



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

September 19, 2016

SUMMARY OF AIRFRAME & ENGINE EXAMINATION

(WPR15FA268)

This document contains 35 embedded photos.

A. ACCIDENT

Location:	Port Townsend, Washington
Date:	September 28, 2015
Aircraft:	Cessna 150F, N8529G
NTSB Investigator-in-Charge	Thomas Little

B. EXAMINATION PARTICIPANTS

Thomas Little
Senior Air Safety Investigator (IIC)
National Transportation Safety Board
Federal Way, Washington

William Shinn
Federal Aviation Administration
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Andrew Hall
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Textron Aviation
Wichita, Kansas

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Air Safety Investigator
Continental Motors, Inc.
Mobile, Alabama

C. SUMMARY

On September 28, 2015, about 1320 Pacific daylight time, a Cessna 150F, N8529G, was substantially damaged following an emergency landing and collision with terrain after a reported loss of engine power during initial climb near Port Townsend, Washington. The commercial pilot and his sole passenger were seriously injured. Visual meteorological conditions prevailed for the personal flight, which was being conducted in accordance with 14 Code of Federal Regulations Part 91, and a flight plan was not filed. The flight departed the Jefferson County International Airport (OS9), Port Townsend, Washington, about 1315, with Skagit Regional Airport (BVS), Burlington, Washington, the destination.

Examination of the accident site, airframe and engine was conducted on July 27 and 28, 2012. On August 16, 2012, an examination of both of the accident airplane's propeller was performed. As a result of the examinations performed referred to above, no evidence of preimpact mechanical malfunction was noted during the examination of the recovered components.

D. DETAILS OF THE EXAMINATION

1.0 Accident Site Examination

On the day following the accident, the NTSB IIC surveyed the accident site. Both of the airplane's wings had simultaneously impacted two trees on a heading of north at about the 40-foot level. This was followed by the engine colliding head on with a 28-inch diameter tree in the same direction, and at about the same height. The airplane then rotated about 90 degrees to the left prior to falling vertically to the ground, coming to rest upright in a dense forested area. The forward section of the airplane and both wings were substantially damaged, while the aft fuselage and empennage sustained only minor damage. There was no postcrash fire. All components necessary for flight were accounted for at the accident site.



Figure 1 - photo of airplane at accident site

2.0 Follow-up examination of airframe and engine

On October 15, 2015, a follow-up examination of the airframe and engine was conducted at the facilities of Aurora Aircraft, Jefferson County Airport, Port Townsend, Washington. The examinations were overseen by representative from the NTSB and FAA, with technical assistance provided by representatives from Textron Aviation and Continental Motors, Inc.

2.0.1 Airframe examination notes

The right wing remained attached to the fuselage at all attach points, with the outboard one-third of the wing substantially damaged due to impact forces with trees. The wing strut remained in place and was not damaged. The right flap remained attached to the wing's trailing edge at all attach points with impact damage. The right aileron remained attached to the wing's trailing edge at all attach points and was not damaged. The right wing fuel tank was intact and not damaged, with the fuel cap in place and tight to touch.



Figure 2 - photos of right wing

The left wing remained attached to the fuselage at all attach points. The outboard two-thirds of the wing was observed to have sustained heavy impact damage and severe deformation as a result of tree impact forces. The wing strut remained in place and was not damaged. The inboard one-third of the wing sustained moderate impact damage, with some wrinkling observed. Additionally, the wing was bent down about 45° at mid-span. The flap was observed attached to the trailing edge of the wing at the outboard two attach points, with the inboard one-third bent upward to about a 30° angle. The left aileron remained attached to the wing's trailing edge at all attach points, with minimal damage observed. The wing's fuel tank was breached due to impact damage, with the fuel cap intact, not damaged, and tight to touch.



Figure 3 - photo of front of left wing



Figure 4 - photo of rear of left wing

The airplane's empennage remained intact, with minor damage observed. The vertical stabilizer was not damaged, and remained attached to the aft fuselage structure at all attach points. The airplane's rudder was observed intact, not damaged, and remained attached to the vertical stabilizer at all attach points. The left horizontal stabilizer was intact, not damaged, and remained attached to the aft fuselage structure at all attach points. The left elevator was intact, not damaged, and remained attached to the left horizontal stabilizer at all attach points. The right horizontal stabilizer was observed intact, and remained attached to the aft fuselage structure at all attach points; the outboard tip of the stabilizer had sustained minor impact damage. The right elevator was intact, and remained attached to the right horizontal stabilizer at all attach points. The outboard tip of the elevator had sustained minor impact damage.



