

Aviation Investigation Final Report

Location:	HANA, MAUI, Hawaii		Accident Number:	LAX00LA089
Date & Time:	January 30, 2000, 08:	30 Local	Registration:	N62DF
Aircraft:	Robinson	R22B	Aircraft Damage:	Substantial
Defining Event:			Injuries:	1 Serious
Flight Conducted Under:	Part 91: General aviation - Instructional			

Analysis

During landing approach at the completion of a solo cross-country flight, the student pilot was slowing below 30 knots to enter a hover when the helicopter began spinning to the right. The student was unable to arrest the right yaw and entered an autorotation, which terminated in a rotating collision with terrain 137 feet short of the runway. He was attempting to land with a left crosswind and/or quartering tailwind from a direction and at a speed conducive to a tail rotor vortex ring state condition. The condition results in tail rotor thrust variations, which can require rapid and continuous pedal movements to maintain heading and cause unanticipated right yaw rates to develop. If the yaw rate is not controlled immediately, the helicopter can rotate into a wind azimuth region where weather cock instability will accelerate the right yaw. This condition will be aggravated at airspeeds below 30 knots when the loss of translational lift results in an increased power demand (more torque) and a corresponding increase in antitorque requirement. The student's total flying experience and pilot-in-command time was about 60.6 and 5.2 hours, respectively.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The student's failure to maintain directional control after encountering a tail rotor vortex ring state induced right yaw.

Findings

Occurrence #1: LOSS OF CONTROL - IN FLIGHT Phase of Operation: LANDING - FLARE/TOUCHDOWN

Findings

- 1. (F) WEATHER CONDITION TAILWIND
- 2. (F) WEATHER CONDITION CROSSWIND
- 3. (C) VORTEX RING STATE ENCOUNTERED PILOT IN COMMAND
- 4. (C) LOSS OF TAIL ROTOR EFFECTIVENESS NOT CORRECTED PILOT IN COMMAND
- 5. (C) DIRECTIONAL CONTROL NOT MAINTAINED PILOT IN COMMAND
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Occurrence #2: IN FLIGHT COLLISION WITH TERRAIN/WATER Phase of Operation: DESCENT - UNCONTROLLED

Factual Information

On January 30, 2000, about 0830 hours Hawaiian standard time, a Robinson R22B Beta, N62DF, operated by Mona Loa Helicopters, Kailua-Kona, Hawaii, experienced an in-flight loss of control on approach for landing. The helicopter touched down hard at the Hana Airport, on the island of Maui. The helicopter was substantially damaged, and the student pilot was seriously injured during the solo instructional flight. Visual meteorological conditions prevailed, and a visual flight rules flight plan was filed. The flight was conducted under the provisions of 14 CFR Part 91, and it originated from Hawi, Hawaii, about 0800.

The operator reported that, at the time of the accident, the pilot's total flying experience and pilot-in-command flight time was about 60.6 and 5.2 hours, respectively. The pilot's flight instructor reported that his student was in the final preparation process of applying for a private pilot certificate.

In the pilot's written statement, he did not report experiencing any mechanical malfunctions during the en route portion of the cross-country flight between the Big Island (Hawaii) and the island of Maui. He indicated that after arrival over the Hana airport, he entered the traffic pattern to runway 26 and noted the existence of a southerly wind. The pilot indicated that when he was between 50 and 75 feet above ground level, at less than 30 knots airspeed, the helicopter suddenly began spinning clockwise. The spinning continued despite his application of left pedal during his attempt at stopping the rotation. The rotation continued, and he then reduced the collective to enter an autorotation; however, did not reduce the throttle. This also had no effect at reducing the direction of the spinning. A moment prior to impacting the ground, the pilot increased the collective to flare, and the rate of spinning increased again.

The Federal Aviation Administration (FAA) inspectors responded to the accident site, examined the helicopter, and interviewed the pilot. The helicopter impacted terrain about 137 feet from the runway. Components separated from the helicopter and were located within approximately a 50-foot radius of the main wreckage. The FAA noted that as the pilot approached runway 26 he would likely have experienced a right crosswind and/or tailwind. The pilot indicated that his ground speed seemed fast. The reported wind about 30 minutes after the accident was from 150 degrees, at 8 knots, or 260 degrees relative bearing from the nose of the helicopter. At no time during the flight did the pilot report having felt any unusual vibration, or having heard any unusual engine sound or the low rotor rpm warning horn. The FAA reported observing no evidence of any preexisting mechanical malfunction with the helicopter.

