

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



ANC25MA018

POWERPLANT FACTUAL REPORT

November 19, 2025

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A. ACCIDENT

Location: Nome, Alaska
Date: February 6, 2025
Time: 15:20 local time
Airplane: Textron Aviation 208B, Registration Number N321BA

B. POWERPLANT GROUP

Group Chair	Harald Reichel National Transportation Safety Board Washington, D.C.
Party Coordinator	Michael Hodge Pratt & Whitney Canada Bridgeport, West Virginia
Party Coordinator	Ernest Hall Textron Aviation Wichita, Kansas
Party Coordinator	Matt Zolnierczyk Woodward Inc. Loves Park, Illinois

C. SUMMARY

On February 6, 2025, about 1520 Alaska standard time, a Textron Aviation (Cessna) 208B airplane, N321BA, operated as Bering Air flight 445, was destroyed when it was involved in an accident near Nome, Alaska. The pilot and nine passengers were fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* (CFR) Part 135 scheduled commuter flight.

The engine was shipped to the Pratt & Whitney Canada facility in Bridgeport, West Virginia where it was disassembled and examined on April 29 to May 1, 2025. The findings of the examination were:

- The propeller hub studs were captured in the propeller shaft flange and had rotationally scored the top and bottom propeller shaft oil seal retain rings, which is consistent with continued rotation of the engine after impact.
- Rotational scoring of all the compressor elements, and the scoring of the stationary components near the bottom location are consistent with a flat impact of an operational engine.

- The power and compressor turbines and shrouds exhibited rotational scoring, consistent with an operating engine during impact.

The fuel control unit (FCU) and the propeller governor or constant speed unit (CSU) were sent to Woodward in Loves Park, Illinois where they were tested on July 10 - 11, 2025. The findings of the test were:

- No discrepancies were found in either unit that would have precluded normal pre-impact operation.

D. DETAILS OF THE EXAMINATION

1.0 Powerplant

1.1 Engine Description

The Pratt & Whitney Canada (P&WC) PT6A-140 engine (**Figure 1**) is a 2-spool turbo-shaft engine. The gas generator (Ng) spool consists of a 3-stage axial and 1 stage centrifugal compressor driven by a single stage compressor turbine (CT). The combustion chamber is a reverse-flow annular type. The power or propeller (Np) spool consists of a two-stage power turbine (PT) which drives the propeller through a 2-stage planetary reduction gearbox (RGB). The constant-speed, variable pitch propeller is a single-acting type and is hydraulically controlled by the propeller governor/constant speed unit (CSU). The engine power management system consists of a hydro-mechanical fuel control unit (FCU) which governs the Ng spool, and the CSU which governs the Np spool. The PT6A-140 produces a takeoff power of 867 horsepower at a 1900 propeller shaft speed in revolutions per minute (RPM).

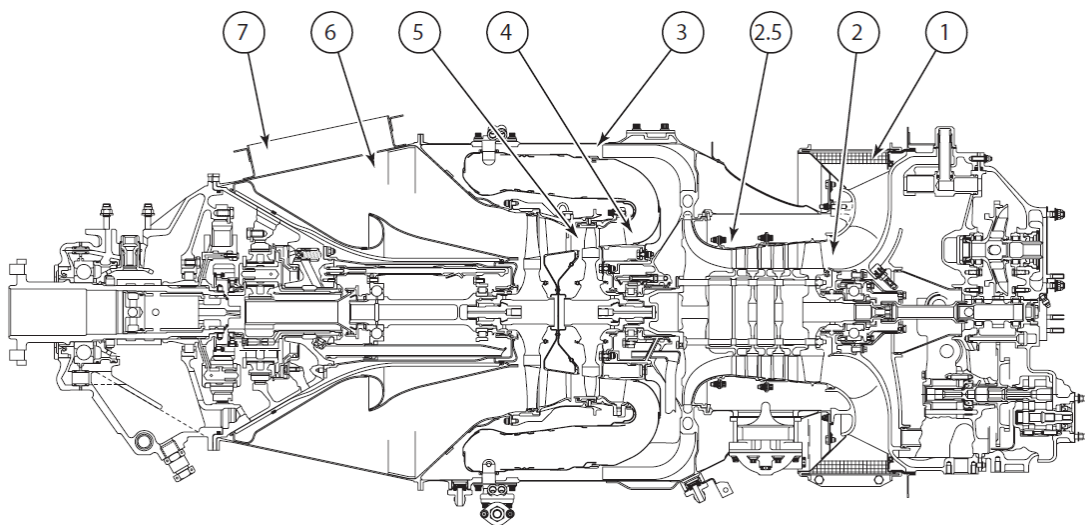


Figure 1 - P&WC PT6A-140 Engine - Courtesy Pratt & Whitney Canada

1.2 Engine History

The engine data plate indicated that the engine was model number PT6A-140 and serial number (S/N) PC-E VA0701 and was manufactured on September 25, 2020. The power module S/N was PS VA0701. The engine FAA type certificate is E4EA. The P&WC engine build specification is 1294.

The engine logbook was not shipped with the engine.

2.0 Engine Disassembly & Examination

2.1 General External Condition

2.1.1 Shipping and Receiving

The engine was in a standard cardboard engine container which was opened in the presence of the NTSB (**Photo 1**).



Photo 1 - Engine in Shipping Container - As Received

The engine did not display any evidence of fire or un-containment (**Photo 2** & **Photo 3**). The engine was generally clean.