Figure 5 - photo 1 of empennage



Figure 6 - photo 2 of empennage



Figure 7 - photo 3 of empennage

It was confirmed that all control cables were properly attached during the review of the wreckage, with control continuity confirmed throughout the airplane. A visual examination of

the flap actuator revealed that the flaps were in the UP position. The flap position indicator was observed in a position beyond the FULL UP position.

Fuel samples from the carburetor and the fuel strainer were observed light blue in color and tested negative for water with water detection paste. The fuel handle was observed in the wreckage and in the off position; however, the NTSB IIC indicated the valve handle had been placed on the OFF position by the first responders. Air was applied to the right wing root fuel line with the wings removed and the fuel valve in the off position. Air was expelled out of the left wing root fuel line. With the fuel selector valve then placed in the ON position and the left wing fuel line held closed, expelled air was confirmed coming from the fuel strainer. The fuel vent line was tested with air and the vent line was free of obstructions.

2.0.2 Engine examination notes

At the direction of the NTSB IIC, the engine was removed from the airframe prior to the examination. Additionally, the #3 rocker box cover was removed, with all ignition leads removed from their respective spark plugs. The starter motor was imbedded and removed from the firewall for the safety reasons.

The engine remained intact and displayed impact damage. All four cylinders remained attached to the engine, and displayed varying degrees of impact damage. The crankcase remained intact and was unremarkable. The two-bladed fixed pitch propeller remained attached to the crankshaft. Both propeller blades displayed minor impact damage, with no bending or twisting deformation observed.



Figure 8 - photo of engine as received

Both magnetos remained attached to their respective mounting pads and displayed minor

impact damage. The ignition harness displayed impact damage, with a few off the ignition leads partially severed. All spark plugs remained intact in their cylinders, and were visually observed to be unremarkable. The carburetor had broken free from the induction system and displayed signatures consistent with impact damage. The induction system displayed impact damage at the induction manifold. The exhaust system displayed damage in the form of bending.

The right magneto remained attached to its mounting pad and displayed minor impact damage. The magneto was removed, and the drive shaft was rotated by hand; it was noted that the impulse coupling operated normally. During impulse coupling operation it was noted that the magneto would produce a spark for all four distributor posts in the normal order. There were no anomalies noted with the magneto.



Figure 9 - photo of right magneto

The left magneto remained attached to its mounting pad and displayed minor impact damage. The magneto was removed, and the drive shaft was rotated by hand; it was noted that the impulse couplings operated normally. During impulse coupling operation it was noted that the magneto would produce a spark on all four distributor posts at the same time. The magneto was retained by the NTSB IIC for further examination.

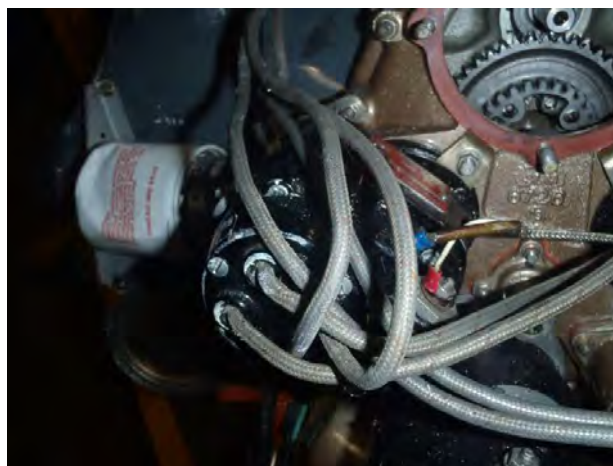


Figure 10 - photo of left magneto

It was noted that the ignition harness leads were removed from all of the spark plugs prior to the investigators' arrival. The ignition harness sustained damage consistent with impact damage; several of the ignition leads for the right magneto were partially severed. The left magneto ignition harness was tested and it was capable of conducting a spark from the magneto to the ignition lead end. There were no pre-impact anomalies noted with the ignition harness.

