Aviation Investigation Final Report

Location:	Pompano Beach, Florida	**Accident Number:**	ERA23FA352
Date & Time:	August 28, 2023, 08:44 Local	**Registration:**	N109BC
Aircraft:	Eurocopter EC135	**Aircraft Damage:**	Destroyed
Defining Event:	Fire/smoke (non-impact)	**Injuries:**	2 Fatal, 1 Serious, 1 Minor
Flight Conducted Under:	Part 135: Air taxi & commuter - Non-scheduled - Air Medical (Medical emergency)		

Analysis

The helicopter was dispatched to pick up a victim from an automobile accident. Electronic devices onboard the helicopter recorded that about 67 seconds after liftoff, the No. 1 electronic engine control unit reported a simultaneous double N1 and double N2 failure. While this failure would have been expected to result in a “FADEC FAIL” cockpit caution, the pilot did not recall seeing or hearing any cockpit caution or warning indications. This condition would also have frozen the fuel control unit to the fuel flow at the time of the failure until the end of the flight, which was 123 l/h, consistent with a climb power setting. The reason for the failure could not be determined.

About 90 seconds after liftoff, at 300 to 400 ft above ground level, the pilot heard a “bang” from the rear of the helicopter and noticed that the turbine outlet temperature (TOT) was rising on the No. 1 engine, but still within limits. He set the No.1 engine throttle to idle, declared an emergency to air traffic control, and reversed direction to return to the airport. Unbeknownst to the pilot, due to the FADEC FAIL condition, setting the engine throttle to idle would have had no effect on fuel flow, but rather the engine twist grip would need to be manipulated to manually control fuel flow to that engine. Despite this condition, fuel flow maintained at that level would not be expected to result in an overtemperature condition in the engine.

The pilot next scanned the cockpit instrument panel and noticed that the No.1 engine fire button had illuminated. He stated that he pressed the button to activate the fire suppression system; however, the TOT continued to rise near 1,000° C (maximum limit 895°C) on the No. 1 engine. The pilot subsequently heard a second “bang” (about 90 seconds after the first “bang”) and was unable to control the helicopter. It spun and descended into an apartment building.

Review of witness video revealed an in-flight fire near the area of the No. 1 engine exhaust and the air conditioner condenser fans. The tailboom partially separated in flight and the helicopter descended in a right spin. Examination of the No. 1 engine revealed that five turbine blades had fractured consistent with overheat fatigue from temperatures in excess of 1,295° C. There was no evidence of fire within the No. 1 engine compartment prior to ground impact; however, exhaust gases in excess of 1,000° C could have been a factor in the initiation of the inflight airframe fire outside of the No. 1 engine compartment. Specifically, a fiberglass air conditioner housing and composite tailboom fuselage were located near the No.1 engine exhaust. While the composite fuselage offered more fire resistance than the fiberglass housing, neither were certified to withstand temperatures in excess of 1,000° C.

While the No. 1 engine fire warning light could provide indications of fires within the engine compartment, this fire was outside the engine compartment. As such, the pilot had no caution and warning indicators of an inflight fire that may have forced a land immediately action, therefore, his decision to return to the airport was reasonable, rather than risk an off-airport emergency landing to a confined area with one engine inoperative.

The No. 1 emergency fuel shutoff valve was in the open position. In the cockpit, the No. 1 engine fire button's breakable safety wire was found unbroken and the button did not exhibit inward deformation. Although the pilot stated that he pressed the fire button, he likely did not. Additionally, the fire suppression system was for inside the engine compartment and would not have extinguished a fire outside of the engine compartment, but pressing the button would have closed the fuel shutoff valve for the No. 1 engine.

In summary, the accident was the result of an inflight fire in the vicinity aft of the helicopter's No. 1 engine exhaust, near the air conditioner condenser fans, and the origin of the fire was likely the result of the engine overheating. The only plausible explanations the investigation could determine for only the No. 1 engine to overheat were foreign object debris, blockage of the No. 1 engine air inlet, or hot gas or combustible fluid ingestion. Because the wreckage was subjected to a postimpact fire, the source of the overtemperature could not be determined.

Probable Cause and Findings

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

An inflight fire outside of the engine firewalls, likely from overheating of the No. 1 engine for undetermined reasons, which resulted in a partial tailboom separation.