Photo 2 - PT6A-140 S/N PC-E VA0701 - Left Side View

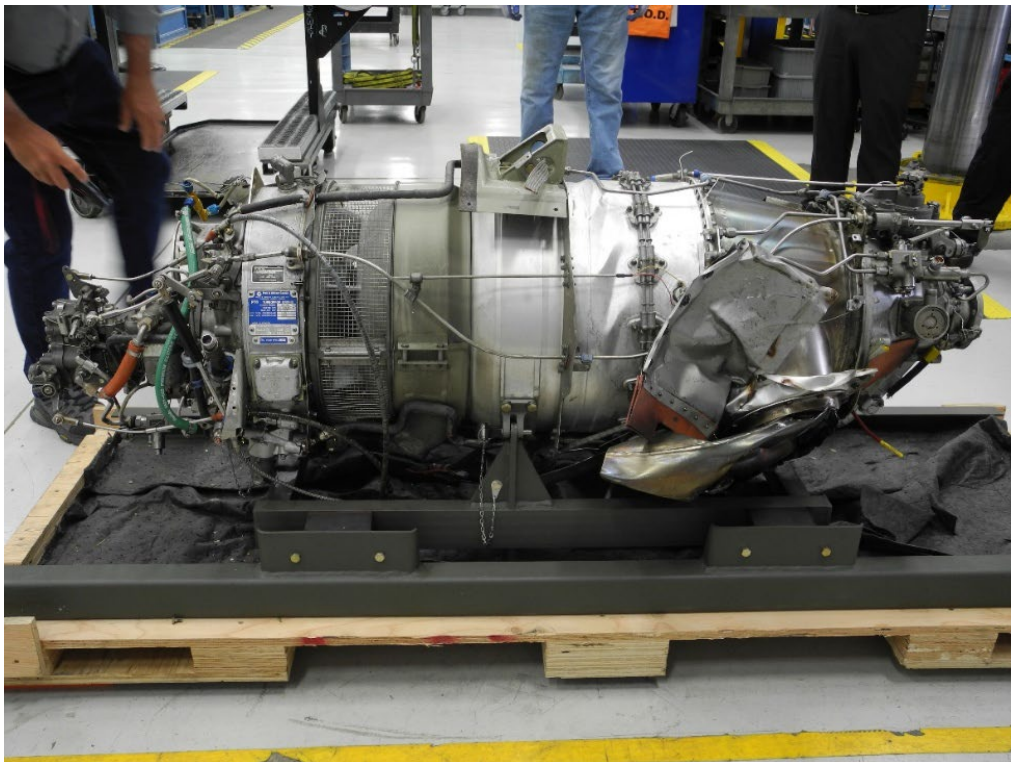
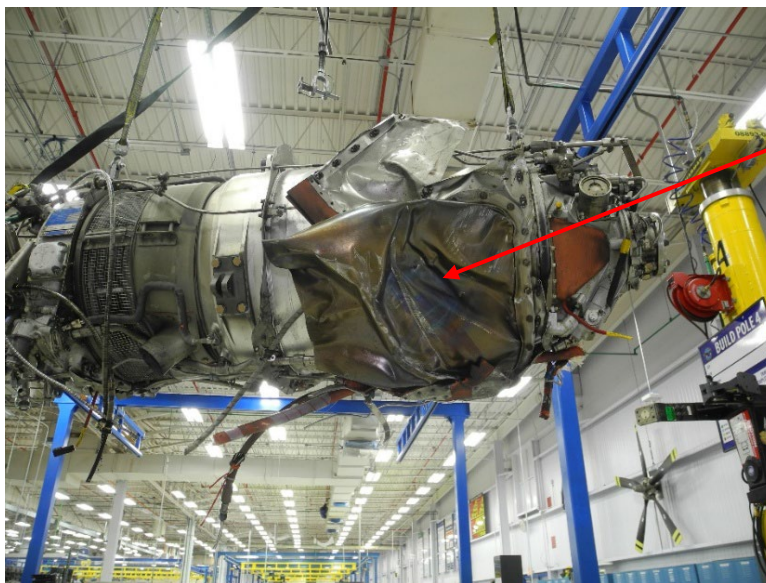


Photo 3 - PT6A-140 S/N PC-E VA0701 - Right Side View

2.1.2 Airframe Components

Most of the airframe components had been previously removed. The starter/generator (S/G) was not present. The S/G flange adapter was present; however, it was fractured. The propeller TKS anti-ice system bracket and its associated tubing were present; however, they were impact damaged and fractured.

The airframe exhaust duct was deformed and folded backwards, almost completely covering the engine exhaust opening (**Photo 4**).



Airframe
Exhaust -
Deformed

Photo 4 - Airframe Exhaust Duct - Blocking Engine Exhaust Port

2.1.3 Fluids, Pneumatics and Chip Detectors

No oil could be seen in the site glass; however, when the oil tank drain plug was removed, approximately one gallon of clean oil was drained. The oil filter (**Photo 5**) was clean and oil wetted. The fuel filter was clean, and the filter bowl contained clean fuel.



Photo 5 - Oil Filter (at Left) and Fuel Filter and Bowl (at Right)

The AGB and RGB chip detectors (**Photo 6**) were clean and oil wetted.



Photo 6 - Chip Detectors - AGB (Left) and RGB (Right)

The P3¹ system was present; however, the P3 filter housing was fractured at the fitting (**Photo 7**) so a pressure test could not be performed. The P3 B-nuts on the compressor housing and the FCU were tight. The P3 filter and filter bowl were free of debris (**Photo 8**). The B-nut of the Py fitting was secure and was removed using 50 inch-pounds in-lbs of torque, however, the safety cable of the B-nut was missing one ferrule. The B-nuts on the bulkhead fittings on the firewall and the torque limiter were tight.

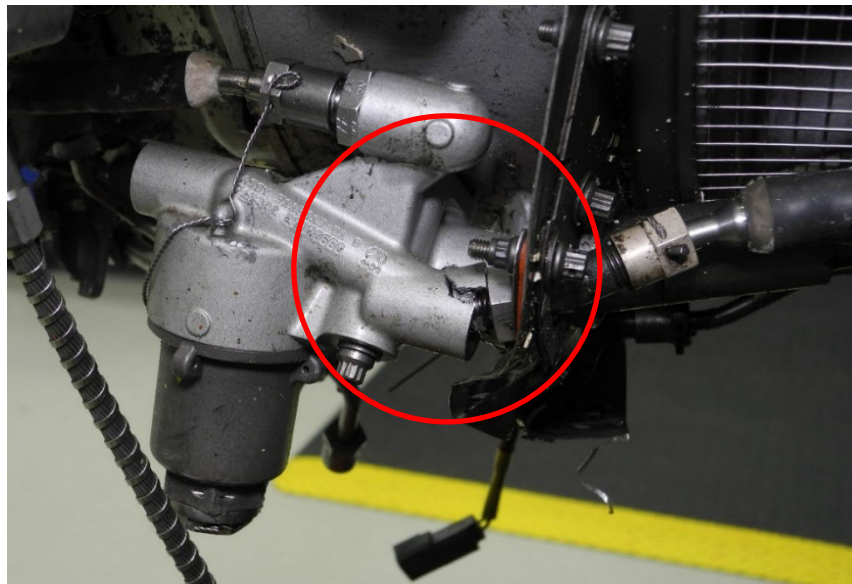


Photo 7 - P3 Filter Housing and Filter - Fractured

¹ P3 is air pressure taken at the 3rd stage compressor location and is used by the FCU to determine the status of the engine. Py pressure is a modified P3 pressure for communication with the CSU.



Photo 8 - P3 Filter and Bowl - Clean

The engine mounted fuel-oil heat exchanger (FOHE) and the thermostatic oil bypass valve were fractured from the engine and were not shipped in the box. The ignitor box was missing. The ignition cable of the right-side ignitor plug was pulled out at the plug connection. The left-hand ignitor cable was pulled at the ignition plug connector.