All of the spark plugs remained installed in their cylinders. The spark plugs were removed and the spark plugs were visually inspected. It was noted that the #2 bottom spark plug was oil soaked which is consistent with post-accident accumulation. It was noted that all of the electrodes displayed normal operating and wear signatures.

The carburetor had broken free from the induction system and displayed damage consistent with impact damage. The both of the control arms remained secure to their shafts. The carburetor inlet fuel screen was removed and it was noted to be clear of contaminants. The carburetor was disassembled and the internal components were inspected. The floats were intact and were attached to the carburetor and the needle valve. It was noted that during float movement the needle valve would not move and was in the up position. Air was blown into the carburetor fuel inlet and it was noted that no air would pass through the valve. The floats were removed and the needle valve was removed; there were no visual anomalies noted with the valve. The valve and floats were reinstalled and actuated; the valve operated; however, occasionally would stick in the full up position. After the needle valve was freed air was blown into the inlet and it was noted that air was capable of passing through the valve. There were no further anomalies noted.

The oil sump displayed damage consistent with impact damage. The oil sump was removed and it was noted that there was a portion of a crankshaft gear bolt and an oil bottle cap in the bottom of the oil sump.

The oil pick-up tube and screen was undamaged and the screen was clear of contaminants.

The oil pump remained intact and was capable of normal rotation. The oil pump was disassembled and it was noted there were a few metal flakes in the oil pump housing. The oil pump gears displayed normal operating signatures and the oil pressure relief valve displayed normal seating and operation signatures.

The engine had an oil filter and adapter installed. The oil filter was removed and the housing was cut open. The oil filter pleats were inspected and it was noted there was a very minute amount of metallic material noted within the filter pleats. It was reported to the investigators that the engine had been overhauled within the last 100 hours.



Figure 11 - photo of oil filter pleats

The original engine oil screen remained installed despite the fact the engine was equipped with an oil filter. The oil screen was removed and it was noted that there was a significant amount of contaminants consistent with metallic material as well as a significant amount of unidentified black colored substance.



Figure 12 - photo 1 of oil screen



Figure 13 - photo 2 of oil screen

The #1 cylinder remained attached to its cylinder bay and was undamaged. It was noted that there was no torque seal on any of the cylinder attachment nuts. The cylinder was removed and visually inspected. It was noted that there was a significant amount of black sealant type material covering the majority of the cylinder flange and skirt. The internal portion of the cylinder displayed normal operating and combustion signatures. The rocker arms, valves, and springs displayed normal operating signatures.

The rocker arm box cover was removed prior to the investigator's arrival. The cylinder remained attached to its cylinder bay and was undamaged. It was noted that there was no torque seal on any of the cylinder attachment nuts. The cylinder was removed and visually inspected. It was noted that there was a significant amount of black sealant type material covering the majority of the cylinder flange and skirt. The internal portion of the cylinder displayed normal operating and combustion signatures. The rocker arms, valves, and springs displayed normal operating signatures.



Figure 14 - photo of #1 cylinder

The #2 cylinder remained attached to its cylinder bay and was undamaged. It was noted that there was no torque seal on any of the cylinder attachment nuts and it was noted that one of the cylinder hold down nuts appeared to be a standard nut in contrast to typical cylinder hold down nuts. The cylinder was removed and visually inspected. The internal portion of the cylinder displayed normal operating and combustion signatures. The rocker arms, valves, and springs displayed normal operating signatures. It was noted that the #2 cylinder was the only cylinder without black sealant present around the flange and skirt.



Figure 15 - photo of #2 cylinder

The #3 cylinder remained attached to its cylinder bay and was undamaged. It was noted that there was no torque seal on any of the cylinder attachment nuts. The cylinder was removed and visually inspected. It was noted that there was a significant amount of black sealant type material covering the majority of the cylinder flange and skirt. The internal portion of the cylinder displayed normal operating and combustion signatures. The rocker arms, valves, and springs displayed normal operating signatures.



Figure 16 - photo of #3 cylinder

The #4 cylinder remained attached to its cylinder bay and was undamaged. It was noted that there was no torque seal on any of the cylinder attachment nuts. The cylinder was removed and visually inspected. It was noted that there was a significant amount of black sealant type material covering the majority of the cylinder flange and skirt. The internal portion of the cylinder displayed normal operating and combustion signatures. The rocker arms, valves, and springs displayed normal operating signatures.



