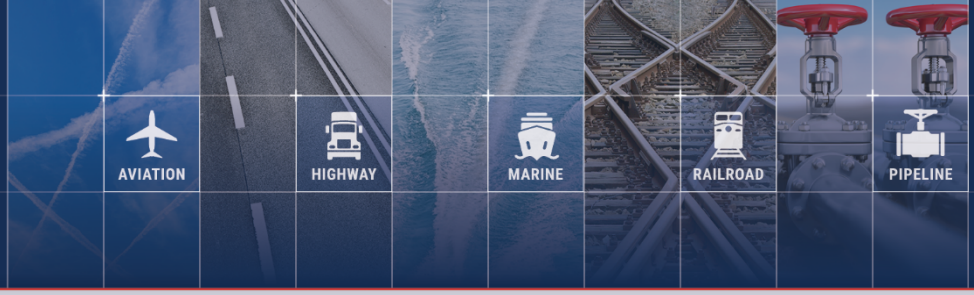

Aviation Investigation Factual Report

Location:	MILAN, New Hampshire	**Accident Number:**	NYC00LA022
Date & Time:	October 30, 1999, 15:30 Local	**Registration:**	N228CH
Aircraft:	Godbout EXEC 162F	**Aircraft Damage:**	Destroyed
Defining Event:		**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Factual Information

HISTORY OF FLIGHT

On October 30, 1999, about 1530 Eastern Daylight Time, a homebuilt Exec 162F, N228CH, was destroyed while maneuvering near Milan, New Hampshire. The certificated student pilot/builder was fatally injured. No flight plan had been filed for the local flight, which originated from the student pilot's back yard in Berlin, New Hampshire. The personal flight was conducted under 14 CFR Part 91.

According to a Federal Aviation Administration (FAA) inspector, the pilot flew about 8 miles west northwest from his home, to a wooded area where his son and a crew were working on a snowmobile trail. A witness, on top of a mountain about 9/10 of a mile from the accident site, observed the helicopter making a low pass, from south to north, along the 5-mile trail. The pilot then flew the helicopter over an area midway up the trail, where a bridge was being constructed over a brook. The helicopter began circling and maneuvering, approximately 50 feet above 30- to 50-foot trees, west of the trail. The witness saw the helicopter go into a very steep right bank, and "tumble" into the trees. He also heard a loud "snap or bang," followed by "a brief pause," before he heard the helicopter impact the trees.

Another witness, on the ground at the worksite, whose view was partially obscured by vegetation, said the helicopter was in a left bank just before the accident. He, and other witnesses at the site reported hearing the engine "rev-up" just before impact with the trees.

PERSONNEL INFORMATION

The pilot held a student pilot certificate, and his third class medical certificate was dated May 21, 1998.

The pilot's student pilot certificate had two endorsements, one on August 6, 1999, and one on September 10, 1999.

Corresponding logbook endorsements included:

On August 6, 1999:

"I certify that [the student pilot] has been "instructed in the flight operations of FAR 61.87 (A)(B)(C)(F 1,2,10,11,13) and found competent for solo hover in his/her assigned test area, in no more than five mph winds. Maneuvers to include hover taxi, hovering turns and patterns in ground-effect below translation in the Rotorway Exec/Exec 90. Day VFR only. Also valid for Exec 162F."

On September 10, 1999:

"I certify that [the student pilot] has been "instructed in the flight operations of FAR 61.87 (A)(B)(C)(F 1,2,10,11,13,16), but only competent in no more than five mph winds. All hovering maneuvers are to be in ground effect. Translational flight is approved to a maximum height of 35 feet AGL while avoiding operation in the shaded area of the height-velocity envelope for the Exec/Exec 90. Also valid for Exec 162F."

The pilot's logbook indicated he had 64.8 hours of flight time as of October 21, 1999. All of that flight time had been in Rotorway Exec helicopters.

On April 17, 1999, with 12.7 hours of flight time, the pilot had a "rollover incident" while attempting to hover his helicopter.

The pilot's formal flight training had been conducted at Rotorway International, where he had completed the first phase and portions of the second phase of a three-phase instructional program.

According to the chief pilot of Rotorway:

"[The student pilot's] first visit to us was the week of 8 March 1999. He received 10.0 hours of flight instruction, administered by myself and...another flight instructor. At the end of that week, I did not feel sufficiently confident in [the student pilot's] ability to hover and land the helicopter to issue an endorsement....