2.1.4 Power Control Linkage and Reversing Linkage

The FCU power lever shaft was bent (**Photo 9**), and the lever was in an over extended position (**Photo 10**). The manual override (MOR) lever shaft was bent but it could still be turned with moderate effort. The MOR was in the non-engaged position. All the push-pull cables were intact; however, most were bent.

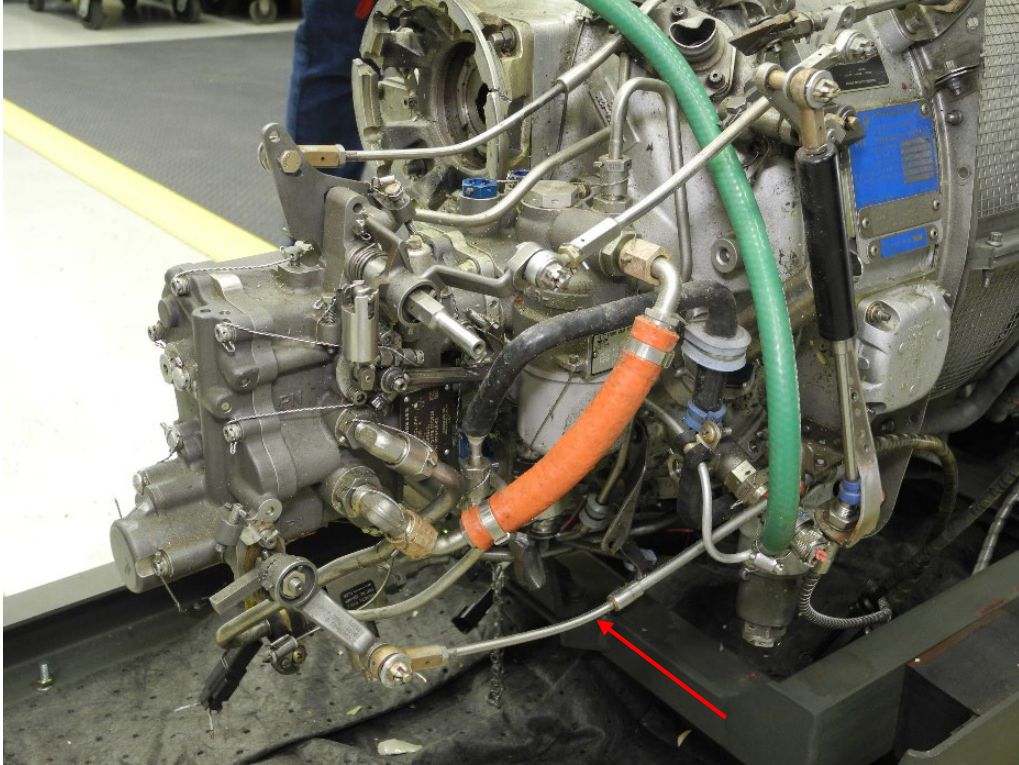


Photo 9 - Control rods - Intact; however, bent.

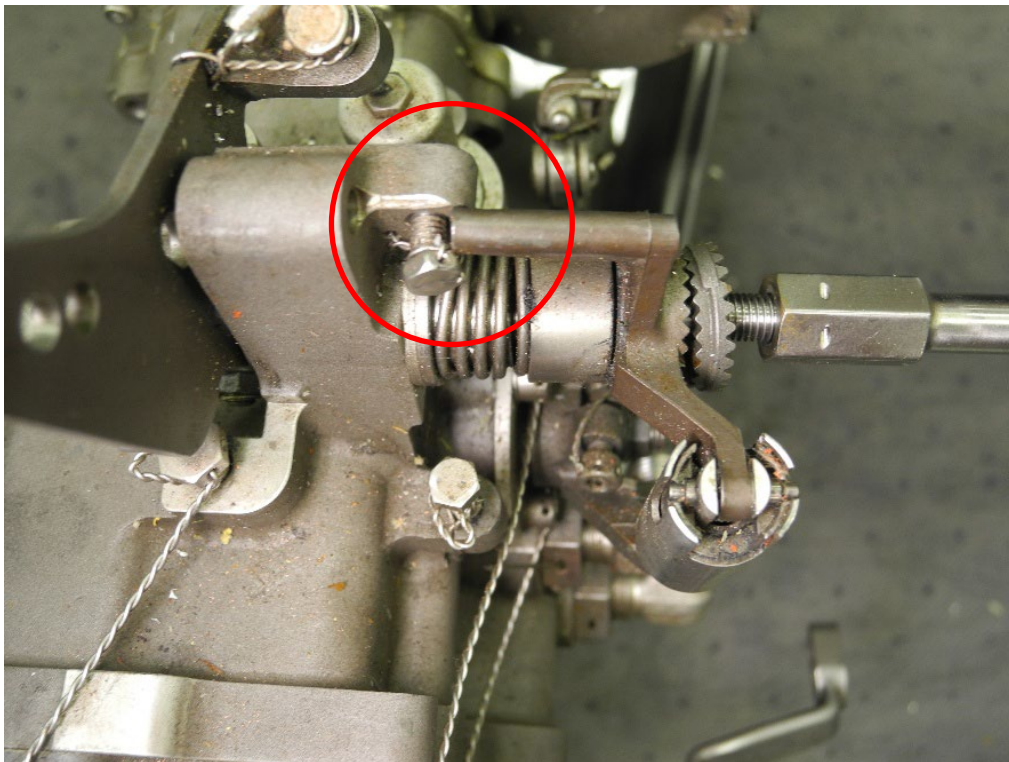


Photo 10 - Power Lever Shaft - Bent and in Over-Extended Position Beyond the Stop

The propeller reverser cam was present; however, it was impact fractured (**Photo 11**).