Figure 17 - photo of #4 cylinder

All of the valve heads displayed normal operating and combustion signatures. During camshaft rotation the valves operated normally. All of the pistons display normal operating and combustion signature. All of the piston rings were intact and free to move in their respective grooves. There were no anomalies noted with the pistons.

The crankcase was intact and undamaged. The crankcase halves were split and the crankcase was visually inspected. It was noted that there was black sealant applied to the crankcase halves mating surfaces and there was no silk thread noted on the crankcase half mating surfaces. It was also noted that the black sealant material was found in several of the oil galleys. There were no signs of bearing shift or lock tab elongation. The accessory case displayed damage on the inside of the case; the damage was consistent with impact with the sheered crankshaft gear bolts.



Figure 18 - photo #1 of crankcase



Figure 19 - photo #2 of crankcase

Each of the three (3) bearing remained within their bearing support and displayed normal operating and lubrication signature.

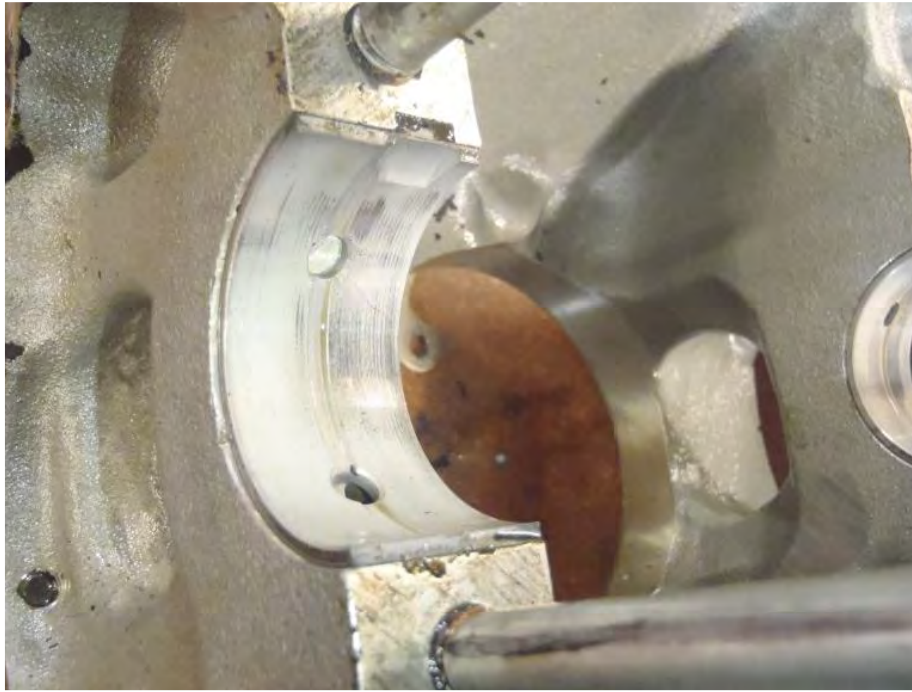


Figure 20 – photo 1 of #1 main bearing half

