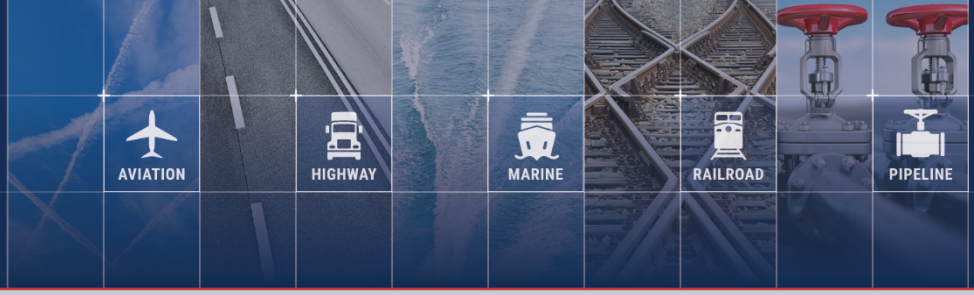

Aviation Investigation Final Report

Location:	Gustavus, Alaska	**Accident Number:**	CEN18FA391
Date & Time:	September 28, 2018, 10:57 Local	**Registration:**	N907PL
Aircraft:	AIRBUS HELICOPTERS INC AS350	**Aircraft Damage:**	Destroyed
Defining Event:	Loss of control in flight	**Injuries:**	3 Fatal, 1 Serious
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The private pilot had just purchased the helicopter and was returning it to his home airport accompanied by a commercial-certificated safety pilot and two passengers. Video from the cockpit image recorder indicated that the pilot, seated in the right seat, was manipulating the flight controls from takeoff until the accident occurred. The surviving passenger stated that, while en route, the pilot indicated that they would be landing on a beach in order to stretch their legs.

The recovered data showed the helicopter flying about 500 to 700 ft over water when the pilots began conversing and pointing toward the shore. The safety pilot, whose hands were on his lap, then raised his right hand in a manner that appeared that he was guarding the cyclic control in anticipation that his assistance or intervention might be required. Shortly thereafter, the pilot twisted the collective twist grip throttle from FLIGHT to IDLE; data from the engine data recorder (EDR) indicated that, at this time, the engine fuel control was set to the idle power setting. Such action is consistent with a practice autorotation. The collective control was adjusted downward slightly, but the main rotor speed (Nr) gauge showed Nr decay from the normal "green" operating range of 375 to 405 rpm to the "yellow" cautionary range of 320 to 375 rpm about 5 seconds after the twist grip was set to IDLE. An Nr value of less than 360 rpm would have resulted in a continuous aural tone to alert the pilots of the low rotor speed. About 7 seconds after the twist grip was set to IDLE, the pilot reached toward the center console, after which the "HORN" caution light illuminated, consistent with the pilot muting the aural tone signaling the low Nr condition. After the horn was muted, Nr continued to decay to a low of 254 rpm. Several small cyclic inputs were observed, then the recorded data ended.

The helicopter impacted the water and was destroyed. The four occupants were ejected from the helicopter; one of the passengers survived the accident and swam to shore. Postaccident examination of the helicopter and the recovered data did not reveal any helicopter malfunctions or failures that would have precluded normal operation.

Since recorded cockpit imagery did not capture microphone audio, the reason for the pilot's decision to

roll the throttle to IDLE could not be determined, and what conversations the pilots may have had before and during the maneuver could not be determined. The passengers' headphones were muted from the pilots' conversation, and the surviving passenger did not know if they planned to practice an autorotation to the beach. Cockpit video recordings from previous flights indicated that the safety pilot did not guard the flight controls when the pilot was performing takeoffs or landings. It is plausible that the pilot's intention was to practice or perform an autorotation to the beach, with the safety pilot guarding the controls. However, the beach was not the most suitable location for a practice autorotation to landing procedure and was out of the ordinary from their previous flights, as observed on the recorded cockpit imagery.

When the twist grip throttle is set to IDLE position during normal flight, Nr will decay unless the pilot takes action to maintain it, such as a reduction in main rotor collective pitch or returning the twist grip throttle to the FLIGHT position. However, after the throttle was set to IDLE, the pilot failed to reduce main rotor collective pitch, which resulted in low rotor rpm. The pilot's action of muting the low rotor rpm alert horn indicated that he was aware of the annunciation to an anomalous condition, but it could not be determined if the pilot understood the nature of why the horn annunciated or the criticality of the situation.

Probable Cause and Findings

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

The pilot's failure to maintain main rotor speed after setting the engine fuel control to idle, which resulted in a loss of helicopter control and impact with water.

