



National Transportation Safety Board Aviation Accident Final Report

Location:	San Juan, PR	Accident Number:	ERA17LA126
Date & Time:	02/21/2017, 1015 AST	Registration:	N413LP
Aircraft:	EUROCOPTER AS 350	Aircraft Damage:	Substantial
Defining Event:	Fire/smoke (non-impact)	Injuries:	2 None
Flight Conducted Under:	Part 91: General Aviation - Instructional		

Analysis

The pilot/owner of the turbine helicopter was practicing autorotations with a flight instructor. After completing several autorotations uneventfully, the instructor asked if he could perform one, and the pilot agreed. Near the flare at the end of the maneuver, the pilot heard the engine overrev, followed by an Nr (rotor speed) aural warning, followed by a fire warning light illumination on the instrument panel. After landing, the pilot exited the helicopter with a fire extinguisher and attempted to extinguish an engine fire.

Review of data downloaded from a vehicle-engine multifunction display and digital engine control unit revealed that the first failure recorded during the flight indicated that the gas generator rotation speed (N1) reached an out-of-limit value. At that time, the fuel regulation was in mixed mode, as the collective twist grip throttle control was out of the "flight" detent and the pilot was manually controlling the throttle. A second failure was recorded 2 seconds later, which indicated that the free turbine rotation speed (N2) reached an out-of-limit value. The failure was triggered by the maximum recorded value of 545 rpm, which equated to a turbine speed (Nr) of 140%.

The engine's freewheeling turbine was designed to separate turbine blades at 150% Nr in order to prevent the turbine disc separating at 170% Nr. It is likely that the flight instructor excessively opened the fuel metering unit via the twist grip throttle manual control, which resulted in an engine overspeed, turbine blade separation, and subsequent engine fire.

Probable Cause and Findings

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

The flight instructor's incorrect manipulations of the twist grip throttle control during a practice autorotation, which resulted in an engine overspeed and subsequent fire.

Findings

Aircraft	Fuel controlling system - Incorrect use/operation (Cause)
Personnel issues	Incorrect action performance - Instructor/check pilot (Cause)

Factual Information

On February 21, 2017, about 1015 Atlantic standard time, an Airbus Helicopters (Eurocopter) AS 350 B3, N413LP, operated by the commercial pilot, was substantially damaged during a practice autorotation at Fernando Luis Ribas Dominicci Airport (TJIG), San Juan, Puerto Rico. The flight instructor and commercial pilot were not injured. The instructional flight was conducted under the provisions of 14 *Code of Federal Regulations* Part 91. Visual meteorological conditions prevailed and no flight plan was filed for the flight that originated from TJIG about 0900.

According to the flight instructor's written statement, he was the pilot-in-command for the flight and the commercial pilot/owner of the helicopter was practicing autorotations. During recovery from the last 180° autorotation, the flight instructor noticed that the engine rpm continued to increase and exceeded limitations, followed by a vibration in the helicopter. He then immediately landed on a grass area near a runway. After the landing, a mechanic told him that the helicopter's engine was on fire. The flight instructor completed the engine fire procedure and exited the helicopter.

According to the commercial pilot's written statement, he had completed several training maneuvers and autorotations uneventfully. The flight instructor then asked if he could perform an autorotation and the commercial pilot agreed. During the flare at the end of the autorotation, the commercial pilot heard the engine overrev, followed by an Nr (rotor speed) aural warning, followed by a fire warning light illumination on the instrument panel. After landing, the commercial pilot exited the helicopter with a fire extinguisher and attempted to extinguish an engine fire.

Review of airport security video revealed that the helicopter was descending to a grass area adjacent to the runway. About 30 feet above ground level, smoke began emitting from the helicopter and it climbed out of the video frame. It then descended back into the video frame and landed on the grass while smoke continued to emit from the helicopter.

Examination of the helicopter by a Federal Aviation Administration inspector revealed that the fire resulted in damage to the engine deck support structure and a portion of the tail rotor drive shaft. A vehicle and engine multifunction display (VEMD), digital engine control unit (DECU), hydromechanical unit (HMU), and assembly valve were retained for examination and data download at the manufacturers' facilities under the supervision of the Bureau d'Enquetes et d'Analyses (BEA) in France. Examination and testing of the HMU and assembly valve did not reveal any anomalies that would have precluded normal engine operation.

Review of data downloaded from the VEMD and DECU revealed that during the accident flight, the first failure recorded by both computers was an NG/N1 failure, respectively. The failure was recorded at 1 hour, 13 minutes, 18 seconds (1:13:18) into the 1-hour, 14-minute flight by the VEMD and 1:13:27 by the DECU. The recorded failure indicated that the gas generator rotation speed (N1) reached an out of limit value. At that time, the fuel regulation was in mixed mode as the collective twist grip throttle control was out of the "flight" detent and the pilot was manually controlling the throttle. A second failure was recorded 2 seconds later, which

indicated that the free turbine rotation speed (N2) reached an out of limit value. The failure was triggered by the maximum recorded value of 545 rpm, which equated to an Nr of 140%.