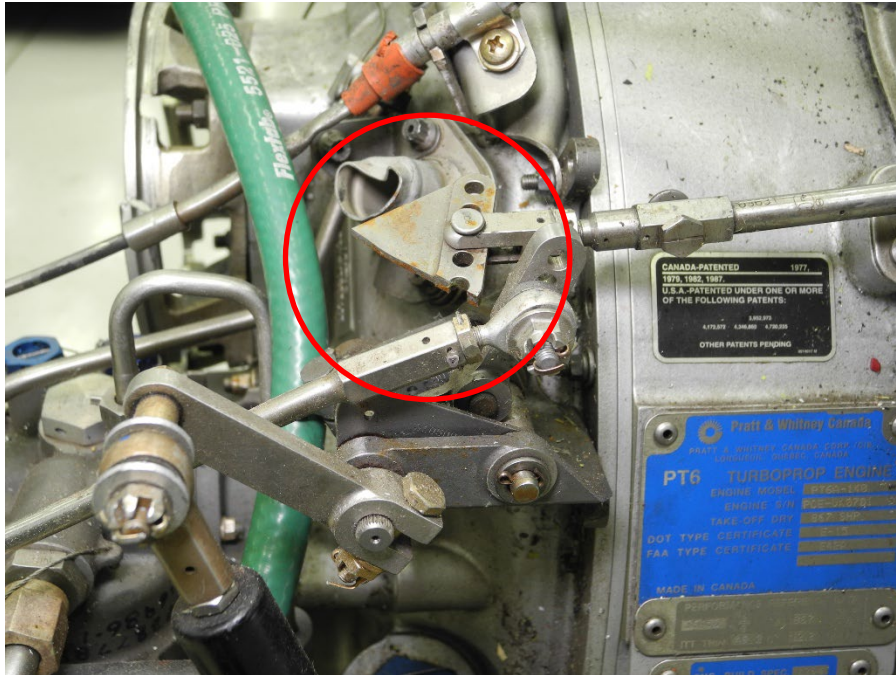


Photo 11 - Reverser Cam - Fractured

The CSU was intact, undamaged, in the Max RPM position and the push-pull cable was still attached (**Photo 12**). The CSU input lever and underspeed lever shafts rotated freely.

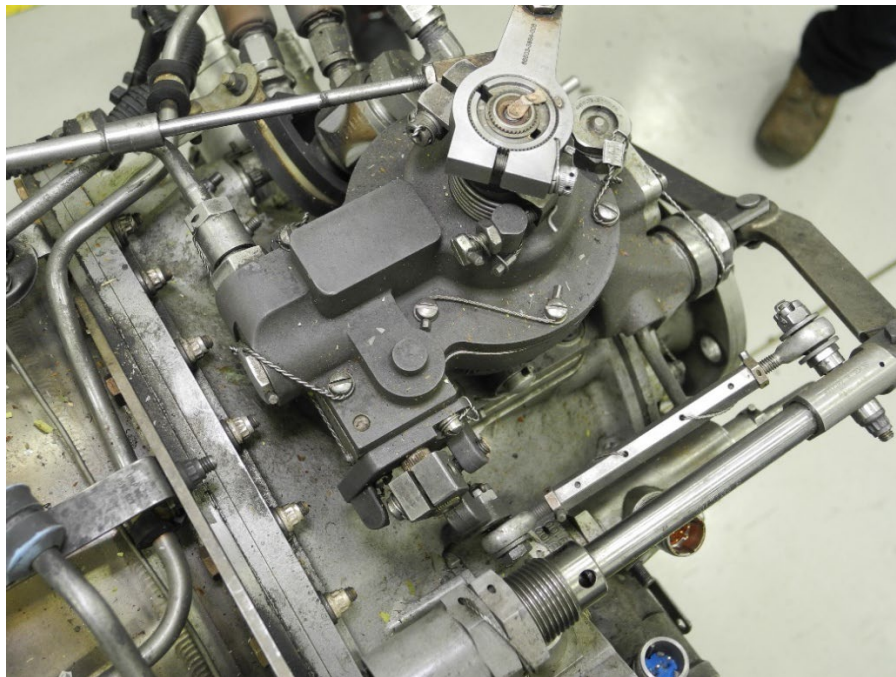


Photo 12 - CSU - Intact and Undamaged

The propeller reversing lever was intact and under the reversing lever guide pin (Photo 13). The guide pin was bent. The carbon block was impact damaged.