Findings

Personnel issues	Incorrect action selection - Pilot
Personnel issues	Incorrect action performance - Pilot
Personnel issues	Delayed action - Pilot
Personnel issues	Aircraft control - Pilot
Personnel issues	Use of equip/system - Pilot

Factual Information

History of Flight

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

On September 28, 2018, at 1057 Alaska daylight time, an Airbus Helicopters AS350-B3e helicopter, N907PL, was destroyed when it was involved in an accident in Glacier Bay National Park, about 60 miles northwest of Gustavus, Alaska. The safety pilot was fatally injured, one passenger sustained serious injuries, and the pilot and another passenger remain missing and are presumed fatal. The helicopter was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

The purpose of the trip was to deliver the newly-purchased helicopter to Anchorage from the Airbus Helicopters factory in Texas. The left seat safety pilot was onboard for insurance coverage purposes and was acting as a safety pilot. The right seat pilot-in-command, who owned the helicopter, planned to drop off the safety pilot in Wasilla, Alaska, then proceed to Anchorage with the passengers. The trip began on September 25, 2018, and included more than 30 stops for sightseeing, fuel, and rest.

In a postaccident interview, the surviving passenger, who was seated in the left rear seat, stated that the accident flight departed Juneau International Airport (JNU), Juneau, Alaska, and proceeded north toward Yakutat Airport (YAK), Yakutat, Alaska, at low altitude parallel to the shoreline. The passengers' headphones were muted, but at one point, the pilot unmuted the passengers' headphones and asked if the passengers wanted to land on a beach to stretch their legs. About 1 minute later, the safety pilot pointed his hand to the right toward a long stretch of beach. The passenger recalled that the pilot initiated a controlled right turn and the helicopter began to descend; the safety pilot did not have his hands on the flight controls. He stated that the pilot pulled up on the collective and rolled the throttle off. He never heard anything abnormal with the engine noise or noticed any anomalies with the helicopter. The pilot left the collective up and the helicopter entered a free fall from about 500 ft agl, then about 30 ft agl the pilot increased the throttle again. Before impact, he heard the pilot yell "NO" and continue to manipulate the flight controls. He felt the helicopter impact the water and noticed water splash in the cabin before he lost consciousness. He later awoke in the water and swam to shore, where he awaited rescue. He was unable to locate the other occupants.

A review of the onboard cockpit image recorder, an Appareo Vision 1000, revealed that the helicopter was refueled at JNU before departing on the accident flight. The helicopter departed JNU and proceeded west over the mountains about 3,000 to 4,000 ft mean sea level (msl), then northwest along the coastline about 500 to 700 ft msl. Figure 1 depicts the helicopter's flight path from JNU to the accident site.

