



Aviation Investigation Final Report

Location:	SEDRO WOOLEY, Washington	Accident Number:	SEA98LA064
Date & Time:	April 19, 1998, 17:30 Local	Registration:	N80SD
Aircraft:	Bell 47G-3B-1	Aircraft Damage:	Destroyed
Defining Event:		Injuries:	3 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

During initial climb immediately after takeoff the helicopter lost power. The pilot attempted to maneuver to a clear area, but struck trees during the descent. Post crash examination revealed no mechanical malfunction with either the engine or carburetor although the carburetor had been subjected to a post crash fire and its fuel metering orifices could not be bench tested. Fuel samples taken from the helicopter's fuel tank prior to the accident, and from the fueling hose from the portable fuel truck were examined by a fuels testing lab and were found to contain 1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester. The pre-accident aircraft fuel sample, which contained a submersed glob of clear substance similar to that observed by the pilot seeping from the cut ends of the fueling hose, was tested. The test revealed that the 'soluble gum' consisted of 1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester' and that nearly 100% of the gum was soluble in the fuel. The operator was advised by the local distributor of the 'Versicon' hose that the hose was acceptable for use with aviation fuels. Specifications provided by the manufacturer of the hose, HBD Industries, provided a note which stated 'Not recommended for the variety of unleaded gas existing presently.'

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: Fuel contamination and subsequent carburetor fuel flow restriction initiated by the use of an improper material (incorrect fuel hose). A factor was the trees.

Findings

Occurrence #1: LOSS OF ENGINE POWER

Phase of Operation: TAKEOFF - INITIAL CLIMB

Findings

1. (C) FLUID,FUEL - CONTAMINATION,OTHER THAN WATER
2. (C) FUEL SYSTEM,CARBURETOR - FLOW RESTRICTED
3. (C) MATERIAL INADEQUATE,IMPROPER

Occurrence #2: IN FLIGHT COLLISION WITH OBJECT

Phase of Operation: EMERGENCY DESCENT/LANDING

Findings

4. (F) OBJECT - TREE(S)

Occurrence #3: IN FLIGHT COLLISION WITH TERRAIN/WATER

Phase of Operation: DESCENT - UNCONTROLLED

Factual Information

On April 19, 1998, approximately 1730 Pacific daylight time, a Bell 47G-3B-1 helicopter, N80SD, registered to and being operated by a private pilot, was destroyed by ground impact and a post crash fire following the loss of power during takeoff near Sedro Wooley, Washington. Visual meteorological conditions prevailed, and no flight plan had been filed. The pilot and two passengers escaped without injuries. The flight, which was personal, was to have been operated under 14CFR91, and was originating from the crash site destined for Arlington, Washington.

The pilot and two passengers were departing a small clearing after visiting friends. The pilot reported that he initiated a departure under a no wind condition from a 10 foot hover and turned east proceeding at high power over trees with 8-10 knots of forward speed. Once over the trees he began to lose manifold pressure and RPM. A rapid descent followed and while attempting a pedal turn to reach a clear area, the rotorcraft struck trees and impacted the ground. The rotorcraft came to rest in a partially upright attitude, and the pilot and two passengers exited (refer to photograph 1). A post crash fire consumed the rotorcraft within approximately five minutes after the accident.

Post-crash examination of the remains of the rotorcraft's Lycoming TVO-435-B1A engine revealed no evidence of any mechanical malfunction.

The rotorcraft's MA-6AA carburetor was disassembled and examined at the facilities of Precision Airmotive Corporation on May 5, 1998. Although it exhibited fire damage (refer to photograph 02, no mechanical malfunction of internal components was noted (refer to attached "Preliminary Incident Investigation Report).

The operator/owner reported that he routinely fueled the rotorcraft from a portable fuel supply system. This system consisted of a 150 gallon steel tank, and externally mounted suction pump. The pumped retrieved fuel through a pickup tube and then pumped it via a short (~18 inch) length of hose through two externally mounted filters. The fueling nozzle used to insert fuel into the rotorcraft was attached to the filter(s) using an approximate 30 foot length of this same terra cotta colored synthetic hose. A receipt from Greenshields Industrial Supply, Inc. (Mill - Construction - Logging Supplies) of Everett, Washington, showed the sale of a 30 foot length of hose to the operator on August 12, 1997. The hose outside diameter (OD) was measured at 1 and 3/16 inch and the inside diameter (ID) was measured at 3/4 inch. The hose was identified with the label "VERSICON" and labeling in yellow letters reading "3/4" I.D. - 300# WP - VERSICON NON-CONDUCTIVE -MADE IN U.S.A." Both ends of each of the lengths of hose (pump to fuel filter unit, and fuel filter unit to input nozzle) had a threaded fitting inserted into the end of the hose. The metal fitting end inserted into the hose was manufactured with sharp circumferential ridges which, upon insertion into the hose end, were designed to prevent the

fitting from easily pulling back out by cutting into the inner surface of the hose (refer to DIAGRAM I).