Sometime between his first and second visit, he attempted to hover his own helicopter, and rolled it over, doing damage to the blades and requiring substantial repair work.

On his second visit, the week of 2 August 1999, [the student pilot] received 11.7 hours of additional instruction, and on 6 August 1999 I issued an endorsement allowing him to hover in his assigned training area, in no more than 5 mph winds, providing that his altitude not exceed the ground effect altitude.

His third visit was on the week of 7 September 1999. This was to be the week that [the student pilot] learned the 'altitude maneuvers' i.e., quick stops, takeoff and landing, traffic pattern, steep approach and maximum power takeoff, and emergency procedures. At the end of the week, I did not feel sufficiently confident in [the student pilot's] abilities to issue the usual endorsement, and so I did not issue the usual endorsement. I did issue an endorsement allowing him to perform one of the trained maneuvers: the quick stop.

The endorsement limited [the student pilot] to practice hovering and flight through effective translational lift, providing that he remain within 35 feet of the ground at all times, and not attempt to fly in a manner which would enter the danger areas of the height-velocity envelope

for the 162F helicopter. He was not to attempt to fly the helicopter at all in more than 5-mph winds."

The FAA inspector conducted an interview with a Rotorway Exec 162F pilot/builder, who had frequently helped other Rotorway builders, and who had approximately 500 hours in Rotorway helicopters. According to the inspector, in September 1999, the other pilot/builder assisted the student pilot in balancing his main and tail rotor blades. He also flew with the student pilot, and noted that his "ability to hover had improved, but his ability to maintain proper rotor rpm was a problem."

WRECKAGE AND IMPACT INFORMATION

All major components were accounted for at the accident scene. According to the FAA Inspector:

"There was no evidence of any fire. The tree damage was limited to the tops of two trees, which were broken off, and two other trees were knocked down. The tree damage indicated the helicopter descended through the...trees in an almost vertical path. The main portion of the helicopter came to rest inverted on its back and resting on the main rotor head with the nose elevated and the tail down...Both main rotor blades were still attached, but damaged, (after-market composite blades, trailing edge separated.) The tail boom had been severed approximately 4 feet from the aft end. The severed portion of the tail boom and the entire tail rotor were found approximately 150 feet from the main wreckage. The tail rotor showed no evidence of rotational...chordwise scoring. There was clear paint transfer and impact damage on the tail boom to match the main rotor blades."

The wreckage was subsequently moved to a garage, where a detailed inspection was performed. During the recovery, 5 gallons of fuel were drained, although additional fuel remained in the tanks.

According to the FAA inspector:

"The cyclic controls were verified to be intact from the stick to the rotorhead and moved throughout the entire range.

The collective controls were verified to be connected and relatively intact. The right collective handle was broken off. The left collective handle was intact and moved through its normal range. The vertical push-pull collective actuating rod behind the left seat was bent and somewhat crushed on impact, but still moved through its normal range.

The tail rotor control cable was severed, but both ends were...connected. The tail rotor actuator mechanism moved freely throughout its normal range.

The main fuel selector T-handle was down (on) and the remote valve was verified to be in the

"on" position.

The four shear bolts for the main rotor drive at the large secondary cog belt drive pulley were all separated.

The four primary "V" drive belts and the secondary drive cog belt were intact.

Both main rotor blade droop stops (teeter stop straps) were bent up on the rotor head.

Both main rotor blades were composite after-market parts...No serial numbers were found on the blades, but each blade tip had been previously marked during the tracking process; one with red ink and the other with black ink. The black blade was...broken at mid-span and bent back in an arc shape. The red blade was straighter with less damage. The top and the bottom of the trailing edge on the red blade was separated along a significant length of the blade.

The red ink from the one main rotor blade tip was clearly visible in the dent on the side of the severed portion of the tail boom."

According to a retired employee of Rotorway, who accompanied the FAA inspector during the garage inspection of the wreckage:

"Engine. We looked at the inside ring of the engine drive pulley and found a deep score...[where] it was forced out of alignment into a stationary port."

The retired employee also stated, "Looking at the teeter stop strap shows it bent up on the back of the thrust block. It shows the blade teetered to 10 1/2 degrees in reference to the main shaft...."

