases about 1,600 ft msl. A ground eyewitness, also a pilot, corroborated that the airplane was "hugging the bases" less than a mile west of the airport.

The video and radar performance studies and witness marks on the runway indicate the airplane crossed over the runway 5 centerline in a steep left bank up to 42º. The descent rate reduced to about 600 fpm just before impact. At 0650:47, the airplane impacted the runway 5 centerline in a 22º left bank and 5º nose-down attitude with indications of increasing pitch, at an airspeed of about 92 knots, and on a north-northeasterly heading.

Video information and witness marks were consistent with the airplane's left wingtip striking the pavement first, followed by the left main landing gear and left propeller. The fuselage impacted the pavement and the left wing separated from the airplane during the impact sequence. The airplane slid off the left side of the runway through the grass safety area and down a hill through trees, coming to rest about 380 feet left of the runway centerline and 85 ft below the runway elevation.

PERSONNEL INFORMATION

Captain

The 47-year-old captain resided in Charleston, West Virginia. His date of hire with ACC was July 1, 2015. Before working for ACC, the captain worked as a "bush" pilot with several cargo and passenger operators in Alaska. Friends of the captain reported that he slept "a lot" but did not appear to have a lack

of energy. He wore a continuous positive airway pressure (CPAP) machine when he slept to treat diagnosed obstructive sleep apnea. According to his girlfriend, he occasionally drank alcohol on weekends and ate well. The captain was overweight and was attempting to lose weight by playing sports several times a week. No history of illicit drug use or alcohol abuse was reported.

The captain was current and qualified under ACC and FAA requirements. He held an airline transport pilot (ATP) certificate issued July 25, 2016. The captain held a current first-class medical certificate with a limitation to have glasses available for near vision. Records indicated he had 4,368.5 hours total flight experience, with 3,970 hours as pilot-in-command (PIC). He had 1,094.1 hours total flight experience in the SD-3-30, with 578.8 hours as PIC. A review of FAA records found no incidents or accidents. A review of the FAA's complete airman file for the captain found several notices of disapproval going back to 1999. Most recently, during the ATP certificate checkride, on July 22, 2016, the captain received a notice of disapproval due to excessive deflection of both the glideslope and localizer for an instrument landing system approach, repeated glideslope and sink rate warnings from the ground proximity warning system, and his subsequent failure to initiate a go-around. He passed the practical reexamination 3 days later.

Historical ATC data (between January and April 2017) of three VOR-A approaches to CRW flown by the captain indicated that the captain descended below the MDA while still in instrument conditions in all three instances. A friend of the first officer mentioned an occasion when the first officer texted that the captain flew at low altitude in hilly terrain while trying to resolve a problem with the landing gear not retracting. Another friend of the first officer reported that she and other ACC personnel had observed that the captain's IFR skills "were not strong." The same friend reported that the first officer indicated during a phone call that the captain had difficulty staying on heading, speed, and course when flying in IMC. She also told him about an occasion when the captain lost situation awareness during a missed approach and almost hit a mountain. The friend indicated that the first officer was hesitant to speak up and believed it was due to her being new and wanting to avoid any hostility while being paired with the captain although she didn't say so.

First Officer

The first officer was 33 years old and resided in Charleston, West Virginia. She began ground school and training with ACC in September 2016, and it was her first professional pilot job. Before working for ACC, the first officer was a flight attendant with Republic Airlines. According to family, the first officer was "pursuing a dream" and had always wanted to be a pilot. Friends and family of the first officer stated she was positive, healthy, and very adaptable. According to pilot-rated friends, she had a difficult time getting used to night flying, but her positive outlook and healthy lifestyle helped her to adapt quickly. No drug or alcohol abuse was reported for the first officer and, according to friends, she rarely drank alcohol. Her sleep patterns were reported as 7 to 8 hours of sleep per night.

A review of FAA records for the first officer found no incidents or accidents. The first officer's records indicated one notice of disapproval in 2015 for her commercial pilot certificate due to lack of satisfactory performance in takeoffs/landings and go-arounds and ground reference maneuvers. She passed the practical examination 9 days later. The first officer held a commercial pilot multi-engine land certificate with instrument rating, with second-in-command (SIC) privileges in the SD-3-30. She held a current first-class medical certificate with no limitations. Records indicated the first officer had 652.4

hours total flight experience, with 214 hours as PIC. Her total flight experience in the SD-3-30—all as SIC—was 333.6 hours.