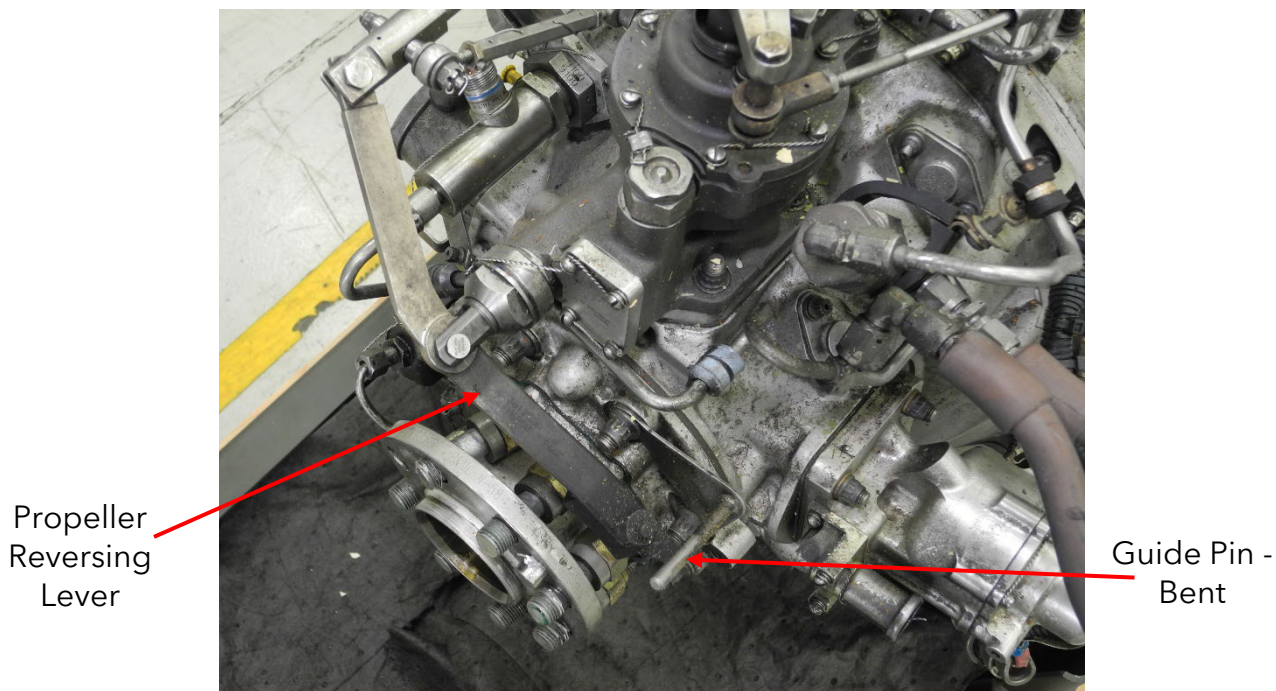


Photo 13 – Propeller Reversing Lever

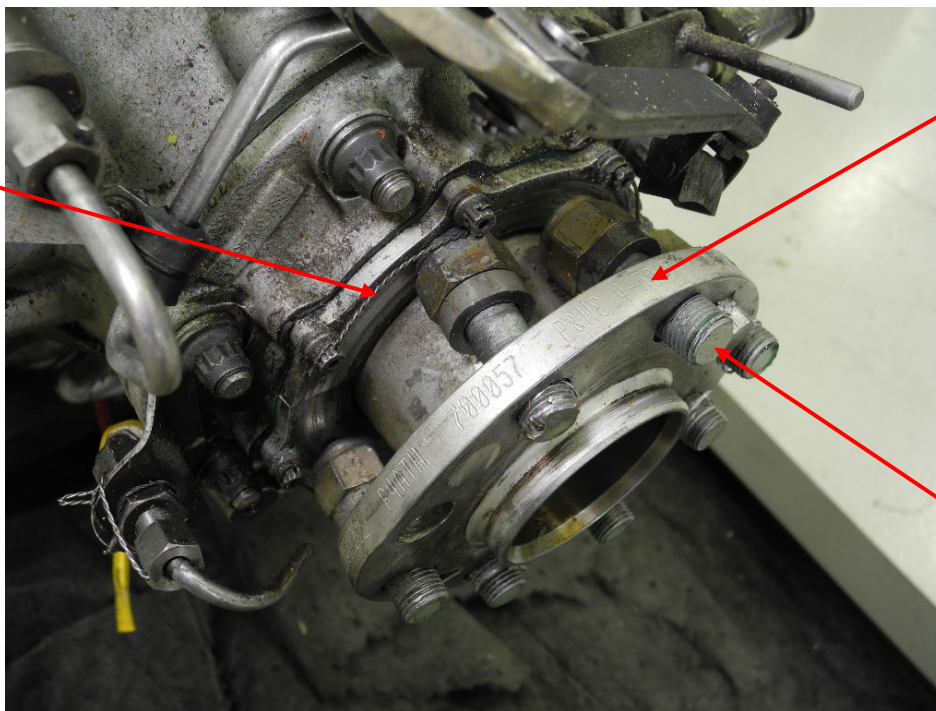
2.2 Disassembly Observations

2.2.1 Reduction Gearbox

The propeller shaft could not be initially turned, and it was noted that the PT was locked in position by contact against the outer displaced shroud. Once the PT blades were free, then the prop shaft could be turned.

The propeller shaft flange was bent (Photo 14). One of the two dowel pins was missing. Seven of the eight propeller mounting studs were pulled out of the propeller hub and captured at the aft side of the flange with the nuts still present. The nuts had contacted the RGB propeller top and bottom oil seal retaining rings and attachment hardware (Photo 15), consistent with propeller shaft rotation after the loss of the propeller.

Propeller Top
and Bottom Oil
Seal Retaining
Rings



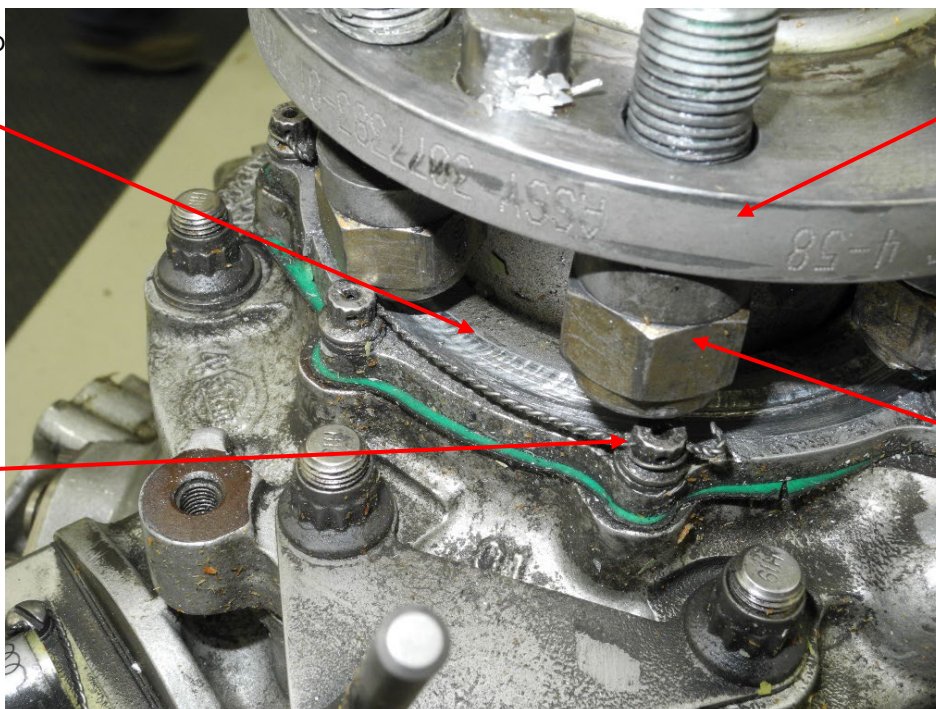
Propeller
Shaft
Flange

Propeller
Mounting
Studs - Pulled

Photo 14 - Propeller Shaft - Bent Propeller Mounting Flange

Propeller Top
and Bottom
Oil Seal
Retaining
Rings -
Rotationally
Scored

Securing Nuts
of Propeller
Top and
Bottom Oil
Seal Retaining
Rings - Impact
Damaged



Propeller
Mounting
Flange

Propeller
Mounting Nuts
and Studs

Photo 15 - Propeller Oil Seal Retaining Rings - Scored by Propeller Mount Nuts

The No. 6 bearing thrust cover was fractured at the 6 o'clock location, exposing an oil transfer tube (**Photo 16**).

