Aviation Investigation Final Report

Location:	Weyers Cave, Virginia	**Accident Number:**	ERA11FA101
Date & Time:	December 31, 2010, 14:26 Local	**Registration:**	N2876L
Aircraft:	Cessna 172H	**Aircraft Damage:**	Substantial
Defining Event:	Midair collision	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot and both crewmembers of the helicopter recalled routine radio communication as the helicopter approached the destination airport. They established visual contact with two airplanes that had announced their positions in the traffic pattern; one on the downwind leg and one on short final. The airplanes were also identified by the traffic avoidance system onboard the helicopter. The pilot followed behind and north of the second airplane and continued to the west side of the airport to complete a landing at the helipad. During the descent, about 500 feet above ground level (agl), the pilot "saw about 2 feet of white wing right outside." He "pulled power" and then felt contact with an airplane. The airplane's right wing separated before it departed controlled flight and descended to the ground, fatally injuring both occupants. The helicopter subsequently landed with minor damage and no injuries to the 3 occupants.

Interpolation of radar data revealed that the accident airplane departed from the same airport about 21 minutes prior to the accident and completed a right downwind departure, contrary to the established left traffic pattern. The airplane’s transponder appeared to be off for about 3 minutes after takeoff before transmitting the visual flight rules transponder code (1200) for the remainder of the observed flight; the transponder appeared to be on and functioning at the time of the collision. The airplane proceeded north of the airport before reversing course and returning to approach the airport from the northeast. The last target was observed about 1.2 nautical miles north of the airport on a track leading toward the west side of the landing runway at an altitude of 500 feet agl. About 25 seconds later, the helicopter passed northeast of the airport on a modified left base, about 500 feet above traffic pattern altitude (1,500 feet agl), crossed the final approach course, and turned parallel to and on the west side of the runway. Although only the helicopter was observed by radar at the time of the collision, extrapolation of the accident airplane’s previously observed targets and flight path placed the

airplane at the accident site about the same time the helicopter was observed there. An analysis of the relative positions of the airplane and helicopter based on radar data indicated that the airplane remained below the helicopter pilot's field of view as the helicopter overtook the airplane from behind and descended upon it from above. Although the data indicated that the airplane would likely have been visible to the pilot of the helicopter, it is important to note that the onboard traffic avoidance system (TAS) did not provide the pilot with any alert of its presence because the system operated on line-of-sight principles. If an intruder aircraft's antenna was shielded from the TAS antenna, the ability of the TAS to track the target would be affected. If a TAS equipped aircraft was located directly above an intruder, the airframe of one or both of the aircraft could cause the TAS's interrogations to be shielded, depending on antenna location (either bottom or top-mounted).

All other airplanes in the traffic pattern were acquired visually by the pilot and crew as their positions were confirmed by the helicopter's onboard traffic avoidance system and the position reports provided by the pilots of each airplane. Because of the high-wing structure of the airplane, and its relative position and altitude, the helicopter's image was either blocked from the airplane pilot's view by the left wing, or was above and behind the airplane in the seconds before collision. Further, no radio position reports from the accident airplane were confirmed. The helicopter pilot's unalerted detection of the airplane against a complex background of ground objects would have been difficult because of both the lack of apparent contrast between the airplane and the ground, its size in the windscreen, its relative lack of movement within the pilot's field of view, and the position and angle of the sun. In addition, the helicopter pilot's familiarity with the customary routes used by fixed-wing pilots to fly into and out of the airport also made detection of the airplane less likely, because the airplane was not in a location that normally contained conflicting traffic. Finally, before the helicopter turned and overtook the airplane, the helicopter pilot's visual attention would have likely been directed toward the landing area, which would also have limited opportunities for detection of the airplane. The airplane's departure and arrival were contrary to published Federal Aviation Administration guidance, the airplane owner's guidance, and the airplane pilot's guidance to his own students with regard to pattern entry at the destination airport.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The inherent limitations of the see-and-avoid concept, which made it difficult for the helicopter pilot to see the airplane before the collision. Contributing to the accident was the airplane pilot's non-standard entry to the airport traffic pattern, which, contrary to published Federal Aviation Administration guidance, was conducted 500 feet below the airport's published traffic pattern altitude and in a direction that conflicted with the established flow of traffic.

Findings

Aircraft	Altitude - Incorrect use/operation
Personnel issues	Monitoring other aircraft - Not specified
Personnel issues	Incorrect action performance - Pilot

Factual Information

History of Flight

Maneuvering	Midair collision (Defining event)

HISTORY OF FLIGHT

On December 31, 2010, about 1426 eastern standard time, a Eurocopter EC-135-P2 helicopter, N312PH, operated by PHI Inc., as AirCare 5, and a Cessna 172H, N2876L, collided in midair approximately 1/2 mile northwest of the Shenandoah Valley Regional Airport (SHD), Weyers Cave, Virginia. The airplane departed controlled flight after the right wing separated, and was destroyed by impact forces at ground contact. The helicopter sustained minor damage and landed safely at SHD. The certificated commercial pilot and passenger on board the airplane were fatally injured. The certificated commercial pilot and two medical flight crewmembers on board the helicopter were not injured. Visual meteorological conditions prevailed for the airplane's local personal flight that originated from SHD, at 1402, and for the helicopter's positioning flight that originated from the University of Virginia Medical Center (8VA5), Charlottesville, Virginia, about 1410. A company flight plan was filed for the helicopter positioning flight, and no flight plan was filed for the airplane flight. Both flights were conducted under the provisions of Title 14 Code of Federal Regulations Part 91.

All three crewmembers aboard the helicopter were interviewed at the scene, and their statements were consistent throughout. They described departing 8VA5 after completing a patient drop-off, crossing "the ridgeline" at 4,500 feet, and approaching SHD from the east. They each described monitoring the common traffic advisory frequency (CTAF), and how the announced traffic, two aircraft established in a left-hand traffic pattern for runway 23, were acquired both visually and on the helicopter's Skywatch traffic collision avoidance device (TCAD) system. The two crewmembers in the front seats correlated the landing-pattern traffic's announced positions both visually and on the TCAD. The third, aft-seated crewmember visually acquired the landing traffic based on their announced positions. The accident airplane was operating in the airport traffic area, but not in the established traffic pattern.

