Aviation Investigation Final Report

Location:	Eastsound, Washington	**Accident Number:**	SEA01LA115
Date & Time:	June 9, 2001, 14:00 Local	**Registration:**	N7362B
Aircraft:	Beech E35	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	3 Serious, 1 Minor
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

Shortly after takeoff, at about 150 feet above ground level, the engine suddenly lost power. The pilot was unable to restart the engine and turned the aircraft toward a clearing. The aircraft stalled just before colliding with trees and subsequently the ground. During the engine examination, it was found that the engine driven fuel pump was loose at the base of the pump, and the splined shaft of the pump was not properly engaged in the pump. The drive pin was not properly engaged and the snap ring securing the seal spring retainer and spring from extending beyond the end of the shaft was not secured around the end of the rotor. A section from the end of the rotor was broken off. Metallurgical examination of the fuel pump components revealed that the seal spring retainer snap ring was severely worn and when assembled in place on the rotor, would barely keep the seal spring retainer on the shaft end of the rotor. The rotor fracture was typical of overstress. The mechanic who last inspected the fuel pump reported that during the inspection of the fuel pump drive pin, he did not disassemble the components as indicated in the accomplishment instructions of a service letter by the engine manufacture that he was using nor the Service Bulletin published by the fuel pump manufacturer. The mechanic reported that he did not remove the snap ring to gain access to the drive pin for the drive pin inspection, nor did he replace any of the fuel pump components. The Service Bulletin, in a note under assembly of the pump, states to not reuse the snap ring.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: Failure of the engine driven fuel pump due to a worn snap ring which resulted in a loss of engine power during initial climb. Failure to comply with Service Bulletin inspection instructions, and collision with trees were factors.

Findings

Occurrence #1: LOSS OF ENGINE POWER
Phase of Operation: TAKEOFF - INITIAL CLIMB

Findings
1. (C) FUEL SYSTEM,PUMP - FAILURE,TOTAL
2. (F) MAINTENANCE,SERVICE BULLETIN/LETTER - NOT COMPLIED WITH - OTHER MAINTENANCE PERSONNEL
3. (C) MISCELLANEOUS,BOLT/NUT/FASTENER/CLAMP/SPRING - WORN

Occurrence #2: FORCED LANDING
Phase of Operation: EMERGENCY DESCENT/LANDING

Occurrence #3: IN FLIGHT COLLISION WITH OBJECT
Phase of Operation: EMERGENCY DESCENT/LANDING

Findings
4. (F) OBJECT - TREE(S)

Factual Information

HISTORY OF FLIGHT

On June 9, 2001, at 1400 Pacific daylight time, a Beech E35, N7362B, registered to and operated by the private pilot as a 14 CFR Part 91 personal flight, experienced a loss of engine power shortly after takeoff from Orcas Island airport, Eastsound, Washington, and subsequently collided with trees and the terrain during the forced landing. Visual meteorological conditions prevailed at the time and no flight plan was filed. The airplane was substantially damaged and the private pilot and two of his passengers were seriously injured. The fourth passenger received minor injuries. The flight was departing for Roche Harbor, Washington.

Witnesses to the accident reported to the San Juan County Sheriff's Department personnel, who responded to the accident site, that the aircraft took off to the south and attained an altitude between 100 and 150 feet above ground level. After the aircraft cleared the runway and the landing gear was retracted, the engine suddenly lost power, "as if turned off." The aircraft continued to the south, loosing altitude as it approached the Lavender Hollow Apartments. The witnesses reported that the aircraft appeared to turn to the left prior to striking trees.

During a telephone interview and subsequent written statement, the pilot reported that the start, taxi, run up and takeoff from runway 16 were normal. The airplane attained an altitude of about 150 feet above ground level when the engine suddenly lost power. The pilot began emergency procedures and adjusted the engine controls (mixture, propeller, throttle) with no engine response. The pilot reported that he did not activate the wobble pump. The stall warning horn sounded, and he lowered the nose of the aircraft to gain airspeed. The pilot noted a clearing to the left and turned toward the clearing. The aircraft subsequently stalled into the trees and collided with the ground.

WRECKAGE AND IMPACT INFORMATION

Personnel from the Sheriff's Department reported to the National Transportation Safety Board (NTSB), that the aircraft appeared to have struck trees with the right wing, then spun around and came to rest right-side-up and facing to the north. The engine had been displaced to the left side, and the cockpit area was severely damaged.

