



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

AIRFRAME AND ENGINE EXAMINATION

WPR18FA095

Accident Date: February 22, 2018
Exam Dates: April 10-11, 2018

This document contains 40 embedded images
Photos Courtesy NTSB & Lycoming

A. ACCIDENT

Location: Monticello, Utah
Date: February 22, 2018
Aircraft: Piper PA-32R-300, C-GYGY, Serial # 32R-7680182
NTSB IIC: Michael Huhn

B. EXAMINATION PARTICIPANTS:

Michael Huhn
Air Safety Investigator
NTSB
Western Pacific Region

Mark Platt
Air Safety Investigator
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Williamsport, PA

C. SUMMARY

The airplane was recovered and transported to Air Transport in Phoenix, AZ. The wreckage was highly fragmented. The entire wreckage was sifted through during this exam at Air Transport. A few key component groups were established for items that warranted additional documentation. These component groups included:

- Documents
- Flight, engine, & navigation instruments
- Engine & engine components
- Propeller
- Personal effects



Figure 1 - Miscellaneous Loose Debris

D. COMPONENT GROUPS

1.0 Documents

The wreckage contained about 300 loose/liberated or partially unbound pages of airplane documents, including maintenance records, Pilots Operating Handbook (POH), and pilot's flight ("Journey") log. Pages varied in damage levels and legibility. The pages were sorted by these groups and reviewed.

The maintenance records that were recovered were the apparent duplicates of maintenance records that were provided in pdf form early in the investigation by the insurance company. The

The POH was originally contained in a full-size (8.5 x 11") 3 ring binder.

The pilot's Journey log had separated into a few major portions, and some pages were missing. The earliest entry was dated February 13, 1983, and the most recent one was dated February 9, 2018. The first entry that cited the accident airplane (C-GYGY) was dated June 24, 2014. A review of the entries in the Journey log indicated that the pilot had accumulated about 346 hours in the accident airplane. His total time could not be determined from the recovered Journey log.

YEAR	2014	PILOT	STUDENT	REMARKS
05/5	C-182	P. Kaupp	B. Kaupp	Pauline Dy - Billings, MT
05/5	C-182	P. Kaupp	B. Kaupp	Bluffs - Shelby, MT
05/5	C-182	P. Kaupp	B. Kaupp	Shelby - YQL
05/5	C-182	P. Kaupp	B. Kaupp	YQL - Bassano
05/5	C-172	B. Kaupp	B. Kaupp	Bassano - Warner
06/1	C-172	B. Kaupp	B. Kaupp	Warner - Local
06/3	C-172	B. Kaupp	B. Kaupp	Warner - Mike R -
06/3	C-172	B. Kaupp	B. Kaupp	Mike River - Local
06/3	C-172	B. Kaupp	B. Kaupp	Mike River - Warner
06/3	C-172	B. Kaupp	B. Kaupp	Warner - Warner
06/24	PA32	YGY	B. Kaupp	YQL - Local

Figure 2 - Pilot's Journey Log (first entry with C-GYGY)

YEAR	2018	PILOT	STUDENT	REMARKS
01/12	PA32R GYGY	B. Kaupp	Paula	Abilene - Brownwood Tx
01/13	PA32R GYGY	B. Kaupp	Paula	Brownwood Tx - Hearsh Tx
01/13	PA32R GYGY	B. Kaupp	Paula	Hearsh Tx - Shohamok La
01/13	PA32R GYGY	B. Kaupp	Paula	Shohamok La - Diamond Head Me
01/23	PA32R GYGY	B. Kaupp	Paula	Diamond Head - Diamond Head
01/31	PA32R GYGY	B. Kaupp	Paula	Diamond Head - Tyler Tx
02/1	PA32R GYGY	B. Kaupp	Paula	Tyler Tx - Aphoe Ne
02/1	PA32R GYGY	B. Kaupp	Paula	Aphoe Ne - McCarty Mr
02/2	PA32R GYGY	B. Kaupp	Paula	McCarty Mr - Cutbank Mr
02/9	PA32R GYGY	B. Kaupp	Roman	Cutbank Mr - Local

Figure 3 - Pilot's Journey Log (most recent entries)

2.0 Flight, Engine, & Navigation Instruments

Most of the instruments had been separated from their mounts during the accident, and many also incurred significant additional damage. Due to damage levels, little usable information was able to be recovered from the instruments. Significant observations included:

- Engine monitor ('G2 Insight'): Internals missing, and removable SD card not located
- Airspeed Indicator: needle absent, no visible 'slap marks'
- Altimeter needles free to swing; Kollsman window set to 30.00
- Tachometer: Needle at 0, no visible 'slap marks', Hours = 3307.75
- Fuel Pressure: Midrange green
- Left Fuel qty: Full or off scale high
- Right Fuel qty: Empty or off scale low
- Oil Temperature: Off scale high
- DATCON hour meter: between 2469.5 and 2469.6
- EGT: Off scale low
- Gyro Pressure: Off scale low
- Autopilot ROLL, HDG, ALT, & PITCH rocker switches OFF
- Autopilot rotary selector switch set to NAV
- KX170B Navcom #37512 COMM = 118.52 NAV = 116.00
- KX170B Navcom #38252 COMM = 122.80 NAV = 115.95 or 115.00
- VOR Head 1 (upper) CDI = 001°
- VOR Head 2 (lower) CDI = 298°
- ELT Dorne & Margolin model ELT 6 sn 57313, switch in OFF position

Many circuit breakers were fracture-separated from their mounts/panel.



Figure 4 - Insight G2 Engine Monitor



Figure 5 - Airspeed Indicator



Figure 6 - Altimeter



Figure 7 - Tachometer



Figure 8 - Gauge Clusters



Figure 9 - Gauges and Circuit Breaker Sub-panel



Figure 10 - Autopilot Controls



Figure 11 - Autopilot Control



Figure 12 - Two KX 170B NavComm Units



Figure 13 - VOR Heads

3.0 Propeller

The propeller was a 3-blade McCauley model B3D36C433-C/180US, serial number 160604. The propeller had been installed on the aircraft January 30, 2017 per McCauley Propeller Systems STC SA433CH at aircraft tach reading of 2,711.3 hours.

The propeller hub was fracture-separated from the engine, the hub was fractured into multiple fragments, and all three propeller blades were liberated from the hub. All three blades incurred moderate aft bending at their 1/2 to 2/3 span locations. All three had multiple leading edge nicks/gouges (larger than normal or acceptable in-service nicks), and moderate scouring of their leading edge and tip paint. One blade had an approximate 1-inch square missing from its trailing edge.

The propeller governor was fracture-separated from its mounting. The fracture surfaces of the propeller governor flange exhibited signatures consistent with overload. The gasket screen was free of visible pre-mishap contamination. The propeller governor was not available for examination. The governor control wheel was observed to have remains of the control rod end securely attached.



Figure 14 - Propeller Blades and Hub Section



Figure 15 - Governor Pad



Figure 16 - Governor Control Arm

4.0 Personal Effects

The personal effects included baggage, clothing, wallets, etc. Two analog watch bodies were also located in the debris. One had stopped at a time of about 1055, and the other had stopped at a time of about 1057. Based on these two watch faces, the accident time was presumed to be about 1056. The smaller of the two watch bodies was a Timex, and was missing its crystal (glass cover). About an hour or two after the watch body had been set on the work table, it began running again.

The personal possessions were boxed and returned to the pilot's family.

E. ENGINE

1.0 General

Model IO-540-K1G5D **Serial Number** L-14119-48A

Total Time 843.7 Hours Since Field O/H

Most recent Annual Inspection by Greg Fleming (Canadian License) on 09/22/2017

Most recent overhaul by Okanagan Aero Engine, Kelowna, BC on 04/09/1991

The powerplant is a six cylinder, air cooled, direct drive, horizontally opposed, normally aspirated (fuel-injected), internal combustion engine rated at 300hp @ 2700rpm. Visual examination of the engine revealed no evidence of pre-impact catastrophic mechanical malfunction or fire.

The engine had been liberated from the airframe at the engine mount during the accident sequence. The engine had sustained significant impact damage, which separated the propeller assembly, starter, alternator, propeller governor, exhaust system, single drive-dual magneto, fuel pump, fuel injection servo and oil filter. The number two cylinder head had sustained significant impact damage that separated most of the rocker box casting and intake valve rocker assembly.

The top spark plugs were removed, examined and photographed. The vacuum pump was removed, and the crankshaft was rotated by hand through the drive pad utilizing a drive tool. The crankshaft was free and easy to rotate in both directions. "Thumb" compression was observed in proper order on all six cylinders. The undamaged portions of valve train were observed to operate in proper order, and appeared to be free of any pre-mishap mechanical malfunction. Normal "lift action" was confirmed at each rocker and lifter assembly. Clean, uncontaminated oil was observed at all rockerbox areas. Mechanical continuity was established throughout the rotating group, valve train and accessory section during hand rotation of the crankshaft.

