Aviation Investigation Final Report

Location:	Richvale, California	**Accident Number:**	WPR09LA241
Date & Time:	May 13, 2009, 09:08 Local	**Registration:**	N843M
Aircraft:	Rotorcraft Development Corp UH-1B	**Aircraft Damage:**	Substantial
Defining Event:	Loss of control in flight	**Injuries:**	1 Serious
Flight Conducted Under:	Part 91: General aviation - Positioning		

Analysis

The helicopter had undergone a 100-hour inspection the day prior to the accident, which included a flushing of the hydraulic system. The pilot reported that as he lifted the helicopter into a hover, he initiated forward movement. The pilot stated that the controls felt "ratchety" and stiff, as if the helicopter had the hydraulic system turned off. He was not able to land the helicopter by lowering the collective, nor was he able to control direction with the cyclic. The helicopter had climbed about 15 feet above the ground and subsequently collided with a hangar about 160 feet away. The fuselage section remained embedded in the building, while the tail section came to rest on the ground below. A post accident examination revealed no mechanical malfunctions or failures that would have precluded normal flight. A representative for Bell stated that it is common during the "initial start up of all of these aircraft after assembly and/or reassembly or after first servicing," to cycle all of the controls for as long as 2 minutes to attain smooth and uninterrupted control motion. He further stated that during these initial run up exercises it would not be unusual to feel "ratcheting or binding in the cyclic that is generally accompanied by a howling noise" as the hydraulics purge air from the lines, pumps, and actuators. It is unknown if the pilot adequately cycled the controls through their full travel prior to flight.

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 control of the helicopter during takeoff for undetermined reasons.

Findings

Not determined	(general) - Unknown/Not determined
Aircraft	Directional control - Not attained/maintained

Factual Information

History of Flight

Takeoff	Loss of control in flight (Defining event)

HISTORY OF FLIGHT

On May 13, 2009, at 0908 Pacific daylight time, a Rotorcraft Development Corporation UH-1B, N843M, collided with a building during takeoff from the Richvale Airport, Richvale, California. The commercial pilot, the sole occupant, sustained serious injuries. The helicopter, owned and operated by AvAg Inc., sustained substantial damage during the crash sequence. The helicopter was operating under the provisions of 14 Code of Federal Regulations Part 91 for the local repositioning flight. Visual meteorological conditions prevailed, and a flight plan had not been filed.

The helicopter had undergone a 100-hour inspection the day prior to the accident. The purpose of the flight was for the pilot, the owner of AvAg, to reposition the helicopter to a nearby ramp area.

The pilot recalled the sequence of events during an interview with a Federal Aviation Administration (FAA) inspector and Bell Helicopter representative. He stated that as he lifted the helicopter into a hover he initiated forward movement. He immediately noticed that the controls felt "ratchety" and stiff. He further described the event as being akin to operating the helicopter with the hydraulic system turned off. The AvAg helper observing the startup was located in front of the helicopter and saw that the pilot was struggling to maintain aircraft control.

The pilot reported that he was not able to touch back down by lowering the collective, nor was he able to control direction with the cyclic. His primary focus was on keeping the helicopter in a level attitude and attempting to avoid lateral oscillations. The helicopter moved forward and collided with a hangar located in front of its original position, about 160 feet to the southwest; it had climbed about 15 feet from the ground. The fuselage section remained embedded in the building, while the tail section came to rest on the ground below the fuselage.

The pilot stated that he cannot remember the collision and events that transpired post impact.

TESTS AND RESEARCH

Following recovery, the helicopter was examined under the supervision of an FAA inspector in Richvale on June 30, 2009. Present to the investigation was one FAA inspector and a technical representative from Bell Helicopter Textron. The FAA inspector had also performed a

preliminary examination immediately following the accident.

Control continuity was established from the cyclic and collective controls to the actuators. The anti-torque control tube between the aft fuselage and tail boom was cut during recovery to facilitate the tail boom removal. The pilot anti-torque pedals were impact damaged and control continuity could not be verified due to excessive crush damage. The bicycle-type chain on the tail boom vertical fin that provides tail rotor control movement was manipulated by hand and tail rotor pitch change was observed at the tail rotor blades. Movement of the chain additionally resulted in movement of the severed tail rotor control tube (sawed during recovery) on the forward end of the tail boom. The synchronized elevator horn on the swash plate non-rotating inner ring was fractured consistent with overload.

The pitch change horns had separated from their respective main rotor hub grips consistent with impact related forces. The main rotor blade pitch change tubes between the scissors assembly and the stabilizer bar exhibited fractures consistent with overload. One stabilizer bar arm fractured consistent with overload forces. The outer ring rotating swash plate freely rotated by hand and the scissors assembly exhibited free movement. A steel vertical support structure from the hangar exhibited impact marks consistent with main rotor contact.

The main transmission separated from its airframe mounting structure during the impact sequence consistent with impact forces. The input spline drive to the sump case was rotated by hand and corresponding rotation was observed on the sump case at the hydraulic pump input drive spline and the tail rotor drive spline. The sump case input spline drive exhibited damage to the splines consistent with the separation of the sump case from the upper main transmission section during impact.

The input spline drive on the Vickers hydraulic pump was moved by hand and it rotated freely in both directions. While being rotated, a small amount of residual fluid was pumped out of the pump. The three main hydraulic servo actuators exhibited impact related damage. The hydraulic switch was in the "ON" position. Electrical continuity of the hydraulic switch was confirmed. Additionally, both light bulbs from the hydraulic caution light located on the instrument panel were checked and electrical continuity through both light bulbs was confirmed.