According to the operator, two days after the accident, the operator moved the fuel tank outside on a forklift to fuel an airplane, and had noticed a clear gum-like substance weeping from the cut ends of the hose where the fittings were inserted, especially at the end of the hose at the fuel nozzle end. He reported that the substance was clear and sticky and appeared to be coming from the cut ends of the hose itself (refer to photograph 3). The operator provided samples as described:

- 1) fuel which contained a submersed glob of clear substance from the helicopter's fuel tank (a pre-accident sample),
- 2) fuel from the fuel truck metal tank (post-accident),
- 3) fuel from within the fueling hose between the filters and fuel nozzle (post-accident). This sample of aviation 100 low lead octane fuel, normally colored blue, was observed to be green-yellow in color as was the sample from the helicopter's fuel tank (refer to photograph 4), and
- 4) a small sample of the clear sticky material taken by the operator from a cut end of the hose where the resin was seen seeping (refer to photograph 5).

These items were submitted to the Chief of the Aerospace Fuels Laboratory, Department of the Air Force, Mukilteo, Washington, for further testing and examination. Gas chromatographic (GC) evaluation of the samples revealed the following:

- 1) sample #1 (pre-accident sample from the helicopters' fuel tank) contained 1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester and separated water.
- 2) sample #2 (post-accident sample from the fuel truck tank) contained no detectable contamination.
- 3) sample #3 (post-accident sample from within the fuel truck's fuel hose) contained 1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester. The report also stated that a "scan of soluble gum from (the) sample appears to be largely comprised of 1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester."

The laboratory then conducted tests on a length of hose by immersing it in aviation fuel for several days duration. At the conclusion of this test the fuel sample had changed color from blue to green-yellow and a GC evaluation resulted in a finding of Benzenedicarboxylic compound. A gum test was then performed on fuel sample #1 with a determination of "abnormally high level of gums for this sample, approx. 1000mg/100ml" and "better than 99% of these gums were soluble gums, that is gums soluble in heptane." Finally, a GC mass spectroscopic scan of the gums showed them to be mostly 1,2-Benzenedicarboxylic acid,

bis(2-ethylhexyl) ester (refer to attached LABORATORY TEST REPORT).

The operator reported that the distributor of the Versicon hose (Greenshields Industrial Supply, Inc.) had advised him that the hose was acceptable for use with aviation fuels. Manufacturer's specifications for the hose acquired after the accident include a note which states "Not recommended for the variety of unleaded gas existing presently" (refer to ATTACHMENT S-I).

Pilot Information

Certificate:	Private	Age:	37,Male
Airplane Rating(s):	None	Seat Occupied:	Center
Other Aircraft Rating(s):	Helicopter	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:	September 23, 1997
Occupational Pilot:	No	Last Flight Review or Equivalent:	
Flight Time:	179 hours (Total, all aircraft), 176 hours (Total, this make and model)		

Aircraft and Owner/Operator Information

Aircraft Make:	Bell	Registration:	N80SD
Model/Series:	47G-3B-1 47G-3B-1	Aircraft Category:	Helicopter
Year of Manufacture:		Amateur Built:	
Airworthiness Certificate:	Normal	Serial Number:	3679
Landing Gear Type:	Skid	Seats:	3
Date/Type of Last Inspection:	March 1, 1998 100 hour	Certified Max Gross Wt.:	2850 lbs
Time Since Last Inspection:	5198 Hrs	Engines:	1 Reciprocating
Airframe Total Time:	32 Hrs	Engine Manufacturer:	Lycoming
ELT:	Not installed	Engine Model/Series:	TVO-435-B1A
Registered Owner:	HELFENBERGER, DANIEL, E.	Rated Power:	270 Horsepower
Operator:	HELFENBERGER, DANIEL, E.	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:	AWO ,137 ft msl	Distance from Accident Site:	22 Nautical Miles
Observation Time:	17:35 Local	Direction from Accident Site:	150°
Lowest Cloud Condition:	Clear	Visibility	10 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	12 knots / None	Turbulence Type Forecast/Actual:	/
Wind Direction:	290°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	30 inches Hg	Temperature/Dew Point:	12°C / 4°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:		Type of Flight Plan Filed:	None
Destination:	ARLINGTON (AWO)	Type of Clearance:	None
Departure Time:	17:30 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 None	Aircraft Damage:	Destroyed
Passenger Injuries:	2 None	Aircraft Fire:	On-ground
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	3 None	Latitude, Longitude:	48.589767,-122.12902(est)

Administrative Information

Investigator In Charge (IIC): McCreary, Steven

Additional Participating Persons: WILLIAM SHINN; RENTON , WA

Original Publish Date: August 13, 2001

Last Revision Date:

Investigation Class: [Class](#)

Note:

Investigation Docket: <https://data.nts.gov/Docket?ProjectID=42775>

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