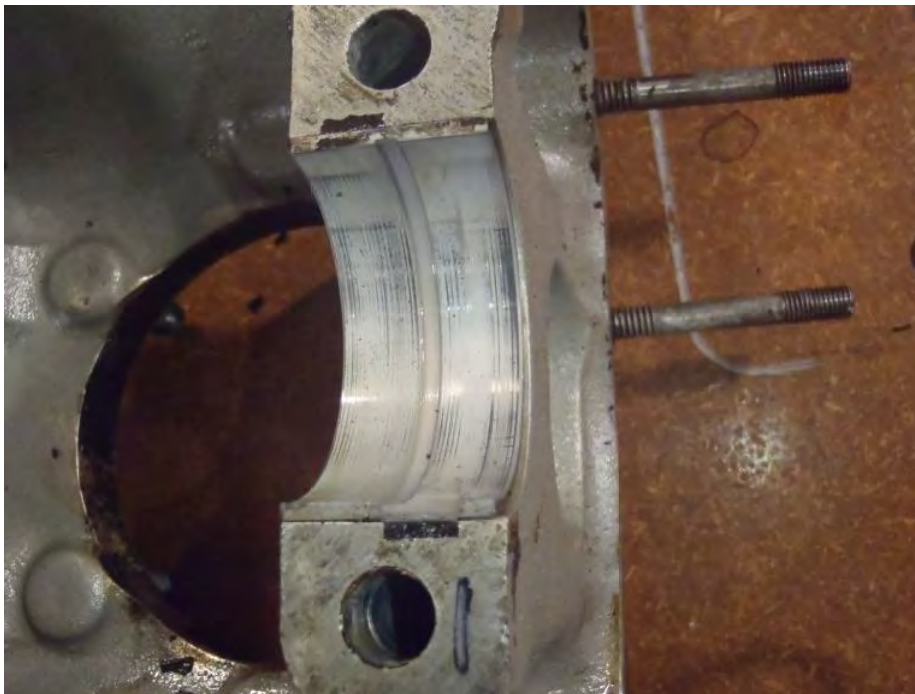


Figure 21 – photo 2 of #1 main bearing half

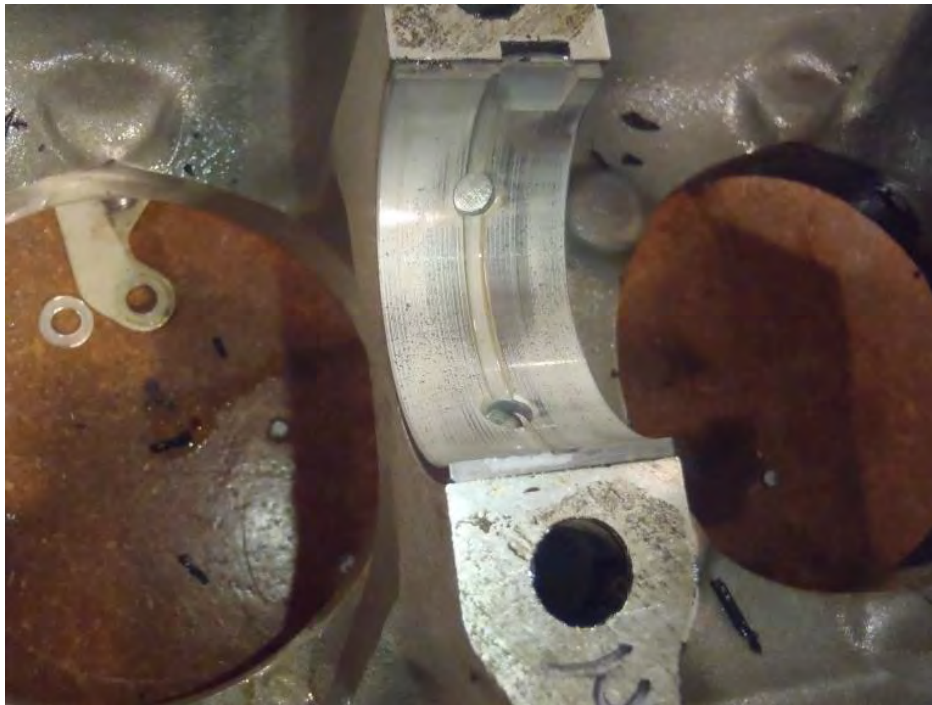


Figure 22 - photo 1 of #2 bearing half



Figure 23 - photo 2 of #2 bearing half



Figure 24 - photo 1 of #3 bearing half



Figure 25 - photo 2 of #3 bearing half

The crankshaft remained intact; however, it was noted that the crankshaft gear bolts and dowel pin had sheered, and the crankshaft gear was no longer secured to the crankshaft. Two of the crankshaft gear bolts remained partially within the gear and were impinged against the accessory case. Additionally, one bolt was located in the oil sump, while another bolt was located in the accessory case. The two bolts that were impinged against the accessory case were noted to be safety wired together, while the other two bolts were not safety wired together. It was noted that one of the bolts had safety wire, and the wire was broken at one end, the other bolt was void of any safety wire. The crankshaft was removed from the crankcase and the connecting rods were removed. The crankshaft, crankshaft gear, crankshaft gear bolts, and crankshaft gear dowel pin were retained by the NTSB IIC for further examination.