Servo Testing

The hydraulic pump and servo were sent to a testing facility in Sun Valley, California, for further examination. The parts were tested in accordance with the Approved Test Procedure (ATP) provided by the facility. No anomalies were noted during the testing of the servos and their respective valves. The hydraulic filters were clean from debris. The hydraulic shutoff and overpressure valve were found to function within normal parameters according to the Bell representative.

During the examination of the hydraulic pump, the check valve was observed to be installed on

the pressure (output) side of the pump. The pump functionally passed all applicable tests with the check valve removed, as per the ATP. The pump was then retested with the check valve installed on the pressure side where it had been originally installed. During that test, the pump failed a test step, where it delivered only 3.85 gallons per minute (gpm) at 940 psi rather than the specified 5.25 gpm. According to a Bell representative, the maintenance manuals and drawings depict the check valve being positioned on the pressure side of the pump, an indication that it was installed correctly on the accident

ADDITIONAL INFORMATION

A representative for Bell stated that it is common during the "initial start up of all of these aircraft after assembly and/or reassembly or after first servicing," to cycle all of the controls for as long as 2 minutes to attain smooth and uninterrupted control motion. He further stated that during these initial run up exercises it would not be unusual to feel "ratcheting or binding in the cyclic that is generally accompanied by a howling noise" as the hydraulics purge air from the lines, pumps, and actuators.

A note contained in the Bell Flight Test Procedure Manual for the 214 and 214ST models manufactured between 1970-1980 states that "control forces may vary considerably during and shortly after the initial engine starts due to the hydraulic systems not being completely purged of air" and that "control feel will probably be irregular and feel spongy, loose or restricted in spots until all air is purged from the system."

Additionally, a note is seen in the Bell Flight Test Procedures for the 204 (UH-1A through UH-1C), 205, and 212 models that were manufactured from around 1960 to early 1990 that states "control forces may vary considerably prior to the first start due to the hydraulic not being completely purged of air" and that "control feel will probably be irregular and feel spongy, loose or restricted in spots, so the primary checks should be to assure travel."

The Army Technical Manual, "Aviation Unit and Intermediate Maintenance Instructions Army Model UH-1B Helicopter[r]s," states on page 7-7, that when performing a test of the hydraulic system, personnel should "cycle the cyclic controls, collective control, and tail rotor control pedals through full travel at least ten times to bleed air from [the] system."

The Director of Maintenance (DOM) of AvAg, stated that during the 100-hour inspection of the helicopters he will normally service the hydraulic system. This includes draining the reservoir, replacing filters, and then refilling the reservoir. After refilling the reservoir a pilot will cycle the controls through full travel to ensure that air trapped in the system can escape. According to the DOM, their maintenance manual does not contain any notes about cycling the hydraulic system to eliminate air from the system; however, this is their common procedure. The AvAg helper that witnessed the accident stated that the pilot spent about 5 minutes on the ground after starting the engine; he was not sure how many times the pilot cycled the controls through their full travel.

Despite numerous requests, the operator failed to file or return a Pilot/Operator Aircraft Accident Report, NTSB Form 6120.1/2.

The helicopter, serial 63-8676, was originally manufactured by Bell. The operator acquired the Type Certificate Data Sheet (TCDS) H13WE in June 1997, and was thereafter listed as a Garlick UH-1B. In February 2009, Rotorcraft Development Corporation procured the TCDS from Garlick Helicopters, Inc.

Pilot Information

Certificate:	Commercial; Private	**Age:**	53,Male
Airplane Rating(s):	Single-engine land; Single-engine sea	**Seat Occupied:**	
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	None Without waivers/limitations	**Last FAA Medical Exam:**	June 1, 2004
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	6500 hours (Total, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Rotorcraft Development Corp	**Registration:**	N843M
Model/Series:	UH-1B	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Restricted (Special)	**Serial Number:**	63-8676
Landing Gear Type:	Skid	**Seats:**	2
Date/Type of Last Inspection:	May 12, 2009 100 hour	**Certified Max Gross Wt.:**	8500 lbs
Time Since Last Inspection:	0 Hrs	**Engines:**	1 Turbo shaft
Airframe Total Time:		**Engine Manufacturer:**	Lycoming
ELT:	Installed, not activated	**Engine Model/Series:**	T53-L-11D
Registered Owner:	AVAG INC	**Rated Power:**	1100 Horsepower
Operator:	AVAG INC	**Operating Certificate(s) Held:**	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	OVE,192 ft msl	**Distance from Accident Site:**	7 Nautical Miles
Observation Time:	08:53 Local	**Direction from Accident Site:**	90°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	4 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	130°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.03 inches Hg	**Temperature/Dew Point:**	18°C / 5°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Richvale, CA (07CL)	**Type of Flight Plan Filed:**	None
Destination:	Richvale, CA (07CL)	**Type of Clearance:**	None
Departure Time:	09:00 Local	**Type of Airspace:**	

Airport Information

Airport:	Richvale Airport 07CL	**Runway Surface Type:**	
Airport Elevation:	100 ft msl	**Runway Surface Condition:**	
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	None

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:**	39.497501,-121.77111

Administrative Information

Investigator In Charge (IIC):	Keliher, Zoe
Additional Participating Persons:	Brian Allen; Federal Aviation Administration; Sacramento, CA
Original Publish Date:	May 11, 2010
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=73824