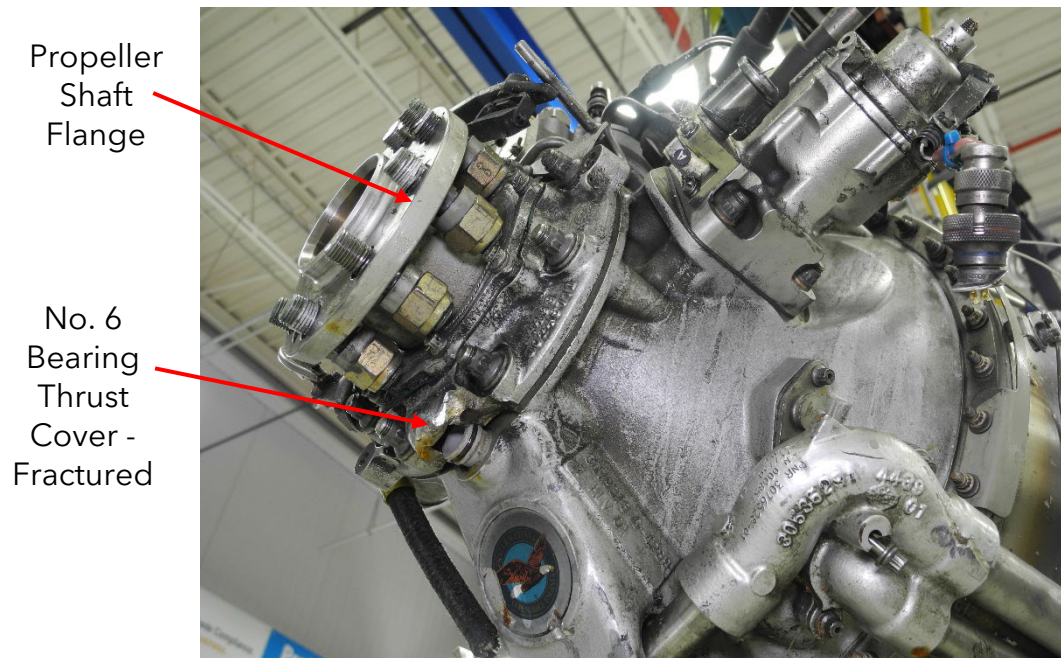


Photo 16 - RGB Housing - View from Bottom

The RGB was disassembled revealing intact, undamaged and oil wetted 1st and 2nd stage planetary gear assemblies (**Photo 17** & **Photo 18**). All gears meshed smoothly, and all bushings and bearings rotated normally.

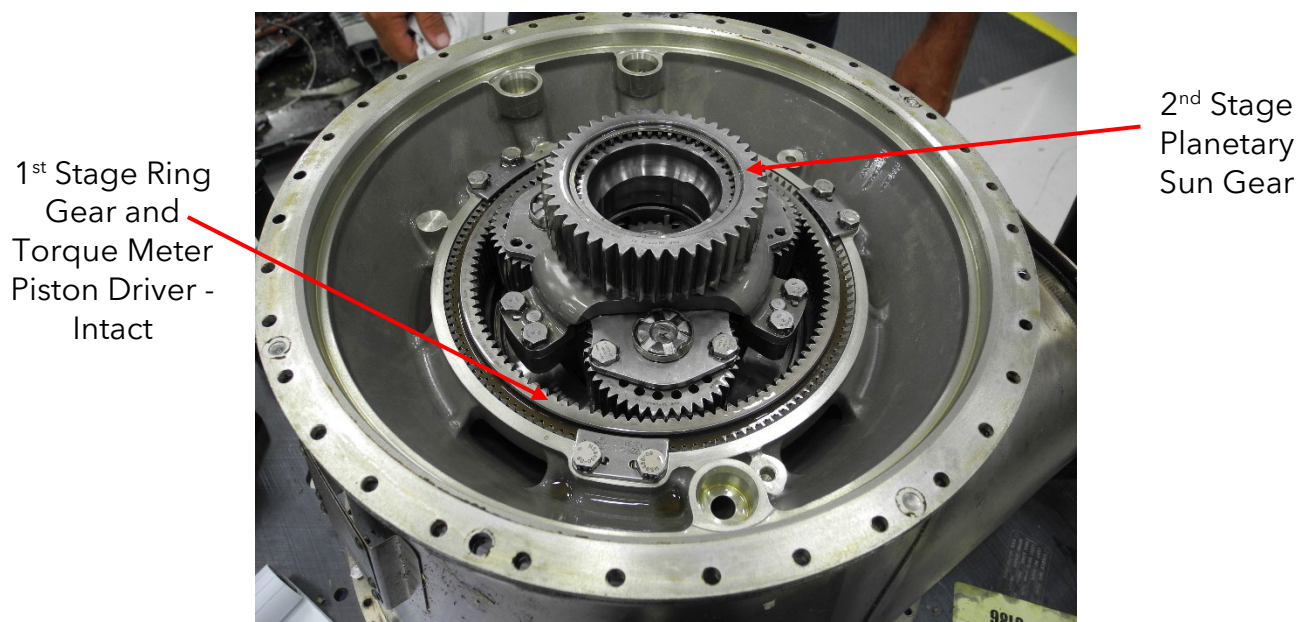


Photo 17 - RGB 1st Stage Reduction Gears - Intact and Undamaged

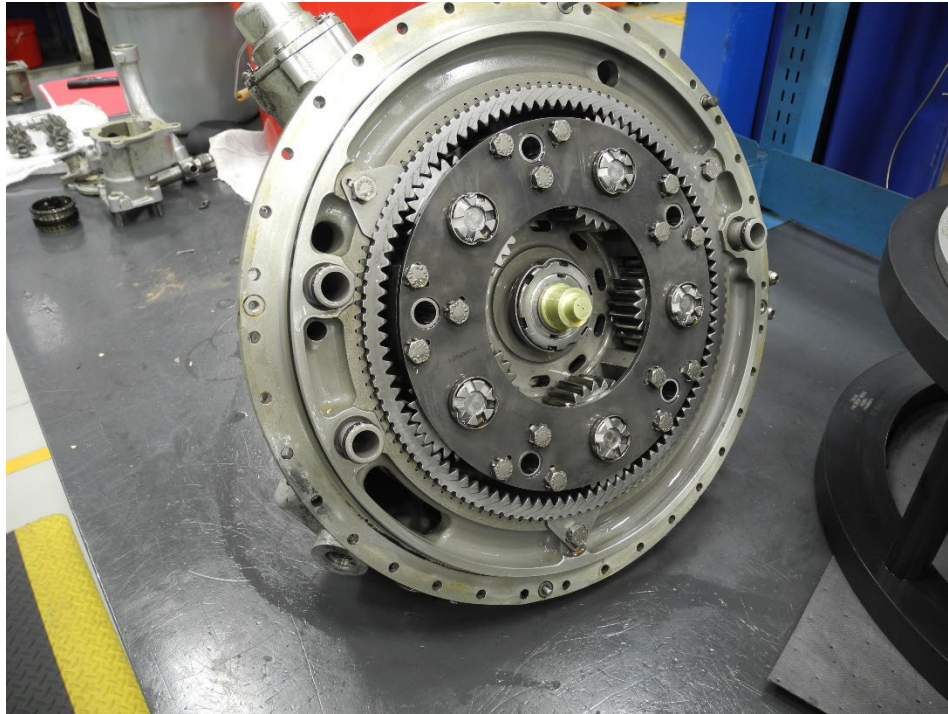


Photo 18 - 2nd Stage RGB Planetary Gear Assembly - Intact and Undamaged

The PT shaft housing was removed from the RGB rear housing (**Photo 19**) revealing an intact 1st stage sun gear (**Photo 20**), PT shaft, coupling and Nos. 3 and 4 bearings. The bearings were oil wetted and rotated normally.