Findings

Not determined	(general) - Unknown/Not determined

Factual Information

History of Flight

Initial climb	Fire/smoke (non-impact) (Defining event)
Approach	Part(s) separation from AC
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On August 28, 2023, about 0844 eastern daylight time, a Eurocopter (Airbus Helicopters) Deutschland GMBH EC135T1, N109BC, was destroyed when it was involved in an accident near Pompano Beach, Florida. The commercial pilot sustained minor injuries. One paramedic onboard and a resident of an apartment building were fatally injured, while a second paramedic onboard was seriously injured. The helicopter was operated as a Title 14 *Code of Federal Regulations* Part 135 air medical flight.

The pilot reported that the helicopter was dispatched to transport a patient from the scene of an automobile accident. About 90 seconds after liftoff and during initial climb, west of Pompano Beach Airpark (PMP), Pompano Beach, Florida, about 300 to 400 ft above ground level, the pilot heard a “bang” from the rear of the helicopter and noticed that the turbine outlet temperature (TOT) was rising on the No. 1 engine, but was still within limits. Prior to the “bang,” the pilot did not recall seeing or hearing any cockpit caution or warning indicators. He set the No.1 engine throttle to idle, declared an emergency to air traffic control, and reversed direction to return to the airport. He scanned the cockpit instrument panel and noticed that the No.1 engine fire button had illuminated. The pilot further stated that he pressed the button to activate the fire suppression system; however, the TOT continued to rise near 1,000° C on the No. 1 engine (maximum limit 895°C). The pilot subsequently heard a second “bang” and was unable to control the helicopter. It spun and descended into an apartment building.

Review of witness video revealed an in-flight fire near the area of the No. 1 engine exhaust, and air conditioner condensing fans. The inflight fire spread to the central area near the tail boom attach point. Subsequently, the tailboom partially separated inflight and the helicopter descended in an uncontrolled right spin.

Pilot Information

Certificate:	Commercial; Private	**Age:**	37,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	4-point
Instrument Rating(s):	Airplane; Helicopter	**Second Pilot Present:**	No
Instructor Rating(s):	Helicopter; Instrument helicopter	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 Without waivers/limitations	**Last FAA Medical Exam:**	December 15, 2022
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	June 9, 2023
Flight Time:	4035 hours (Total, all aircraft), 272 hours (Total, this make and model), 3750 hours (Pilot In Command, all aircraft), 16 hours (Last 90 days, all aircraft), 6 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Cabin crew Information

Certificate:		**Age:**	50,Male
Airplane Rating(s):		**Seat Occupied:**	Left
Other Aircraft Rating(s):		**Restraint Used:**	4-point
Instrument Rating(s):		**Second Pilot Present:**	No
Instructor Rating(s):		**Toxicology Performed:**	Yes
Medical Certification:		**Last FAA Medical Exam:**	
Occupational Pilot:		**Last Flight Review or Equivalent:**	
Flight Time:			

Cabin crew Information

Certificate:		**Age:**	29,Male
Airplane Rating(s):		**Seat Occupied:**	Rear
Other Aircraft Rating(s):		**Restraint Used:**	4-point
Instrument Rating(s):		**Second Pilot Present:**	No
Instructor Rating(s):		**Toxicology Performed:**	Yes
Medical Certification:		**Last FAA Medical Exam:**	
Occupational Pilot:		**Last Flight Review or Equivalent:**	
Flight Time:			

The pilot held a commercial pilot certificate with ratings for rotorcraft helicopter and instrument helicopter. He also held a second-class medical certificate. The pilot reported 3,895 hours of total helicopter experience, of which 272 hours were in the same make and model as the accident helicopter. He had been flying for the operator for over four years.

Aircraft and Owner/Operator Information

Aircraft Make:	Eurocopter	**Registration:**	N109BC
Model/Series:	EC135 T1	**Aircraft Category:**	Helicopter
Year of Manufacture:	1999	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	0139
Landing Gear Type:	Skid	**Seats:**	4
Date/Type of Last Inspection:	May 23, 2023 100 hour	**Certified Max Gross Wt.:**	6250 lbs
Time Since Last Inspection:	24 Hrs	**Engines:**	2 Turbo shaft
Airframe Total Time:	5557 Hrs as of last inspection	**Engine Manufacturer:**	Turbomeca
ELT:	C126 installed, not activated	**Engine Model/Series:**	Arrius 2B1
Registered Owner:	BROWARD COUNTY SHERIFFS OFFICE	**Rated Power:**	670 Horsepower
Operator:	BROWARD COUNTY SHERIFFS OFFICE	**Operating Certificate(s) Held:**	On-demand air taxi (135)

