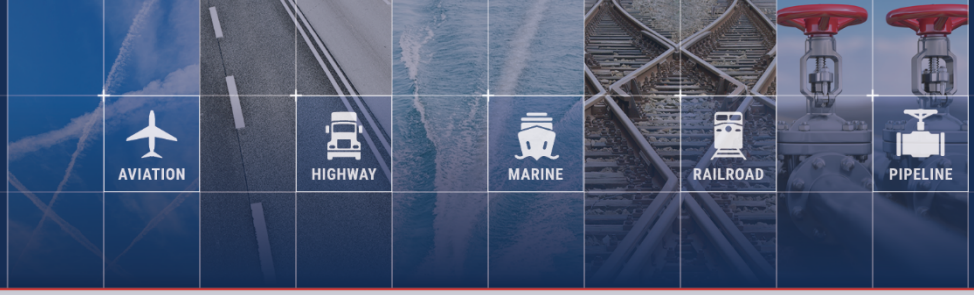

Aviation Investigation Final Report

Location:	Anchorage, Alaska	**Accident Number:**	ANC23LA024
Date & Time:	March 5, 2023, 14:00 Local	**Registration:**	N5688R
Aircraft:	Enstrom F-28C	**Aircraft Damage:**	Substantial
Defining Event:	Hard landing	**Injuries:**	2 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot reported that the helicopter preflight and engine runup were normal; however, he could not maintain main rotor rpm on departure and the engine lost partial power. The pilot made a run-on landing to a snow-covered lake, which resulted in substantial damage to the tail boom.

Postaccident examination of the engine revealed no evidence of any preimpact mechanical malfunctions or failures that would have precluded normal operation.

Since there were no mechanical anomalies with the helicopter, it is likely the pilot allowed the main rotor rpm to decrease and exceeded the available engine power to recover from the low main rotor rpm condition. When the main rotor rpm decreases, the amount of power the engine can produce also decreases, which is likely the reason the pilot perceived a partial loss of engine power. In addition, the obstacles along the departure path prevented the pilot from lowering the collective to regain main rotor rpm, which resulted in the pilot electing to perform a run-on landing.

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 rpm on takeoff, which resulted in a forced run-on landing.

Findings

Aircraft	Powerplant parameters - Capability exceeded
Aircraft	Prop/rotor parameters - Not attained/maintained
Personnel issues	Use of equip/system - Pilot

Factual Information

History of Flight

Takeoff	Miscellaneous/other
Landing	Hard landing (Defining event)

On March 5, 2023, about 1400 Alaska Standard Time, an Enstrom F-28C Helicopter, N5688R, sustained substantial damage when it was involved in an accident in Anchorage, Alaska. The pilot and passengers were not injured. The helicopter was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

The pilot completed the preflight inspection and engine run-up with no anomalies noted. The helicopter departed from Lake Hood Seaplane Base (LHD), Anchorage, Alaska. The pilot reported that during takeoff, about 30 ft above the ground, the helicopter could not maintain main rotor rpm. He stated the engine lost partial power and the helicopter was too low to perform an autorotation procedure. The pilot made a run-on landing to a snow-covered lake. The helicopter sustained substantial damage to the tail boom. Review of the accident site revealed buildings and parked airplanes in front of the departure path of the helicopter.

An engine examination was performed by a National Transportation Safety Board investigator after the accident. The engine started normally and responded normally to throttle inputs with cylinder head temperature indications equal across all cylinders. Both engine magnetos were fully operational. Engine compression was good on all cylinders. The bottom spark plugs were removed from the engine and no anomalies were observed with their electrodes. The turbocharger was inspected, and all gaskets and hoses were secure, with the turbocharger fan moving freely. All intake and exhaust connections were secure and undamaged with no blockages observed. The main rotor blade belt tensioner operated normally and was in the engaged position at the start of the examination. No anomalies were identified with the main rotor drive belt. The main rotor transmission moved freely by hand. The examination of the engine and airframe revealed no evidence of any preimpact mechanical malfunctions or failures that would have precluded normal operation.

An annual inspection was completed May 5, 2022, to include a 100-hour inspection on the engine. The maintenance entry noted that the engine test run was satisfactory. On November 20, 2022, the helicopter main rotor blades were removed and the helicopter was placed in storage for the winter. On March 5, 2023, the main rotor blades were installed; the helicopter was run up and hover checks were satisfactory.

According to the Federal Aviation Administration’s Helicopter Flying Handbook, as the main rotor rpm decreases, the amount of horsepower the engine can produce also decreases.

Engine horsepower is directly proportional to its rpm, so a 10% loss in main rotor rpm due to overpitching will result in a 10% loss in the engine's ability to produce horsepower, making recovery even slower and more difficult than it would otherwise be. With less power from the engine and less lift from the decaying rotor rpm, the helicopter will start to settle. If the pilot raises the collective to stop the settling the situation will feed upon itself, rapidly leading to rotor stall.