Photo 19 - PT Shaft Housing and RGB Aft Housing

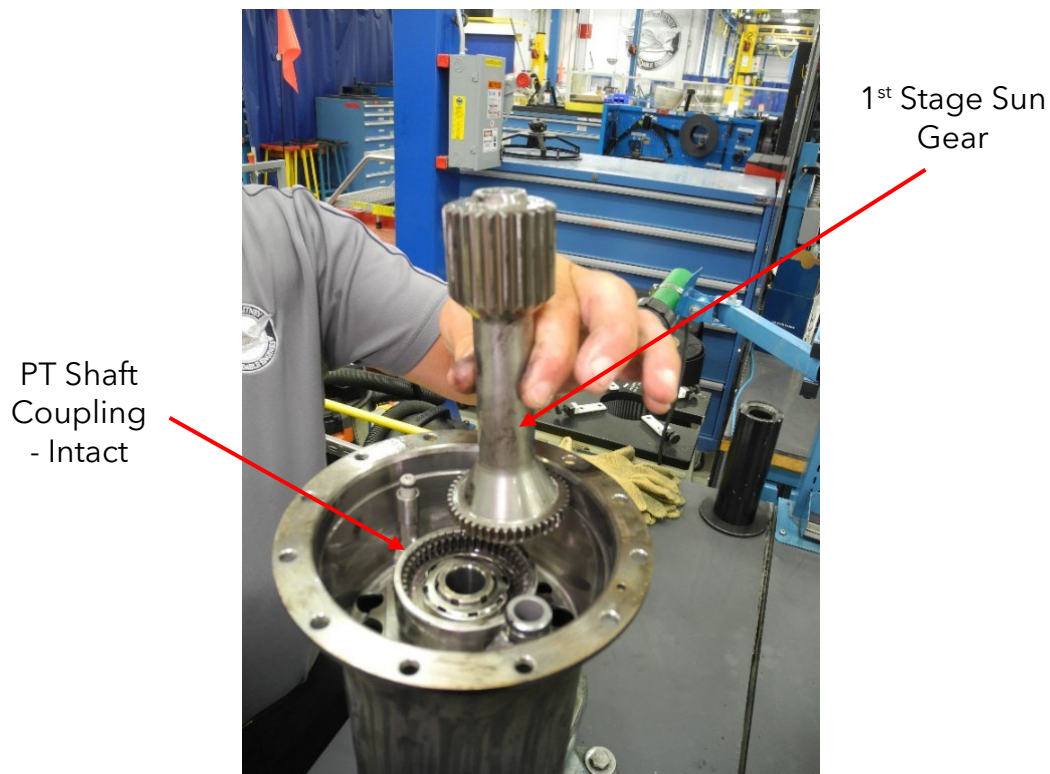


Photo 20 - PT Shaft Housing and Coupling

2.2.2 Power Turbine (PT) and Exhaust Housing Section

The exhaust duct was intact and undamaged (**Photo 21**).