Flight Crew's 72-Hour History

In keeping with ACC's staffing and crew pairing policies, the accident flight crew were assigned to the company's base at CRW and their pairing was permanent (see the Organizational and Management Information section for more information). They were first paired on December 12, 2016. The flight crew arrived at SDF from Raleigh County Memorial Airport, Beckley, West Virginia about 0130 on May 2. They then departed SDF about 0520 and arrived at CRW about 0622. According to data from the captain's CPAP machine, he used the machine between about 0659 and 1630. Data from the first officer's personal electronic devices (PED) indicated activity about 1755. The flight crew departed CRW for SDF about 2302.

The flight crew arrived at SDF about 0025 on May 3. They departed SDF about 0450 and arrived at CRW about 0549. The captain's CPAP machine showed use from 0654 until 1242 and his PED records showed an outgoing text message about 0715. PED records for the first officer indicated activity from 1711 to about 1800.The flight crew departed CRW for SDF about 2302.

The flight crew arrived at SDF about 1206 on May 4. They departed SDF about 0528 on a return flight to CRW, arriving about 0637. The captain's CPAP showed use from 0712 to 1511. He cooked dinner for his girlfriend that night and met her around 1900. He got ready for work around 2100. The first officer's PED records showed an outgoing text message about 1330. She talked to her brother from 1658 to 1838, cooked dinner, then talked to her brother again. The flight crew departed CRW about 2242 and arrived at SDF about 2358.

AIRCRAFT INFORMATION

The accident airplane was a Short Brothers SD3-30 Variant 200, serial number SH-3029 (see figure 1). An all-aluminum, high-wing, twin turboprop airplane, it was built in 1979 as a passenger airplane capable of transporting up to 30 people. ACC purchased and converted the airplane to a cargo configuration in December 1998 through the installation of several supplemental type certificates. Following completion of this work, the FAA issued a standard airworthiness certificate in the transport category on December 17, 1998. According to ACC, the cockpit voice recorder (CVR) was removed from the airplane during the conversion to the cargo configuration.

Figure 1. Photograph of accident airplane (N334AC).

The airplane was equipped with retractable landing gear in a tricycle arrangement and twin vertical stabilizers and rudders mounted at the outboard ends of the horizontal stabilizer. The airplane was powered by two Pratt & Whitney Canada PT6A engines with five-blade Hartzell tractor propellers.

Before the accident flight, the airplane had accrued 28,023.2 hours and 36,738 cycles. Review of service records provided by ACC (spanning 2 years preceding the accident) found no relevant discrepancies or service issues.

The airplane had a maximum takeoff weight of 22,900 lbs and a maximum landing weight of 22,600 lbs. Documentation for the accident flight indicated a takeoff weight of 21,435 lbs, including 3,874 lbs of cargo and 185 gallons of fuel.

METEOROLOGICAL INFORMATION

CRW was equipped with an automated surface observing system (ASOS) located within a mile of the accident site at an elevation of 947 ft; the ASOS was supplemented by an official weather observer. The 0554 weather observation for CRW was wind from 080° at 11 knots, 10 miles visibility, scattered clouds at 700 ft agl, and a broken ceiling at 1,300 ft agl.

The 5-minute ASOS observation data indicated that the cloud ceilings dropped from 1,300 ft agl to 500 ft agl between 0625 and 0630. The ASOS cloud ceilometer observed the cloud ceiling as a broken layer at 500 ft agl at 0628:04, but, based on real-time observation, the official weather observer edited the 0630 special weather observation to indicate an overcast condition at 500 ft agl. The observer also added "few clouds at 100 feet" and "valley fog" to the 0630 special weather observation, which reported wind from 170° at 4 knots and 10 miles visibility.