The pilot's operating handbook stated in part:

MAXIMUM POWER TAKEOFF FROM CONFINED AREAS

Conditions may occur in which the helicopter must be operated from confined areas in which take-off distances (from hover to best rate of climb speed) are not sufficient to clear obstacles that may be in the flight path (trees, buildings, wires, etc.). In order to clear such obstacles safely, the climb portion of the take-off must utilize the best angle of climb airspeed (30 MPH safe side of height velocity curve). This angle of climb will substantially shorten the distance required to clear obstacles. To accomplish this type of take-off, hover helicopter at 3 to 5 feet altitude and 2900 RPM. Apply forward cyclic smoothly. As the helicopter begins to accelerate forward, apply collective and throttle until 36.5 inches of manifold pressure is obtained at 2900 engine RPM. Do not increase collective beyond this point (over pitching) as this will cause engine and rotor RPM to decrease. Maintain 3 to 5 feet altitude by use of cyclic control. As translational speed is reached (15-20 MPH) apply aft cyclic to seek climb angle that will maintain 30-35 MPH (refer to height ~ velocity diagram in flight manual). After clearing all obstacles at this airspeed, apply forward cyclic and readjust collective and throttle as desired for further flight.

Allowing main rotor rpm to decrease below the allowable range is one of the most dangerous situations a helicopter pilot can get into. Low-rotor rpm can occur at almost any time, and it's usually the result of improperly coordinating the collective and throttle. If a pilot waits for the rotor rpm to decrease, it's too late because the helicopter is now on the back side of its power curve. As the blade tips cone upwards because of the reduction in rotor rpm, the apparent area of the rotor disc, as seen from above, decreases. With less area, the rotor disc produces less lift, and the helicopter descends. If the pilot reacts to the loss of lift by raising the collective, the extra drag on the rotor blades slows them down even more. If the pilot of a light, piston-engine helicopter lets low-rotor rpm develop, merely opening the throttle may not produce enough engine power to overcome the rapidly rising drag on the rotor blades. If the helicopter is close to the ground, lowering the collective may be the last thing on a pilot's mind, but simultaneously lowering the collective and applying full throttle is the only sure way to recover the lost rotor rpm.

Low main rotor RPM is a dangerous condition that can occur when rotor RPM is not carefully monitored, or maximum power limitations are not observed. If the rotor RPM is allowed to decay too far, recovery may be impossible. In the event of a low rotor RPM condition, the pilot

should simultaneously apply full power and lower the collective until normal rotor RPM is achieved.

Pilot Information

Certificate:	Commercial	**Age:**	48,Male
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land; Multi-engine sea	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	Unknown
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane single-engine; Helicopter	**Toxicology Performed:**	
Medical Certification:	Class 2 None	**Last FAA Medical Exam:**	October 11, 2022
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	January 15, 2022
Flight Time:	21000 hours (Total, all aircraft), 900 hours (Total, this make and model), 20500 hours (Pilot In Command, all aircraft), 13 hours (Last 90 days, all aircraft), 11 hours (Last 30 days, all aircraft), 0 hours (Last 24 hours, all aircraft)		

Passenger Information

Certificate:		**Age:**	
Airplane Rating(s):		**Seat Occupied:**	Right
Other Aircraft Rating(s):		**Restraint Used:**	Unknown
Instrument Rating(s):		**Second Pilot Present:**	No
Instructor Rating(s):		**Toxicology Performed:**	
Medical Certification:		**Last FAA Medical Exam:**	
Occupational Pilot:	UNK	**Last Flight Review or Equivalent:**	
Flight Time:			

Aircraft and Owner/Operator Information

Aircraft Make:	Enstrom	**Registration:**	N5688R
Model/Series:	F-28C	**Aircraft Category:**	Helicopter
Year of Manufacture:	2015	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	466-2
Landing Gear Type:	None; Skid	**Seats:**	3
Date/Type of Last Inspection:	May 1, 2022 Annual	**Certified Max Gross Wt.:**	2350 lbs
Time Since Last Inspection:	3.2 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	1833.9 Hrs at time of accident	**Engine Manufacturer:**	Lycoming
ELT:	Installed	**Engine Model/Series:**	HIO-36-E1AD
Registered Owner:	On file	**Rated Power:**	205 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	PANC,132 ft msl	**Distance from Accident Site:**	2 Nautical Miles
Observation Time:	13:53 Local	**Direction from Accident Site:**	270°
Lowest Cloud Condition:	Scattered / 20000 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	4 knots /	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	80°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	30.4 inches Hg	**Temperature/Dew Point:**	-7°C / -17°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Anchorage, AK	**Type of Flight Plan Filed:**	None
Destination:	Willow, AK (UUO)	**Type of Clearance:**	VFR
Departure Time:		**Type of Airspace:**	Class D

Airport Information

Airport:	Lake Hood Seaplane LHD	**Runway Surface Type:**	
Airport Elevation:	73 ft msl	**Runway Surface Condition:**	Ice
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 None	**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	2 None	**Latitude, Longitude:**	61.184112,-149.97584(est)

Administrative Information

Investigator In Charge (IIC):	Ward, Mark
Additional Participating Persons:	Mitch Deremer; FAA; Anchorage, AK
Original Publish Date:	May 16, 2024
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=106823