On August 12, 2017, about 1649 eastern daylight time, a Bell 407, N31VA, operated by the Virginia State Police (VSP), was destroyed after impacting trees and terrain in Charlottesville, Virginia. The airline transport rated pilot, and private pilot-rated observer, were fatally injured. Visual meteorological conditions prevailed, and no flight plan was filed for the public use aerial observation flight that departed Charlottesville-Albemarle Airport (CHO), Charlottesville, Virginia about 1554.

According to the VSP, the mission of the helicopter flight crew was to provide continuous video downlink to the VSP command center of the public demonstrations that were occurring in Charlottesville, Virginia. After being refueled, the helicopter departed CHO about 1554, with the airline transport pilot flying the helicopter, and observer operating the helicopter's camera.

The helicopter arrived over the city of Charlottesville at 1604, and remained over the city until 1642 when they were re-tasked to provide over-watch for the Governor of Virginia's motorcade. At 1643, the helicopter crew advised the VSP command center that they were heading directly to the motorcade, and were about 30 seconds away. About 1649, another helicopter advised the VSP command center that the accident helicopter had crashed.

Preliminary radar data provided by the Federal Aviation Administration (FAA), indicated that just prior to the accident, at 1648, the helicopter was flying at an altitude of approximately 2,200 ft above mean sea level (msl) in the area of the motorcade. At that time, the helicopter was traveling north-northwestbound before it began to turn to the right and descend rapidly. At 1648:30, radar indicated that the helicopter was descending through 1,450 ft msl, at a calculated groundspeed of 30 knots. Moments later, the helicopter descended below the floor of radar coverage, and radar contact was lost.

Approximately 37 witnesses were interviewed, and their descriptions of the altitude, direction of flight, and velocity of the helicopter varied; however, the preponderance of witness statements reported that the helicopter initially was hovering, began a rolling oscillation, began to spin (rotate about the vertical axis), and then descended in a 45° nose down attitude, while continuing to spin until it was lost from sight below the tops of the surrounding trees. They then observed a plume of smoke rising from the area of the accident site.
Preliminary review of security camera video provided by the University of Virginia corroborated statements from witnesses regarding the rotation (spinning) of the helicopter during the descent, and the nose down pitch attitude.

Examination of the accident site revealed, that the main wreckage had come to rest upright, on a magnetic heading of 333° in heavily wooded terrain, adjacent to a residence. The helicopter fuselage was highly fragmented from impact and postimpact fire damage, but most major components were present. A debris field, that was several hundred feet long was observed to the west of the main wreckage, with several pieces of debris coming to rest on the roof of the residence.

The debris field was comprised primarily of sheet metal from the tailboom, aluminum honeycomb sandwich structure from the airframe, tail rotor drive system pieces, and tail rotor control tube pieces. The main wreckage was comprised of the cockpit and cabin, baggage area, and the forward tailboom attachment to the main fuselage.

Examination of the high skid type landing gear revealed that the left landing gear skid tube was fragmented about 27 inches from the aft end of the tube. The aft cross-member had remained attached to the left landing gear skid. The left landing gear skid was also fractured from the forward cross-member above the tube cuff. The right landing gear skid was fractured from the forward and aft cross-members above the cross-member tube cuff. The right high step, which spanned the length of the right landing gear skid tube, was found loose in the wreckage, and was fractured at its forward and aft cross-member attachment points. The aft left step and the forward left step, located on the cross-member attachments, exhibited a fractured aft left step that was not recovered and an intact forward left step. The left side of the cross-members, which were normally attached to the left landing gear skid tube and curved, had a more flattened appearance than the right cross-members.

Examination of the tailboom revealed that the mid-section, which included the horizontal stabilizer, had come to rest adjacent to the forward right side of the nose section. The left horizontal stabilizer exhibited an angled cut consistent with main rotor blade contact. The outboard forward slat was separated from the left horizontal stabilizer, and the upper and lower vertical fin were separated from the stabilizer and found loose in the debris field. The right vertical fin exhibited partial fractures at the upper and lower fin but, the right horizontal stabilizer had remained intact.

The tailboom aft section, which contained the tail rotor gearbox and tail rotor, was fractured about 48.5 inches from the tail rotor axis of rotation. The tailboom aft section came to rest in a tree about 40 ft above the ground and 100-150 ft south-southwest of the main wreckage. The left side of the tailboom aft section had an impact mark consistent with contact with a tail rotor blade. The impact mark was located about 27-31 inches from the tail rotor axis of rotation.