ASOS observations are automatically sent to the ATC operator interface device but the 0630 observation was not recorded on the ATIS broadcast and was not relayed to the accident flight crew by ATC. The CRW tower controller stated in an interview that he expected the weather to change once again in a short time, and it was a judgment call not to update the ATIS. He was relieved from the position about

0644 and did not brief the relieving tower controller that the ATIS was not current. An observation recorded immediately after the accident, about 0654, reported wind from 230º at 3 knots, 10 miles visibility, few clouds at 100 ft agl, and an overcast ceiling at 500 ft agl.

FAA Order 7110.65, *Air Traffic Control*, states in part, that a new ATIS recording should be made "upon receipt of any new official weather regardless of whether there is or is not a change in values." Paragraph 3-10-1h requires controllers to issue "ceiling and visibility if either is below basic [visual flight rules] minima" if not included in the current ATIS.

AIDS TO NAVIGATION

The VOR-A circling instrument approach was designated a circling approach because its final approach segment is more than 30º different from the alignment of runway 5 (the intermediate and final approach course for the VOR-A approach is on an 84º radial). The accident airplane was equipped with DME that allowed the flight crew to use the FOGAG fix minimums as indicated on the CRW VOR-A approach chart (see figure 2) These minimums indicated an MDA of 1,600 ft and 1-mile visibility after crossing FOGAG, which is 2 DME from the missed approach point (MAP). If visual contact with the runway is not established by the MAP, according to the approach chart, a missed approach should be performed by initiating a climbing left turn to 3,000 ft mean sea level (msl) via a heading of 55º and HVQ radial 069º to CAMMA intersection at 21 DME (see the Additional Information section for information about ACC's missed approach guidance). A postaccident flight check by the FAA found no problems with the navigation system.

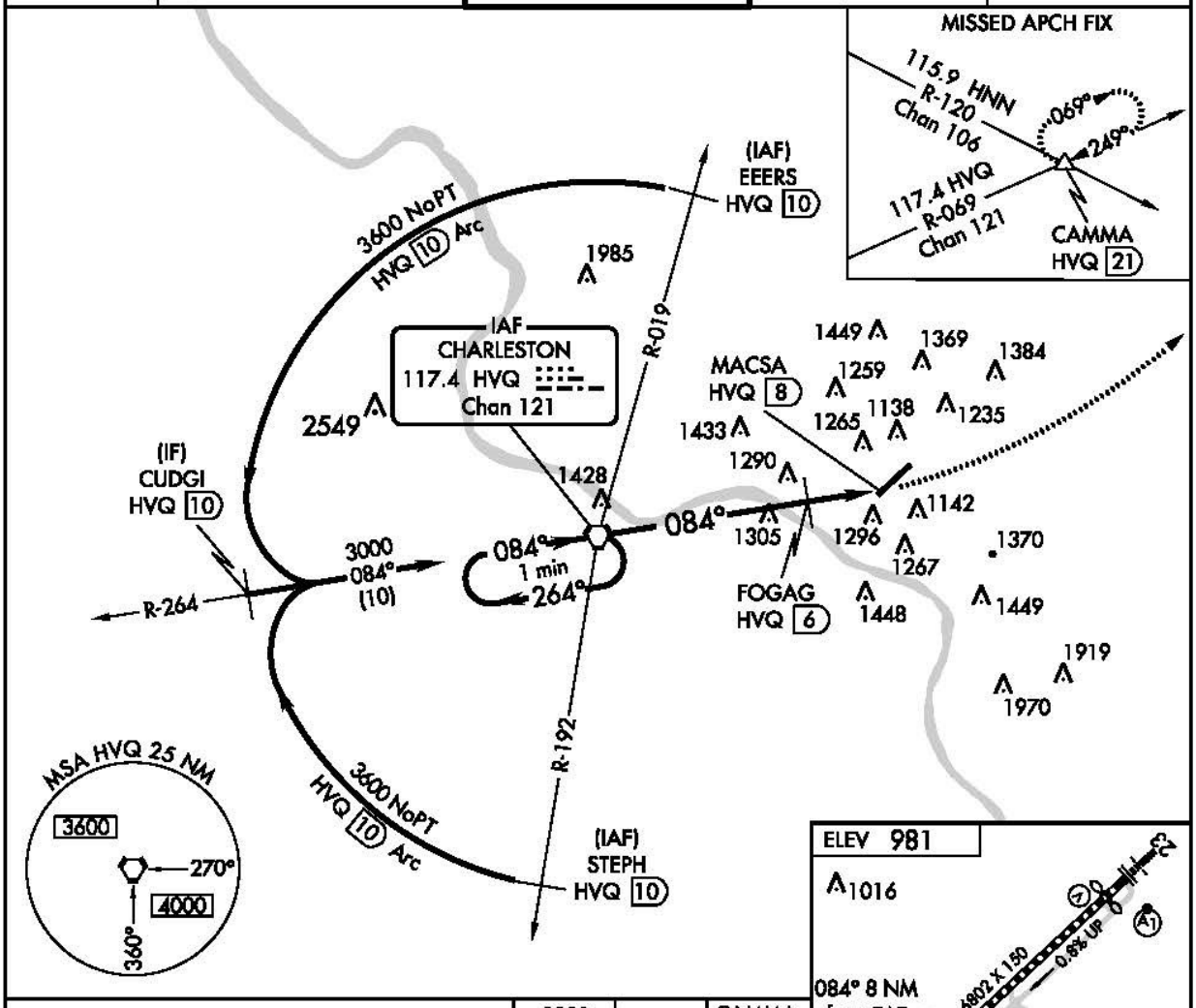
The localizer to runway 5 was in service and available to the flight crew at the time of the accident. The runway 5 visual approach slope indicator and runway end identifier lights had been reported out of service in notices to airmen since July 2015. The runway 5 glideslope was also out of service but was not used on any published approach.