The helicopter was manufactured in 1999 and powered by two Turbomeca Arrius 2B1, 670-turboshaft-horsepower engines. It was maintained under a manufacturer's approved inspection program. Its most recent 100-hour inspection was completed on May 23, 2023. At that time, the airframe had accrued 5,557.1 total hours. The engines had accrued 5,327.2 hours since new (2,251.3 hours since overhaul in 2016). The helicopter was operated about 24 hours from the time of the most recent inspection until the accident. An air conditioner was installed on the helicopter under supplemental type certificate on August 1, 2023, about 16 flight hours prior to the accident flight.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	PMP,15 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	08:53 Local	**Direction from Accident Site:**	60°
Lowest Cloud Condition:	Few / 2400 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	Broken / 7000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	7 knots / None	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	190°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	29.81 inches Hg	**Temperature/Dew Point:**	31°C / 24°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Pompano Beach, FL	**Type of Flight Plan Filed:**	Company VFR
Destination:	Pompano Beach, FL	**Type of Clearance:**	None
Departure Time:		**Type of Airspace:**	Class D

Airport Information

Airport:	Pompano Beach Airpark PMP	**Runway Surface Type:**	Asphalt
Airport Elevation:	19 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	6	**IFR Approach:**	None
Runway Length/Width:	4001 ft / 150 ft	**VFR Approach/Landing:**	Straight-in

Wreckage and Impact Information

Crew Injuries:	1 Fatal, 1 Serious, 1 Minor	**Aircraft Damage:**	Destroyed
Passenger Injuries:	N/A	**Aircraft Fire:**	In-flight
Ground Injuries:	1 Fatal	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal, 1 Serious, 1 Minor	**Latitude, Longitude:**	26.240252,-80.122249

The wreckage came to rest on its left side, facing south, through the roof of a one-story apartment building. A postcrash fire consumed a majority of the airframe. The tailboom was located about 30 ft south of the main wreckage and its fenestron (tailrotor) remained intact. All four main rotor blades separated near the blade root, consistent with impact damage. Both engines and their respective electronic engine control units (EECUs) were retained for further

examination and data download. Additionally, the No. 1 engine fuel shutoff valve assembly was also retained for further examination.

The No. 1 engine was further examined at the manufacturer's facility. The examination revealed that five turbine blades had fractured below the blade platform. Metallurgical examination of the separated turbine blades revealed their inner walls exhibited dissolution of material precipitates (microstructural transformation) consistent with an overheating condition beyond 1,295° C and fatigue cracking due to excessive temperatures. There was no evidence of fire inside the No. 1 engine; however, the exhaust gases in excess of 1,000° C were consistent with an ignition source. Specifically, a fiberglass air conditioner housing and composite tailboom fuselage were located near the No.1 engine exhaust. While the composite fuselage offered more fire resistance than the fiberglass housing, neither were certified to withstand temperatures in excess of 1,000° C. (For more information, see the Airworthiness Group Chair's Factual Report, Powerplants Group Chair's Factual report, and Materials Laboratory Report in the public docket for this investigation.)

Review of data downloaded from the No. 1 engine EECU revealed a simultaneous double N1 and double N2 failure recorded about 67 seconds after liftoff, and about 25 seconds before the pilot heard the first "bang." This failure would result in a "FADEC FAIL" cockpit caution and would freeze the fuel control unit (FCU) at the fuel flow at the time of the failure, which was 123 l/h. Postaccident examination and testing of the FCU resolver revealed that it remained in a 123 l/h position. The reason for the failure could not be determined. Consequently, setting the engine throttle to idle will have no effect on fuel flow, but rather the engine twist grip must be manipulated to manually control fuel flow to that engine.

Computed Tomography scanning of the No. 1 emergency fuel shutoff valve revealed that it was in the open position. Examination of the cockpit revealed that the No. 1 and No. 2 engine fire buttons' breakable safety wire were found unbroken and the the buttons did not exhibit inward deformation. Examination of the No. 1 engine air inlet did not reveal any blockages; however, that area had been subject to a postcrash fire.

Administrative Information

Investigator In Charge (IIC):	Gretz, Robert
Additional Participating Persons:	Ricardo Queiroz; FAA/FSDO; Miramar, FL Seth Buttner; Airbus Helicopters; Grand Prairie, TX Bryan Larimore; Safran Helicopter Engines; Grand Prairie, TX Paul-Etienne Jactat; Safran Helicopter Engines David Keenan; FAA AVP-100; Washington, DC Don Lambert; Metro Aviation; Shreveport, LA
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Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=192950