MEDICAL AND PATHOLOGICAL INFORMATION

On October 31, 1999, an autopsy was performed on the pilot's remains by the State of New Hampshire, Office of the Chief Medical Examiner, Concord, New Hampshire.

TESTS AND RESEARCH

The helicopter's engine was equipped with a Fully Automated Electronic Control (FADEC). It was an electronic control that was fully redundant; if a failure of the primary system occurred, a secondary system would automatically activate.

Both systems had a down-loadable, data access capability.

The primary system indicated consistent engine parameters until the last 7 seconds of FADEC operation. Significant parameters for the last 8 seconds included:

Engine rpm: 4,325; 4,300; 4,350; 1,175; 575; 175; 150; 0

Engine coolant temperature: 72; 72; 72; 72; 72; 72; 88; 88

Ignition advance in degrees: 30; 30; 30; 28; 15; 14; 14; 14

Barometric pressure in KPa: 99; 99; 99; 99; 99; 100; 100; 100

Intake pressure in KPa: 83; 83; 85; 94; 100; 99; 100; 100

Throttle position percent: 39; 38; 39; 21; 7; 12; 38; 38

A further review of the throttle position revealed that it had, with some excursions, been in the general range of 29 to 32 percent, for the first 4, of the last 5 minutes, of the recording. From 56 seconds, until 6 seconds prior to the last recording, it was in the general range, again with some excursions, of 38 to 40 percent.

The secondary system indicated consistent engine parameters until the last 6 seconds of FADEC operation. Significant parameters for the last 8 seconds included:

Engine rpm: 4,325; 4,325; 4,400; 4,250; 575; 0; 125; 0

Engine coolant temperature: 82; 82; 82; 82; 82; 82; 82; 82

Ignition advance in degrees: 30; 30; 30; 30; 15; 14; 14; 14

Barometric pressure in KPa: 99; 99; 99; 99; 100; 100; 100; 100

Intake pressure in KPa: 88; 88; 88; 88; 88; 88; 88; 88

Throttle position percent: 39; 38; 50; 7; 22; 12; 38; 39

The student pilot had installed composite McCutchen Sky Wheel Corporation rotor blades on the helicopter. One complete rotor blade, which cut into three pieces for shipping, and an excised segment of the other rotor blade, were forwarded to the Safety Board Materials Laboratory for examination.

According to the Materials Laboratory Factual Report,

"Examination of the outside surface of the blades revealed no marking that would identify a manufacturer or a serial number. McCutchen indicated that...the blade...was serial number 20-200-0088.... The blade was made by the wet lay-up process, and the skin was made from composite materials. Beginning from the inside and proceeding out, the skin was made with a layer of E-glass, three layers of carbon fiber, and a layer of E-glass. The inboard section of the

blade is also reinforced with additional layers of composite materials. The blade contains an aluminum spar, and a brass rod attached to the most leading end of the spar. During the manufacturing process, the composite skin is wrapped around the spar and rod.

Areas to be bonded are primed with vinyl ester resin.... After the application of the primer, a paste of resin (thickened with micro spheres) is applied to the inboard end and to the tip. Paste of resin is applied to the trailing edge and extrusion area on both sides of the mold. The molds are mated together, and the blade is cured overnight at room temperature. A representative of Rotorway, the manufacturer of the helicopter [kit], indicated that the blades rotate clockwise when looking down at the helicopter."

Visual examination of the complete rotor blade revealed that the 24-inch inboard portion contained downward deformation, and the 25-inch outboard portion of the blade contained upward deformation. The white paint on the exterior surface of the blade contained chordwise cracking marks in areas of bending deformation.

"The upper and lower skins were disbanded from each other along significant portions of the trailing edge. This disbond extended between 10 inches and 163 inches from the inboard end." The greatest width of separation was 4.3 inches.

"The skin at the leading edge contained a longitudinal gaping crack in the area that corresponded to the location of the inboard bending deformation. This gaping crack extended between 9 inches and 33 inches from the inboard end. In this area of the blade, the lower skin was also disbanded from the spar."

"Visual examination of [the] blade revealed disbond at the trailing edge was, for the most part, between the adhesive and skin.... The separation between the adhesive and skin was characterized as a combination of mostly 'cohesive' separation, and to a minor extent, substrate separation. Only a few areas contained 'adhesive' separation."

