Aviation Investigation Final Report

Location:	Mt. Comfort, Indiana	**Accident Number:**	CEN14LA307
Date & Time:	June 21, 2014, 10:30 Local	**Registration:**	N6828D
Aircraft:	Rotorway EXEC 162F	**Aircraft Damage:**	Substantial
Defining Event:	Roll over	**Injuries:**	2 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot reported that, while the experimental, amateur-built helicopter was climbing through 300 feet, he heard a loud "bang" come from the rear compartment and that the helicopter subsequently yawed right. He made an emergency autorotation landing to a field. During the landing, the helicopter's skids sunk into the mud, and the main rotor blades contacted the ground. The helicopter then came to rest on its side. A postaccident examination of the helicopter revealed that the main rotor belt was not approved for aircraft use and that it was broken straight across in a crimp-type failure. According to the belt manufacturer, belt crimping damage is "commonly associated with belt mishandling, inadequate belt installation tension, sub-minimal sprocket diameters, and/or entry of foreign objects within the belt drive." No foreign object preimpact damage was found. Further, although the belt was an unapproved part, it should have been inspected during each 25-hour standard inspection and the belt tension was to be tested during each annual inspection. At the time of the accident, the belt had accumulated 215.9 total hours. Based on this evidence, the pilot installed an unauthorized main rotor drive belt and then failed to properly inspect the belt, which resulted in inadequate belt tension, the belt's failure, and the subsequent loss of engine power.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

The pilot's installation of an unauthorized main rotor belt and his subsequent failure to properly inspect the belt, which resulted in inadequate belt tension, the belt's failure, and the subsequent loss of engine power.

Findings

Aircraft	(general) - Failure
Aircraft	(general) - Incorrect service/maintenance
Personnel issues	Installation - Pilot
Environmental issues	Wet/muddy terrain - Contributed to outcome

Factual Information

History of Flight

Landing-flare/touchdown	Abnormal runway contact
Landing-flare/touchdown	Roll over (Defining event)
Initial climb	Loss of engine power (total)
Initial climb	Powerplant sys/comp malf/fail

On June 21, 2014, about 1030 eastern daylight time, an experimental-amateur built Rotorway Exec 162F helicopter, N6828D, made a forced landing and rolled over following a loss of engine power near the Indianapolis Regional Airport (KMQJ), Indianapolis, Indiana. The pilot and one passenger were not injured. The helicopter sustained substantial damage. The helicopter was registered to and operated by a private individual under the provisions of 14 Code of Federal Regulations Part 91 as a personal flight. Visual meteorological conditions prevailed and no flight plan was filed. The flight was originating at the time of the accident and was destined for the Goshen Municipal Airport (KGSH), Goshen, Indiana.

The pilot reported that he and his daughter departed in the helicopter to the north. While climbing through 300 feet, he heard a loud "bang" from the rear compartment and the helicopter yawed to the right. The pilot made an emergency autorotation into a field ahead. During the landing, the helicopter's skids sunk into the mud, the main rotor blades contacted the ground and it rolled onto its side, which resulted in substantial damage.

A postaccident examination of the helicopter revealed that the main rotor belt was broken straight across. There was no evidence of preimpact damage from foreign objects.

The pilot later reported that he installed the main rotor belt on June 15, 2003, at a Hobbs time of 155.5 hours. At the time of the accident the belt had accumulated 215.9 total hours. The belt was to be inspected during each 25 hour standard inspection and the belt tension was to be tested during each annual inspection. The belt did not have a required replacement time; the recommended replacement time was 500 hours.

The Rotorway Exec162F Helicopter Maintenance Manual specifies part number E23-1210: Main Drive Belts, which is a part that is available from Rotorway.

The belt used on the accident helicopter was manufactured by Gates and was not approved for aircraft use. The Gates Parts Catalog included an "Aircraft Policy" which stated:

"WARNING! BE SAFE! Do not use Gates belts, pulleys or sprockets on aircraft propeller or rotor drive systems or in-flight accessory drives. Gates products are not designed or intended for aircraft use."

Gates also produced a "Synchronous Belt Failure Analysis Guide" in order to accurately determine belt failure modes. The "Belt Crimp Failures" section stated in part:

"A "crimp" type belt failure often resembles a straight tensile failure as illustrated in Figure 3. A straight type of break like this may occur when belt tensile cords are bent around an excessively small diameter. A sharp bend may result in large compressive forces within the tensile members causing individual fibers to buckle or crimp, reducing the overall ultimate tensile strength of the belt. Belt crimping damage is most commonly associated with belt mishandling, inadequate belt installation tension, sub-minimal sprocket diameters, and/or entry of foreign objects within the belt drive."

Pilot Information

Certificate:	Private	**Age:**	49
Airplane Rating(s):	None	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	3-point
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	June 7, 2012
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	May 21, 2014
Flight Time:	478 hours (Total, all aircraft), 423 hours (Total, this make and model), 405 hours (Pilot In Command, all aircraft), 7 hours (Last 90 days, all aircraft), 6 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Rotorway	**Registration:**	N6828D
Model/Series:	EXEC 162F	**Aircraft Category:**	Helicopter
Year of Manufacture:	2000	**Amateur Built:**	Yes
Airworthiness Certificate:	Experimental (Special)	**Serial Number:**	6460
Landing Gear Type:	Skid	**Seats:**	2
Date/Type of Last Inspection:	January 14, 2014 Annual	**Certified Max Gross Wt.:**	1500 lbs
Time Since Last Inspection:	371 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	at time of accident	**Engine Manufacturer:**	ROTORWAY
ELT:	Not installed	**Engine Model/Series:**	RW-145
Registered Owner:	Tim G Payne	**Rated Power:**	160 Horsepower
Operator:	Tim G Payne	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KGEZ,804 ft msl	**Distance from Accident Site:**	17 Nautical Miles
Observation Time:	13:53 Local	**Direction from Accident Site:**	165°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	350°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.95 inches Hg	**Temperature/Dew Point:**	26°C / 21°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Mt. Comfort, IN (MQJ)	**Type of Flight Plan Filed:**	None
Destination:	GOSHEN, IN (GSH)	**Type of Clearance:**	None
Departure Time:	10:30 Local	**Type of Airspace:**	Class G

Airport Information

Airport:	INDIANAPOLIS RGNL MQJ	**Runway Surface Type:**	
Airport Elevation:	862 ft msl	**Runway Surface Condition:**	Dry
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 None	**Latitude, Longitude:**	39.85889,-85.909164

Administrative Information

Investigator In Charge (IIC):	Lindberg, Joshua
Additional Participating Persons:	Don Shipman; Federal Aviation Administration; Indianapolis, IN
Original Publish Date:	December 15, 2014
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=89511