



Aviation Investigation Final Report

Location:	Anchorage, Alaska	Accident Number:	ANC15LA015
Date & Time:	March 13, 2015, 07:15 Local	Registration:	N814EH
Aircraft:	Airbus AS350 B2	Aircraft Damage:	Substantial
Defining Event:	Flight control sys malf/fail	Injuries:	3 None
Flight Conducted Under:	Part 135: Air taxi & commuter - Non-scheduled		

Analysis

The commercial pilot was conducting a 14 *Code of Federal Regulations* Part 135 on-demand charter flight in the helicopter. The pilot reported that, while the helicopter was in cruise flight, about 1,000 ft above ground level, he felt a "clunk" in the tail rotor control pedals. Immediately thereafter, the helicopter began to yaw left. The pilot attempted to counteract the yaw by pressing the right tail rotor control pedal up to its forward stop, but the helicopter did not respond. The pilot declared an in-flight emergency with air traffic control, returned to the departure airport, and executed an emergency run-on landing.

An examination of the helicopter revealed that the tail rotor pitch change spider assembly had fractured into two pieces with rotational scarring present along the fractured surfaces; the inside of the spider assembly exhibited dark discoloration consistent with thermal damage. Half of the inner race of the ball bearing within the spider assembly was found loose on the tail rotor gearbox output shaft. Further examination revealed that the spider assembly failure was consistent with bearing seizure.

No evidence of grease was found on the bearing surfaces or the bearing housing. A review of maintenance records revealed that, about 13 months before the accident, the pitch change spider assembly was overhauled by a certified repair station, during which the original ball bearing was replaced. According to the helicopter manufacturer's spider assembly overhaul procedures, grease was to be applied during the installation of the new bearing.

The spider assembly was installed on the helicopter by the operator's maintenance personnel about 1 month later, at which time a mechanic signed off completing the helicopter manufacturer's 600-flight-hour/24-month inspection checklist, which included regreasing the bearing. The bearing failed about 10 months and 141 flight hours after the spider assembly was installed on the helicopter.

Given that no grease was found on the fractured components and that the signatures were consistent with thermal damage due to a bearing seizure, it is likely that the overhaul facility did not follow the

helicopter manufacturer's overhaul procedures and failed to apply grease to the bearing. During the subsequent installation of the overhauled spider assembly, it is likely that the mechanic presumed that the newly overhauled spider assembly bearing contained grease and, therefore, did not complete the bearing regreasing procedure in accordance with the inspection checklist, which led to the lack of grease in the bearing going undetected.

Probable Cause and Findings

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

The failure of the ball bearing within the pitch change spider assembly due to its operation with no grease within the bearing, which resulted in the subsequent fracture of the spider assembly and a loss of tail rotor control authority. Also causal to the accident were the overhaul facility's failure to follow the helicopter manufacturer's spider assembly overhaul procedures, which resulted in the assembly leaving the facility with no grease in the bearing, and the mechanic's failure to complete all of the tasks on the 600-flight-hour/24-month inspection checklist, which led to the lack of grease in the bearing going undetected.

Findings

Aircraft	Tail rotor control system - Failure
Aircraft	Grease - Fluid level
Aircraft	Prop/rotor parameters - Attain/maintain not possible
Aircraft	Tail rotor control system - Inadequate inspection
Aircraft	Tail rotor control system - Not inspected
Personnel issues	Scheduled/routine inspection - Maintenance personnel
Organizational issues	Oversight of maintenance - Maintenance provider
Aircraft	Grease - Incorrect service/maintenance

Factual Information

History of Flight

Enroute-cruise	Flight control sys malf/fail (Defining event)
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On March 13, 2015, about 0715 Alaska daylight time, a turbine-powered Airbus Helicopters AS350 B2 helicopter, N814EH, sustained substantial damage as a result of a tail rotor pitch control failure while en route from Merrill Field, Anchorage, Alaska, to an off airport landing site near Beluga, Alaska. The flight was being operated as a visual flight rules (VFR) on-demand commercial flight under Title 14 Code of Federal Regulations (CFR) part 135. The certificated commercial pilot and two passengers sustained no injuries. Visual meteorological conditions prevailed for the flight. Company flight following procedures were in effect, and a company flight plan was filed and activated.