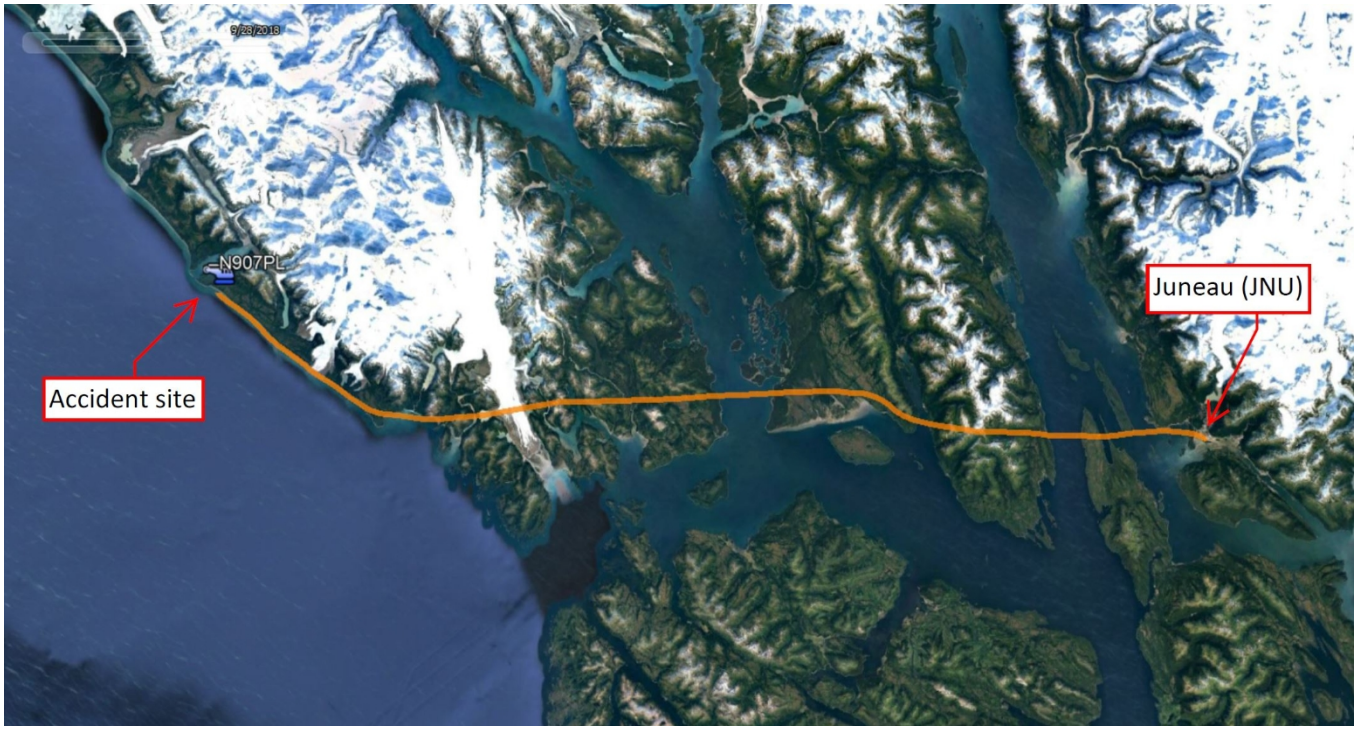

Figure 1 – The helicopter flight track in orange from JNU to the accident site.

Pilot Information

Certificate:	Private	**Age:**	42,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	5-point
Instrument Rating(s):	None	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 3 Without waivers/limitations	**Last FAA Medical Exam:**	May 3, 2018
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 1129 hours (Total, all aircraft), 26 hours (Total, this make and model), 94 hours (Last 90 days, all aircraft), 25 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Co-pilot Information

Certificate:	Commercial	**Age:**	53,Male
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	5-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 Without waivers/limitations	**Last FAA Medical Exam:**	October 23, 2017
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 15350 hours (Total, all aircraft), 4350 hours (Total, this make and model)		

Passenger Information

Certificate:		**Age:**	14,Male
Airplane Rating(s):		**Seat Occupied:**	Left
Other Aircraft Rating(s):		**Restraint Used:**	3-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:			

Passenger Information

Certificate:		**Age:**	11,Male
Airplane Rating(s):		**Seat Occupied:**	Right
Other Aircraft Rating(s):		**Restraint Used:**	3-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:			

The pilot began his helicopter flight training in a Robinson R44 helicopter and had accumulated 59 hours of helicopter flight experience. On forms provided to Airbus before conducting AS350-B3e model transition training, the pilot reported no experience in the accident helicopter make and model. On June 4, 2018, the pilot completed transition training for the AS350-B3e with an Airbus Helicopters flight instructor at the Airbus factory in Grand Prairie, Texas; this training included 3 hours of flight time and 1 hour of simulator time.

From June 18 to August 29, 2018, the pilot completed at least 10 flights (more than 18.3 hours) in an AS350-B2 model operated by the safety pilot's company in Alaska. in Alaska. Of the 18.3 hours, 11.4 were conducted with the accident safety pilot and 6.9 were conducted with a company flight instructor.

On August 5, 2018, the pilot completed a 1.5-hour flight at the Airbus factory with the same Airbus Helicopters flight instructor in an AS350-B3e. The pilot had accumulated 4.5 flight hours in the B3e before departing Texas with the accident helicopter.

The safety pilot was the owner, director of operations, and chief pilot for two different commercial helicopter operators in Alaska that operated several AS350-B2 model helicopters.
The surviving passenger was not a pilot, but he did attend helicopter ground school classes with the accident pilot and had knowledge of helicopter procedures and helicopter flight theory. The passenger stated that, when taking delivery of the accident helicopter in Texas, the safety pilot did not seem recently familiar with the B3e model and the options that were installed on the accident helicopter. The safety pilot asked a lot of questions about the B3e, and the pilot appeared more familiar with the helicopter systems than the safety pilot.

Aircraft and Owner/Operator Information

Aircraft Make:	AIRBUS HELICOPTERS INC	**Registration:**	N907PL
Model/Series:	AS350 B3	**Aircraft Category:**	Helicopter
Year of Manufacture:	2018	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	8471
Landing Gear Type:	Skid	**Seats:**	6
Date/Type of Last Inspection:		**Certified Max Gross Wt.:**	
Time Since Last Inspection:		**Engines:**	1 Turbo shaft
Airframe Total Time:	40 Hrs at time of accident	**Engine Manufacturer:**	Safran Helicopter Engines
ELT:	C126 installed, not activated	**Engine Model/Series:**	Arriel 2D
Registered Owner:	On file	**Rated Power:**	952 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

The Airbus Helicopters was equipped with a three-bladed main rotor system and a two-bladed tail rotor system. The flight controls are were hydraulically assisted by a dual hydraulic system. The helicopter was equipped with both pilot and safety pilot controls and a Genesys Aerosystems HeliSAS autopilot and stability augmentation system.