The aircraft was recovered from the accident site and taken to the airport by personnel from Island Aircraft Services, where it was stored until a Federal Aviation Administration Inspector from the Flight Standards District Office arrived on site to inspect the engine. During the inspection, the engine driven fuel pump was found loose at the base of the pump. The pump

was removed, and the inspector noted that, "... the splined shaft of the pump was not properly engaged in the pump, and the drive pin which should be installed through the shaft was still located in the pump, but was not attached through the drive shaft." The pump was retained for further inspection and taken to an accessory shop for teardown.

During the inspection, it was noted that the seal spring retainer snap ring was loose and not secured in the groove to the rotor (see attached photo). A small piece was found fractured from the shaft end of the rotor. The drive pin was found loose and not secured in the rotor holes. The fuel pump was sent to the National Transportation Safety Board Materials Laboratory in Washington DC for further examination.

TESTS AND RESEARCH

The NTSB Senior Metallurgist reported that the shaft end of the rotor, with two sets of holes spaced equally around the circumference of the shaft, fractured such that it intersected two of the four holes. The fracture extended through approximately 30 percent of the shaft circumference. The holes were measured in the circumferential and axial directions as indicated in Service Bulletin ESD 182D, dated April 1981 (See attachment Service Bulletin ESD 182D). One set of holes was not worn and measured within specifications. The other set of holes exhibited severe wear and was elongated in the circumferential direction. This set of holes exceeded the wear limits as specified in the Service Bulletin. The fracture intersected one worn and one unworn hole. The metallurgist reported that the fracture revealed features typical of overstress separation. No evidence of fatigue cracking or corrosion degradation was found on the fractured end. The groove around the shaft where the retainer snap ring is installed to keep the seal spring retainer and spring from extending beyond the end of the shaft was examined. The metallurgist reported that the groove exhibited minor wear. The snap ring itself exhibited severe wear damage, both on the internal and external surface. The ends of the snap ring were worn from both edges on both the inside and outside. The seal spring retainer exhibited severe wear in the area that corresponds to the installed position of the snap ring.

The metallurgist reassembled the rotor, drive pin, snap ring, and seal spring retainer. The metallurgist noted that the wear to the snap ring was severe enough that it just barely kept the seal spring retainer on the shaft end of the rotor. Additional wear marks and evidence of wear damage to include a narrow gouge mark that extended all around the bore of the pump body was noted. The location of the gouge mark lines up with the rotational axis of an assembled drive pin. Both ends of the pin contained deformation at the edge of the pin. A half moon indent, consistent with the size of the pin was noted at one point along the gouge line around the bore of the pump body.

ADDITIONAL INFORMATION

The maintenance logbooks were made available to the NTSB for review. It was noted that on June 13, 1956, the logbook page listing Airworthiness Directive (AD) compliance, indicated that AD 55-26-02 was accomplished. The method of compliance was listed as "converted

Thompson fuel pump to Model TF 1900." This AD directed the removal of TF-1100 fuel pump and replace with Thompson TF-1900 pump having a larger diameter drive pin. TF-1100 pumps may be converted to TF-1900 pumps when modified in accordance with Thompson Service Bulleting ESD-182A and amendment ESD-182B (See attachment Engine Logbook Excerpts and AD 55-26-02).

The logbook entries indicated that the engine, to include the fuel pump, was overhauled on January 7, 1978. Additional entries for maintenance up to March 1, 1999, do not indicate if the fuel pump was inspected or overhauled during this time. On March 1, 1999, at an engine tach time of 717.9 hours and 817.9 hours since overhaul, the airframe and engine were signed off for an annual inspection. The logbook entry sign-off does not indicate if the fuel pump was inspected, however, the section for AD compliance indicated an entry on "3-1-99, Thompson fuel pump pin, 55-26-02, 717.9" Neither the engine nor the airframe logbook indicate that an annual inspection was performed on or before March 2000. Airframe logbook entries recording oil changes on April 10, 2000, tach time 852 hours, and July 29, 2000, tach time 898 hours indicate that the aircraft continued to operate in 2000. The next entry in the engine logbook dated January 14, 2001, at tach time 890 hours, indicated that the engine was removed due to oil leaks. The entry further stated that "CW (Complied with) AD 55-26-02." The engine was reinstalled and test run. On May 1, 2001, at tach time of 950.9 and 1,050 hours since overhaul, the aircraft and engine were signed off for an annual inspection. The aircraft accumulated a total of approximately 24 hours since the last annual inspection at the time of the accident.