During an interview with the National Transportation Safety Board (NTSB) investigator-in-charge, along with a Federal Aviation Administration (FAA) aviation safety inspector on March 13, 2015, the pilot stated that while en route, about 1,000 feet above ground level (agl), he felt a "clunk" in the tail rotor control pedals and the helicopter began to yaw to the left. When he attempted to counteract theyaw by depressing the right tail rotor control pedal, there was no reaction from the helicopter and the right pedal travelled to the forward stop. The pilot declared an in-flight emergency with air traffic control, returned to Merrill Field, and executed an emergency run-on landing.

A post flight examination of the helicopter revealed the tail rotor pitch change spider assembly, partnumber 350A33-2030-00, had fractured into two pieces, with rotational scarring and smeared metal present along the fractured surfaces. The inside of the spider assembly contained dark discoloration consistent with thermal damage. Half of the inner race of the ball bearing within the spider assembly was found loose on the tail rotor gearbox output shaft. None of the roller elements of the spider ball bearing were recovered. Bands of circumferential scarring were observed on the tail rotor gearbox output shaft beginning about 3 inches outboard of the gearbox housing. The bands were about 3 inches wide.

The tail rotor pitch change spider assembly was sent to the NTSB Materials Laboratory in Washington, DC, for further examination. During the examination, it was determined that the spider assembly failed in a manner consistent with bearing seizure. No evidence of grease was found on the bearing surfaces and the surfaces of the bearing housing.

The affected pitch change spider assembly, serial number (S/N) M2057, was overhauled on April 16, 2014, by Able Engineering and Component Services, Inc., Mesa, Arizona. The original ball bearing was replaced with a new ball bearing, S/N NR7842; the lab examination observed "NR7842" stamped on the side of the ball bearing inner race. The Airbus Helicopters AS350 pitch change spider overhaul manual, No. 65.20.31, states in part:

- (f) Add grease until it comes out of the lip of seal.
- (g) Add grease in three steps, turning the sleeve through 180° between each step.
- (j) Final inspection.

The overhaul manual for the pitch change spider assembly is located in the public docket for this accident.

The pitch change spider assembly was installed on the accident helicopter on May 24, 2014. Following the installation, but prior to any operation of the helicopter, a 600-flight-hour/24-month inspection was signed off in the aircraft records signifying that it had been completed. The AS350 B2 600-flight hour/24-month inspection checklist from Airbus Helicopters, No. 05-22-00, contains an inspection item titled "TRH pitch change unit – greasable bearing." One of the documents referenced for this inspection is the Airbus Helicopters Aircraft Maintenance Manual, "Tail Gearbox – Inspection / Check", No. 65-21-00, Section 6-8. This procedure states in part:

1. Check manually and by touching that there are no rough running points:
 1. Rotate in both directions alternately while applying an axial load on stationary spider.
 2. Grease the bearing (65-21-00, 3-1).

No. 65-21-00, Section 3-1 refers to the "Tail Gearbox – Servicing" section of the Airbus Helicopters Aircraft Maintenance Manual. The document states in part:

1. Remove the protective cap from the grease fitting.
2. Using a hand pump, inject grease CM101 through the grease fitting until new grease appears on the nut side (pump approximately 30 times).
3. During grease injection, turn the pitch change spider $\frac{1}{4}$ of a turn every 4 pump strokes.
4. Remove the excess grease by means of a clean cloth.
5. Install the protective cap.

The notes for this inspection item instruct the person completing this inspection to check the bearing for friction points and greasing.

After installation, the accident helicopter operated about 141 hours before the pitch change spider assembly fracture occurred.

A second pitch change spider assembly (P/N: 350A33-2030-00, S/N:M2116) overhauled by Able Engineering and Component Services and held by the operator as a spare, was quarantined during this investigation. An examination of the second assembly performed by the operator revealed a rattling noise, consistent with bearing movement, during handling. When grease was applied, it took about 45 pumps of the grease gun before grease came out of the lip of the seal. The rattle and amount of grease required was consistent with the bearing being absent of grease.