Examination of the main rotor revealed that, all four main rotor blades (blue, orange, red, and green) were present. The inboard ends of all four were thermally damaged from the postcrash fire, and each displayed differing degrees of damage:
The whole span of the blue main rotor blade was found at the main wreckage site. An outboard section (near the tip) was fractured but was still attached to the blade, and the blade displayed evidence of low rotational energy at impact. The inboard end was thermally damaged. The blade was still attached to grip/spindle, which was still attached to the hub. The pitch horn was still attached to grip, and the pitch control link (PCL) upper rod end was attached but, the pitch link body was fractured and thermally damaged.

The blade span of the orange main rotor blade, which was primarily composed of the spar was found at the main wreckage site. Most of the afterbody was missing from this segment of blade. The spar was fractured near the outboard end, and a portion of the tip end about 24 inches-long was found in the debris field. The blade was separated from the grip/spindle, and came to rest next to the hub, which still contained the grip/spindle (but was loose from the head). The grip/spindle was fractured and exhibited evidence of thermal damage. The pitch horn and PCL upper rod end was still attached to the grip. The PCL body was fractured and thermally damaged.

An inboard section of the red main rotor blade remained attached to the grip/spindle. The blade was fractured about 66 inches from the blade retaining bolts, though a portion of the spar remained, measuring about 78 inches in length. This remaining portion of spar was missing its afterbody and the leading-edge abrasion strip, the latter of which was found loose in the wreckage. A 103-inch-long piece of the blade was found under large branches about 20 ft south-southwest of the main wreckage. The blade piece displayed an impact mark on the leading edge, around the 128-inch blade station position. The blade remained attached to the grip/spindle and the pitch horn remained attached, but the pitch horn lug normally connected to the PCL upper rod end was fractured with signatures consistent with overload. The PCL upper rod end and its attached pitch horn lug were not recovered. A tip end from the blade, about 16 inches in length, was found in the debris field. A separated outboard adjustable weight package was also found in the debris field.

The whole blade span of the green main rotor blade was found at the wreckage site. The tip remained attached to the blade but the lower skin was peeled/separated (but still attached). The blade remained attached to the grip/spindle and the pitch horn remained attached to the grip/spindle. The PCL was still attached to the pitch horn but the link body was fractured and thermally damaged.

The composite main rotor hub was thermally damaged and exhibited splaying. The hub connection for the red main rotor blade was fractured in the blade-chordwise direction. The main rotor head fairing also had remained installed. Removal of the fairing revealed that the eight vibration attenuation springs were in their normally installed position.

The main rotor head remained connected to the main rotor mast. The main gearbox housing exhibited evidence of sooting and thermal distress from the postcrash fire. The kaflex coupling on the forward end of the input driveshaft was intact. The aft kaflex coupling was fractured. A portion of it was found loose in the main wreckage and exhibited thermal damage. Rotation of the input driveshaft resulted in rotation of the main rotor head, consistent with drive continuity through the main gearbox. The main gearbox remained attached to the helicopter airframe and exhibited no evidence of separation.
Examination of the tail rotor drive shafts (TRDS) revealed that, the oil cooler remained installed to the airframe. The forward and aft splines were thermally damaged but did not exhibit evidence of smeared or missing spline teeth. Rotation of the forward splines resulted in rotation of the cooler fan and the aft splines. Several pieces of separated TRDS were also discovered in the debris field. Normally four hanger bearings are present on the TRDS on the tailboom. Only 3 bearings were recovered. On a typical installation, there was 1 steel TRDS segment between engine and oil cooler, then 5 aluminum TRDS segments between oil cooler and tail rotor. The 5 aluminum TRDS segments were supported by 4 hanger bearings. The aluminum TRDS are numbered 1 (forward-most TRDS) to 5 (aft-most TRDS). The steel TRDS was whole with evidence of heat stress, the forward end flex coupling was fractured, and the attaching hardware was present. The splines at the aft end of the steel TRDS did not show evidence of smearing or fractured teeth.

TRDS 1 was fractured about 1/3 its length from the aft end. The splines on the forward end of the TRDS were intact with no evidence of smearing or fracturing. The fracture location was in line with a main rotor blade strike line observed on the adjacent tailboom sheet metal. The aft end of the fracture exhibited heat damage. The aft flexible coupling was whole and exhibited serpentining and opening of the laminates.