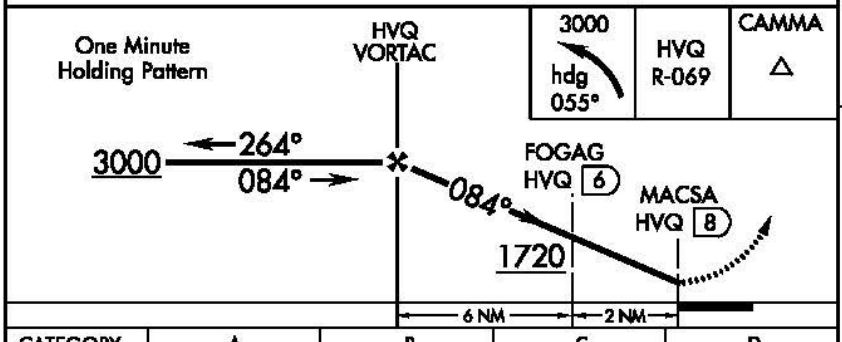
VORTAC HVQ 117.4 Chan 121	APP CRS 084°	Rwy Idg N/A TDZE N/A Apt Elev 981

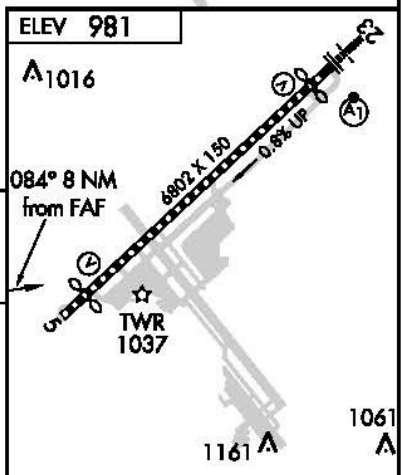
VOR-A
YEAGER (CRW)

MISSED APPROACH: Climbing left turn to 3000 via heading 055° and HVQ R-069 to CAMMA INT/21 DME and hold.

ATIS	CHARLESTON APP CON	CHARLESTON TOWER	GND CON	CLNC DEL
127.6	124.1 269.125	125.7 257.8	121.8 348.6	118.55







CATEGORY	A	B	C	D
CIRCLING	1720-1 739 (800-1)		1720-2 739 (800-2)	1720-2¼ 739 (800-2¼)
FOGAG FIX MINIMUMS				
CIRCLING	1600-1 619 (700-1)		1600-1¾ 619 (700-1¾)	1620-2 639 (700-2)

HIRL Rwy 5-23
REIL Rwys 5

FAF to MAP 8 NM

Knots	60	90	120	150	180
Min:Sec	8:00	5:20	4:00	3:12	2:40

NE-4, 27 APR 2017 to 25 MAY 2017

Figure 2. CRW VOR-A approach chart.