One flight nurse rode on the left side of the helicopter, behind the copilot's station, and faced aft. She stated that she was aware of two airplanes in the traffic pattern, one on "short final," the second airplane behind, and that the helicopter would be "the third aircraft to land." According to the flight nurse, "I was in the back under sterile cockpit procedures. Everyone was 'eyes-out' looking for traffic. I felt a bump and a shudder and the pilot said, 'What was that?'" She looked out and saw a white rectangle under the helicopter for "less than a millisecond."

A second flight nurse who rode in the copilot (left) seat gave a similar account, and stated that he had visual contact with the two airplanes that were also displayed on the helicopter's TCAD

device. He added, "We were talking to all of them." The helicopter was in a gradual descent, and the nurse had visual contact with the airplanes on the base and final legs of the traffic pattern when he felt a bump. He reported that he never saw anything outside the helicopter at the time he felt the bump.

The pilot recalled routine radio communication as the helicopter approached SHD, as well as a radio call to request fuel upon landing. He described two airplanes in the traffic pattern: one on the downwind leg, and one on short final. The pilot followed behind and north of the second airplane and continued to the west side of the airport to complete a landing at the west side helipad. During the descent, about 500 feet above ground level, the pilot "saw about 2 feet of white wing right outside." He "pulled power" and then felt the contact.

All three crewmembers stated that the TCAD did not alert them to the accident airplane. They all described the crew coordination efforts to assess the damage to their aircraft, and the completion of a safe landing at the west-side helipad.

Witness interviews and written statements provided were largely consistent throughout. The witnesses were familiar with the airport, and with what they described as the usual traffic pattern of aircraft around the airport. Most of the witnesses described their vantage points as being 90 degrees from the direction of flight for both accident aircraft, and that the aircraft were traveling from roughly north to south. Most described the aircraft in level flight, with some differences as to whether the helicopter was on the airplane's left or right. Both aircraft were described as being "lower than usual," "awfully close," "almost even…next to each other." Consistently, witnesses described the helicopter as it overtook the airplane from behind, "barely touching" the airplane, and then watching as the right wing departed the airplane, and the remainder of the airplane "nose-dived" to ground contact.

In a written statement he provided along with photographs, one witness described the airplane as it approached the airport on the west side of the runway, and the helicopter's descent until the two aircraft collided. He added, "When I saw the airplane on the west side of the runway I found it kind of strange that it was there due to the fact that all the other airplanes were flying a left traffic pattern. I honestly had no idea why it was on this side of the runway. If it was trying to fly a right traffic pattern - it was going the wrong way."

In interviews with a Federal Aviation Administration (FAA) aviation safety inspector, pilots operating in the traffic pattern at SHD around the time of the accident said they recalled hearing various radio calls with regards to departures to the northwest, "maneuvering 6 miles to the northwest," and hearing the accident helicopter announce its position as it approached SHD. One pilot said he recalled hearing an airplane announce entering "upwind for runway 23" at SHD. All of the pilots stated that the traffic pattern at SHD was "unusually busy" around the time of the accident.

A pilot operating in the local flying area at the time of the accident said he had 15 hours of flight instruction from the pilot of the accident airplane, and that he would likely have

recognized the instructor's voice over the radio had he heard it. He added that he distinctly recalled 3 separate position reports from the helicopter as it approached SHD, and standard traffic calls from airplanes in left traffic at SHD. He did not recall hearing a radio call that announced a non-standard entry, but added that the frequency was crowded on the day of the accident.

Radar data identified the accident helicopter by its assigned transponder code. The helicopter's ground track and altitudes were consistent with crewmember descriptions. The other radar targets were all depicted with the visual flight rules (VFR) "1200" transponder code. The number of airplanes that these "VFR targets" represented could not be reconciled.

PERSONNEL INFORMATION

A review of Federal Aviation Administration (FAA) airman records revealed that the pilot in the airplane held a commercial pilot certificate with ratings for airplane single-engine land, airplane multiengine, and instrument airplane. He held a flight instructor certificate with ratings for airplane single-engine, multiengine land, and instrument airplane. His most recent FAA first-class medical certificate was issued June 23, 2010, at which time he reported 2,300 total hours of flight experience.

The passenger on board the airplane held no FAA certificates. However, a pilot logbook bearing his name was recovered and reflected 7 total hours of flight experience logged.

The pilot of the helicopter held an airline transport pilot certificate with a rating for airplane multiengine land, and a commercial pilot certificate with ratings for rotorcraft - helicopter and instrument helicopter. His most recent FAA second-class medical certificate was issued October 5, 2010. The pilot reported 6,803 total hours of flight experience, of which approximately 700 hours were in the same make and model as the accident helicopter.

AIRCRAFT INFORMATION

According to FAA records, the airplane was manufactured in 1967 and registered to an individual in 2009. It was equipped with a Lycoming 145-horsepower, horizontally-opposed four-cylinder reciprocating engine. The airplane's most recent annual inspection was completed November 18, 2010, at which time it had accrued 7,366.3 total aircraft hours. According to the owner, the airplane was based at SHD.

According to FAA records, the helicopter was manufactured in 2005, and was registered to a corporation in December of 2005. It was equipped with two 431-horsepower, Pratt and Whitney Canada 206B2 turbo shaft engines. The most recent approved aircraft inspection program (AAIP) maintenance inspection was completed on December 31, 2010. At the time of the accident, the helicopter had accrued 2,209 total aircraft hours. According to the operator, the helicopter was based at SHD.

METEOROLOGICAL INFORMATION

The 1420 weather observation at SHD included clear skies, winds from 220 degrees at 3 knots, 10 miles visibility, temperature 17 degrees C, dew point 6 degrees C, and an altimeter setting of 30.14 inches of mercury.
According to the United States Naval Observatory, about the time of the accident the sun was at 211 degrees about 22 degrees above the horizon.

AERODROME INFORMATION

SHD was located about 10 miles southeast of Harrisonburg, Virginia at an elevation of 1,201 feet. The airport was not tower-controlled. Runway 5/23 was 6,002 feet long and 150 feet wide, and was located along the east side of the field. The published traffic pattern altitude for piston-powered airplanes was 2,001 feet mean sea level (msl). The traffic pattern was a standard left-hand pattern, as there was no published "RP" or right-pattern designation.