The bottom spark plugs were not removed. The combustion chamber of each cylinder was examined through the spark plug holes utilizing a lighted borescope. The combustion chambers and bottom spark plug electrodes remained mechanically undamaged, and there was no evidence of foreign object ingestion or detonation. The valves were intact and undamaged. There was no evidence of valve to piston face contact observed. The gas path and combustion signatures observed at the spark plugs, combustion chambers and exhaust system components displayed coloration consistent with normal operation. There was no oil residue observed in the exhaust system gas path.



Figure 17 - Accessory End of Engine



Figure 18 - Engine Front



Figure 19 - Engine Top Right



Figure 20 - Engine Top Left

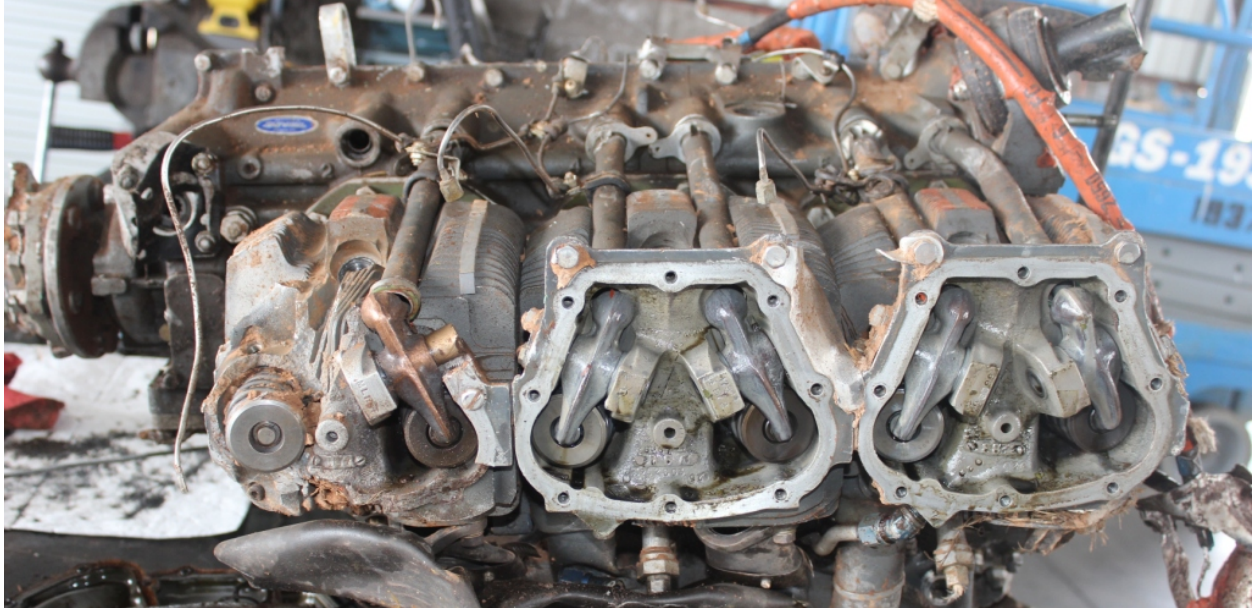


Figure 21 - Left Cylinder Bank

2.0 Engine Fuel System

Fuel System ☒ Injection ☐ Carburetor ☐ Electronic ☐ Destroyed			
Manufacturer: Bendix		Model: RSA-10ED1	Setting: 2524273-11
Serial. No: 55253		Floats: ☐ Metal ☐ Composite ☐ Plastic ☐ N/A	

Fuel Screens	Carburetor/Injector Inlet: ☒ Clean ☐ Contaminated ☐ Destroyed ☐ Unknown
	Aircraft Main Fuel Strainer: ☒ Clean ☐ Contaminated ☐ Destroyed ☐ Unknown

Control Positions	
Throttle: Unobtainable	Carburetor Heat: N/A
Mixture Control: Unobtainable	Alternate Air: Unobtainable

Flow Divider ☐ N/A ☐ Destroyed			
Manufacturer: unknown		Part No: unknown	Serial No: unknown
Evidence of Fuel Found?	☐ Yes ☒ No	Contamination Observed? None	
Diaphragm Condition?	☒ Intact ☐ Compromised ☐ Destroyed ☐ Unknown ☐ See Remarks		