AIRPORT INFORMATION

CRW is located about 3 miles east of Charleston, West Virginia, at an elevation of 946 ft msl. The airport has an FAA ATC tower and is surrounded by Class C airspace. The runway, 5/23, is 6,802 feet long and 150 feet wide with an asphalt surface and a 578-ft displaced threshold on the approach end of runway 5.

FLIGHT RECORDERS

The airplane was not equipped with a CVR or flight data recorder nor was it required to be. None of the numerous PEDs recovered from the airplane contained relevant flight, voice, or video data from the accident flight.

WRECKAGE AND IMPACT INFORMATION

The first ground scar where the airplane's left wingtip impacted runway 5 at the centerline originated about 330 feet from the displaced threshold directly on the centerline seam and was oriented on a heading of about 16°. Gouges and ground scars were found farther along the centerline and transitioned to the left side of the runway on a north-northeasterly orientation of 15° to 30°. The ground scar trail widened as it continued to the edge of the runway, through the runway safety area, and to the edge of a steep drop off that was located about 178 ft from the left edge of runway 5.

The left wing and attached engine, left wing strut, left main landing gear, and the left landing gear fairing separated from the airplane and were found in the runway safety area on the left side of runway 5. The remainder of the airplane (see figure 3) was located about 380 ft to the left of the centerline in steep, heavily wooded terrain, about 85 ft below the runway surface.

Figure 3. Photograph of the main wreckage.

The fuselage was resting on its left side with significant crushing damage and deformation observed forward of the location of the main landing gear. There was no evidence of fire. The cockpit area was crushed and damaged on the left side.

The right wing was fractured at the wing root and deformed forward and leading edge down. The right wing was intact, partially attached to the fuselage, and mostly undamaged. The right engine remained attached to the right wing. The right vertical stabilizer and rudder, right horizontal stabilizer and elevator, and center elevator remained attached to the empennage.

Flight control continuity was confirmed either visually or by moving control rods and observing distant movement of a control rod or surface. In many cases, the movement was severely limited by binding and damage. Both wings had fractured flight control components at the wing root area and wing hinge locations. All examined control system fractures were consistent with overload separation.

The flight deck was damaged and distorted. Both power levers were found at the "Flight Idle" position and both fuel levers were found at the "Ground" position. The left propeller lever was found in an aft position, and the right propeller lever was full forward. The flaps handle was in the 35° detent. Both control columns were broken at the base and had partial movement in the forward/aft and left/right directions. Both control wheels were jammed in a full-right-turn position. Both rudder pedal assemblies were deformed, and the left pedals were missing. The control column bases, control wheels, and rudder pedals remained coupled and moved together.

The left engine was deformed and damaged. The reduction gearbox and propeller separated as a unit at the fractured c-flange and was located next to the fuselage. The propeller blades all exhibited leading edge chunking, spanwise curling, and significant abrasion damage to the forward faces. About 1/3 of one blade was fractured and separated. The first-stage impeller blades had damage to the leading edges.

The right engine remained intact but was deformed and damaged. The propeller blades all exhibited aft bending and minor leading-edge damage. A portion of one blade was separated. Debris (such as grass, paint chips, and dirt) was found on the air intake screens of both engines.

MEDICAL AND PATHOLOGICAL INFORMATION

Autopsies of the captain and first officer were performed by the Office of the Chief Medical Examiner, Department of Health and Human Services, Charleston, West Virginia. The cause of death for both crewmembers was multiple blunt force injuries.

FAA Forensic Sciences performed toxicological testing on tissue specimens from both pilots; tests were negative for ethanol and a wide range of drugs, including major drugs of abuse.