The mechanic who accomplished the annual inspections in March 1999, and May 2001, and accomplished the engine removal and replacement in January 2001, was interviewed. The mechanic reported that he was aware of the 300 hour drive pin inspection for this fuel pump. The mechanic later produced a Continental Motors Corporation (CFC) Service for the Thompson Products Model TF 1900 Main Engine Fuel Pump. There was no date or service number identified on this document (See attachment CFC Service) The objective of this service was to inspect the drive pin at 300 hour intervals and overhaul of the pump was required at 1200 hours of operation. The mechanic reported that during the inspection of the fuel pump, he did not remove the seal spring retainer snap ring to gain access to the drive pin as indicated in the accomplishment instructions. Instead, he reported that he pushed down on the seal spring and removed the drive pin. The mechanic reported that he visually inspected the drive pin, and the rotor holes for wear. The pump was then reassembled without replacing any parts, and reinstalled on the engine. The mechanic also reported that the drive pin inspection kit is no longer available and replacing parts, such as the snap ring, are hard to get.

A representative of the fuel pump manufacture reported that components of these kits are still available from some service centers and wholesalers throughout the country. The American Bonanza Society Magazine, April 2001 edition contained an article titled, "Thompson fuel pump drive pin inspection" reported by name and phone number of a company in California that supplied the drive pin, snap ring, countersunk lock washers and gaskets.

On March 13, 1981, Beechcraft sent an Executive Airplane Service Communique to all Beechcraft wholesalers, aviation centers, aero centers and all international distributors and dealers and all owners of record of Models 35, A35, B35, C35, D35, E35, G35 and 35R Serials D-1 thru D-4865, D-15001, and D-15002. The communique reported that some of the Thompson Fuel Pumps were not being overhauled at the designated recommended overhaul time of 800 hours. Beech Aircraft recommended that all aircraft equipped with the model TF-1900 pump comply with TRW Service Bulletin #ESD 182D. (See attached Beechcraft Service Communique)

TRW Service Bulletin ESD 182D, dated April 1981, indicated that the objective was: "To provide instruction for a special inspection and replacement of drive pin P/N TF1991, and to establish the requirement for repeated drive pin inspections at 300 hour intervals." The bulletin also stated that pump overhaul is required at 900 hours of operation. (See attachment Service Bulletin ESD 182D)

The CFC Service and ESD 182D instructions for inspection are similar except for the hours required for overhaul. The CFC Service indicated 1,200 hours for overhaul, while ESD 182D indicated 900 hours for overhaul. ESD 182D also identified a Note in section D. " Assemble pump as follow;" which stated:

Note -
1) Inspection Kit P/N 216835 has been established to contain parts required for pin inspection.

2) A new drive pin P/N TF1991 of TRW Manufacture must be installed at each inspection.

3) Do not reuse seal spring retainer snap ring, P/N TF1126, as it may be deformed during disassembly.

The CFC Service does not list this note, nor does it give instructions on where to order the inspection kit.

Pilot Information

Certificate:	Private	**Age:**	47,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 3 None	**Last FAA Medical Exam:**	May 27, 1999
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	November 26, 1999
Flight Time:	561 hours (Total, all aircraft), 364 hours (Total, this make and model), 459 hours (Pilot In Command, all aircraft), 39 hours (Last 90 days, all aircraft), 20 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Beech	**Registration:**	N7362B
Model/Series:	E35	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	D-3825
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	May 1, 2001 Annual	**Certified Max Gross Wt.:**	2750 lbs
Time Since Last Inspection:	24 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	6904 Hrs at time of accident	**Engine Manufacturer:**	Continental
ELT:	Installed, not activated	**Engine Model/Series:**	E-225-8
Registered Owner:	John C. Laursen	**Rated Power:**	225 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:	FHR,113 ft msl	**Distance from Accident Site:**	10 Nautical Miles
Observation Time:	13:53 Local	**Direction from Accident Site:**	217°
Lowest Cloud Condition:		**Visibility**	10 miles
Lowest Ceiling:	Overcast / 4500 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	7 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	230°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.1 inches Hg	**Temperature/Dew Point:**	14°C / 7°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Eastsound, WA	**Type of Flight Plan Filed:**	None
Destination:	Roche Harbor, WA	**Type of Clearance:**	None
Departure Time:		**Type of Airspace:**	Class E

Airport Information

Airport:	Orcas Island ORS	**Runway Surface Type:**	
Airport Elevation:	31 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 Serious	**Aircraft Damage:**	Substantial
Passenger Injuries:	2 Serious, 1 Minor	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 Serious, 1 Minor	**Latitude, Longitude:**	48.619953,-122.870361(est)

Administrative Information

Investigator In Charge (IIC):	Eckrote, Debra
Additional Participating Persons:	Brent Morrow; Federal Aviation Administration; Renton, WA
Original Publish Date:	December 18, 2001
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=52490