Aviation Investigation Final Report

Location:	Williamsburg, Virginia	**Accident Number:**	ERA18FA187
Date & Time:	July 8, 2018, 16:33 Local	**Registration:**	N616HS
Aircraft:	Robinson R44	**Aircraft Damage:**	Destroyed
Defining Event:	Loss of control in flight	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

On the morning of the accident, the pilot flew the helicopter cross-country to attend a meeting at another airport. He departed on the return flight to his home airport later that afternoon and climbed the helicopter to an altitude of about 1,700 ft, leveled off, and the groundspeed increased. About 3 minutes after takeoff, the helicopter entered a right descending turn that continued until it impacted a condominium building at a high vertical speed. Witnesses reported that the helicopter rocked "back and forth unsteadily" before it suddenly pitched downward to impact the roof of the building.

Examination of the wreckage revealed no anomalies that would have precluded normal operation. The engine crankshaft gear bolt was found unthreaded and the alignment pin for the crankshaft gear was found sheared. The locking tab designed to prevent rotation of the bolt was found attached and intact. Examination of the bolt, locking tab, and accessory gears revealed no pre-impact damage. Had the bolt unthreaded during flight, the engine would have stopped running; however, the engine oil coolers exhibited grinding damage consistent with the engine rotating at the time of impact, and witnesses reported hearing the engine running continuously until the impact. It is therefore likely that the bolt unthreaded during the accident sequence. The forward-facing accessory case cover was found impact damaged and partially missing. Had the accessory gear train stopped rotating due to impact or from fragments of the cover or debris in the gear mesh, the crankshaft could continue to rotate briefly, allowing the bolt to unthread without damaging the locking tab.

The 85-year-old pilot was diagnosed with Parkinson's disease about 3 years before the accident. He experienced tremors in both hands, which was treated with medication and surgery with some success. The tremors consistently affected his left hand more than the right, and he reported that the tremors were more pronounced later in the day. Although the severity of his tremors or to what degree they may have affected his ability to fly the helicopter could not be determined, it is possible that they may have had more of an effect during the accident flight than on the day's earlier flight.

In the 2 years preceding the accident, the pilot's doctors noted mild dementia and mild cognitive impairment. His dementia was treated with medication (which he subsequently discontinued), and

reportedly improved, although his mild cognitive impairment persisted. His doctors also noted that the pilot had impaired measures of simple attention and visual scanning and tracking speed, and mild, relative difficulty with sustained attention. They recommended that the pilot not fly due to concerns with his attention, reaction time, and judgment.

It is likely that impairment resulted from one or more of the pilot's well-documented progressive impaired cognitive and physical abilities negatively affected his ability to safely operate the helicopter and led to the loss of control.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's failure to safely operate the helicopter due to his impaired cognitive and physical abilities, which resulted in a loss of control.

Findings

Personnel issues	Neurological - Pilot
Personnel issues	Physical fitness - Pilot
Personnel issues	Aircraft control - Pilot
Aircraft	(general) - Not attained/maintained

Factual Information

History of Flight

Enroute	Loss of control in flight (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On July 8, 2018, about 1633 eastern daylight time, a Robinson R44-II, N616HS, was destroyed when it was involved in an accident in Williamsburg, Virginia. The pilot and one person on the ground were fatally injured. The helicopter was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

The pilot had flown from Stafford Regional Airport (RMN), Stafford, Virginia, to Williamsburg Jamestown Airport (JGG), Williamsburg, Virginia, earlier that morning to attend a meeting at JGG. Airport personnel reported that the helicopter had been refueled to capacity before the pilot departed on the return flight to RMN.

Automatic dependent surveillance-broadcast (ADS-B) data showed that the helicopter departed JGG about 1630, then turned north. The helicopter climbed to a pressure altitude about 1,700 ft. After reaching 1,700 ft, the helicopter leveled off and the groundspeed increased from about 60 knots to about 110 knots over the next 1.5 minutes. The helicopter then entered a right, decreasing-radius, turning descent that continued until tracking coverage was lost. At the last recorded position, the helicopter was in the vicinity of the accident site, descending at a rate greater than 10,000 ft per minute.

Several witnesses near the accident site described the helicopter as flying low; one estimated its height about 100 ft above the ground as it approached a two-story condominium complex. They described it as flying relatively straight and level, or slightly descending, before suddenly pitching nose down and descending into the roof of the building. One witness described the helicopter as "rocking back and forth unsteadily" just before it pitched downward. Another witness, located about 300 ft south of accident site, recalled the engine making a "constant sound" as it flew over his head.

The helicopter impacted a condominium building located about 3 nautical miles north of JGG.