TESTS AND RESEARCH

Following airplane recovery, a detailed examination and teardown of the left and right propellers were performed. Evidence suggested the propellers were rotating under power in a low-to-windmilling thrust condition at the time of impact. In addition, a propeller strike analysis (using the distance between the left engine propeller strikes found on the runway and the estimated airspeed at impact derived from the NTSB's video and radar performance studies) suggested that the propeller speed at impact was about

1,400 rpm. According to the operator, this is within a reasonable rpm range for a typical approach with the power levers set to "Flight Idle" and the propeller levers positioned full forward.

The NTSB reviewed airport security footage of 17 of the flight crew's landings at CRW (10 on runway 5 and 7 on runway 23) in the month before the accident to evaluate the crew's airplane maneuvering during approach and landing. Due to camera positioning, a view of the base and final legs of the traffic pattern were viewable only for runway 23. A review of all seven landings on runway 23 (four performed by the captain, three performed by the first officer, and all via visual approach) found final approach segments—from turn to final to flare initiation—lasting 12 to 39 seconds compared to 75 seconds for final approaches flown per the operator's standard operating procedures.

ORGANIZATIONAL INFORMATION

At the time of the accident, ACC operated as a scheduled Title 14 *CFR* Part 135 cargo airline and was based in Milwaukee, Wisconsin. The company operated a fleet of 2 Shorts SD3-30 and 16 Shorts SD3-60 airplanes. The company employed 103 employees, including 38 pilots (25 captains, many of whom acted as reserve pilots when needed, and 13 first officers). ACC operated out of 12 crew bases at airports in the United States and Puerto Rico.

Crew Base Assignments and Pairings

ACC's crew assignment policies were base-specific. There was no formal rotation schedule; paired pilots were essentially "partners." Pilots could bid to be assigned to other bases or they could be reassigned based on need. If a pilot called in absent, the chief pilot or designee would fill in for the absent crewmember. When asked about the pros and cons of permanent crew pairings during postaccident interviews, the chief pilot stated, "a con was that people could pick up bad habits."

When the FAA principal operations inspector was asked about ACC's crew pairing model, he stated he was not aware of pilot experience levels or crew pairing issues. He stated that he only examined whether pilots were conducting a safe operation. As a positive aspect of permanent crew pairings, the POI stated that he "considered two pilots flying exclusively together to be beneficial as there was value in familiarity with the other person."

Safety and Oversight Program

ACC's chief pilot stated that the company did not have a formal or documented irregularity or safety reporting program. To issue a report, including any difficulties with colleagues, pilots were expected to call or e-mail the director of training or chief pilot. Safety reports were not formally logged or tracked. There was no method to research or evaluate trends of safety or monitor pilots, such as the captain, with previous performance issues. Operational oversight consisted of annual recurrent training.

ACC did not have an initial operating experience-type of program. The chief pilot stated that he would check in with new-hire pilots after the first week on the job to see how they were doing and answer any questions. This type of follow-up was not conducted with the accident first officer. He assumed that if pilots were having difficulties, that they would reach out. ACC did not solicit feedback regarding how flight crews were working together.

ADDITIONAL INFORMATION

Title 14 *CFR* 91.175(c)(1), "Takeoff and Landing Under IFR," states that pilots must not leave the MDA until the "aircraft is continuously in a position from which a descent to a landing on the intended runway can be made at a normal descent rate using normal maneuvers, and for operations conducted under part 121 or part 135 unless that descent rate will allow touchdown to occur within the touchdown zone of the runway of intended landing."

The FAA Instrument Flying Handbook, FAAH-8083-15B, Chapter 10, describes procedures for circling approaches and includes recommended patterns.

The ACC FOM, dated November 20, 2009, Chapter 5, page 13 stated, in part, the following concerning descent rate:

During the descent, a constant rate of descent of about 500 ft./min. should be maintained. The top of the descent point should be calculated so that (ideally) the descent finishes at the start of the final approach. This saves fuel. The chosen descent speed will depend on local circumstances, i.e. ATC may request a set speed. In many instances, however, the choice of speed lies with the operator.

The ACC FOM, Chapter 6 page 13, addresses stabilized approaches as follows:

During an approach, significant speed and configuration changes can seriously complicate tasks associated with aircraft control. In addition, it can increase the difficulty of properly evaluating an approach as it progresses, and complicate the decision of the proper action to take at the decision point. The approach process is simplified by maintaining a stable speed, descent rate, vertical flight path, and configuration during the final stages of an approach. This is referred to as the stabilized approach concept.

