



National Transportation Safety Board Aviation Accident Final Report

Location:	Chandler, AZ	Accident Number:	LAX02LA121
Date & Time:	04/01/2002, 0955 MST	Registration:	N21901
Aircraft:	Rotorway Exec 165F	Aircraft Damage:	Substantial
Defining Event:		Injuries:	1 Serious, 1 Minor

Flight Conducted Under: Part 91: General Aviation - Instructional

Analysis

The helicopter collided with the ground following a loss of tail rotor drive during a steep approach. After performing various maneuvers, the certified flight instructor (CFI) and the student began traffic patterns to a landing zone (LZ). On short final, approximately 40 feet agl, and 40 mph, the helicopter yawed left slowly. When the helicopter had reached a 45-degree left yaw, the CFI took the controls. As the helicopter approached a 90-degree left yaw, the CFI had applied full right pedal. Simultaneously, he lowered the collective and reduced power. The helicopter rotated 360 degrees about 3 times before impact. Post accident inspection revealed incorrect installation of the forward end of the intermediate drive belt on the intermediate pulley group. The tail rotor drive system uses three belts, interconnected via pulleys at various points within the tail boom, to drive the tail rotor. The forward and aft belts and pulleys were normal. The intermediate belt was found shredded, burned, and separated. The aft end of the intermediate belt was positioned correctly on the rear pulley; however, the forward end was around the wrong pulley, the one meant for the forward belt, which induced a large misalignment of the intermediate belt and consequent rub between it and the pulley side. All pulleys were installed with specified tightness and with fore/aft play as stated in the maintenance manual. Maintenance records for the helicopter indicated that the belts were replaced twice in the past 8 months, both times by the manufacturer. The first time was in August 2001, for a heavy maintenance rebuild. The second time was in November 2001 following a tail rotor strike. The belts had about 200 hours operating time since their last replacement in November.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The tail rotor drive system failure as a result of incorrect installation procedures by the manufacturer's personnel.

Findings

Occurrence #1: AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION
Phase of Operation: APPROACH - VFR PATTERN - FINAL APPROACH

Findings

1. (C) ROTOR DRIVE SYSTEM, TAIL ROTOR DRIVE SHAFT - FAILURE
2. (C) MAINTENANCE, INSTALLATION - IMPROPER - MANUFACTURER

Occurrence #2: LOSS OF CONTROL - IN FLIGHT
Phase of Operation: APPROACH - VFR PATTERN - FINAL APPROACH

Findings

3. (C) TAIL ROTOR/ANTI-TORQUE CONTROL - NOT AVAILABLE
4. DIRECTIONAL CONTROL - NOT POSSIBLE - PILOT IN COMMAND

Occurrence #3: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: DESCENT - UNCONTROLLED

Findings

5. TERRAIN CONDITION - GROUND

Factual Information

On April 1, 2002, at 0955 mountain standard time, a Rotorway Exec 165F helicopter, N21901, collided with the ground following a loss of tail rotor drive during a steep approach near Chandler, Arizona. The helicopter, owned and operated by Rotorway International under 14 CFR Part 91, was on a local area instructional flight. The helicopter sustained substantial damage. The commercial pilot/flight instructor sustained serious injuries, and an airline transport pilot student sustained minor injuries. Visual meteorological conditions prevailed and no flight plan was filed. The flight departed from Stellar Airpark, Chandler, about 0900.

The CFI reported that after performing various maneuvers, he and the student began traffic patterns to a landing zone (LZ). On short final, approximately 40 feet, and 40 miles per hour (mph), the helicopter yawed left slowly. When the helicopter had reached a 45-degree left yaw, the CFI took the controls. As the helicopter approached a 90-degree left yaw, the CFI had applied full right pedal. Simultaneously, he lowered the collective and reduced power. The helicopter rotated 360 degrees about 3 times before impact. The helicopter impacted the ground, collapsing the right skid, and coming to rest on its right side.

The helicopter was examined at Rotorway International in Chandler under the auspices of the Federal Aviation Administration (FAA) inspector. He reported that the tail rotor drive system uses three belts, interconnected via pulleys at various points within the tail boom, to drive the tail rotor. The forward and aft belts and pulleys were normal. The intermediate belt was found shredded, burned, and separated. The aft end of the intermediate belt was positioned correctly on the rear pulley; however, the forward end was around the wrong pulley, the one meant for the forward belt, which induced a large misalignment of the belt and consequent rub between it and the pulley side. All pulleys were installed with specified tightness and with fore/aft play as stated in the maintenance manual. The engine, clutch, drive belt system, and transmission were found in working order.