WRECKAGE AND IMPACT INFORMATION

The airplane was examined at the site on December 31, 2010 and January 1, 2011, and all major components were accounted for at the scene. The right wing was separated from the airplane during the collision, and was located approximately 700 feet prior to the main wreckage along an approximate 230-degree path. The main wreckage came to rest inverted, immediately beyond the initial impact crater, and was severely deformed by impact forces.

One propeller blade was buried in the crater. The other propeller blade remained attached to the engine at its hub. The propeller hub was fractured in half, and each blade displayed span wise bending and light chord wise scratching. The engine was separated from the firewall and displayed significant impact damage, and the accessories and carburetor were separated and destroyed by impact.

The instrument panel, cockpit, and cabin areas displayed significant impact damage, and the empennage was crushed forward towards the cabin. The instrument panel, including the transponder and communication radios, revealed no useful information due to impact damage.

The wreckage was moved to an airport building for a detailed examination on January 2, 2011. The wreckage was disassembled and the components were placed on the ground in their approximate original positions. Once placed, several dents and transfer marks consistent with the dimensions and paint of the helicopter landing gear skids were identified. The marks were indicative of a left-rear-to-right-front movement across the top of the airplane's fuselage at an approximate 15-degree angle. Impact transfers at both the rear and forward carry-through spars about 12 inches inboard of the right wing attach bolts were identified. The cabin roof structure, from the aft carry-through spar to the windshield eyebrow, was separated by impact in flight and found near the right wing. The left side of the vertical stabilizer displayed a long, concave, linear scar consistent with the dimension and paint color of the helicopter skid tubes.

Examination of the right wing and the right wing strut revealed damage consistent with a downward separation. Blue paint transfer marks on the underside of the outboard right wing were consistent with the damage and transfer marks on the underside of the left horizontal stabilizer.

The helicopter was examined in the operator's hangar on January 2, 201l, and revealed only minor damage. The "elf shoe" on the forward left skid tube was bent outboard, but remained attached. Both skid tubes and cross tubes displayed significant scratching and paint transfers. The outboard portion of the right skid displayed paint transfers consistent with the left side of the airplane's vertical stabilizer.

MEDICAL AND PATHOLOGICAL INFORMATION

The Office the Chief Medical Examiner for the Commonwealth of Virginia in Roanoke, Virginia, performed autopsies on both pilots. The autopsy reports listed the cause of death as “blunt impact injuries.”

The FAA’s Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma, performed toxicological testing of the pilot and instructor. The testing was negative for the presence of carbon monoxide, cyanide, and ethanol.

ADDITIONAL INFORMATION

Radar Study

A radar study completed by an NTSB air traffic control investigator revealed that, as the helicopter approached SHD from the southeast, there were at least three other radar targets besides the accident airplane operating under VFR in the vicinity of the airport. Two of the targets were located northwest of the helicopter in the left traffic pattern for runway 23, and one was approaching the airport from the southwest about 2,000 feet above pattern altitude.

Interpolation of available radar data revealed that the accident airplane departed from SHD shortly before 1405. The target completed a right downwind departure, contrary to the established left traffic pattern. The airplane’s transponder appeared to be off until about 1408, when the primary radar targets in the track became 1200 transponder code targets. The airplane displayed a 1200 transponder code for the remainder of the observed flight. The accident airplane proceeded north of the airport before reversing course and returning to approach the airport from the northeast. The last target was observed about 1.2 nm north of the airport on a track leading toward the west side of runway 23 at an altitude of 500 feet above ground level (agl). About 25 seconds later, the helicopter passed northeast of the airport on a modified left base, about 500 feet above traffic pattern altitude (1,500 feet agl), crossed the final approach course, and turned parallel to runway 23 on the west side of the runway.

Although only the helicopter was observed by radar at the time of the collision, extrapolation of

the accident airplane's previously observed targets and flight path placed the airplane at the accident site approximately the same time the helicopter was observed there. Therefore, the radar data obtained appeared to account for all the known traffic in the vicinity as well as the proximity of the two accident aircraft at the time of the collision.

Traffic Advisory System

The accident helicopter was fitted with an L-3 Avionics SKYWATCH Traffic Advisory System (TAS). As installed, the system included an L-3 Avionics SKY 497 transmitter/receiver unit and an L-3 Communications NY164 antenna located on the helicopter's belly panel. The traffic information developed by the SKY 497 system was displayed in the cockpit on a Garmin 430 display.

According to the manufacturer, the SKYWATCH TAS monitored the airspace around the aircraft for other transponder-installed aircraft by querying Mode C or Mode S transponder information. This data was then displayed visually to the pilot in the cockpit. The system also provided aural announcements on the flight deck audio system. If an intruder aircraft's transponder did not respond to interrogations, the TAS did not establish a track on that aircraft. The system was not equipped with recording capability.

The SKYWATCH system operated on line-of-sight principles. If an intruder aircraft's antenna was shielded from the SKYWATCH system antenna, the ability of the SKY 497 to track the target would be affected. If a SKY 497-equipped aircraft was located directly above an intruder, the airframe of one or both of the aircraft could cause the SKY 497's interrogations to be shielded, depending on antenna location (either bottom or top-mounted). The SKY 497 also had the capability to coast (predict) an intruder's track to compensate for a momentary shielding.

The manufacturer was provided with the recorded radar data for the two accident aircraft and determined that the SKY 497 would not have generated a traffic alert based on the recorded radar data as the lack of a transponder signal to radar facilities would likewise not be available to the SKY 497. The lack of transponder information from the accident airplane between the second-to-last and last radar target would have made it impossible for the SKY 497 to calculate the path of the airplane and determine the risk of collision.

In addition, at the time of the second-to-last radar plot, when a transponder signal would have been available to the SKY 497, the accident airplane was not close enough to the helicopter to have generated a traffic alert from the SKYWATCH TAS.

Visibility Study

After reviewing radar track data for both aircraft, the NTSB calculated vertical angle and horizontal azimuth to determine the approximate size of the airplane's image in the helicopter windscreen as the two aircraft converged. The airplane was at a constant altitude of 500 feet

agl, and the helicopter was descending at 800 fpm. When both airplanes were within 3 miles of the airport, they were separated laterally by about 4 miles.