Concerning stabilized approaches, the FOM also states, "At about 1,000 ft start the turn onto final…the landing configuration and proper speed should be set and stabilized by 400 ft agl."

ACC guidance for conducting circling approaches stated the following in part:

A circling approach should be made when an instrument approach procedure does not permit a straight in landing to the active runway. ...

Pilots should follow the circling procedure to position downwind abeam the threshold, not below MDA with the runway in sight…continue downwind but do not lose visual contact with the runway. Turn onto base leg using up to 30 degrees bank until an intercept to a normal final approach and landing can be made, using a normal 2.5 to 3degree glidepath, holding a speed of Vref +10 kts on final.

According to the ACC *Standard Operating Procedures* manual dated November 20, 2009, "if visual contact is not established at [the missed approach point], initiate the missed approach using the normal go-around procedure."

A policy such as ACC's crew pairing policy can lead to a phenomenon known as procedural drift in which crewmembers perform procedures but don't encounter an example of its effectiveness as a safety protection. As a result, they may experience a decreased perception of the procedures importance leading them to disregard the procedure and reallocate their effort towards other goals that they regard as

more important. Such changes can lead to a new set of norms about what is expected and an increasing disparity between written guidance and actual operating practice.

Pilot Information

Certificate:	Airline transport	**Age:**	47
Airplane Rating(s):	Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 1	**Last FAA Medical Exam:**	
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	4368.5 hours (Total, all aircraft), 578.7 hours (Total, this make and model)		

Co-pilot Information

Certificate:	Commercial	**Age:**	
Airplane Rating(s):	Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):		**Restraint Used:**	
Instrument Rating(s):		**Second Pilot Present:**	Yes
Instructor Rating(s):		**Toxicology Performed:**	No
Medical Certification:	Class 1	**Last FAA Medical Exam:**	
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	652.4 hours (Total, all aircraft), 333.6 hours (Total, this make and model)		

Aircraft and Owner/Operator Information

Aircraft Make:	SHORT BROS. & HARLAND	**Registration:**	N334AC
Model/Series:	SD3 30 SHERPA VAR	**Aircraft Category:**	Airplane
Year of Manufacture:	1979	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	SH3029
Landing Gear Type:	Tricycle	**Seats:**	
Date/Type of Last Inspection:		**Certified Max Gross Wt.:**	
Time Since Last Inspection:		**Engines:**	2 Turbo prop
Airframe Total Time:		**Engine Manufacturer:**	P&W
ELT:		**Engine Model/Series:**	PT6A SER
Registered Owner:	ACC INTEGRATED SERVICES INC	**Rated Power:**	0 Horsepower
Operator:	Air Cargo Carriers	**Operating Certificate(s) Held:**	Commuter air carrier (135)

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument (IMC)	**Condition of Light:**	Dawn
Observation Facility, Elevation:	KCRW,947 ft msl	**Distance from Accident Site:**	0 Nautical Miles
Observation Time:	10:30 Local	**Direction from Accident Site:**	0°
Lowest Cloud Condition:	Few / 100 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	Overcast / 500 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	4 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	170°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.39 inches Hg	**Temperature/Dew Point:**	14°C / 13°C
Precipitation and Obscuration:			
Departure Point:	Louisville, KY (KSDF)	**Type of Flight Plan Filed:**	IFR
Destination:	Charleston, WV (KCRW)	**Type of Clearance:**	IFR
Departure Time:	05:00 Local	**Type of Airspace:**	Class C

Airport Information

Airport:	Yeager Airport KCRW	**Runway Surface Type:**	Concrete
Airport Elevation:	947 ft msl	**Runway Surface Condition:**	
Runway Used:	5	**IFR Approach:**	Circling;VOR
Runway Length/Width:	6800 ft / 150 ft	**VFR Approach/Landing:**	

Wreckage and Impact Information

Crew Injuries:	2 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	38.375831,-81.593055

Administrative Information

Investigator In Charge (IIC):	English, William
Additional Participating Persons:	
Original Publish Date:	September 24, 2019
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=95115