Aviation Investigation Final Report

Location:	Sterling, Massachusetts	**Accident Number:**	NYC02LA099
Date & Time:	June 8, 2002, 16:00 Local	**Registration:**	N54VP
Aircraft:	Boucher Revolution Mini 500	**Aircraft Damage:**	Destroyed
Defining Event:		**Injuries:**	1 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot hover-taxied the helicopter from its tiedown spot to a grassy area for takeoff. Upon reaching the grassy area, he initiated a takeoff, and the helicopter accelerated through effective translational lift and began to climb. About 30 feet and 25 mph, the rotor system drive belt broke. The helicopter yawed to the left, and the pilot immediately lowered the collective and applied right rudder to correct the yaw. The helicopter impacted the ground "straight ahead but tail down." The main rotor deflected downward, and a rotor blade stuck the tail boom. The helicopter's right skid collapsed, and the helicopter rolled over on its right side and caught on fire. A section of drive belt, about 46 inches in length, had "broomstraw" separations at both ends. On the toothed side of the belt, there were about 15 areas along one edge that were worn down or missing. Another section of belt, about 40 inches in length, also had broomstaw separations at both ends, although one end had considerably less. The belt was missing material its entire length, with the missing material varying between 1/2 to 3/4 the width of the belt.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: A misalignment of the rotor system drive belt, which resulted in belt chaffing, its subsequent separation, and a resultant loss of power to the rotor system. Also causal was the relatively low altitude and airspeed at which the separation occurred, which inhibited the pilot's inability to maintain a level attitude during the autorotation.

Findings

Occurrence #1: AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION
Phase of Operation: TAKEOFF - INITIAL CLIMB

Findings
1. ROTOR DRIVE SYSTEM,MAIN ROTOR DRIVE BELT - CHAFED
2. (C) MAINTENANCE,ALIGNMENT - NOT MAINTAINED
3. ROTOR DRIVE SYSTEM,MAIN ROTOR DRIVE BELT - SEPARATION

Occurrence #2: LOSS OF CONTROL - IN FLIGHT
Phase of Operation: TAKEOFF - INITIAL CLIMB

Findings
4. (C) HEIGHT/VELOCITY CURVE - LOW - PILOT IN COMMAND
5. ROTOR RPM - NOT MAINTAINED
6. REMEDIAL ACTION - NOT SUCCESSFUL - PILOT IN COMMAND

Occurrence #3: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: EMERGENCY LANDING

Findings
7. TERRAIN CONDITION - GROUND

Factual Information

On June 8, 2002, about 1600 eastern daylight time, a homebuilt Revolution Mini 500 helicopter, N54VP, was destroyed in a post-impact fire, following a forced landing during an attempted takeoff at Sterling Airport (3B3), Sterling, Massachusetts. The certificated private pilot was not injured. Visual meteorological conditions prevailed, and no flight plan had been filed for the local personal flight, conducted under 14 CFR Part 91.

According to the pilot, he hover-taxied the helicopter from its tiedown spot to a grassy area for takeoff. Upon reaching the grassy area, the pilot initiated the takeoff, and the helicopter accelerated through effective translational lift and began to climb. About 30 feet and 25 mph, the rotor system drive belt broke. The helicopter yawed to the left, and the pilot immediately lowered the collective and applied right rudder to correct the yaw. The helicopter impacted the ground "straight ahead but tail down." The main rotor deflected downward, and a rotor blade stuck the tail boom. The helicopter's right skid collapsed, and the helicopter rolled over on its right side and caught on fire.

A certificated airframe and powerplant mechanic reported that he had seen the pilot conduct a preflight inspection and later start the helicopter's engine. The pilot performed a run-up, then the helicopter lifted off the ground and into a hover. The mechanic turned away to work on a glider, but looked up when he heard the helicopter's engine rpm rapidly increase. He then saw the helicopter's main rotor blades hit the ground and the helicopter roll over. A small fire began in the vicinity of the engine compartment (the engine was no longer running), and eventually consumed almost the entire helicopter.

According to a Federal Aviation Administration (FAA) inspector, among the charred remains of the helicopter, was a separated main rotor drive belt. The belt had worn areas along both edges. The belt had been supplied with the helicopter kit, and had, along with the helicopter, accumulated 212 hours of operation.

Two sections of drive belt were provided to the Safety Board for examination. One section, about 46 inches in length, had "broomstraw" separations at both ends. On the toothed side of the belt, there were about 15 areas along one edge that were worn down or missing.

The other section of belt was about 40 inches in length, and also had broomstaw separations at both ends, although one end had considerably less. The belt was missing material its entire length, with the missing material varying between 1/2 to 3/4 the width of the belt.

The belt part number provided by the FAA inspector was 0506. A review of the Mini-500 master parts list described part number 0506 as "Drive belt cog type 50 mm." The belt provided by the FAA inspector had a maximum continuous width of 30 mm.

Pilot Information

Certificate:	Private	**Age:**	56,Male
Airplane Rating(s):	None	**Seat Occupied:**	Single
Other Aircraft Rating(s):	Glider; Helicopter	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 3 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	January 31, 2001
Occupational Pilot:	UNK	**Last Flight Review or Equivalent:**	July 9, 2000
Flight Time:	4500 hours (Total, all aircraft), 212 hours (Total, this make and model), 20 hours (Last 90 days, all aircraft), 3 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Boucher	**Registration:**	N54VP
Model/Series:	Revolution Mini 500	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	Yes
Airworthiness Certificate:	Experimental (Special)	**Serial Number:**	0054
Landing Gear Type:	Skid	**Seats:**	1
Date/Type of Last Inspection:	May 31, 2002 Continuous airworthiness	**Certified Max Gross Wt.:**	
Time Since Last Inspection:	1.4 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	212.2 Hrs at time of accident	**Engine Manufacturer:**	Rotax
ELT:	Not installed	**Engine Model/Series:**	582
Registered Owner:	Robert E. Boucher	**Rated Power:**	67 Horsepower
Operator:		**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	ORH,459 ft msl	**Distance from Accident Site:**	
Observation Time:	15:45 Local	**Direction from Accident Site:**	
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	8 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	200°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.26 inches Hg	**Temperature/Dew Point:**	19°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Sterling, MA (3B3)	**Type of Flight Plan Filed:**	None
Destination:		**Type of Clearance:**	None
Departure Time:	14:00 Local	**Type of Airspace:**	Class G

Airport Information

Airport:	Sterling Airport 3B3	**Runway Surface Type:**	Grass/turf
Airport Elevation:	459 ft msl	**Runway Surface Condition:**	Dry
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 None	**Latitude, Longitude:**	42.424999,-71.791114

Administrative Information

Investigator In Charge (IIC):	Cox, Paul
Additional Participating Persons:	Joe S Santos; FAA/FSDO; Windsor Locks, CT
Original Publish Date:	July 23, 2003
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=54726