As the helicopter approached the airport, the airport would have been located on the left of the helicopter, at an angle of about 30 degrees, increasing to 90 degrees. The airplane would have been straight ahead of the helicopter during this time, but 1000 feet to 1200 feet below, and closing to within one mile laterally. At a distance of four miles, the airplane's image would appear about 0.045 inches in size as viewed through the helicopter windscreen. As the aircraft converged, the airplane would have been more readily visible, but well below the helicopter. At a distance of one mile, the airplane would appear to be about 0.18 inches in size through the helicopter windscreen.
As the aircraft were converging from one mile lateral separation, the helicopter was generally following the airplane, with the vertical separation decreasing from 1000 feet; a position ahead of and approximately 15 degrees below the horizon relative to the helicopter.

Because of the high-wing structure of the airplane, and its relative position and altitude, the helicopter's image was either blocked from the airplane pilot's view by the left wing, or was above and behind the airplane in the seconds prior to collision.

Flight Simulation Video

Using ATC radar track data for the helicopter and the accident airplane, the helicopter manufacturer developed an animation of the accident flight. The animation was from the fixed point of view of a pilot in the right seat of the helicopter, and incorporated major structural elements that would restrict the visual field. When the animation began, the helicopter appeared on the base leg of the traffic pattern headed in a westerly direction, and showed that about this time the airplane's flight path was approximately perpendicular to and lower than the helicopter's flight path. As the helicopter completed its left turn towards the helipad, the airplane appeared stationary in the area above the pilot's Primary Flight Display (PFD). The airplane remained approximately in this lateral position but appeared to move below, and become masked by, the instrument panel as the helicopter paralleled the airplane's flight track and descended. The airplane remained blocked by cockpit structure in the field of view until its wing structure became visible in the left-hand portion shortly before the animation ended.
Traffic Pattern

According to FAR 91.126, when operating on or in the vicinity of an airport in Class G airspace, “(1) Each pilot of an airplane must make all turns of that airplane to the left unless the airport displays approved light signals or visual markings indicating that turns should be made to the right, in which case the pilot must make all turns to the right; and (2) Each pilot of a helicopter or a powered parachute must avoid the flow of fixed-wing aircraft.”

Traffic Pattern Entry

According to a legal opinion published by the FAA, “Section 91.126(b)(1) applies to pilots

approaching to land at an airport without a control tower and is designed to promote predictable aircraft maneuvers, traffic flows and patterns in Class G uncontrolled airspace. The AIM (Aeronautical Information Manual), while not regulatory, consists of recommended procedures to assist pilots in executing their responsibilities as required by the regulations."

The AIM recommended a midfield entry on the downwind leg at a 45-degree angle. In an FAA presentation entitled "Traffic Pattern Entries," it was also recommended that upwind fly-bys of the runway (opposite the downwind leg side) be conducted "side-stepped" and at 500 feet above the traffic pattern altitude.

Upwind Entry at SHD

According to the owner of the accident airplane, he had specifically discussed how upwind entries were to be conducted in his airplane at SHD with the accident airplane pilot, and with the students that each of them taught. In an interview, he stated that in those discussions he directed that entries on the upwind (northwest) side for Runway 23 were to be conducted abeam the midpoint of the runway on a 45-degree angle.

When asked why he thought the pilot would enter the traffic pattern straight into the upwind leg, on the opposite side of the established traffic pattern, well below traffic pattern altitude, he said, "I don't know why they were there... [The pilot] would have entered the field at the mid left upwind leg of the traffic pattern. [He] would have been at a 45 for upwind midfield. We always teach that and drill that. Entering on the beginning of the upwind leg was not characteristic."

The owner repeated that he had "no idea" why the pilot would position the airplane where it was, at low altitude, at the time of the collision. He said, "I wouldn't believe [the pilot] to be that low. It's totally uncharacteristic of [him]. I've racked my brain trying to think why he was there."

A pilot who had received 15 hours of flight instruction from the accident airplane pilot said that during instruction, the 45-degree entry on the downwind for left traffic at SHD was stressed. The accident pilot demonstrated and discussed ways to accomplish the entry, depending on the direction from which the airplane approached SHD. In each case, the airplane entered left traffic for landing.

Pilot Information

Certificate:	Commercial; Flight instructor	**Age:**	32,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	No
Medical Certification:	Class 1 Without waivers/limitations	**Last FAA Medical Exam:**	June 23, 2010
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	2300 hours (Total, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N2876L
Model/Series:	172H	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	17256076
Landing Gear Type:	Tricycle	**Seats:**	4
Date/Type of Last Inspection:	November 18, 2010 Annual	**Certified Max Gross Wt.:**	2300 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	7366 Hrs as of last inspection	**Engine Manufacturer:**	CONT MOTOR
ELT:	Installed, not activated	**Engine Model/Series:**	O-300 SER
Registered Owner:	PRICE MICHAEL W	**Rated Power:**	145 Horsepower
Operator:	PRICE MICHAEL W	**Operating Certificate(s) Held:**	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	SHD,1201 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	14:20 Local	**Direction from Accident Site:**	8°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	3 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	220°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.13 inches Hg	**Temperature/Dew Point:**	17°C / 6°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Weyers Cave, VA (SHD)	**Type of Flight Plan Filed:**	None
Destination:	Weyers Cave, VA (SHD)	**Type of Clearance:**	None
Departure Time:	14:02 Local	**Type of Airspace:**	Class E

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	38.27222,-78.889999(est)

Administrative Information

Investigator In Charge (IIC):	Rayner, Brian
Additional Participating Persons:	Dave Keenan; FAA/AVP; Washington, DC Steven Miller; Cessna Aircraft Company; Wichita, KS Terry Kaufman; Petroleum Helicopters Inc; Lafayette, LA
Original Publish Date:	November 26, 2012
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=78077

Aviation Investigation Final Report

Location:	Weyers Cave, Virginia	**Accident Number:**	ERA11FA101
Date & Time:	December 31, 2010, 14:26 Local	**Registration:**	N312PH
Aircraft:	EUROCOPTER DEUTSCHLAND GMBH EC 135 P2	**Aircraft Damage:**	Minor
Defining Event:	Midair collision	**Injuries:**	3 None
Flight Conducted Under:	Part 91: General aviation - Positioning		

Analysis

The pilot and both crewmembers of the helicopter recalled routine radio communication as the helicopter approached the destination airport. They established visual contact with two airplanes that had announced their positions in the traffic pattern; one on the downwind leg and one on short final. The airplanes were also identified by the traffic avoidance system onboard the helicopter. The pilot followed behind and north of the second airplane and continued to the west side of the airport to complete a landing at the helipad. During the descent, about 500 feet above ground level (agl), the pilot "saw about 2 feet of white wing right outside." He "pulled power" and then felt contact with an airplane. The airplane's right wing separated before it departed controlled flight and descended to the ground, fatally injuring both occupants. The helicopter subsequently landed with minor damage and no injuries to the 3 occupants.