The collective-mounted engine control twist grip throttle contains two positions: IDLE and FLIGHT. In the normal procedures section of the AS350 B3e rotorcraft flight manual (RFM), the twist grip throttle is moved from the IDLE position to the FLIGHT position during the run-up checks. The twist grip throttle remains in the FLIGHT position until the postlanding engine and rotor shutdown procedures are performed. When the twist grip throttle is outside of its FLIGHT position, a "TWT GRIP" warning light

illuminates on the cockpit caution and warning panel (CWP).

According to Airbus Helicopters, the airframe and engine had accumulated a total time of 13.7 hours at the time of delivery. An estimated 25-30 hours was accumulated from delivery until the accident.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	CSP,89 ft msl	**Distance from Accident Site:**	39 Nautical Miles
Observation Time:		**Direction from Accident Site:**	128°
Lowest Cloud Condition:	Unknown	**Visibility**	
Lowest Ceiling:	Unknown	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:		**Temperature/Dew Point:**	
Precipitation and Obscuration:	Light - None - Rain		
Departure Point:	Juneau, AK (JNU)	**Type of Flight Plan Filed:**	None
Destination:	Yakutat, AK (YAK)	**Type of Clearance:**	VFR
Departure Time:		**Type of Airspace:**	Class G

The National Weather Service (NWS) Alaska Aviation Weather Unit issued flying weather graphics, which forecast marginal visual flight rules and no low-level turbulence for the accident area.

The FAA Aviation Weather Cameras for YAK and Cape Spencer, Alaska, revealed a broken to overcast cloud layer and clear visibility around the time of the accident flight.
The Appareo Vision 1000 onboard the helicopter showed brief periods of light rain on the helicopter's windscreen. The rain stopped about 7 minutes before the accident.

Wreckage and Impact Information

Crew Injuries:	2 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	1 Fatal, 1 Serious	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 Fatal, 1 Serious	**Latitude, Longitude:**	58.595275,-137.594451(est)

The main fuselage was found on a beach on its left side and partially embedded in the sand as shown in Figure 3. The structure forward of the aft cabin bulkhead had separated from the main fuselage. The left and right aft bench seats remained attached to the aft cabin bulkhead. The two longitudinal floor beams

for the cabin floor structure were fractured several inches forward of the aft cabin bulkhead. The rear structure of the main fuselage was crushed inward throughout its circumference. The engine firewall remained attached to the main fuselage; its base was deformed in the aft direction and its upper portion was partially fractured. The engine deck was deformed downward. The engine air inlet barrier filter remained installed within its frame, but the cowling surrounding the frame had separated. Sand was found within the barrier filter.

Figure 3 – Helicopter main wreckage partially embedded in the sand at low tide.

The cockpit floor, with the front seats attached, was recovered. The cockpit and cabin roof structure, about 5.5 ft in length measured from the upper windshield attachment, was also recovered. The Vision 1000 remained attached to the roof structure.

The three main rotor blades were found separated from the rotor hub and were broken into large pieces.

The tail boom, tail rotor assembly, and most of the instrument panel were not found.

The fuel tank remained installed within the center fuselage and was removed at the accident site by the investigation team in support of the wreckage recovery. About 25 gallons of fuel was removed from the fuel tank at the site; additional fuel was removed after recovery of the fuel tank. Evidence of saltwater was observed in the fuel removed from the fuel tank.

All engine electrical, oil, fuel, and pneumatic connections were installed and intact. These connections were separated to facilitate removal of the engine from the airframe. One of the first stage compressor blades exhibited curling deformation in the direction opposite of normal rotation at its tip end.

The pilot cyclic control was fractured from its lower attachment but remained with the wreckage via electrical wiring through its post. The grip remained attached to the pilot cyclic control. The safety pilot cyclic control and grip remained installed but exhibited deformation in multiple locations. Fractures were observed on multiple control tubes between the pilot and safety pilot cyclic controls to the mixing unit.

The pilot and safety pilot collective controls remained installed. The pilot collective head was present on the control stick but was partially separated and rotated to the right. The safety pilot collective head had separated and was missing from the control stick. The engine throttle twist grip was present on both the pilot and safety pilot collective controls and both twist grips were in the FLIGHT position. An attempt to manually rotate the twist grip was unsuccessful. Fractures were observed on multiple control tubes between the pilot and co- pilot collective controls to the mixing unit. All fractures exhibited signatures consistent with overload. The pilot and safety pilot pedals remained installed. The pilot pedals moved independently of each other and the interconnect linkages were fractured. The safety pilot pedal set remained interconnected. There were several impact-related separations leading up to the tail boom separation point. The tail rotor controls aft of the tail boom separation point were not recovered. The rotor brake and the emergency fuel shutoff handles remained installed on the roof and were in the stowed position.