According to a representative from the engine manufacturer, the engine's freewheeling turbine was designed for its turbine blades to separate at 150% turbine speed. The design was to prevent the turbine disc from separating at a turbine speed of 170%. During his examination of the engine, the representative observed evidence consistent with the turbine blades separating, resulting in an engine fire.

History of Flight

Autorotation	Miscellaneous/other Fire/smoke (non-impact) (Defining event)
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Pilot Information

Certificate:	Airline Transport; Commercial	Age:	37, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	Seat Occupied:	Left
Other Aircraft Rating(s):	Helicopter	Restraint Used:	3-point
Instrument Rating(s):	Airplane; Helicopter	Second Pilot Present:	Yes
Instructor Rating(s):	Helicopter; Instrument Helicopter	Toxicology Performed:	No
Medical Certification:	Class 1 Without Waivers/Limitations	Last FAA Medical Exam:	02/07/2017
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	09/20/2016
Flight Time:	6250 hours (Total, all aircraft), 950 hours (Total, this make and model), 5500 hours (Pilot In Command, all aircraft), 280 hours (Last 90 days, all aircraft), 40 hours (Last 30 days, all aircraft), 3 hours (Last 24 hours, all aircraft)		

Pilot Information

Certificate:	Commercial	Age:	74, Male
Airplane Rating(s):	Single-engine Land	Seat Occupied:	Right
Other Aircraft Rating(s):	Helicopter	Restraint Used:	3-point
Instrument Rating(s):	None	Second Pilot Present:	Yes
Instructor Rating(s):	None	Toxicology Performed:	No
Medical Certification:	Class 1 With Waivers/Limitations	Last FAA Medical Exam:	03/03/2016
Occupational Pilot:	No	Last Flight Review or Equivalent:	01/01/2016
Flight Time:	8467 hours (Total, all aircraft), 5200 hours (Total, this make and model), 8467 hours (Pilot In Command, all aircraft), 31 hours (Last 90 days, all aircraft), 12 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	EUROCOPTER	Registration:	N413LP
Model/Series:	AS 350 B3	Aircraft Category:	Helicopter
Year of Manufacture:	1999	Amateur Built:	No
Airworthiness Certificate:	Normal	Serial Number:	3228
Landing Gear Type:	High Skid	Seats:	6
Date/Type of Last Inspection:	06/09/2016, 100 Hour	Certified Max Gross Wt.:	4961 lbs
Time Since Last Inspection:	59 Hours	Engines:	1 Turbo Shaft
Airframe Total Time:	1846 Hours at time of accident	Engine Manufacturer:	Turbomeca
ELT:	C126 installed, not activated	Engine Model/Series:	Arriel 2B
Registered Owner:	HELICORP INC	Rated Power:	871 hp
Operator:	On file	Operating Certificate(s) Held:	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Day
Observation Facility, Elevation:	TJIG, 10 ft msl	Distance from Accident Site:	0 Nautical Miles
Observation Time:	1001 AST	Direction from Accident Site:	0°
Lowest Cloud Condition:	Scattered / 3000 ft agl	Visibility	8 Miles
Lowest Ceiling:	Broken / 5500 ft agl	Visibility (RVR):	
Wind Speed/Gusts:	6 knots / 12 knots	Turbulence Type Forecast/Actual:	/ None
Wind Direction:	330°	Turbulence Severity Forecast/Actual:	/ N/A
Altimeter Setting:	29.95 inches Hg	Temperature/Dew Point:	23°C / 19°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	San Juan, PR (TJIG)	Type of Flight Plan Filed:	None
Destination:	San Juan, PR (TJIG)	Type of Clearance:	None
Departure Time:	0900 AST	Type of Airspace:	

Airport Information

Airport:	Fernando Luis Ribas Dominicci (TJIG)	Runway Surface Type:	Grass/turf
Airport Elevation:	10 ft	Runway Surface Condition:	Dry
Runway Used:	N/A	IFR Approach:	None
Runway Length/Width:		VFR Approach/Landing:	Simulated Forced Landing

Wreckage and Impact Information

Crew Injuries:	2 None	Aircraft Damage:	Substantial
Passenger Injuries:	N/A	Aircraft Fire:	In-Flight
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	2 None	Latitude, Longitude:	18.456667, -66.098333 (est)

Administrative Information

Investigator In Charge (IIC):	Robert J Gretz	Report Date:	01/25/2018
Additional Participating Persons:	Rafael Gonzalez; FAA/FSDO; San Juan, PR		
Publish Date:	01/25/2018		
Note:	The NTSB did not travel to the scene of this accident.		
Investigation Docket:	http://dms.nts.gov/pubdms/search/dockList.cfm?mKey=94847		

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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](#).