Interpolation of radar data revealed that the accident airplane departed from the same airport about 21 minutes prior to the accident and completed a right downwind departure, contrary to the established left traffic pattern. The airplane’s transponder appeared to be off for about 3 minutes after takeoff before transmitting the visual flight rules transponder code (1200) for the remainder of the observed flight; the transponder appeared to be on and functioning at the time of the collision. The airplane proceeded north of the airport before reversing course and returning to approach the airport from the northeast. The last target was observed about 1.2 nautical miles north of the airport on a track leading toward the west side of the landing runway at an altitude of 500 feet agl. About 25 seconds later, the helicopter passed northeast of the airport on a modified left base, about 500 feet above traffic pattern altitude (1,500 feet agl), crossed the final approach course, and turned parallel to and on the west side of the runway. Although only the helicopter was observed by radar at the time of the collision,

extrapolation of the accident airplane’s previously observed targets and flight path placed the airplane at the accident site about the same time the helicopter was observed there. An analysis of the relative positions of the airplane and helicopter based on radar data indicated that the airplane remained below the helicopter pilot's field of view as the helicopter overtook the airplane from behind and descended upon it from above. Although the data indicated that the airplane would likely have been visible to the pilot of the helicopter, it is important to note that the onboard traffic avoidance system (TAS) did not provide the pilot with any alert of its presence because the system operated on line-of-sight principles. If an intruder aircraft’s antenna was shielded from the TAS antenna, the ability of the TAS to track the target would be affected. If a TAS-equipped aircraft was located directly above an intruder, the airframe of one or both of the aircraft could cause the TAS’s interrogations to be shielded, depending on antenna location (either bottom or top-mounted).

All other airplanes in the traffic pattern were acquired visually by the pilot and crew as their positions were confirmed by the helicopter's onboard traffic avoidance system and the position reports provided by the pilots of each airplane. Because of the high-wing structure of the airplane, and its relative position and altitude, the helicopter's image was either blocked from the airplane pilot's view by the left wing, or was above and behind the airplane in the seconds before collision. Further, no radio position reports from the accident airplane were confirmed. The helicopter pilot’s unalerted detection of the airplane against a complex background of ground objects would have been difficult because of both the lack of apparent contrast between the airplane and the ground, its size in the windscreen, its relative lack of movement within the pilot’s field of view, and the position and angle of the sun. In addition, the helicopter pilot’s familiarity with the customary routes used by fixed-wing pilots to fly into and out of the airport also made detection of the airplane less likely, because the airplane was not in a location that normally contained conflicting traffic. Finally, before the helicopter turned and overtook the airplane, the helicopter pilot’s visual attention would have likely been directed toward the landing area, which would also have limited opportunities for detection of the airplane. The airplane's departure and arrival were contrary to published Federal Aviation Administration guidance, the airplane owner's guidance, and the airplane pilot's guidance to his own students with regard to pattern entry at the destination airport.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The inherent limitations of the see-and-avoid concept, which made it difficult for the helicopter pilot to see the airplane before the collision. Contributing to the accident was the airplane pilot’s non-standard entry to the airport traffic pattern, which, contrary to published Federal Aviation Administration guidance, was conducted 500 feet below the airport's published traffic pattern altitude and in a direction that conflicted with the established flow of traffic.

Findings

Personnel issues	Monitoring other aircraft - Not specified
Personnel issues	Incorrect action performance - Pilot of other aircraft

Factual Information

History of Flight

Approach-VFR pattern base	Midair collision

HISTORY OF FLIGHT

On December 31, 2010, about 1426 eastern standard time, a Eurocopter EC-135-P2 helicopter, N312PH, operated by PHI Inc., as AirCare 5, and a Cessna 172H, N2876L, collided in midair approximately 1/2 mile northwest of the Shenandoah Valley Regional Airport (SHD), Weyers Cave, Virginia. The airplane departed controlled flight after the right wing separated, and was destroyed by impact forces at ground contact. The helicopter sustained minor damage and landed safely at SHD. The certificated commercial pilot and passenger on board the airplane were fatally injured. The certificated commercial pilot and two medical flight crewmembers on board the helicopter were not injured. Visual meteorological conditions prevailed for the airplane's local personal flight that originated from SHD, at 1402, and for the helicopter's positioning flight that originated from the University of Virginia Medical Center (8VA5), Charlottesville, Virginia, about 1410. A company flight plan was filed for the helicopter positioning flight, and no flight plan was filed for the airplane flight. Both flights were conducted under the provisions of Title 14 Code of Federal Regulations Part 91.

All three crewmembers aboard the helicopter were interviewed at the scene, and their statements were consistent throughout. They described departing 8VA5 after completing a patient drop-off, crossing "the ridgeline" at 4,500 feet, and approaching SHD from the east. They each described monitoring the common traffic advisory frequency (CTAF), and how the announced traffic, two aircraft established in a left-hand traffic pattern for runway 23, were acquired both visually and on the helicopter's Skywatch traffic collision avoidance device (TCAD) system. The two crewmembers in the front seats correlated the landing-pattern traffic's announced positions both visually and on the TCAD. The third, aft-seated crewmember visually acquired the landing traffic based on their announced positions. The accident airplane was operating in the airport traffic area, but not in the established traffic pattern.