Examination of the turboshaft engine revealed that the linking tube that housed the power transmission shaft was dented on its underside where it normally contacts the engine rear mount saddle. The reduction gearbox was removed from the engine. The index mark on the splined nut (in the reduction gearbox) was slightly offset in the tightening direction. The offset was measured to be greater than 0 millimeter (mm) but less than 1 mm. The splined nut and its mating splines did not exhibit anomalous damage. The reduction gearbox geartrain exhibited continuity, but rotation was limited with evidence of binding. Sand was observed within the visible interior surfaces of the reduction gearbox. All free turbine blades were present and did not exhibit anomalous damage. Once separated from the engine, the free turbine spun freely when manually rotated. The free turbine nozzle guide vanes were removed, revealing the high pressure turbine. All high pressure turbine blades were present and did not exhibit anomalous damage.

The gas generator module could not be rotated by hand. Sand was observed within the gas generator module. The axial compressor and gas generator modules were subsequently removed, after which continuity of drive through the accessory gearbox was confirmed via manual rotation of the accessory gearbox input drive. The fuel filter was removed and the filter element was clean. Sand was observed in the fuel filter bowl along with residual fuel. The oil filter was removed and the filter element exhibited

no evidence of debris. A residual liquid with the appearance of an oil and water mixture was observed within the oil filter bowl. The turbine inlet temperature thermocouples were removed and exhibited no evidence of melting. Removal of the engine's two magnetic chip detectors revealed evidence of sand. Removal of the engine's electronic chip detector revealed no evidence of debris. The bleed valve port and the auxiliary port were packed with sand.

Examination of the engine and airframe did not reveal any preimpact mechanical malfunctions or failures that would have precluded normal operation. For more detailed information, reference the Airworthiness Factual Report in the public docket for this investigation.

Flight recorders

Appareo Vision 1000

The helicopter was equipped with an Appareo Vision 1000 cockpit image and data recorder at the time of manufacture. The unit was capable of recording images, audio, GPS coordinates, and pitch, roll, yaw and acceleration data. The unit was mounted in the aft center ceiling of the cockpit.

The unit recorded images, ambient audio, and parametric data for the entire accident flight. The field of view included over-the-shoulder images of the forward cockpit, including both cyclic controls and the right seat collective and pedal controls, along with most of the instrument panel and a view out the lower forward portion of the windscreen. The unit did not record any radio or microphone audio; only engine and transmission noises could be heard for the duration of the recording.

The following excerpts are a summary of the Vision 1000 contents beginning at 10:46:00.
At 10:46:00, the helicopter continued northwest along the coastline at 650 ft msl with rain visibly impacting the windscreen.

At 10:50:42, the pilot's left hand manipulated his boom mic near his mouth and then made an arcing hand motion to the right. The safety pilot looked over at the pilot. About this time, rainfall on the windscreen diminished. About 10:53:00, the pilot made another series of hand gestures, the safety pilot continued to look in the direction of the pilot. At 10:53:20, the pilot made another series of hand gestures in which he pointed to the right.

About 10:54:00, the safety pilot picked up his iPhone and manipulated the map screen on the ForeFlight app. The map screen showed the helicopter's GPS location inside the Alaska Air Defense Identification Zone (ADIZ), just south of Lituya Bay, Alaska. At 10:55:20, the pilot made some additional gestures with his left hand, the safety pilot looked in the direction of the pilot. There were no more hand gestures from the pilot; however, the safety pilot was actively looking to the right of the helicopter toward the shoreline.

At 10:57:00, the helicopter was flying straight and level on a heading of 300° at an altitude of 590 ft msl and a groundspeed of 114 knots. There were no indications illuminated on the helicopter's CWP or any anomalous engine instrument indications.

The safety pilot was sitting with his hands on his knees and his feet flat on the floorboard. The pilot had his right hand on the base of the cyclic grip and his left hand was resting on his left knee. At 10:57:20, the safety pilot looked in the direction of the shoreline and moved his mouth as if he were making a comment.

At 10:57:34.75, the rotor speed (Nr) gauge indicated about 395 rpm, the first limit indicator (FLI) on the VEMD indicated about 8.5 FLI, the fuel gauge indicated about ¾ full, engine parameter indicator gauges were in the normal range and the autopilot system was inactive. Parametric data indicated the helicopter was pitched forward approximately 6° nose down; roll attitude was level. GPS data showed the helicopter at 618 ft msl and 116 knots groundspeed. The pilot moved his left hand off of his left knee and onto the twist grip portion of the collective control. About the same time that the pilot gripped the twist grip, the safety pilot moved his left hand out of view to his left and also moved his right hand into a ready position, hovering it near his cyclic control grip. At this point, the safety pilot's left hand was not visible on the video. Before this moment, the safety pilot had not previously hovered his hands near the flight controls at any time in the flight.