Cohesive separation was defined as "separation occurring within the adhesive material, resulting in some of the adhesive remaining on both sides of the bonded objects." Substrate separation was defined as "separation between layers of composite material." Adhesive separation was defined as "separation of the adhesive from one of the bonded objects."

Samples of adhesive were subjected to thermal analysis. Test results indicated that the cure value was 0.67, while values greater than 0.9 were considered fully cured. There was no available data as to the minimum acceptable cure value needed to ensure continued blade operation under normal in-flight parameters.

The leading edge of the rotor blade contained impact damage marks at 4 inches, 24 inches, and 26 inches from the outboard end. The middle impact mark was located slightly outboard of the bending deformation of the blade. The leading edge had a "longitudinal split" located between 23 inches and 32 inches from the outboard end. A crack branched out from the

longitudinal split, and a piece of the surface skin was missing from the impact area. The damage between the middle and inboard damage marks had penetrated the composite skin and exposed the brass rod at the leading edge.

"The leading edge of the rotor blade also had transparent tape that extended between 5 inches and 48 inches from the outboard end.... The tape was torn off at the upper skin side in the area that extended between 19 and 24 inches from the outboard end. In the area where the tape was torn off, the upper surface of the leading edge contained chordwise streaks of compacted soil. The adhesive backing of the tape in the torn areas contained fragments of white and blue paint, deposits of dirt and pieces of what appeared to be bark (wood from a tree or branch).

The skin of the blade contained a red paint transfer mark at the most outboard end. This mark extended between the trailing edge and 3 inches forward of the trailing edge. The leading edge also contained blue paint transfer marks that extended between 4 inches and 22 inches from the most outboard end. Barely visible blue paint transfer marks were found on the top surface of the blade in areas that extended between 22 inches and the saw cut.... The barely visible blue paint transfer marks were oriented in different directions."

Regarding the examination of the other blade segment:

"The location of the transparent tape, when compared to [the other] blade, indicates that the piece from blade "B" was excised from an area located near the outboard end of the blade."

In addition:

"The skin at the cut ends of [the] piece of blade "B" had separated from the spar. The lower skin in the area near the inboard cut end contained wrinkle marks and cracking as if the blade had bent down. The skins at the trailing edge had separated from each other from an area that extended between 1 inch and 18 inches from the outboard end. The lower skin contained a longitudinal crack that extended between the chordwise cut at the inboard end to approximately to approximately 5 inches from the cut at the inboard end. This crack corresponded to the location of the aft end of the spar. Examination of the separated adhesive areas revealed mixed mode separation features similar to those in [the other] blade."

Pilot Information

Certificate:	Student	**Age:**	50,Male
Airplane Rating(s):	None	**Seat Occupied:**	Left
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 Medical--no waivers/lim.	**Last FAA Medical Exam:**	May 21, 1998
Occupational Pilot:	UNK	**Last Flight Review or Equivalent:**	
Flight Time:	65 hours (Total, all aircraft), 52 hours (Last 90 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Godbout	**Registration:**	N228CH
Model/Series:	EXEC 162F EXEC 162F	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	Yes
Airworthiness Certificate:	Experimental (Special)	**Serial Number:**	6318
Landing Gear Type:	Skid	**Seats:**	2
Date/Type of Last Inspection:	Continuous airworthiness	**Certified Max Gross Wt.:**	1500 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	51 Hrs	**Engine Manufacturer:**	Rotorway
ELT:	Installed	**Engine Model/Series:**	RI 162F
Registered Owner:	ROGER GODBOUT	**Rated Power:**	150 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:	BML ,1160 ft msl	**Distance from Accident Site:**	8 Nautical Miles
Observation Time:	15:52 Local	**Direction from Accident Site:**	120°
Lowest Cloud Condition:	Scattered / 9500 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	7 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	190°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	12°C / 2°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	BERLIN (NONE)	**Type of Flight Plan Filed:**	None
Destination:		**Type of Clearance:**	None
Departure Time:	00:00 Local	**Type of Airspace:**	Class G

Airport Information

Airport:		**Runway Surface Type:**	
Airport Elevation:		**Runway Surface Condition:**	
Runway Used:	0	**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal	**Latitude, Longitude:**	

Administrative Information

Investigator In Charge (IIC):	Cox, Paul
Additional Participating Persons:	PAUL HUBBARD; PORTLAND, ME ELBERT WOLTER; CHANDLER, AZ
Report Date:	March 20, 2001
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=47693