One flight nurse rode on the left side of the helicopter, behind the copilot's station, and faced aft. She stated that she was aware of two airplanes in the traffic pattern, one on "short final," the second airplane behind, and that the helicopter would be "the third aircraft to land." According to the flight nurse, "I was in the back under sterile cockpit procedures. Everyone was 'eyes-out' looking for traffic. I felt a bump and a shudder and the pilot said, 'What was that?'" She looked out and saw a white rectangle under the helicopter for "less than a millisecond."

A second flight nurse who rode in the copilot (left) seat gave a similar account, and stated that he had visual contact with the two airplanes that were also displayed on the helicopter's TCAD

device. He added, "We were talking to all of them." The helicopter was in a gradual descent, and the nurse had visual contact with the airplanes on the base and final legs of the traffic pattern when he felt a bump. He reported that he never saw anything outside the helicopter at the time he felt the bump.

The pilot recalled routine radio communication as the helicopter approached SHD, as well as a radio call to request fuel upon landing. He described two airplanes in the traffic pattern: one on the downwind leg, and one on short final. The pilot followed behind and north of the second airplane and continued to the west side of the airport to complete a landing at the west side helipad. During the descent, about 500 feet above ground level, the pilot "saw about 2 feet of white wing right outside." He "pulled power" and then felt the contact.

All three crewmembers stated that the TCAD did not alert them to the accident airplane. They all described the crew coordination efforts to assess the damage to their aircraft, and the completion of a safe landing at the west-side helipad.

Witness interviews and written statements provided were largely consistent throughout. The witnesses were familiar with the airport, and with what they described as the usual traffic pattern of aircraft around the airport. Most of the witnesses described their vantage points as being 90 degrees from the direction of flight for both accident aircraft, and that the aircraft were traveling from roughly north to south. Most described the aircraft in level flight, with some differences as to whether the helicopter was on the airplane's left or right. Both aircraft were described as being "lower than usual," "awfully close," "almost even…next to each other." Consistently, witnesses described the helicopter as it overtook the airplane from behind, "barely touching" the airplane, and then watching as the right wing departed the airplane, and the remainder of the airplane "nose-dived" to ground contact.

In a written statement he provided along with photographs, one witness described the airplane as it approached the airport on the west side of the runway, and the helicopter's descent until the two aircraft collided. He added, "When I saw the airplane on the west side of the runway I found it kind of strange that it was there due to the fact that all the other airplanes were flying a left traffic pattern. I honestly had no idea why it was on this side of the runway. If it was trying to fly a right traffic pattern - it was going the wrong way."

In interviews with a Federal Aviation Administration (FAA) aviation safety inspector, pilots operating in the traffic pattern at SHD around the time of the accident said they recalled hearing various radio calls with regards to departures to the northwest, "maneuvering 6 miles to the northwest," and hearing the accident helicopter announce its position as it approached SHD. One pilot said he recalled hearing an airplane announce entering "upwind for runway 23" at SHD. All of the pilots stated that the traffic pattern at SHD was "unusually busy" around the time of the accident.

A pilot operating in the local flying area at the time of the accident said he had 15 hours of flight instruction from the pilot of the accident airplane, and that he would likely have

recognized the instructor's voice over the radio had he heard it. He added that he distinctly recalled 3 separate position reports from the helicopter as it approached SHD, and standard traffic calls from airplanes in left traffic at SHD. He did not recall hearing a radio call that announced a non-standard entry, but added that the frequency was crowded on the day of the accident.

Radar data identified the accident helicopter by its assigned transponder code. The helicopter's ground track and altitudes were consistent with crewmember descriptions. The other radar targets were all depicted with the visual flight rules (VFR) "1200" transponder code. The number of airplanes that these "VFR targets" represented could not be reconciled.

PERSONNEL INFORMATION

A review of Federal Aviation Administration (FAA) airman records revealed that the pilot in the airplane held a commercial pilot certificate with ratings for airplane single-engine land, airplane multiengine, and instrument airplane. He held a flight instructor certificate with ratings for airplane single-engine, multiengine land, and instrument airplane. His most recent FAA first-class medical certificate was issued June 23, 2010, at which time he reported 2,300 total hours of flight experience.

The passenger on board the airplane held no FAA certificates. However, a pilot logbook bearing his name was recovered and reflected 7 total hours of flight experience logged.

The pilot of the helicopter held an airline transport pilot certificate with a rating for airplane multiengine land, and a commercial pilot certificate with ratings for rotorcraft - helicopter and instrument helicopter. His most recent FAA second-class medical certificate was issued October 5, 2010. The pilot reported 6,803 total hours of flight experience, of which approximately 700 hours were in the same make and model as the accident helicopter.

AIRCRAFT INFORMATION

According to FAA records, the airplane was manufactured in 1967 and registered to an individual in 2009. It was equipped with a Lycoming 145-horsepower, horizontally-opposed four-cylinder reciprocating engine. The airplane's most recent annual inspection was completed November 18, 2010, at which time it had accrued 7,366.3 total aircraft hours. According to the owner, the airplane was based at SHD.

According to FAA records, the helicopter was manufactured in 2005, and was registered to a corporation in December of 2005. It was equipped with two 431-horsepower, Pratt and Whitney Canada 206B2 turbo shaft engines. The most recent approved aircraft inspection program (AAIP) maintenance inspection was completed on December 31, 2010. At the time of the accident, the helicopter had accrued 2,209 total aircraft hours. According to the operator, the helicopter was based at SHD.

METEOROLOGICAL INFORMATION

The 1420 weather observation at SHD included clear skies, winds from 220 degrees at 3 knots, 10 miles visibility, temperature 17 degrees C, dew point 6 degrees C, and an altimeter setting of 30.14 inches of mercury.
According to the United States Naval Observatory, about the time of the accident the sun was at 211 degrees about 22 degrees above the horizon.

AERODROME INFORMATION

SHD was located about 10 miles southeast of Harrisonburg, Virginia at an elevation of 1,201 feet. The airport was not tower-controlled. Runway 5/23 was 6,002 feet long and 150 feet wide, and was located along the east side of the field. The published traffic pattern altitude for piston-powered airplanes was 2,001 feet mean sea level (msl). The traffic pattern was a standard left-hand pattern, as there was no published "RP" or right-pattern designation.