At 10:57:35.25, using his left hand, the pilot rotated the twist grip out of the FLIGHT detent to the IDLE position. The twist grip red warning light illuminated on the CWP. The pilot repositioned his left hand on the twist grip, but the collective control position remained unchanged. The safety pilot was still hovering his right hand near his cyclic control and his feet remained flat on the floor.

At 10:57:38.50, the FLI had dropped to a value of 7 and a green bleed valve indicator light (see the NOTE in ADDITIONAL INFORMATION) illuminated on the VEMD. A sound consistent with engine deceleration was audible on the Appareo ambient audio recording. Nr began decreasing just below 390 rpm. The pilot slightly lowered the collective. The pitch attitude of the helicopter was 3.6° nose down, groundspeed was 115 knots, and altitude was 627 ft msl. The pilot began a slight left pedal input. The safety pilot's position had not changed from the last observation.

In the next seven frames (1.75 seconds, 10:57:40.25), the FLI needle decreased to 1.75 FLI and the Nr gauge indicated 328 rpm. The twist grip remained in the IDLE position and the pilot had input a small amount of left pedal. Engine parameter indicator gauges were in the normal range. The helicopter was at 630 ft msl and 112 knots groundspeed with 8° pitch nose down and a level roll attitude. The safety pilot still had his feet flat on the floor, but now raised his right arm away from his grip and motioned with his right thumb in a pointing manner in the direction of the shoreline, to the right of the helicopter. The shoreline was visible in the upper right corner of the camera's view. Five frames later (1.25 seconds, 10:57:41.50), the FLI had decreased to 1.25 FLI and the Nr gauge indicated 300 rpm. The twist grip remained in the IDLE position. The pilot's left pedal input had not changed. The pilot's left hand then moved off of the collective control and reached up toward the horn on/off switch. The safety pilot was no longer pointing toward the shore and his right hand was back on his right knee, his left hand was still not visible, and he still had both feet flat on the floor. The helicopter was at 625 ft msl and 109 knots groundspeed with 2° pitch nose up and about 7° right roll. At 10:57:42.00, the "HORN" caution light illuminated on the CWP (silenced condition), Nr indicated 290 rpm, FLI indicated about 1.25 FLI. The safety pilot began reaching with his right hand toward his cyclic control. The helicopter was 623 ft msl and 108 knots groundspeed with 3° pitch nose up and about 9° right roll.

Two frames later (0.50 seconds, 10:57:42.50), the Nr gauge indicated 285 rpm, FLI indicated about 1.25 FLI. The pilot had moved his left hand back to his collective control. The collective control moved slightly toward the floor. The safety pilot now gripped his cyclic control with his right hand using a firm grip. The pilot was also manipulating his cyclic control. The helicopter was at 619 ft msl and 106 knots groundspeed with 3.6° pitch nose up and a value of about 11° right roll.

At 10:57:43.50, the Nr gauge indicated 282 rpm, FLI indicated about 1.25. The safety pilot was still gripping his cyclic control with his right hand; his right foot was now on his right pedal.

At 10:57:43.75, the Nr gauge indicated 283 rpm, FLI indicated about 1.25 FLI. The HYD1 light illuminated on the CWP and then cleared 0.25 seconds later. The collective control had risen slightly.

At 10:57:44.75, the Nr Gauge indicated 259 rpm, FLI indicated about 1.75 FLI. Both the pilot and the safety pilot had their hands on their cyclic grips. The cyclic controls were moving forward and to the left, it was unclear who was performing cyclic control inputs. The safety pilot now had both feet on his pedals. The collective control was moved to a slightly lower position.

At 10:57:46.00, the Nr gauge indicated 259 rpm, FLI indicated about 1.75. Both pilots appeared to be manipulating their respective flight controls. The twist grip remained in the IDLE position. Loose objects in the cockpit showed an indication of a negative G force as they floated in the air.

At 10:57:47.00, the Nr gauge indicated 254 rpm, FLI indicated about 1.50 FLI. The MGB P light (main gear box oil pressure warning light) illuminated on the CWP. Both pilots appeared to be manipulating the flight controls. The pilot looked down at his collective control then rotated the twist grip to the left from IDLE and back toward the FLIGHT detent.

At 10:57:47.50, the Nr gauge indicated 256 rpm, FLI indicated about 1.50 FLI. Both pilots appeared to be manipulating their respective flight controls. The twist grip was now back in the FLIGHT detent and the pilot was still looking down at the collective control. The twist grip warning light on the CWP had extinguished.

