Aviation Investigation Final Report

Location:	PATTERSON, Louisiana	**Accident Number:**	FTW00LA153
Date & Time:	May 24, 2000, 10:25 Local	**Registration:**	N350JG
Aircraft:	Eurocopter AS350B2	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	2 Minor
Flight Conducted Under:	Part 135: Air taxi & commuter - Non-scheduled		

Analysis

The helicopter was in level flight at 1,000 feet msl, when the pilot felt a thump and a yaw. He moved the anti-torque pedals; however, there was no "tail rotor response." A pilot from another helicopter confirmed that the tail rotor was still turning. The pilot reported that he reviewed the emergency procedure for tail rotor failure and flew the helicopter to a nearby airport. The pilot stated that he maintained about 70 knots indicated airspeed and pressed the "HYD" test button for 5 seconds, then returned it to the normal position, as called for in the procedure. The pilot also reported that at this time he turned off the warning horn which alerts the pilot of low main rotor rpm or loss of hydraulic pressure. He completed three shallow approaches to burn off fuel and to see how the helicopter would respond to control movements. While turning left to downwind, during the fourth go-around, the pilot was having trouble controlling the left yaw when he realized the helicopter's hydraulic system had failed. The pilot initiated an autorotation downwind and instructed the passenger to "pull the [fuel flow control] lever off." When the helicopter touched down, "it slid with a yaw left and flipped over coming to rest on its left side." Examination of the cockpit revealed that the console hydraulic test switch (located next to the horn switch) was pressed in (hydraulics off). According to the manufacturer, the hydraulic test switch cuts off hydraulic power; however, the pilot would not lose control assist until the accumulators were depleted. The horn switch was not pressed in (warning horn deactivated, for the horn to function, the switch has to be pressed in). Post accident testing of the hydraulic system revealed no anomalies. Examination of the tail rotor system revealed that the spider bearing inner race was cut through the rotating housing. Examination of the tail rotor spider revealed that the bearing seal exhibited heat damage, and the bearing would not rotate due to small pieces of cage material loose in between the inner and outer races. No evidence of lubrication was present on the race or balls.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: the failure of the tail rotor spider bearing, the pilot's failure to follow the proper emergency procedures as stated in the helicopter's checklist by not performing a run-on landing, and the inadvertent deactivation of the hydraulic system.

Findings

Occurrence #1: AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION
Phase of Operation: CRUISE

Findings
1. (C) ROTOR SYSTEM,TAIL ROTOR HUB PITCH CHANGE MECHANISM - FAILURE
2. (C) HYDRAULIC SYSTEM - INADVERTENT DEACTIVATION - PILOT IN COMMAND
3. (C) CHECKLIST - NOT FOLLOWED - PILOT IN COMMAND
4. RUN ON LANDING - NOT PERFORMED - PILOT IN COMMAND
5. AUTOROTATION - INITIATED - PILOT IN COMMAND

Occurrence #2: FORCED LANDING
Phase of Operation: DESCENT - EMERGENCY

Occurrence #3: ROLL OVER
Phase of Operation: LANDING - FLARE/TOUCHDOWN

Factual Information

On May 24, 2000, at 1025 central daylight time, a Eurocopter AS350B2 helicopter, N350JG, was substantially damaged during an emergency landing at the Harry P Williams Memorial Airport, Patterson, Louisiana. The helicopter was registered to the First Security Bank NA Trustee, and operated by Tex Air of Houston, Texas. The commercial pilot and his only passenger sustained minor injuries. Visual meteorological conditions prevailed, and a company flight plan was filed for the 14 Code of Federal Regulations Part 135 nonscheduled air taxi flight. The flight originated from Morgan City, Louisiana, at 0925, with a destination of Eugene Island 307B platform in the Gulf of Mexico.