WRECKAGE AND IMPACT INFORMATION

The airplane was examined at the site on December 31, 2010 and January 1, 2011, and all major components were accounted for at the scene. The right wing was separated from the airplane during the collision, and was located approximately 700 feet prior to the main wreckage along an approximate 230-degree path. The main wreckage came to rest inverted, immediately beyond the initial impact crater, and was severely deformed by impact forces.

One propeller blade was buried in the crater. The other propeller blade remained attached to the engine at its hub. The propeller hub was fractured in half, and each blade displayed span wise bending and light chord wise scratching. The engine was separated from the firewall and displayed significant impact damage, and the accessories and carburetor were separated and destroyed by impact.

The instrument panel, cockpit, and cabin areas displayed significant impact damage, and the empennage was crushed forward towards the cabin. The instrument panel, including the transponder and communication radios, revealed no useful information due to impact damage.

The wreckage was moved to an airport building for a detailed examination on January 2, 2011. The wreckage was disassembled and the components were placed on the ground in their approximate original positions. Once placed, several dents and transfer marks consistent with the dimensions and paint of the helicopter landing gear skids were identified. The marks were indicative of a left-rear-to-right-front movement across the top of the airplane's fuselage at an approximate 15-degree angle. Impact transfers at both the rear and forward carry-through spars about 12 inches inboard of the right wing attach bolts were identified. The cabin roof structure, from the aft carry-through spar to the windshield eyebrow, was separated by impact in flight and found near the right wing. The left side of the vertical stabilizer displayed a long, concave, linear scar consistent with the dimension and paint color of the helicopter skid tubes.

Examination of the right wing and the right wing strut revealed damage consistent with a downward separation. Blue paint transfer marks on the underside of the outboard right wing were consistent with the damage and transfer marks on the underside of the left horizontal stabilizer.

The helicopter was examined in the operator's hangar on January 2, 201l, and revealed only minor damage. The "elf shoe" on the forward left skid tube was bent outboard, but remained attached. Both skid tubes and cross tubes displayed significant scratching and paint transfers. The outboard portion of the right skid displayed paint transfers consistent with the left side of the airplane's vertical stabilizer.

MEDICAL AND PATHOLOGICAL INFORMATION

The Office the Chief Medical Examiner for the Commonwealth of Virginia in Roanoke, Virginia, performed autopsies on both pilots. The autopsy reports listed the cause of death as “blunt impact injuries.”

The FAA’s Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma, performed toxicological testing of the pilot and instructor. The testing was negative for the presence of carbon monoxide, cyanide, and ethanol.

ADDITIONAL INFORMATION

Radar Study

A radar study completed by an NTSB air traffic control investigator revealed that, as the helicopter approached SHD from the southeast, there were at least three other radar targets besides the accident airplane operating under VFR in the vicinity of the airport. Two of the targets were located northwest of the helicopter in the left traffic pattern for runway 23, and one was approaching the airport from the southwest about 2,000 feet above pattern altitude.

Interpolation of available radar data revealed that the accident airplane departed from SHD shortly before 1405. The target completed a right downwind departure, contrary to the established left traffic pattern. The airplane’s transponder appeared to be off until about 1408, when the primary radar targets in the track became 1200 transponder code targets. The airplane displayed a 1200 transponder code for the remainder of the observed flight. The accident airplane proceeded north of the airport before reversing course and returning to approach the airport from the northeast. The last target was observed about 1.2 nm north of the airport on a track leading toward the west side of runway 23 at an altitude of 500 feet above ground level (agl). About 25 seconds later, the helicopter passed northeast of the airport on a modified left base, about 500 feet above traffic pattern altitude (1,500 feet agl), crossed the final approach course, and turned parallel to runway 23 on the west side of the runway.

Although only the helicopter was observed by radar at the time of the collision, extrapolation of

the accident airplane's previously observed targets and flight path placed the airplane at the accident site approximately the same time the helicopter was observed there. Therefore, the radar data obtained appeared to account for all the known traffic in the vicinity as well as the proximity of the two accident aircraft at the time of the collision.

Traffic Advisory System

The accident helicopter was fitted with an L-3 Avionics SKYWATCH Traffic Advisory System (TAS). As installed, the system included an L-3 Avionics SKY 497 transmitter/receiver unit and an L-3 Communications NY164 antenna located on the helicopter's belly panel. The traffic information developed by the SKY 497 system was displayed in the cockpit on a Garmin 430 display.

According to the manufacturer, the SKYWATCH TAS monitored the airspace around the aircraft for other transponder-installed aircraft by querying Mode C or Mode S transponder information. This data was then displayed visually to the pilot in the cockpit. The system also provided aural announcements on the flight deck audio system. If an intruder aircraft's transponder did not respond to interrogations, the TAS did not establish a track on that aircraft. The system was not equipped with recording capability.

The SKYWATCH system operated on line-of-sight principles. If an intruder aircraft's antenna was shielded from the SKYWATCH system antenna, the ability of the SKY 497 to track the target would be affected. If a SKY 497-equipped aircraft was located directly above an intruder, the airframe of one or both of the aircraft could cause the SKY 497's interrogations to be shielded, depending on antenna location (either bottom or top-mounted). The SKY 497 also had the capability to coast (predict) an intruder's track to compensate for a momentary shielding.

The manufacturer was provided with the recorded radar data for the two accident aircraft and determined that the SKY 497 would not have generated a traffic alert based on the recorded radar data as the lack of a transponder signal to radar facilities would likewise not be available to the SKY 497. The lack of transponder information from the accident airplane between the second-to-last and last radar target would have made it impossible for the SKY 497 to calculate the path of the airplane and determine the risk of collision.

In addition, at the time of the second-to-last radar plot, when a transponder signal would have been available to the SKY 497, the accident airplane was not close enough to the helicopter to have generated a traffic alert from the SKYWATCH TAS.

Visibility Study

After reviewing radar track data for both aircraft, the NTSB calculated vertical angle and horizontal azimuth to determine the approximate size of the airplane's image in the helicopter windscreen as the two aircraft converged. The airplane was at a constant altitude of 500 feet

agl, and the helicopter was descending at 800 fpm. When both airplanes were within 3 miles of the airport, they were separated laterally by about 4 miles.