Injector Nozzles ☐ N/A ☐ Destroyed			
GAMIjectors ☐ Yes ☒ No ☐ Unknown		Type: One Piece	Condition: Unobstructed
Lines secure: ☒ Yes ☐ No ☐ Compromised ☐ Destroyed ☐ Unknown ☐ See Remarks			

Fuel Pump ☐ N/A ☐ Destroyed			
☒ Diaphragm ☐ Geared ☐ Electric ☐ Gravity Fed ☐ See Remarks ☐ Unknown			
Manufacturer: unknown		Part No.: 15473	Serial # / Date Code: 9010

The fuel injection servo was fracture-separated from the engine. The fracture surface signatures were consistent with overload. The throttle control rod end was found securely attached at the

control arm of the servo. The mixture control arm and attaching hardware were fracture-separated from the servo and exhibited overload. The plug on the side of the injector body was secure with the safety wire in place. The servo fuel inlet screen was found properly installed and free of contamination. The fuel injection servo was disassembled, examined and photographed. The internal diaphragms remained intact. There was no visible contaminants within the fuel cavities and passages of the servo.

The fuel injection servo and induction system were examined and observed to be free of obstruction. The foam filter element was crushed. The filter element remained intact and exhibited no evidence of pre-impact obstruction to airflow.

The fuel flow divider ('spider') remained secure at the mounting bracket situated at the top of the engine. The fuel lines remained secure at each flow divider fitting and fuel injector at each cylinder. The flow divider was disassembled. There was no evidence of internal mechanical malfunction or obstruction to fuel flow. The diaphragm remained intact and undamaged.

The fuel injection nozzles remained secure at each cylinder with the respective fuel line attached. The No 2 nozzle had sustained impact damage. The nozzles were removed and examined. The nozzles were free of visible contamination or obstruction to flow.