TRDS 2 was fractured near its midpoint. The fracture location was in line with a main rotor blade strike line observed on the adjacent tailboom sheet metal. The aft flexible coupling was whole and it exhibited serpentining.

TRDS 3: only the forward riveted end cap was recovered. The rivets were fractured consistent with shear.

TRDS 4 was fractured about 2/3 of its length from the forward end, consistent with a main rotor blade strike of the tailboom. Only the aft end of the shaft was recovered. The aft flexible coupling had remained attached and exhibited opening of its laminates. Fractured attachment flanges from the aluminum TRDS 5, along with its attaching hardware, remained attached to the aft flexible coupling, and the attachment flange fractures exhibited overload signatures.

TRDS 5 and its aft flexible coupling were intact, did not exhibit evidence of damage, and remained attached to the tail rotor gear box (TRGB) input flange.

Examination of the TRGB revealed, that it had remained firmly attached to the structure. Manual rotation of the input flange resulted in a corresponding rotation of the tail rotor. The oil sight gage revealed the presence of oil within the gearbox. The chip detector was removed and revealed no evidence of chips or debris.

The tail rotor, which was still installed on the aft portion of the tail boom, came to rest in the top of a tree. Examination of the tail rotor revealed that, both blades (white and red) remained attached, and the tail rotor rotated freely with no evidence of binding. The white tail rotor blade displayed damage to the tip, consistent with contacting the left side of the tail boom. Its leading edge also displayed a damaged area about 3 inches wide about 15.5 inches inboard from the tip. The red tail rotor blade did not exhibit any anomalous damage.
Examination of the engine revealed that hard body foreign object damage was present on the first stage compressor blades, consistent with the engine operating at the time of the accident. The combined engine oil and fuel filter was present but found loose within the wreckage. The filter elements were present, but the aluminum filter bowls were missing with evidence of melting and were not recovered. The left engine mount was fractured from the structure, and the engine was laying on its right side. Residual oil observed within gearbox was tarred, the oil from the top was bright brown in color. The gearbox chip detectors when examined revealed that the upper and lower chip detectors were missing their magnet. Manual rotation of the first stage compressor resulted in rotation of the gears and the spline to the turbine. The electronic control unit (ECU) was found loose in the wreckage with one of its electrical connectors connected. The ECU exhibited thermal damage from exposure to the postcrash fire.

Examination of the flight controls revealed that the three main actuators were in the debris at the main accident site near their normally installed locations. One of the actuators consisted of only the piston, and the body had been consumed by fire. The tail rotor control tube was continuous from the tail rotor to the tail boom aft section, where the tailboom had fractured and separated. Manual movement of the tail rotor control tube resulted in pitch change of the tail rotor blades with no evidence of binding.

The tail rotor PCLs were intact and exhibited slight bending near the rod ends. Witness marks near the upper rod ends of the tail rotor PCLs were consistent with the rods contacting the outboard washer weights. The stationary swashplate for the right cyclic arm was fractured, and the collective lever was attached but fractured at its lower clevis. The rotating swashplate PCL arms for the red and orange main rotor blades were fractured, consistent with overload and thermal damage. The orange blade rotating swashplate PCL arm was found loose in the recovered main wreckage debris. The two PCL lower rod ends, with attaching hardware present, were recovered loose in the recovered main wreckage debris. The swashplate drive levers were present, and the drive lever between the blue and the orange blade was fractured with heat distress. The non-rotating swashplate anti-drive upper lever was melted, while the lower lever was present. A rod end consistent with the left cyclic upper rod end for the stationary swashplate was found loose in the recovered main wreckage debris.

The bellcranks between the main rotor servos and the stationary swashplate were found loose in the wreckage and contained clevis connections with the attaching hardware. The tail rotor push-pull tube was fractured at the tailboom to main fuselage interface. The push-pull tube was continuous to the idler link above the servo. Control continuity was established up to the servo. At the forward end of the servo, the connections from the sides of the servo to the connecting link (at the forward end) were fractured and melted. The servo exhibited thermal damage.

A remnant of the push-pull tube for tail rotor control was observed underneath the transmission deck. The tube exhibited a fracture at the aft end with thermal damage. The tube was continuous under the transmission deck and thermally damaged and fractured at its forward end.