As the helicopter approached the airport, the airport would have been located on the left of the helicopter, at an angle of about 30 degrees, increasing to 90 degrees. The airplane would have been straight ahead of the helicopter during this time, but 1000 feet to 1200 feet below, and closing to within one mile laterally. At a distance of four miles, the airplane's image would appear about 0.045 inches in size as viewed through the helicopter windscreen. As the aircraft converged, the airplane would have been more readily visible, but well below the helicopter. At a distance of one mile, the airplane would appear to be about 0.18 inches in size through the helicopter windscreen.
As the aircraft were converging from one mile lateral separation, the helicopter was generally following the airplane, with the vertical separation decreasing from 1000 feet; a position ahead of and approximately 15 degrees below the horizon relative to the helicopter.

Because of the high-wing structure of the airplane, and its relative position and altitude, the helicopter's image was either blocked from the airplane pilot's view by the left wing, or was above and behind the airplane in the seconds prior to collision.

Flight Simulation Video

Using ATC radar track data for the helicopter and the accident airplane, the helicopter manufacturer developed an animation of the accident flight. The animation was from the fixed point of view of a pilot in the right seat of the helicopter, and incorporated major structural elements that would restrict the visual field. When the animation began, the helicopter appeared on the base leg of the traffic pattern headed in a westerly direction, and showed that about this time the airplane's flight path was approximately perpendicular to and lower than the helicopter's flight path. As the helicopter completed its left turn towards the helipad, the airplane appeared stationary in the area above the pilot's Primary Flight Display (PFD). The airplane remained approximately in this lateral position but appeared to move below, and become masked by, the instrument panel as the helicopter paralleled the airplane's flight track and descended. The airplane remained blocked by cockpit structure in the field of view until its wing structure became visible in the left-hand portion shortly before the animation ended.
Traffic Pattern

According to FAR 91.126, when operating on or in the vicinity of an airport in Class G airspace, “(1) Each pilot of an airplane must make all turns of that airplane to the left unless the airport displays approved light signals or visual markings indicating that turns should be made to the right, in which case the pilot must make all turns to the right; and (2) Each pilot of a helicopter or a powered parachute must avoid the flow of fixed-wing aircraft.”

Traffic Pattern Entry

According to a legal opinion published by the FAA, “Section 91.126(b)(1) applies to pilots

approaching to land at an airport without a control tower and is designed to promote predictable aircraft maneuvers, traffic flows and patterns in Class G uncontrolled airspace. The AIM (Aeronautical Information Manual), while not regulatory, consists of recommended procedures to assist pilots in executing their responsibilities as required by the regulations."

The AIM recommended a midfield entry on the downwind leg at a 45-degree angle. In an FAA presentation entitled "Traffic Pattern Entries," it was also recommended that upwind fly-bys of the runway (opposite the downwind leg side) be conducted "side-stepped" and at 500 feet above the traffic pattern altitude.

Upwind Entry at SHD

According to the owner of the accident airplane, he had specifically discussed how upwind entries were to be conducted in his airplane at SHD with the accident airplane pilot, and with the students that each of them taught. In an interview, he stated that in those discussions he directed that entries on the upwind (northwest) side for Runway 23 were to be conducted abeam the midpoint of the runway on a 45-degree angle.

When asked why he thought the pilot would enter the traffic pattern straight into the upwind leg, on the opposite side of the established traffic pattern, well below traffic pattern altitude, he said, "I don't know why they were there... [The pilot] would have entered the field at the mid left upwind leg of the traffic pattern. [He] would have been at a 45 for upwind midfield. We always teach that and drill that. Entering on the beginning of the upwind leg was not characteristic."

The owner repeated that he had "no idea" why the pilot would position the airplane where it was, at low altitude, at the time of the collision. He said, "I wouldn't believe [the pilot] to be that low. It's totally uncharacteristic of [him]. I've racked my brain trying to think why he was there."

A pilot who had received 15 hours of flight instruction from the accident airplane pilot said that during instruction, the 45-degree entry on the downwind for left traffic at SHD was stressed. The accident pilot demonstrated and discussed ways to accomplish the entry, depending on the direction from which the airplane approached SHD. In each case, the airplane entered left traffic for landing.

Pilot Information

Certificate:	Airline transport; Commercial	**Age:**	43,Male
Airplane Rating(s):	Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	Airplane; Helicopter	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 2 Without waivers/limitations	**Last FAA Medical Exam:**	October 5, 2010
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	September 26, 2010
Flight Time:	6803 hours (Total, all aircraft), 743 hours (Total, this make and model), 5409 hours (Pilot In Command, all aircraft), 31 hours (Last 90 days, all aircraft), 11 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	EUROCOPTER DEUTSCHLAND GMBH	**Registration:**	N312PH
Model/Series:	EC 135 P2	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	404
Landing Gear Type:	Skid	**Seats:**	5
Date/Type of Last Inspection:	December 31, 2010 AAIP	**Certified Max Gross Wt.:**	6265 lbs
Time Since Last Inspection:		**Engines:**	2 Turbo shaft
Airframe Total Time:	2209 Hrs at time of accident	**Engine Manufacturer:**	P&W CANADA
ELT:	Installed, not activated	**Engine Model/Series:**	PW206B SERIES
Registered Owner:	PHI INC	**Rated Power:**	431 Horsepower
Operator:	PHI Inc	**Operating Certificate(s) Held:**	On-demand air taxi (135)

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	SHD,1201 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	14:20 Local	**Direction from Accident Site:**	8°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	3 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	220°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.13 inches Hg	**Temperature/Dew Point:**	17°C / 6°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Charlottesville, VA (8VA5)	**Type of Flight Plan Filed:**	Company VFR
Destination:	Weyers Cave, VA (SHD)	**Type of Clearance:**	None
Departure Time:	14:11 Local	**Type of Airspace:**	Class E

Wreckage and Impact Information

Crew Injuries:	3 None	**Aircraft Damage:**	Minor
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 None	**Latitude, Longitude:**	38.27222,-78.889999(est)

Administrative Information

Investigator In Charge (IIC):	Rayner, Brian
Additional Participating Persons:	Dave Keenan; FAA/AVP; Washington, DC Steven Miller; Cessna Aircraft Company; Wichita, KS Terry Kaufman; Petroleum Helicopters Inc; Lafayette, LA
Original Publish Date:	November 26, 2012
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=78077