



# National Transportation Safety Board Aviation Accident Final Report

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<b>Location:</b>	Knoxville, Tennessee	<b>Accident Number:</b>	ERA20LA273
<b>Date &amp; Time:</b>	August 3, 2020, 19:41 Local	<b>Registration:</b>	N55GJ
<b>Aircraft:</b>	Eurocopter EC130	<b>Aircraft Damage:</b>	Substantial
<b>Defining Event:</b>	Settling with power/vortex ring state	<b>Injuries:</b>	1 Fatal, 3 None
<b>Flight Conducted Under:</b>	Part 91: General aviation - Personal		

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## Analysis

The helicopter pilot was returning to his property located adjacent to a river. As the helicopter descended toward the water at a 25° angle with low forward airspeed, the pilot applied power to arrest the descent. However, the helicopter continued to descend until it impacted the river short of the intended landing area. The pilot and two passengers survived the impact and a third passenger drowned.

The investigation revealed no preimpact mechanical malfunctions or anomalies that would have prevented the normal operation of the helicopter. Recovered flight data indicated the engine was producing power at the time of impact. Weather reports and statements from the pilot and witnesses indicated that the helicopter descended steeply with little forward airspeed and a tailwind of about 5 knots, which is a flight profile conducive to vortex ring state. The pilot's reported lack of collective authority when increasing power to arrest the helicopter's descent is also consistent with the helicopter entering vortex ring state. A pilot's failure to monitor altitude, airspeed, and rate of descent during an approach can result in a flight profile conducive to vortex ring state.

## Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

The pilot's entry into vortex ring state and his inability to arrest the helicopter's descent while maneuvering for landing.

## Findings

Aircraft	Descent rate - Not attained/maintained
Personnel issues	Incorrect action performance - Pilot
Personnel issues	Aircraft control - Pilot

## Factual Information

### History of Flight

Approach	Settling with power/vortex ring state (Defining event)
Approach	Collision with terr/obj (non-CFIT)

On August 3, 2020, at 1941 eastern daylight time, an Airbus EC130-B4 helicopter, N55GJ, was substantially damaged when it was involved in an accident near Knoxville, Tennessee. One passenger was fatally injured, and the pilot and two additional passengers were not injured. The helicopter was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

After refueling the helicopter, the pilot and his passengers departed McGhee Tyson Airport (TYS), Knoxville, Tennessee, about 1826 for a flight in the local area. About 1940 the pilot made a right circling approach over the Tennessee River toward a landing site on his property near the river's edge. He stated that he "was descending with low power and a 25° angle of descent, slowing to come to a hover at low speed over the water." He further stated that he was planning to hover taxi to the landing site at a height about 75 feet above the water and that when he added power to arrest the descent, the helicopter "started to settle." He stated he "pulled max power to stop the settling," but it was as if the helicopter "didn't have any power" and it continued to descend until it impacted the river.

A witness on the neighboring property reported that the helicopter "came from the south and kind of hovered over the water pretty low." She stated that it hovered longer than usual before tilting toward the south and descending into the water.

A passenger stated that when the helicopter descended toward the water in a level attitude, the left "skid hit and then rotor hit" and the helicopter was "torqued into the water on the left side." The pilot and two of the passengers were able to egress the helicopter before it sank; however, one passenger was unable to egress and was subsequently recovered by first responders.

A pilot who had previously flown with the accident pilot reported that he spoke to the accident pilot the morning after the accident. He stated that the accident pilot recalled he was making a steep approach and he "came in vertically with little-to-no airspeed," estimating that his descent rate was greater than 300 feet per minute.