At 10:57:47.75, the "MGB P" warning light extinguished from the CWP.

At 10:57:48.50, the Nr gauge indicated 277 rpm, FLI indicated about 2 FLI. Both pilots appeared to be manipulating their respective flight controls. There appeared to be cyclic control inputs to the forward and left. The twist grip warning light illuminated again on the CWP and the twist grip was not in the FLIGHT detent. The collective control had risen slightly. The LIMIT light illuminated on the CWP.

At 10:57:50.50, the Nr gauge indicated 270 rpm, FLI indicated about 2 FLI. Both pilots appeared to be manipulating the flight controls. The pilot looked back down toward the twist grip on the collective. There was forward and left cyclic input.

At 10:57:51.00, in the next two frames (0.50 seconds), the collective raised slightly, the twist grip was momentarily rolled slightly toward FLIGHT.

At 10:57:52.00, the Nr gauge indicated 254 rpm, FLI indicated about 2 FLI. An amber caution light

illuminated but was not legible; the location of the caution light on the CWP was consistent with the "DOOR" caution light.

At 10:57:53.50, in the final six frames, the helicopter impacted water. During the descent to impact, the collective control position was raised. The helicopter rolled to the right and pitched nose up. The images exhibited signatures of rolling shutter blurriness consistent with an impact. The ELT light illuminated. Both pilots had their hands and feet on their respective flight controls.

The recording ended. No further information was recovered.

Figure 2 depicts a snapshot of a simulation created from the Vision 1000 data. The figure shows a representative helicopter and the flight track in yellow. The flight track descends toward the water where the recorded data ended.

