Aviation Investigation Final Report

Location:	Paragould, Arkansas	**Incident Number:**	CEN13IA387
Date & Time:	June 28, 2013, 11:00 Local	**Registration:**	N699TX
Aircraft:	MARTIN CHARLES A ZENITH STOL CH 750	**Aircraft Damage:**	Minor
Defining Event:	Part(s) separation from AC	**Injuries:**	1 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot reported that, during the climb after takeoff, the engine "developed an immediate and heavy vibration." The intensity of the vibration increased, and the pilot was considering shutting the engine down when the vibration abruptly ceased. Looking out the windshield, he observed that the propeller had separated from the airplane. The pilot subsequently executed a forced landing to a field. Metallurgical examination determined that the propeller separation was initiated by a fatigue failure of two propeller flange-to-engine crankshaft flange attachment bolts. Further examination revealed that an incorrect thread lock compound was used on the propeller bolts, and the presence of a second compound suggested that the bolts were not properly cleaned before installation. In addition, washers used in the installation did not correspond with the washers specified by the manufacturer. Finally, extensive fretting damage to the propeller and crankshaft flanges in conjunction with the limited number of flight hours indicated that the attachment bolts were not torqued sufficiently at the time of installation. Available maintenance records did not include any entry noting that the propeller assembly had been removed since the initial installation.

Probable Cause and Findings

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

The improper installation of the propeller flange, which resulted in an in-flight separation of the propeller assembly.

Findings

Aircraft	Propeller assembly - Incorrect service/maintenance
Personnel issues	Installation - Other

Factual Information

History of Flight

Enroute-climb to cruise	Part(s) separation from AC (Defining event)
Emergency descent	Off-field or emergency landing

On June 28, 2013, about 1100 central daylight time, an experimental, amateur-built Martin Zenith STOL CH 750 airplane, N699TX, sustained minor damage during a forced landing after the propeller assembly separated from the engine crankshaft near Paragould, Arkansas. The pilot was not injured. The airplane was registered to a private individual and operated by the pilot under the provisions of 14 Code of Federal Regulations Part 91 as a personal flight. Visual meteorological conditions prevailed for the flight, which was not operated on a flight plan. The flight originated from the Kirk Field Airport (PGR), Paragould, Arkansas, about 1050. The ultimate destination was the Grosse Ile Municipal Airport (ONZ), Detroit/Grosse Ile, Michigan.

The pilot reported that during the climb out after takeoff, about 5 miles northeast of the airport, the engine "developed an immediate and heavy vibration." He altered course to return to the airport. The intensity of the vibration increased to the level that the pilot considered shutting the engine down, when the vibration abruptly ceased. Looking out the windshield, he observed that the propeller had separated from the airplane. The pilot subsequently executed a forced landing to a field with no additional damage to the airplane.

A postaccident examination of the airplane revealed that the propeller flange-to-engine crankshaft flange attachment bolts had failed. The mating surfaces of the propeller and crankshaft flanges exhibited fretting damage. Portions of five of the six bolts remained with the crankshaft flange; one bolt had separated and was not recovered.

Metallurgical examination revealed that two bolt fragments exhibited features consistent with fatigue fracture. The remaining three recovered bolt fragments exhibited features consistent with overstress fracture. Damage was observed to the threads on three of the crankshaft flange bolt holes, including the bolt that had separated completely. Deposits consistent with thread lock were observed on the threads of the bolt fragments and the bolt holes in the crankshaft flange. The thread lock material appeared red in color; in addition, a substance that appeared to be yellow in color was observed between the red thread lock and the thread flank.

Washers recovered with the propeller exhibited 12 radially-oriented step features on one face and 40 radially-oriented step features on the opposite face consistent with a disk-type lock washer. Impressions corresponding to the washer steps were observed adjacent to the attachment holes on the propeller flange and the clamping face of two bolt heads. The propeller flange also exhibited contact marks consistent with the edge of a larger spring or cone-shaped washer. The engine manufacturer's documentation noted that the standard washer for propeller flange installation was to be a Belleville (cone or spring) washer.

The accident airplane was equipped with a 120-horsepower, six-cylinder, Jabiru model 3300 reciprocating engine. The operator reported that the airframe and engine had accumulated about 32 hours at the time of the accident, with 6 hours since the most recent inspection. Copies of the airframe and engine maintenance logbooks were provided to the National Transportation Safety Board (NTSB). The engine logbook copies included a single maintenance entry dated June 17, 2013. It noted the completion of a 100-hour inspection at an airframe/engine time of 15.2 hours. There were no subsequent entries.

In July 2008, the engine manufacturer issued a service bulletin informing pilots and mechanics of several incidents in which the propeller and engine crankshaft flanges had separated. The bulletin noted that the cases had involved the improper installation of the propeller. The bulletin advised operators that if the propeller was not installed properly, it should be refitted to the correct procedure. It noted that the bolt and crankshaft threads should be cleaned to remove any remaining thread lock compound. In addition, the use of Loctite 620 was required because of its high temperature tolerance. Loctite 620 was green in color.

Pilot Information

Certificate:	Airline transport	**Age:**	65,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane; Sport pilot	**Toxicology Performed:**	No
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	August 30, 2011
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	August 16, 2011
Flight Time:	11000 hours (Total, all aircraft), 30 hours (Total, this make and model), 10700 hours (Pilot In Command, all aircraft), 46 hours (Last 90 days, all aircraft), 15 hours (Last 30 days, all aircraft), 0 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	MARTIN CHARLES A	**Registration:**	N699TX
Model/Series:	ZENITH STOL CH 750	**Aircraft Category:**	Airplane
Year of Manufacture:	2012	**Amateur Built:**	
Airworthiness Certificate:	Experimental (Special)	**Serial Number:**	75-8037
Landing Gear Type:	Tricycle	**Seats:**	2
Date/Type of Last Inspection:	June 27, 2013 Condition	**Certified Max Gross Wt.:**	1320 lbs
Time Since Last Inspection:	6 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	32 Hrs at time of accident	**Engine Manufacturer:**	Jabiru
ELT:	Installed, not activated	**Engine Model/Series:**	3300
Registered Owner:	On file	**Rated Power:**	120 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	PGR,290 ft msl	**Distance from Accident Site:**	2 Nautical Miles
Observation Time:	11:00 Local	**Direction from Accident Site:**	45°
Lowest Cloud Condition:	Clear	**Visibility**	20 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	7 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	330°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.1 inches Hg	**Temperature/Dew Point:**	27°C / 21°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Paragould, AR (PGR)	**Type of Flight Plan Filed:**	None
Destination:	Grosse Ile, MI (ONZ)	**Type of Clearance:**	None
Departure Time:	10:50 Local	**Type of Airspace:**	

Airport Information

Airport:	Kirk Field PGR	**Runway Surface Type:**	
Airport Elevation:	290 ft msl	**Runway Surface Condition:**	
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Minor
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 None	**Latitude, Longitude:**	36.063888,-90.509162(est)

Administrative Information

Investigator In Charge (IIC):	Sorensen, Timothy
Additional Participating Persons:	
Original Publish Date:	August 7, 2014
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=87362