Figure 22 - Fuel Servo

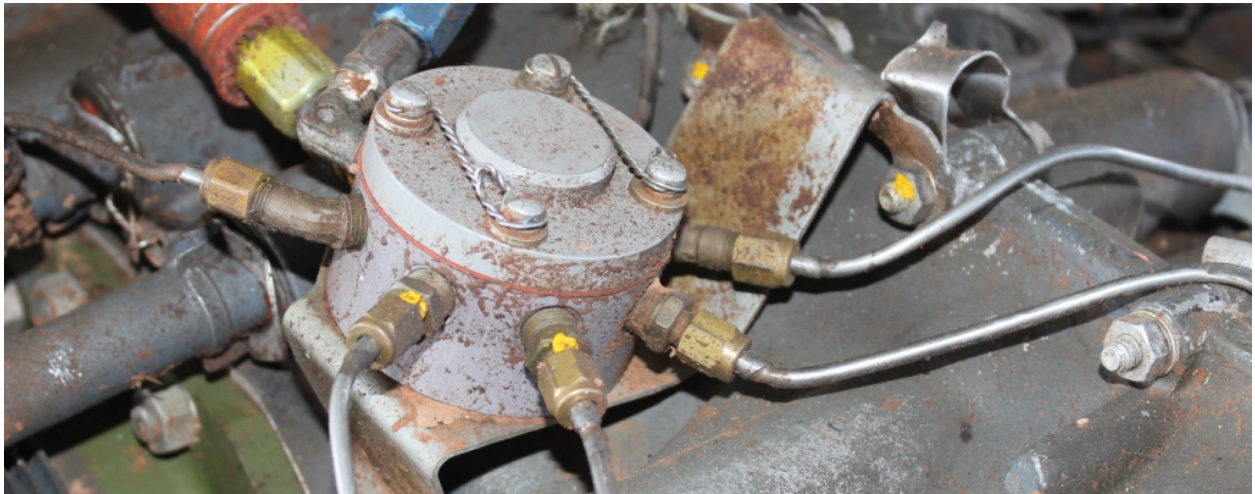


Figure 23 - Fuel Flow Divider



Figure 24 - Fuel Flow Divider

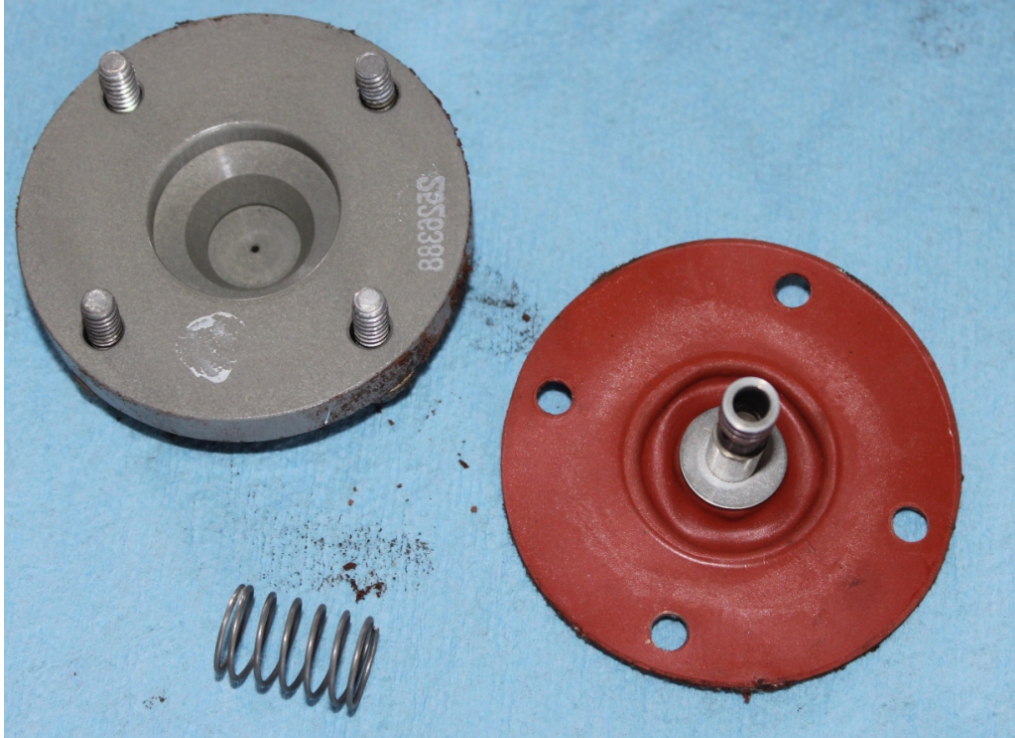


Figure 25 - Fuel Flow Divider



Figure 26 - Fuel Flow Divider



Figure 27 - Fuel Injection Nozzles



Figure 28 - Fuel Servo Internal Screen



Figure 29 - Fuel Pump

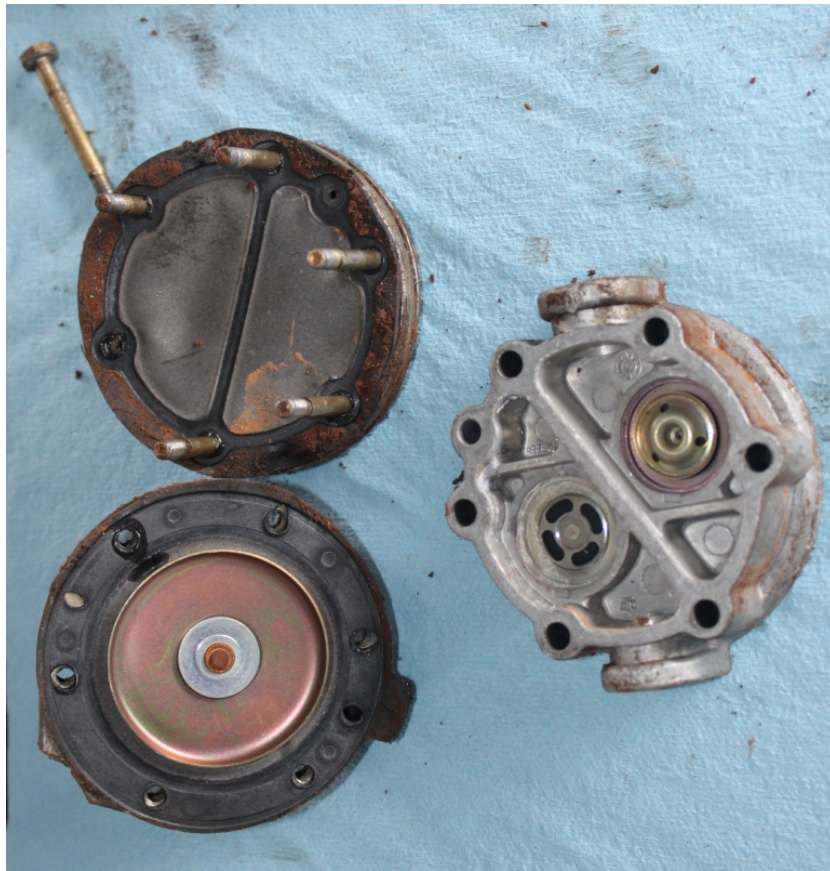


Figure 30 - Fuel Pump

3.0 Ignition System

☐ Left ☒ Dual Magneto ☐ Electronic ☐ Destroyed			
Manufacturer: TCM		Model: D6LN-3000	P/N: BL-682560-13 S/N: G02AA009R
Impulse Coupling? ☒ Yes ☐ No		Functioning? ☐ Yes ☐ No ☐ Unknown	
Timing Checked? ☐ Yes ☒ No		Results:	
Drive Secure? ☐ Yes ☐ No ☐ Unknown		Sparks at all leads ☐ Yes ☒ No ☐ Unknown	
Damage: Impact damaged distributor block			

Spark Plugs

Manufacturer: Champion		Type: REM-40E		SI 1042 Approved? ☒ Yes ☐ No	
Spark Plug Condition (per Champion Aviation Check-A-Plug Card AV-27)					
1 Top	Undamaged Electrode/Normal	1 Bottom	Undt		
2 Top	Undamaged Electrode/Normal	2 Bottom	Undt		
3 Top	Undamaged Electrode/Normal	3 Bottom	Undt		
4 Top	Destroyed	4 Bottom	Undt		
5 Top	Undamaged Electrode/Normal	5 Bottom	Undt		
6 Top	Undamaged Electrode/Normal	6 Bottom	Undt		
7 Top		7 Bottom			
8 Top		8 Bottom			

The impact damaged spark plugs were secure at each position with their respective spark plug leads attached. Some of the spark plug barrels were impact-separated, with their respective ignition leads attached. The spark plugs were removed, examined and photographed. The spark plug electrodes remained mechanically undamaged, and according to the Champion Spark Plugs Check-A-Plug chart AV-27, the spark plug electrodes displayed coloration consistent with normal operation.

The ignition harness leads had sustained varying degrees of impact damage, and were not tested.