The FAA publication, ROTORCRAFT FLYING HANDBOOK (FAA-H-8083-21), describes a Loss of Tail Rotor Effectiveness (LTE) phenomena called Tail Rotor Vortex Ring State. Winds coming from an azimuth range from 210 degrees to 330 degrees relative to the helicopter's nose at

speeds from 8 to 12 knots can induce a tail rotor vortex ring state condition. The condition results in tail rotor thrust variations, which can require rapid and continuous pedal movements to maintain heading and cause unanticipated right yaw rates to develop. If the yaw rate is not controlled immediately, the helicopter can rotate into a wind azimuth region where weathercock instability will accelerate the right yaw. This condition will be aggravated at airspeeds below 30 knots when the loss of translational lift results in an increased power demand (more torque) and a corresponding increase in antitorque requirement.

Robinson Helicopter Company management verbally reported to the Safety Board investigator that the tail rotor is driven by a takeoff from the main rotor transmission, and if the main rotor rpm were allowed to decrease below operational limits, the tail rotor's thrust capability would be significantly decreased. Thereafter, if a pilot were to respond by increasing the throttle, the increased torque reaction during application of the throttle might produce a clockwise helicopter rotation.

Pilot Information

Certificate:	Student	Age:	37,Male
Airplane Rating(s):	None	Seat Occupied:	Right
Other Aircraft Rating(s):	None	Restraint Used:	
Instrument Rating(s):	None	Second Pilot Present:	No
Instructor Rating(s):	None	Toxicology Performed:	No
Medical Certification:	Class 3 Valid Medicalw/ waivers/lim	Last FAA Medical Exam:	November 4, 1999
Occupational Pilot:	UNK	Last Flight Review or Equivalent:	
Flight Time:	61 hours (Total, all aircraft), 61 hours (Total, this make and model), 5 hours (Pilot In Command, all aircraft), 52 hours (Last 90 days, all aircraft), 22 hours (Last 30 days, all aircraft), 3 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Robinson	Registration:	N62DF
Model/Series:	R22B R22B	Aircraft Category:	Helicopter
Year of Manufacture:		Amateur Built:	
Airworthiness Certificate:	Normal	Serial Number:	1643
Landing Gear Type:	Skid	Seats:	2
Date/Type of Last Inspection:	January 15, 2000 100 hour	Certified Max Gross Wt.:	1370 lbs
Time Since Last Inspection:	70 Hrs	Engines:	1 Reciprocating
Airframe Total Time:	1275 Hrs	Engine Manufacturer:	Lycoming
ELT:		Engine Model/Series:	0-320-B2C
Registered Owner:	MONA LOA HELICOPTERS	Rated Power:	131 Horsepower
Operator:		Operating Certificate(s) Held:	None
Operator Does Business As:		Operator Designator Code:	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	HNM ,78 ft msl	Distance from Accident Site:	
Observation Time:	09:00 Local	Direction from Accident Site:	
Lowest Cloud Condition:	Scattered / 2000 ft AGL	Visibility	15 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	8 knots / None	Turbulence Type Forecast/Actual:	/
Wind Direction:	150°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	30 inches Hg	Temperature/Dew Point:	73°C / 64°C
Precipitation and Obscuration:	No Obscuration; No Precipitat	tion	
Departure Point:	HAWI (UPP)	Type of Flight Plan Filed:	VFR
Destination:	(HNM)	Type of Clearance:	None
Departure Time:	08:00 Local	Type of Airspace:	Class E

Airport Information

Airport:	HANA HNM	Runway Surface Type:	Asphalt
Airport Elevation:	78 ft msl	Runway Surface Condition:	Dry
Runway Used:	26	IFR Approach:	None
Runway Length/Width:	3606 ft / 100 ft	VFR Approach/Landing:	Full stop;Traffic pattern

Wreckage and Impact Information

Crew Injuries:	1 Serious	Aircraft Damage:	Substantial
Passenger Injuries:		Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	1 Serious	Latitude, Longitude:	20.769395,-155.99057(est)

Administrative Information

Investigator In Charge (IIC):	Pollack, Wayne
Additional Participating Persons:	LARRY WAKEFIELD; HONOLULU , HI
Original Publish Date:	June 25, 2003
Last Revision Date:	
Investigation Class:	<u>Class</u>
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=48583

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 <u>here</u>.