The right (pilot) side cyclic pitch control and collective pitch control were found in the remains of the cockpit. The cyclic pitch control grip was melted, but the stick was still connected at the
base. The collective pitch control was disconnected, and fractured near its base. The left (observer) and right collective stick attachment points remained connected to the collective jackshaft, which was connected to the mixing unit. The left and right cyclic attachment points remained connected to the lateral jackshaft. The lateral push-pull tube was thermally damaged and had a small fracture on a portion of its tube, but was continuous. The lower portion of the left cyclic vertical push-pull tube (going up to the servo) rod end was connected at the mixer, but its tube was fractured and thermally damaged. The remainder of the tube was not observed. The lower portion of the collective vertical push-pull tube was fractured at the thread end of the tube. The remainder of the tube was not observed. The lower portion of the right cyclic vertical push-pull tube was fractured above the rod end threads. The tube showed evidence of impact marks. The remainder of the tube was not observed.

Control continuity was established between the cyclic pitch control to the mixing unit. The tail rotor fore-aft push-pull tube (routed under collective stick) was continuous back to the bellcrank (underneath the mixing unit). The bellcrank was attached to the structure, and the vertical push-pull tube was fractured at the lower rod end threads. The vertical push-pull tube exhibited thermal damage. The fore-aft push-pull tube was continuous up to the forward bellcrank. The lateral push-pull tubes from the left and right pedal sets were connected to the forward bellcrank.

The pedal travel limiter was installed but exhibited impact damage to its lower surface, and the cam was present. The pedal travel limiter emergency release was found in the cockpit but was thermally damaged. The copper safety wire remained intact.

The right pedal set was loose in the wreckage. The lateral push-pull tube was fractured in overload. The left pedal set remained installed in the cockpit but its lateral push-pull tube was fractured in overload. The pedals were consistent with being "locked out," and the left seat cyclic pitch control, and collective pitch control were found in the rear baggage compartment as required by VSP when an observer was seated in the left seat.

During the examinations, no evidence was observed to suggest that the accident was the result of a mid-air collision involving another aircraft, animal, or object.

The wreckage was retained by the National Transportation Safety Board for further examination.

According to FAA airworthiness records and helicopter maintenance records, the helicopter was manufactured in 2000. The helicopter's most recent 100-hour inspection was completed on August 3, 2017. At the time of the accident, the helicopter had accrued approximately 6,000 total hours of operation.

The pilot, a VSP Lieutenant, joined the aviation unit in 1999. In December 2012, he became the commander of the aviation unit. According to FAA airman and pilot records, he held an airline transport pilot certificate with a rating for rotorcraft-helicopter, as well as a commercial pilot certificate with ratings for airplane single-engine land, airplane multi-engine land, and instrument airplane. He also held a flight instructor certificate with ratings for airplane single-engine, airplane multi-engine, rotorcraft-helicopter, instrument airplane, and instrument
helicopter. He also possessed a remote pilot certificate with a rating for small unmanned aircraft systems. He had accrued approximately 5,831 total hours of flight time, 2,704.6 of which were in helicopters. His most recent FAA second-class medical certificate was issued on August 19, 2016.

The observer, a VSP Trooper, joined the aviation unit in July 2017. According to FAA airman records, he held a private pilot certificate with a rating for airplane single-engine land. He had accrued approximately 97 total hours of flight time. His most recent FAA second-class medical certificate was issued on May 12, 2017.

The reported weather at CHO, located 7 nautical miles north-northeast of the accident site, at 1653, included: wind 190° at 6 knots, 10 statute miles visibility, with a thunderstorm in the vicinity, clear skies, temperature 30° C, dew point 22° degrees C, and an altimeter setting of 29.87 inches of mercury.

### Aircraft and Owner/Operator Information

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### Meteorological Information and Flight Plan

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### Wreckage and Impact Information

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### Administrative Information

**Investigator In Charge (IIC):**  
Todd G Gunther

**Additional Participating Persons:**  
Patrick Hempen; FAA / AVP-100; Washington, DC  
Nora Valee; TSBC; Ottawa,  
Mark Stuntzner; Bell Helicopter; Fort Worth, TX  
Jack Johnson; Rolls Royce Corporation; Indianapolis, IN  
Jeffrey Bush; Virginia State Police; Richmond, VA

**Note:**  
The NTSB traveled to the scene of this accident.