Pilot Information

Certificate:	Commercial	**Age:**	85,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	Unknown
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	None None	**Last FAA Medical Exam:**	
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 5693 hours (Total, all aircraft), 545 hours (Total, this make and model)		

According to Federal Aviation Administration (FAA) airman records, the pilot did not possess a valid medical certificate at the time of the accident. His application for a medical certificate in 2016 was deferred to the FAA for evaluation of his recent surgical interventions for tremors related to Parkinson's disease. As recently as April 2018, the FAA denied issuing a medical certificate due to the pilot's cognitive impairment and Parkinson's disease.

The last entry in the pilot's logbook was a round-trip flight from RMN to JGG in December 2017. Although not logged as such, that flight was with an instructor, according to a witness statement. During doctor visits in 2017 and 2018, he reported that his last flight was on August 1, 2016.

Aircraft and Owner/Operator Information

Aircraft Make:	Robinson	**Registration:**	N616HS
Model/Series:	R44 II	**Aircraft Category:**	Helicopter
Year of Manufacture:	2004	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	10449
Landing Gear Type:	N/A; Skid	**Seats:**	4
Date/Type of Last Inspection:	August 24, 2017 Annual	**Certified Max Gross Wt.:**	2500 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	619 Hrs as of last inspection	**Engine Manufacturer:**	Lycoming
ELT:	Installed	**Engine Model/Series:**	IO-540-AE1A5
Registered Owner:	On file	**Rated Power:**	260 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

The most recent recorded maintenance was an oil change performed on January 26, 2018, at an airframe and engine total time of 649 hours, and 35 hours since engine overhaul. The airframe total time at the time of the accident could not be determined.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	JGG,49 ft msl	**Distance from Accident Site:**	3 Nautical Miles
Observation Time:	16:35 Local	**Direction from Accident Site:**	168°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.27 inches Hg	**Temperature/Dew Point:**	29°C / 10°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Williamsburg, VA (JGG)	**Type of Flight Plan Filed:**	None
Destination:	Stafford, VA (RMN)	**Type of Clearance:**	None
Departure Time:	16:30 Local	**Type of Airspace:**	Class G

Airport Information

Airport:	Williamsburg-Jamestown JGG	**Runway Surface Type:**	
Airport Elevation:	49 ft msl	**Runway Surface Condition:**	
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	On-ground
Ground Injuries:	1 Fatal	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	37.288333,-76.729446

The main wreckage came to rest inside the north end of the building, with some components, including a section of the tail rotor drive shaft, found along the 70-ft wreckage path extending from the building on a heading of about 20° magnetic. All the major components of the helicopter were present at the accident site except for the tail boom. The vertical stabilizer, aft bulkhead, and a section of the tail rotor guard were located; however, building damage prevented access to several areas surrounding the main

wreckage. Many of the components were partially or completely consumed by a post-crash fire. Remnants of the removable copilot side controls were found near their stowed position. Remnants of all pilot side controls were present. All hydraulic controls were identified, with portions of all push-pull rods extending from the hydraulic actuators. Portions of the flight control rods were thermally damaged. All main and tail rotor flight control rod ends were secure to their attachment points at both ends, except for the tail rotor gear box connection, which was not recovered. The transmission input sheave (pulley) was manually rotated in both the locking and freewheeling modes, and the main rotor drive shaft rotated with the sheave, with some interference from a damaged flex coupling. A score mark on the aft face of the upper sheave was about 4 inches long in the direction of rotation. The leading edges of both main rotor blades were dented and bent in several locations and remained attached to the rotor hub. Most of the remainder of the main rotor blades were consumed by fire. The tail rotor gearbox mounting bolts were fractured consistent with overload. The transmission continuity was confirmed from the upper sheave to the main rotor mast and to the intermediate flex coupling. The main and auxiliary fuel tanks were severely damaged. The main tank cap was in place; the auxiliary tank cap was missing. Portions of the main and auxiliary fuel tanks were consumed by post-crash fire. The tail rotor gearbox, remnants of tail rotor blades, and remnants of the main rotor tips were found near the location of the main wreckage during a subsequent search of the accident site in October 2018.