Maintenance records for the helicopter indicated that the belts were replaced twice in the past 8 months. The first time was in August 2001, for a heavy maintenance rebuild. The second time was in November 2001 following a tail rotor strike. The belts had about 200 hours operating time since their last replacement in November.

On April 4, 2002, Rotorway International issued a Mandatory Compliance Bulletin M-20 that required immediate inspection to verify proper routing of tail rotor drive belts through the tail boom. Any belt not properly routed into the correct idler pulley groove required immediate replacement.

Flight Instructor Information

Certificate:	Flight Instructor; Commercial	Age:	47, Male
Airplane Rating(s):	Single-engine Land	Seat Occupied:	Right
Other Aircraft Rating(s):	Helicopter	Restraint Used:	Seatbelt, Shoulder harness
Instrument Rating(s):	Helicopter	Second Pilot Present:	Yes
Instructor Rating(s):	Helicopter	Toxicology Performed:	No
Medical Certification:	Class 2 Valid Medical--w/ waivers/lim.	Last FAA Medical Exam:	06/26/2001
Occupational Pilot:		Last Flight Review or Equivalent:	04/30/2000
Flight Time:	1600 hours (Total, all aircraft), 800 hours (Total, this make and model), 1500 hours (Pilot In Command, all aircraft)		

Student Pilot Information

Certificate:	Airline Transport; Flight Instructor; Commercial; Flight Engineer	Age:	55, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land; Single-engine Sea	Seat Occupied:	Left
Other Aircraft Rating(s):	Helicopter	Restraint Used:	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	Second Pilot Present:	Yes
Instructor Rating(s):	None	Toxicology Performed:	No
Medical Certification:	Class 1 Valid Medical--w/ waivers/lim.	Last FAA Medical Exam:	12/18/2001
Occupational Pilot:		Last Flight Review or Equivalent:	11/17/2001
Flight Time:	17000 hours (Total, all aircraft), 1 hours (Total, this make and model), 13000 hours (Pilot In Command, all aircraft), 180 hours (Last 90 days, all aircraft), 60 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Rotorway	Registration:	N21901
Model/Series:	Exec 165F	Aircraft Category:	Helicopter
Year of Manufacture:		Amateur Built:	No
Airworthiness Certificate:	Experimental	Serial Number:	6035
Landing Gear Type:	Skid	Seats:	2
Date/Type of Last Inspection:	03/18/2002, Continuous Airworthiness	Certified Max Gross Wt.:	1500 lbs
Time Since Last Inspection:	12 Hours	Engines:	1 Reciprocating
Airframe Total Time:	1776 Hours as of last inspection	Engine Manufacturer:	Rotorway
ELT:	Installed, not activated	Engine Model/Series:	162F
Registered Owner:	Cobb International, Inc.	Rated Power:	150 hp
Operator:	Cobb International, Inc.	Operating Certificate(s) Held:	None
Operator Does Business As:	Rotorway International	Operator Designator Code:	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Day
Observation Facility, Elevation:	KCHD, 1243 ft msl	Distance from Accident Site:	8 Nautical Miles
Observation Time:	0947 MST	Direction from Accident Site:	60°
Lowest Cloud Condition:	Scattered / 20000 ft agl	Visibility	35 Miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	/	Turbulence Type Forecast/Actual:	/
Wind Direction:		Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	29.87 inches Hg	Temperature/Dew Point:	23° C / 1° C
Precipitation and Obscuration:			
Departure Point:	Chandler, AZ (P19)	Type of Flight Plan Filed:	None
Destination:		Type of Clearance:	None
Departure Time:	0900 TL	Type of Airspace:	Class E

Wreckage and Impact Information

Crew Injuries:	1 Serious, 1 Minor	Aircraft Damage:	Substantial
Passenger Injuries:	N/A	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	1 Serious, 1 Minor	Latitude, Longitude:	33.269167, -111.811111

Administrative Information

Investigator In Charge (IIC): JEFF RICH **Report Date:** 02/05/2004

Additional Participating Persons: John Eller; Federal Aviation Inspector; Scottsdale, AZ

Publish Date:

Investigation Docket: NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at pubinq@ntsb.gov, or at 800-877-6799. Dockets released after this date are available at <http://dms.nts.gov/pubdms/>.

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