Due to the sheered crankshaft gear nuts and dowel pin, the internal timing could not be verified.



Figure 26 - photo of crankshaft gear

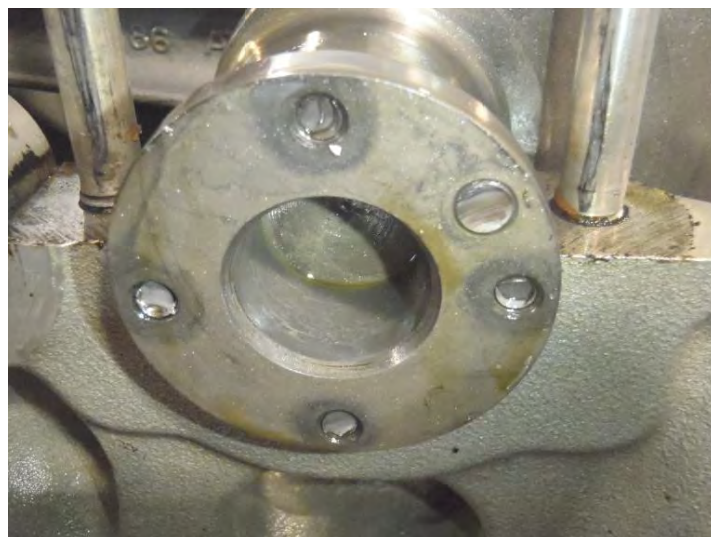


Figure 27 - photo of crankshaft



Figure 28 - photo of crankshaft gear bolts



Figure 29 - photo of crankshaft gear bolts

The #1 connecting rod remained attached to its connecting rod journal and to the piston pin. The connecting rod displayed normal operating signatures. There were no anomalies noted.

The #1 connecting rod bearing remained intact and installed in its connecting rod. The bearing displayed normal operating and lubrication signatures.

The #2 connecting rod remained attached to its connecting rod journal and to the piston pin. The connecting rod displayed normal operating signatures. There were no anomalies noted.

The #2 connecting rod bearing remained intact and installed in its connecting rod. The bearing displayed normal operating and lubrication signatures.

The #3 connecting rod remained attached to its connecting rod journal and to the piston pin. The connecting rod displayed normal operating signatures. There were no anomalies noted.

The #3 connecting rod bearing remained intact and installed in its connecting rod. The bearing displayed normal operating and lubrication signatures.

The #4 connecting rod remained attached to its connecting rod journal and to the piston pin. The connecting rod displayed normal operating signatures. There were no anomalies noted.

The #4 connecting rod bearing remained intact and installed in its connecting rod. The bearing displayed normal operating and lubrication signatures.

The camshaft remained intact and undamaged. Due to the sheered crankshaft gear bolts and dowel pin the camshaft would not rotate during crankshaft rotation. A tool was placed in the rear of the camshaft and the camshaft was rotated by hand; it was noted that the camshaft was capable of normal rotation and the camshaft operated valve train.



Figure 30 - photo of camshaft

All of the lifters were undamaged and displayed normal operating and lubrication signatures. There were no anomalies noted with the lifters.

All of the accessory gears displayed normal operating signatures. There were no anomalies noted.

The starter had been removed prior to the investigator's arrival. According to the recovery personnel the starter motor was imbedded in the aircraft firewall and was removed for safety reasons. The starter displayed damage consistent with impact damage and was broken into two pieces. The starter gear and clutch assembly was separated from the rest of the motor; the starter gear that engages the crankshaft gear was checked to ensure it would spin freely when spun in the direction of normal crankshaft rotation, the gear operated normally. The starter was retained by the NTSB for possible further examination.



Figure 31 - photo #1 of starter



Figure 32 - photo #2 of starter

The generator remained intact and undamaged. There were no anomalies noted with the generator.



Figure 33 - photo of generator

The vacuum pump had broken free from its mounting location and displayed damage consistent with impact damage. It was noted that the sheer coupling remained intact. There were no anomalies noted with the vacuum pump.



The propeller remained intact and attached to the crankshaft. Both of the propeller blades displayed very little impact damage and it was noted that there was no bending or twisting deformation. The spinner was crushed aft and had material consistent with wood imbedded in the center portion of the spinner.



Figure 34 - photo of propeller



Figure 35 - photo of propeller spinner