The closest weather reporting facility is Anchorage International Airport, Anchorage, about 25 miles from the accident site. At 0553, an aviation routine weather report (METAR) from the Anchorage Airport was reporting in part: wind from 020 degrees at 8 knots; sky condition, scattered clouds at 8000 feet; visibility, 10 statute miles; temperature 3 degrees F; dew point -13 degrees F; altimeter 29.48inHG.

Pilot Information

Certificate:	Commercial; Flight instructor	Age:	36
Airplane Rating(s):	None	Seat Occupied:	Front
Other Aircraft Rating(s):	Helicopter	Restraint Used:	4-point
Instrument Rating(s):	Helicopter	Second Pilot Present:	No
Instructor Rating(s):	Instrument helicopter	Toxicology Performed:	No
Medical Certification:	Class 2 Without waivers/limitations	Last FAA Medical Exam:	April 16, 2014
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	June 2, 2014
Flight Time:	(Estimated) 3122 hours (Total, all aircraft), 352 hours (Total, this make and model), 3050 hours (Pilot In Command, all aircraft), 20 hours (Last 90 days, all aircraft), 15 hours (Last 30 days, all aircraft), 1.3 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Airbus	Registration:	N814EH
Model/Series:	AS350 B2	Aircraft Category:	Helicopter
Year of Manufacture:	1992	Amateur Built:	
Airworthiness Certificate:	Normal	Serial Number:	2641
Landing Gear Type:	Emergency float; Skid	Seats:	6
Date/Type of Last Inspection:	June 10, 2014 Continuous airworthiness	Certified Max Gross Wt.:	4960 lbs
Time Since Last Inspection:	141 Hrs	Engines:	1 Turbo shaft
Airframe Total Time:	5615 Hrs as of last inspection	Engine Manufacturer:	TURBOMECA
ELT:	C91A installed, not activated	Engine Model/Series:	ARRIEL 1 SER
Registered Owner:	HELIFLEET 2013-01 LLC	Rated Power:	732 Horsepower
Operator:	ERICKSON HELICOPTERS	Operating Certificate(s) Held:	On-demand air taxi (135)
Operator Does Business As:		Operator Designator Code:	E8KG

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Night/bright
Observation Facility, Elevation:	PANC,132 ft msl	Distance from Accident Site:	25 Nautical Miles
Observation Time:	13:53 Local	Direction from Accident Site:	98°
Lowest Cloud Condition:	Scattered / 8000 ft AGL	Visibility	10 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	8 knots /	Turbulence Type Forecast/Actual:	/ None
Wind Direction:	20°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	29.47 inches Hg	Temperature/Dew Point:	-16°C / -25°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	ANCHORAGE, AK (MRI)	Type of Flight Plan Filed:	Company VFR
Destination:	BELUGA, AK (BLG)	Type of Clearance:	VFR
Departure Time:	06:30 Local	Type of Airspace:	

Wreckage and Impact Information

Crew Injuries:	1 None	Aircraft Damage:	Substantial
Passenger Injuries:	2 None	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	3 None	Latitude, Longitude:	61.22861,-150.870834(est)

Administrative Information

Investigator In Charge (IIC):	Williams, David
Additional Participating Persons:	Kenneth Clarke; FAA; Anchorage, AK Scott Gross; Able Engineering; Phoenix, AZ Lindsay Cunningham; Airbus Helicopters Ray Touzeau; Erickson Helicopters; Portland, OR
Original Publish Date:	April 4, 2016
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=90869

The National Transportation Safety Board (NTSB) is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in other modes of transportation—railroad, transit, highway, marine, pipeline, and commercial space. We determine the probable causes of the accidents and events we investigate, and issue safety recommendations aimed at preventing future occurrences. In addition, we conduct transportation safety research studies and offer information and other assistance to family members and survivors for each accident or event we investigate. We also serve as the appellate authority for enforcement actions involving aviation and mariner certificates issued by the Federal Aviation Administration (FAA) and US Coast Guard, and we adjudicate appeals of civil penalty actions taken by the FAA.

The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, “accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties ... and are not conducted for the purpose of determining the rights or liabilities of any person” (Title 49 *Code of Federal Regulations* section 831.4). Assignment of fault or legal liability is not relevant to the NTSB’s statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report (Title 49 *United States Code* section 1154(b)). A factual report that may be admissible under 49 *United States Code* section 1154(b) is available [here](#).