The single drive-dual magneto had sustained impact damage, and was fracture-separated from the mounting pad. The magneto clamps remained in place at the studs, and in conformance with Lycoming Service Instruction SI1508C. Magneto-to-engine timing could not be ascertained. The impulse coupler drive was found intact and secure. The drive functioned normally during hand rotation of the drive. The impact damage to the distributor block and internal components rendered the magneto unsuitable for testing. The contact assemblies were observed to open and close during hand rotation of the drive. The magneto was opened for examination. The plastic gears and distributor rotors were intact and undamaged, but the mount for one had been fracture-separated by impact.



Figure 31 - Dual Magneto



Figure 32 - Dual Magneto



Figure 33 - Magneto Gears



Figure 34 - Magneto Ignition Leads



Figure 35 - Top Spark Plugs

4.0 Accessories

The starter and alternator were fracture-separated from the engine. Both were severely damaged and not further examined or tested. The accessory case was removed. The accessory gears including the crankshaft gear, bolt and dowel were intact and remained undamaged by any pre-impact malfunction. The vacuum pump (Airborne model 211CC, sn 9AG 6779) was secure at the mounting pad. The pump was removed, examined and photographed. The drive was intact. The rotor was fractured, but the vanes were intact.



Figure 36 - Vacuum Pump



Figure 37 - Vacuum Pump

5.0 Lubrication System

Oil Suction Screen: Clean	Oil Pressure Screen: N/A
Oil Filter: Clean	Oil Cooler Integrity: Destroyed By Impact
Oil Cooler Hoses: Destroyed By Impact	

The oil suction screen was found secure and uncontaminated by any pre-mishap debris. The oil filter was fracture-separated from the engine. The full flow oil filter was cut open to expose the filter media. There was no evidence of pre-mishap metal contamination observed in/on the filter media.



Figure 38 - Oil Filter and Screen

6.0 Exhaust System

There was significant ductile bending of the exhaust system components. The exhaust system and mufflers were found free of obstructions.



Figure 39 - Exhaust and Mufflers



Figure 40 - Exhaust and Mufflers