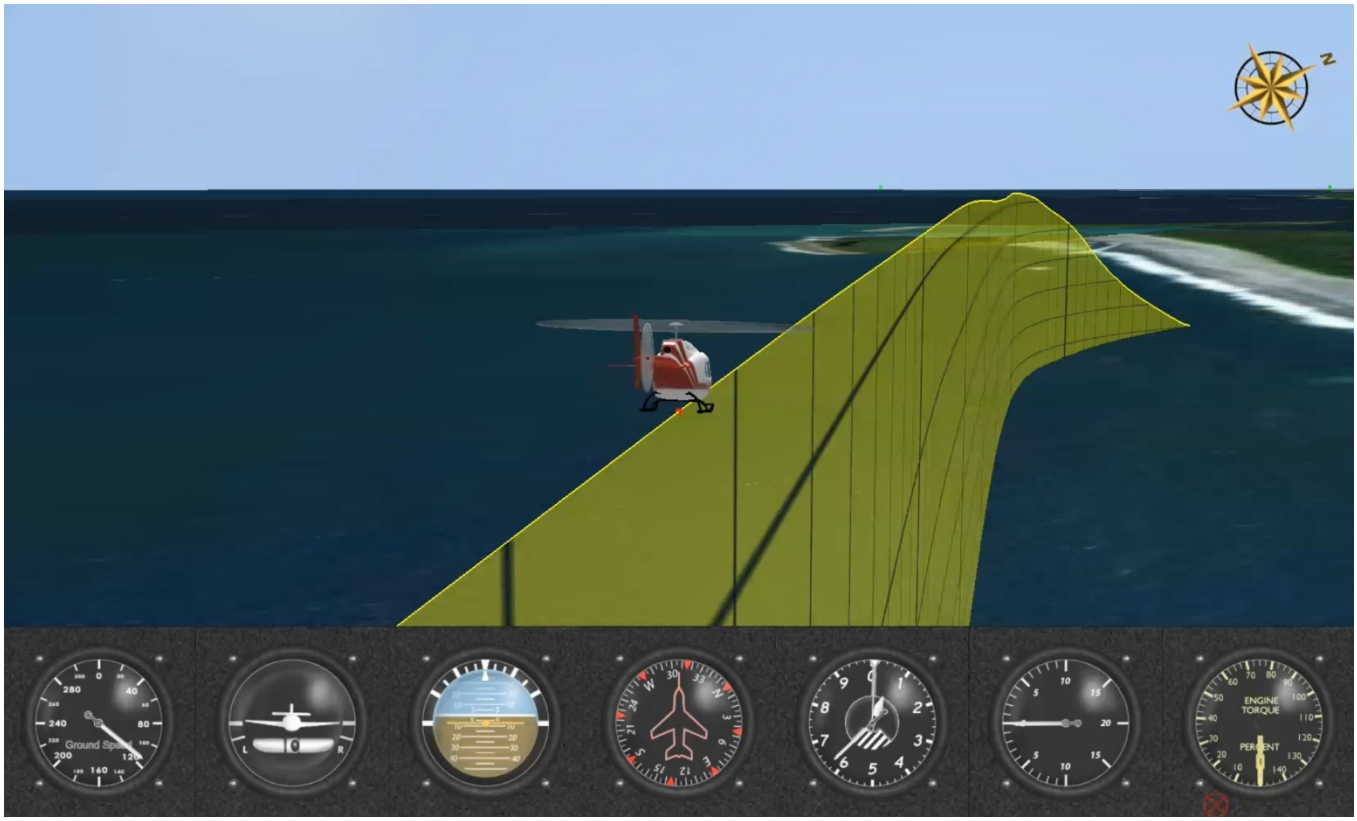

Figure 2 – Snapshot from Vision 1000 data simulation.

FADEC and Engine Data Recorder (EDR)

The FADEC on the Arriel 2D engine is a dual-module digital control unit that performs fuel regulation,

engine parameters management, and engine data recording. On each module, engine parameters, logical words and failure flags are stored on non-volatile memory components for maintenance purposes. Engine parameters are recorded at a sample rate of 1 second in a continuous recording and at a sample rate of 20 ms on a limited duration when a failure occurs.

The EDR is a recorder that exclusively records data sent by the FADEC, in the same manner, on a non-volatile memory component for maintenance purposes.

The FADEC and EDR were sent to the Bureau of Enquiry and Analysis (BEA) for Civil Aviation Safety in France for examination and analysis. The data revealed that, during the flight and in the last 16 seconds of the recording, the twist grip was actuated from FLIGHT to IDLE to FLIGHT to IDLE and finally back to FLIGHT. The engine parameters varied accordingly to the FLIGHT or IDLE twist grip position with no anomalous indications noted. The FADEC recorded four failures at the very end of the recording that were associated with the helicopter impacting the water.

Medical and Pathological Information

The Alaska State Medical Examiner's Office, Anchorage, Alaska, conducted an autopsy of the safety pilot. The autopsy report concluded that the cause of death was multiple blunt-force injuries. The autopsy revealed severe coronary artery disease with 75% stenosis of the left anterior descending coronary artery. There was no thromboembolus and no evidence of a recent or past heart attack. There were no autopsy findings to suggest an incapacitating event; additionally, the recorded images from the Vision 1000 revealed that the safety pilot was conscious and functioning at the time of the accident.

Toxicological testing of urine specimens by the FAA Forensic Sciences Laboratory detected no drugs or ethanol.

The pilot's body was not recovered.

Additional Information

According to the helicopter's RFM, the bleed valve is normally open when the engine is shut down, during starting, and at low power settings. The bleed valve open indicator, displayed as a solid green-colored flag with two vertical white stripes, appears above the FLI when the bleed valve is open. The bleed valve open indicator disappears when the bleed valve closes.

Fuel Sample

Immediately after the accident, a manager at the fixed based operator at JNU where the helicopter had

refueled secured a fuel sample from their fuel supply. The sample was tested for water and visible contaminants; no water or other contamination was found.

Appareo Vision 1000

A review of additional images from the unit showed that during the most recent flights preceding the accident flight, the safety pilot did not guard the cyclic or collective while the pilot was executing a takeoff or landing maneuver.

Autorotation Procedures

In an autorotation maneuver, after the removal of engine power, whether due to engine failure or intentional throttle reduction, the pilot is required to manipulate the flight controls in order to maintain Nr and a normal attitude during the autorotative descent. The primary means to control Nr during an autorotation is the collective control. Excessive Nr can result in a main rotor overspeed, and an increase in collective pitch is required to reduce Nr to the required range. If Nr becomes too slow, a decrease in collective pitch is required to increase Nr to the required range.
Supplement 6 of the AS350 B3e RFM contained procedures for autorotation landing training. According to Supplement 6, in the event of an engine failure or a loss of engine power, "the helicopter will yaw to the right, some red warnings may come on associated with the gong audio warning, the Nr will decay, and the low Nr audio warning will sound if Nr goes below 360 rpm." A loss of engine power could be simulated by setting the twist grip to the IDLE detent, which would produce the same symptoms as that of an actual engine failure or loss of engine power. A note within the emergency procedures of Supplement 6 stated that, "if necessary, it is possible to quickly turn the twist grip back to the FLIGHT position at any time and for any Nr value."

Administrative Information

Investigator In Charge (IIC):	Lindberg, Joshua
Additional Participating Persons:	Daniel Figueroa; Federal Aviation Administration; Juneau, AK Stéphane Veillon; Bureau d'Enquêtes et d'Analyses; Le Bourget Seth Buttner; Airbus Helicopters; Grand Prairie, TX Bryan Larimore; Safran Helicopter Engines; Grand Prairie, TX
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Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=98368