The pilot reported that the helicopter was in level flight at 1,000 feet msl, when he felt a thump and a yaw. He moved the anti-torque pedals; however, there was no "tail rotor response." The pilot contacted another helicopter pilot in the area and requested that he visually confirm that the tail rotor was still operating. The pilot confirmed that the tail rotor was still turning. The pilot further reported that he reviewed the emergency procedure and flew the helicopter to the Harry P Williams Memorial Airport (PTN). He added that he was in contact with representatives from American Eurocopter during the flight to PTN. He stated that he maintained about 70 knots indicated airspeed and pressed the "HYD" test button for 5 seconds, then returned it to the normal position (this procedure relieves accumulator pressure and helps center the tail rotor pedals). After the fire trucks and rescue vehicles arrived at PTN, he completed three shallow approaches to runway 24 to burn off fuel and to see how the helicopter would respond to control movements. While turning left to downwind, during the fourth go-around, the pilot was having trouble controlling the left yaw when he realized the helicopter's hydraulic system had failed. He "decided the safest thing to do was as soon as possible enter autorotation over [the] grass near [the] fire trucks." The pilot stated that he briefed the passenger on which lever was the fuel flow control. He entered autorotation downwind and instructed the passenger to "pull the [fuel flow control] lever off." When the helicopter touched down, "it slid with a yaw left and flipped over coming to rest on its left side."

The passenger reported that he was briefed regarding the operation of the exit and the emergency evacuation procedures. The pilot then proceeded to circle the airport to burn off excess fuel and discuss with several "helicopter operation personnel" various emergency actions. The pilot "asked me to pull the flight manual and read him the instructions for failed tail rotor procedure." After making several practice approaches, the pilot felt that "we had lost all hydraulic control power and briefed me up on what I need[ed] to do to assist him," which was to cut the fuel flow control lever at his command.

Prior to the accident occurring, a local representative from American Eurocopter arrived at PTN to assist in trouble shooting a maintenance discrepancy on another aircraft. The local representative upon learning of the situation with N350JG, telephoned a test pilot at the

American Eurocopter facility in Grand Prairie, Texas. The test pilot requested that the pilot conduct the emergency procedure for hydraulic failure of the tail rotor servo. Before the local representative could confirm if the pilot had initiated any hydraulic isolation, the pilot reported a total hydraulic failure and stated that he was going to enter autorotation.

Following the accident, the pilot reported to a representative from the American Eurocopter facility in Grand Prairie that during the fourth go-around the cyclic jerked and the hydraulic light came on. The pilot further reported that when he had pressed the "HYD" test button earlier in the flight, he had deactivated the warning horn. The cyclic pressure felt aft right, and the collective had to be held down. After entering autorotation, the pilot turned the hydraulic switch located on the collective to the off position.

Examination of the helicopter by the FAA and the manufacturer's representative from Grand Prairie revealed that the helicopter was lying on its left side. The tail boom was separated from the fuselage with hoses still connected at the tail rotor servo. The hydraulic reservoir was full and no anomalies were found with the hydraulic and air conditioner belts. Examination of the tail rotor system revealed that the spider bearing inner race was cut through the rotating housing.

Examination of the cockpit revealed that the collective hydraulic switch was in the off position, and the console hydraulic test switch (located next to the horn switch) was pressed in (hydraulics off). According to the manufacturer, the hydraulic test switch cuts off hydraulic power; however, the pilot would not lose control assist until the accumulators were depleted. The horn switch was not pressed in (warning horn was deactivated, for the warning horn to function, the switch has to be pressed in). According to the manufacturer, the warning horn alerts the pilot of either a low main rotor rpm condition or the loss of hydraulic pressure.

The hydraulic system was tested at the American Eurocopter facility in Grand Prairie under the supervision of the NTSB investigator-in-charge (IIC). The main and tail rotor servos, hydraulic pump, and regulation manifold were connected on another main rotor shaft. The hydraulic pump was powered by using a drill motor to turn the drive splines with sufficient speed to develop pressure and operate the servos, manifold, and electrical solenoids. Electrical switching was accomplished by connecting N350JG's wiring to an aircraft in Eurocopter's facility. No anomalies were noted with the hydraulic system.