## Pilot Information

<b>Certificate:</b>	Airline transport; Private	<b>Age:</b>	86, Male
<b>Airplane Rating(s):</b>	Single-engine land; Multi-engine land	<b>Seat Occupied:</b>	Left
<b>Other Aircraft Rating(s):</b>	Glider; Helicopter	<b>Restraint Used:</b>	4-point
<b>Instrument Rating(s):</b>	Airplane	<b>Second Pilot Present:</b>	Yes
<b>Instructor Rating(s):</b>	None	<b>Toxicology Performed:</b>	No
<b>Medical Certification:</b>	Class 3 Waiver time limited special	<b>Last FAA Medical Exam:</b>	May 4, 2019
<b>Occupational Pilot:</b>	No	<b>Last Flight Review or Equivalent:</b>	January 24, 2020
<b>Flight Time:</b>	(Estimated) 12600 hours (Total, all aircraft), 300 hours (Total, this make and model), 10000 hours (Pilot In Command, all aircraft), 5 hours (Last 90 days, all aircraft), 5 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

## Pilot-rated passenger Information

<b>Certificate:</b>	Private	<b>Age:</b>	84, Male
<b>Airplane Rating(s):</b>	Single-engine land; Multi-engine land	<b>Seat Occupied:</b>	Center
<b>Other Aircraft Rating(s):</b>	None	<b>Restraint Used:</b>	4-point
<b>Instrument Rating(s):</b>	Airplane	<b>Second Pilot Present:</b>	Yes
<b>Instructor Rating(s):</b>	None	<b>Toxicology Performed:</b>	Yes
<b>Medical Certification:</b>		<b>Last FAA Medical Exam:</b>	
<b>Occupational Pilot:</b>	No	<b>Last Flight Review or Equivalent:</b>	
<b>Flight Time:</b>			

## Passenger Information

<b>Certificate:</b>		<b>Age:</b>	Male
<b>Airplane Rating(s):</b>		<b>Seat Occupied:</b>	Right
<b>Other Aircraft Rating(s):</b>		<b>Restraint Used:</b>	4-point
<b>Instrument Rating(s):</b>		<b>Second Pilot Present:</b>	Yes
<b>Instructor Rating(s):</b>		<b>Toxicology Performed:</b>	No
<b>Medical Certification:</b>		<b>Last FAA Medical Exam:</b>	
<b>Occupational Pilot:</b>	No	<b>Last Flight Review or Equivalent:</b>	
<b>Flight Time:</b>			

## Passenger Information

Certificate:	Age:	Male
Airplane Rating(s):	Seat Occupied:	Left
Other Aircraft Rating(s):	Restraint Used:	4-point
Instrument Rating(s):	Second Pilot Present:	Yes
Instructor Rating(s):	Toxicology Performed:	No
Medical Certification:	Last FAA Medical Exam:	
Occupational Pilot: No	Last Flight Review or Equivalent:	
Flight Time:		

## Aircraft and Owner/Operator Information

Aircraft Make:	Eurocopter	Registration:	N55GJ
Model/Series:	EC130 B4	Aircraft Category:	Helicopter
Year of Manufacture:	2003	Amateur Built:	
Airworthiness Certificate:	Normal	Serial Number:	3745
Landing Gear Type:	Skid	Seats:	6
Date/Type of Last Inspection:	October 14, 2019 Annual	Certified Max Gross Wt.:	5350 lbs
Time Since Last Inspection:		Engines:	1 Turbo shaft
Airframe Total Time:	2012 Hrs at time of accident	Engine Manufacturer:	Turbomeca
ELT:	C126 installed, not activated	Engine Model/Series:	Arriel 2B1
Registered Owner:		Rated Power:	747 Horsepower
Operator:	On file	Operating Certificate(s) Held:	None

According to the helicopter's flight manual, and the helicopter's weight and balance chart, the helicopter's gross weight at the time of the accident would have been about 4,440.2 lbs. The limitations section of the helicopter's flight manual indicated a maximum gross weight of 5,350 lbs. The longitudinal and lateral CG locations were within flight manual limits.

## Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	TYS, 979 ft msl	Distance from Accident Site:	8 Nautical Miles
Observation Time:	19:53 Local	Direction from Accident Site:	193°
Lowest Cloud Condition:	Few / 4000 ft AGL	Visibility	10 miles
Lowest Ceiling:	Broken / 25000 ft AGL	Visibility (RVR):	
Wind Speed/Gusts:	5 knots /	Turbulence Type Forecast/Actual:	None / None
Wind Direction:	80°	Turbulence Severity Forecast/Actual:	N/A / N/A
Altimeter Setting:	29.9 inches Hg	Temperature/Dew Point:	27° C / 20° C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Knoxville, TN (TYS )	Type of Flight Plan Filed:	None
Destination:	Knoxville, TN	Type of Clearance:	None
Departure Time:	18:20 Local	Type of Airspace:	Class G

## Wreckage and Impact Information

Crew Injuries:	1 None	Aircraft Damage:	Substantial
Passenger Injuries:	1 Fatal, 2 None	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	1 Fatal, 3 None	Latitude, Longitude:	35.945278, -83.95639 (est)

Examination of the accident site by a Federal Aviation Administration (FAA) inspector revealed that the helicopter came to rest on the bottom of the Tennessee River about 435 ft and 149° from the intended landing site on the pilot's property. The helicopter's fenestron was recovered floating nearby.

The helicopter was recovered from the river mostly intact. Examination of the wreckage revealed a large hole in the left side windshield; the left door window broken out; damage to all rotor blades consistent with water impact; and two of the four suspension bars fractured midspan. The tailboom remained attached to the fuselage, and the fenestron separated from the tailboom just aft of the ring frame.

Examination of the airframe and flight control system components revealed no evidence of a pre-impact failure or mechanical malfunction that would have precluded normal operation,

and the pilot reported that there were no mechanical malfunctions or failures prior to the accident sequence.

The helicopter was equipped with a vehicle and engine monitoring display and a digital engine control unit that stored records of failure messages associated with engine operations. The data revealed no failures or limit exceedances prior to impact and indicated the engine was running at the time of impact. All failure indications occurred around the time of impact. No preimpact anomalies were noted with the engine that would have precluded the normal production of power.

## Additional Information

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### Vortex Ring State

According to the FAA's Helicopter Flying Handbook (FAA-H-8083-21B), vortex ring state, formerly referenced as settling-with-power, "describes an aerodynamic condition in which a helicopter may be in a vertical descent with 20 percent up to maximum power applied, and little or no climb performance:

Situations that are conducive to a vortex ring state condition are attempting to hover out of ground effect (OGE) without maintaining precise altitude control, and approaches, especially steep approaches, with a tailwind component.

The following combination of conditions is likely to cause settling in a vortex ring state in any helicopter:

1. A vertical or nearly vertical descent of at least 300 fpm. (Actual critical rate depends on the gross weight, rpm, density altitude, and other pertinent factors.)
2. The rotor disk must be using some of the available engine power (20–100 percent).
3. The horizontal velocity must be slower than effective translational lift.

When recovering from a vortex ring state condition, the pilot tends first to try to stop the descent by increasing collective pitch. The traditional recovery is accomplished by increasing airspeed, and/or partially lowering collective to exit the vortex. In most helicopters, lateral cyclic thrust combined with an increase in power and lateral antitorque thrust will produce the quickest exit from the hazard.”

According to the FAA's Helicopter Flying Handbook, hovering more than one main disc (rotor) diameter above the surface is considered hovering OGE. The accident helicopter rotor diameter was 35 ft 1 in.

## Administrative Information

<b>Investigator In Charge (IIC):</b>	Spencer, Lynn		
<b>Additional Participating Persons:</b>	Jim Ruckman; FAA/FSDO; Nashville, TN Marion Watremez; BEA; Le Bourget Seth D Buttner; Airbus Helicopters Inc; Grand Prairie, TX Bryan Larimore; Safran Helicopter Engines; Grand Prairie, TX		
<b>Original Publish Date:</b>	June 28, 2022	<b>Investigation Class:</b>	3
<b>Note:</b>	The NTSB did not travel to the scene of this accident.		
<b>Investigation Docket:</b>	<a href="https://data.nts.gov/Docket?ProjectID=101730">https://data.nts.gov/Docket?ProjectID=101730</a>		

The National Transportation Safety Board (NTSB), established in 1967, is an independent federal agency mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The NTSB makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available [here](#).