The engine crankshaft rotated freely by hand. The crankshaft gear index pin was sheared, and the gear bolt was found mostly unthreaded. The locking tab on the bolt head was found in place against the bolt head. After securing the gear in place, valvetrain and continuity from the engine crankshaft to the accessory section was confirmed. A subsequent examination of the crankshaft gear bolt, locking tab, and accessory gears in the NTSB Materials Laboratory revealed no preimpact damage or anomalies. The engine accessory case cover, which covers the crankshaft gear and accessory gears, was impact damaged and partially missing. The engine was oriented in the helicopter with the accessory case facing forward. Both oil coolers, one on each side of the engine, exhibited grinding damage in line with the starter ring gear. Thumb compression and suction were present on all cylinders, though weaker on cylinder No. 5. The cylinder head and intake pipe for cylinder No. 5 displayed impact damage, and debris was found in the intake. All spark plugs exhibited normal wear and coloration when compared to the Champion check-a-plug chart; the Nos. 4 and 6 bottom spark plugs were oil-soaked. Both magnetos were impact and fire damaged and could not be functionally tested. Borescope inspection of all cylinders revealed no damage or scoring marks on piston tops, cylinder walls, or valves. The fuel injection servo inlet screen was free of debris. The butterfly valve was found in the full-open position; however, the input control rod was damaged and not connected. Impact damage to the mixture control actuator precluded determination of its position. The mixture control knob in the cockpit was found in the full-rich position. All six fuel injector nozzles were found unobstructed.

Medical and Pathological Information

An autopsy of the pilot was performed by the Office of the Chief Medical Examiner, Central District of Virginia. The pilot's cause of death was blunt force trauma.

Toxicology testing performed on the pilot by the FAA Forensic Sciences Laboratory identified 0.032 grams per deciliter (gm/dL) of ethanol in kidney tissue and no drugs or ethanol in muscle. The finding of

ethanol in kidney tissue but not muscle is consistent with postmortem production.

The 85-year-old pilot had a long history of progressive upper extremity tremor that he had reported to the FAA. According to personal medical records, the pilot had been diagnosed with a parkinsonian syndrome in April 2015. Treatment with medication resulted in some improvement of his symptoms. He subsequently had a deep brain stimulator (DBS) implanted that improved his right-hand tremor. Neuropsychological evaluations performed pre- (September 2015) and post- (August 2016) surgery determined increased cognitive decline to mild cortical dementia; cognitive decline can be a side-effect of the surgery. After the surgery, the pilot reported that his right-hand tremors had improved, but worsened later in the day, attributed to fatigue. The neuropsychological testing in August 2016 determined that the pilot was not insightful about his cognitive issues and that he had worsening of psychomotor speed and attention. In a letter written to the FAA in September 2016, the pilot's neurologist recommended that he not fly due to his dementia. The pilot was started on medication to treat the dementia. The pilot began seeing a new neurologist in June of 2017 when he informed the neurologist of his desire to return to flight status and he complained of tremors and memory difficulties. The second neurologist concurred that the pilot should not fly and should only drive short distances because he was concerned about the pilot's reaction time and judgment. The neurologist ordered physical therapy.

In an August 2017 visit to the neurologist, the pilot reported having had six motor vehicle accidents through the spring of that year, and was having constant daily left hand tremors and imbalance. Left hand resting tremors, which were greater than the right hand, were noted. A follow-up evaluation found improvement from previous testing with evidence of mild cognitive impairment instead of dementia. Also noted was that the pilot had impaired measures of simple attention and visual scanning and tracking speed and mild, relative difficulty with sustained attention. The pilot reported self-discontinuing his medication for dementia in September 2017 because of a letter from the FAA that stated, "that as long as he used the patch, he would not be able to receive a flying license." At numerous physician office visits, the pilot had reported difficulty with tremors, balance, and memory. A driver rehab evaluation performed in October 2017 noted below-normal dynamic vision and vision information processing. The pilot demonstrated deficits in both sustained and divided attention. A driving restriction of "drive within a 15-mile radius from home" was recommended. Subsequently, at the pilot's neurologist visit on October 31, 2018, the pilot reported failing his department of motor vehicle (DMV) driver's test and mentioned that he was going to try a different DMV office to get his driver's license reinstated. At the January 19, 2018, visit, the pilot told the neurologist that his driver's license had been reissued. The last office visit to the neurologist prior to the accident was on May 4, 2018. The pilot reported his disappointment with the April 2018 FAA denial to issue his medical certificate. He stated he had had an appointment with the neurosurgeon in the next 6 months to a year to replace his DBS battery. The pilot reported continued bilateral hand tremors with mild imbalance. On a physical exam, slowed movements, decreased eyeblinks, a mild wide-based gait, and left greater than right hand resting tremors were noted.

Administrative Information

Investigator In Charge (IIC):	Brazy, Douglass
Additional Participating Persons:	Michael Marchelletta; FAA/FSDO ; Richmond, VA Thom Webster; Robinson Helicopter Inc; Torrence, CA David Harsanyi; Lycoming Engines; Williamsport, PA
Original Publish Date:	May 19, 2020
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=97708