Examination of the tail rotor spider was performed at the American Eurocopter facility under the supervision of the NTSB IIC. The bearing was removed from the housing. The bearing seal exhibited heat damage, and the bearing would not rotate due to small pieces of cage material that were loose between the inner and outer races. No evidence of lubrication was present on the race or balls. The cage had broken areas where the balls ride inside the cage and at several points where the cage is riveted together. The bearing balls exhibited surface corrosion.

Airworthiness Directive (AD) 99-24-18 and mandatory Service Bulletin 05.00.29 for the tail rotor

hub pitch change spider bearing check were in effect throughout the time this assembly had been in service. Aircraft maintenance records indicated the AD had been complied with every 50 hours as required. As of May 24, 2000, the tail rotor spider bearing had a total time of 450.1 hours.

For a tail rotor control failure the AS350 flight manual states, "set I.A.S. [indicated airspeed] 70 knots (130km/hr), in level flight. Press the hyd. [hydraulic] accumulator test push-button (this cuts off hydraulic power to the yaw servo control and depressurizes the load-compensating servo accumulator). After 5 seconds, reset the test button to the normal position. Make a shallow approach to a clear landing area with a slight side slip to the left. Perform a run-on landing; the side slip will be reduced progressively as power is applied."

For a hydraulics failure the AS350 flight manual states in part, "calmly reduce collective pitch and adjust the airspeed to between 40 and 60 knots (74 to 111 km/hr) in level flight. Cut off the hydraulic pressure, using collective lever pushbutton. Make a flat approach over a clear landing area and land with slight forward speed."

At 1015, the recorded wind at PTN was from 220 degrees at 10 knots.

Pilot Information

Certificate:	Commercial	**Age:**	40,Male
Airplane Rating(s):	None	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	Helicopter	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 2 Valid Medical--no waivers/lim.	**Last FAA Medical Exam:**	May 10, 2000
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	2626 hours (Total, all aircraft), 454 hours (Total, this make and model), 2456 hours (Pilot In Command, all aircraft), 177 hours (Last 90 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Eurocopter	**Registration:**	N350JG
Model/Series:	AS350B2 AS350B2	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	3232
Landing Gear Type:	Skid	**Seats:**	6
Date/Type of Last Inspection:	May 14, 2000 100 hour	**Certified Max Gross Wt.:**	4951 lbs
Time Since Last Inspection:	36 Hrs	**Engines:**	1 Turbo shaft
Airframe Total Time:	461 Hrs	**Engine Manufacturer:**	Turbomeca
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	ARRIEL-1D1
Registered Owner:	FIRST SECURITY BANK NA TRUSTEE	**Rated Power:**	732 Horsepower
Operator:	TEX AIR HELCOPTERS, INC.	**Operating Certificate(s) Held:**	On-demand air taxi (135)
Operator Does Business As:		**Operator Designator Code:**	TXEA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	PTN ,9 ft msl	**Distance from Accident Site:**	
Observation Time:	10:15 Local	**Direction from Accident Site:**	
Lowest Cloud Condition:	Scattered / 2000 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	10 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	220°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29 inches Hg	**Temperature/Dew Point:**	84°C / 72°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	MORGAN CITY , LA (NONE)	**Type of Flight Plan Filed:**	Company VFR
Destination:	EI 307B , GM (0000)	**Type of Clearance:**	
Departure Time:	09:25 Local	**Type of Airspace:**	Class E

Airport Information

Airport:	HARRY P WILLIAMS MEMORIAL PTN	**Runway Surface Type:**	Grass/turf
Airport Elevation:	9 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	0	**IFR Approach:**	
Runway Length/Width:		**VFR Approach/Landing:**	Forced landing;Traffic pattern

Wreckage and Impact Information

Crew Injuries:	1 Minor	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Minor	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Minor	**Latitude, Longitude:**	29.689756,-91.299865(est)

Administrative Information

Investigator In Charge (IIC):	Wigington, Douglas
Additional Participating Persons:	JAMES M BOWLING; BATON ROUGE , LA ROBERT REULAND; GRAND PRAIRIE , TX EDWARD L BEHNE; HOUSTON , TX
Original Publish Date:	November 14, 2001
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=49269