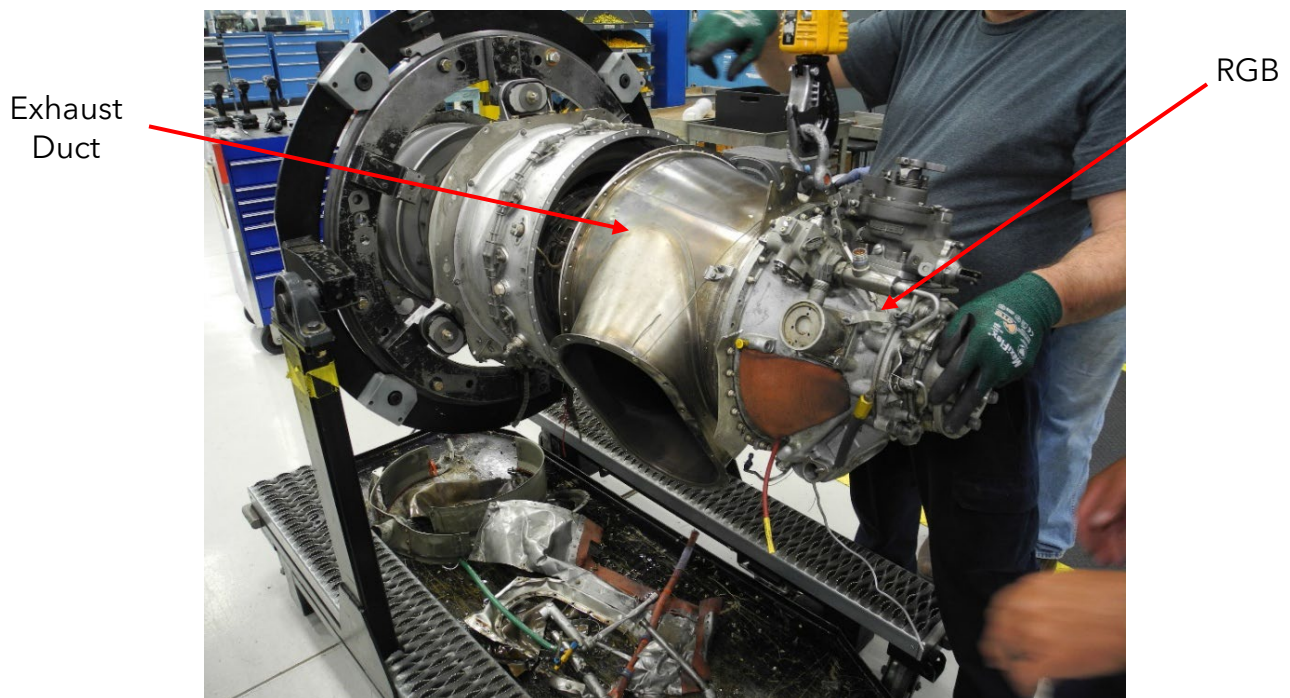
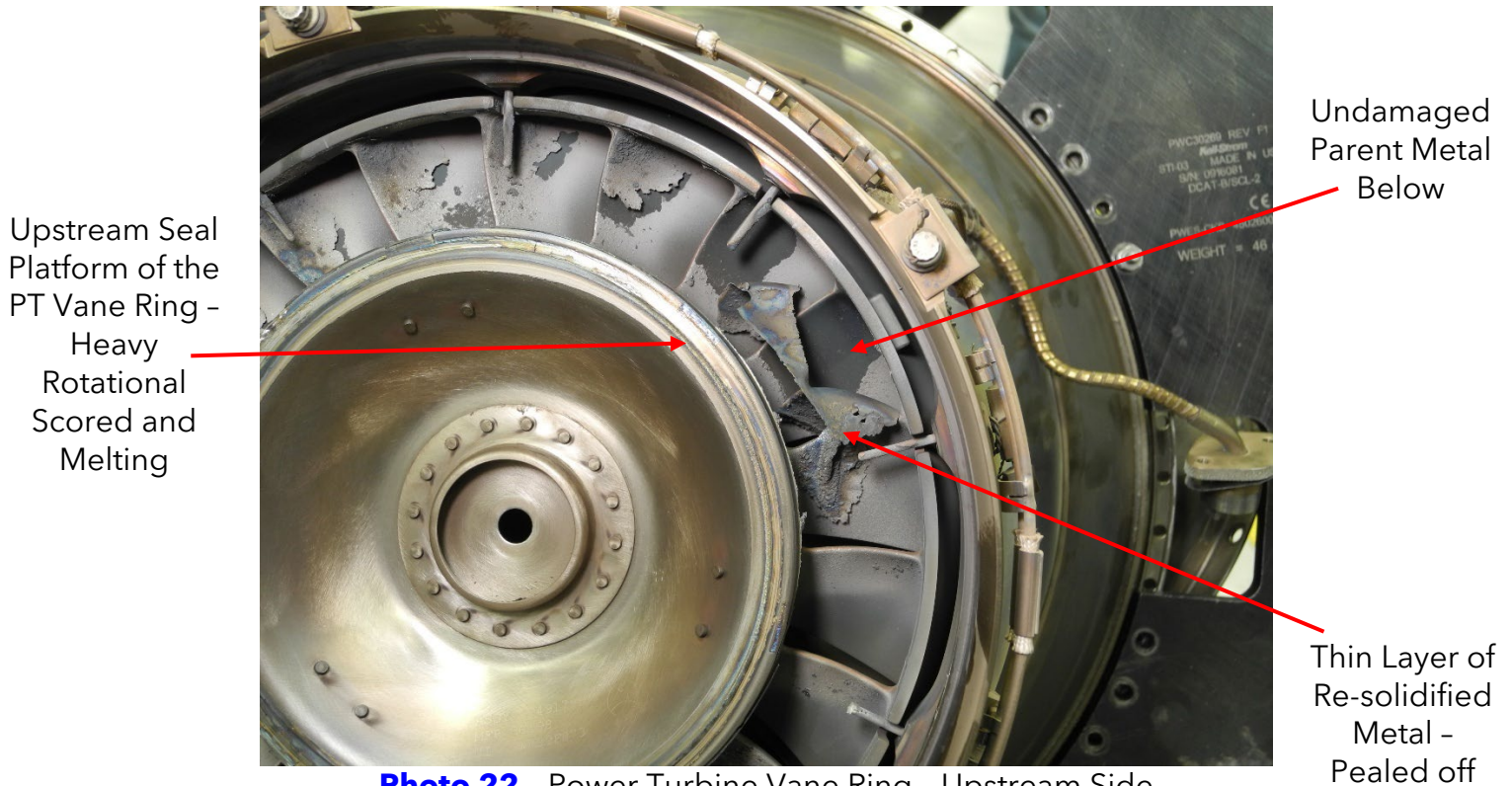
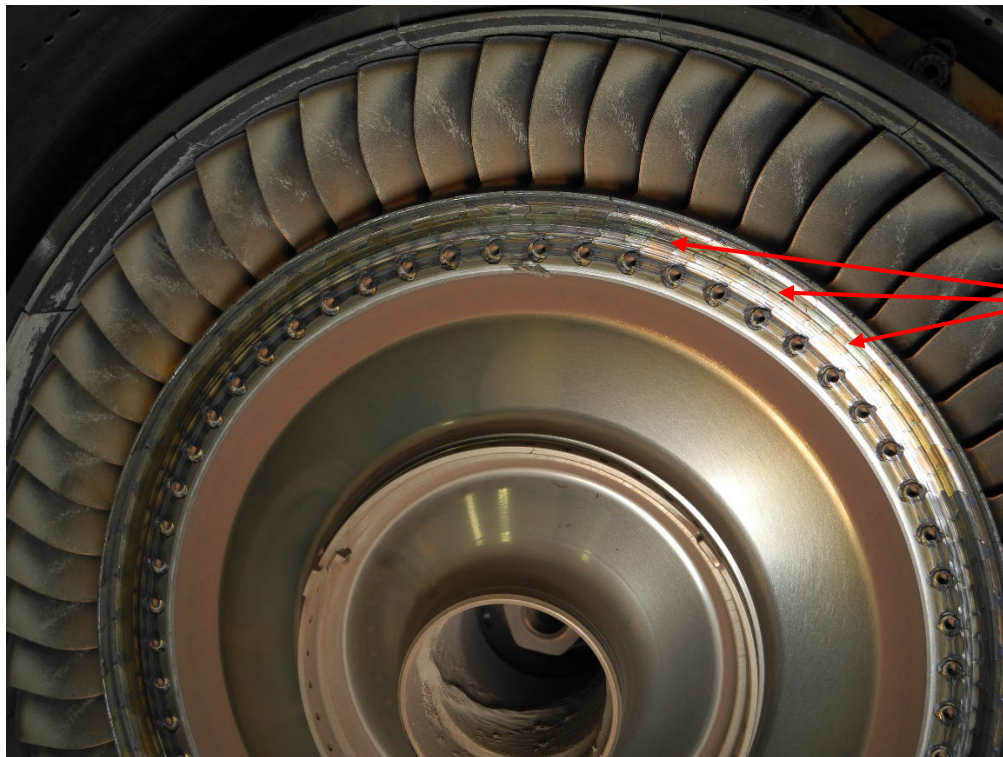


Photo 21 - Exhaust Duct and RGB Removal

The PT vane ring (**Photo 22**) was intact; however, the upstream² side of some of the vanes of the PT vane ring had an uneven splatter of re-solidified metal consistent with metal being melted from contact between the stationary upstream vane platform of the PT and the rotating downstream blade platforms of the CT wheel (**Photo 23**). The splattered material was easily peeled away from the parent metal, exposing undamaged PT vane surfaces.



² Because the internal mechanical architecture of the PT6 engine is of a reverse and folded configuration, and the installed orientation of the PT6 engine reversed, directional and positional designators such as 'forward' and 'aft' are ambiguous. Therefore, the more accurate designator of 'upstream' and 'downstream' with respect to the engine's internal airflow is used when describing internal parts.



Downstream
Blade
Platforms of
the CT Wheel
- Heavy
Rotational
Scored and
Melting

Photo 23 - CT Wheel - Downstream Side

The downstream side of the PT vane ring was intact. There was a circular score on the baffle, consistent with contact against the PT disk. The PT hub and blades were intact (**Photo 24**).



Photo 24 - PT Vane Ring and PT Wheel - Intact

The leading edges of the PT blades had a rough finish, consistent with erosion and metal splatter from upstream.

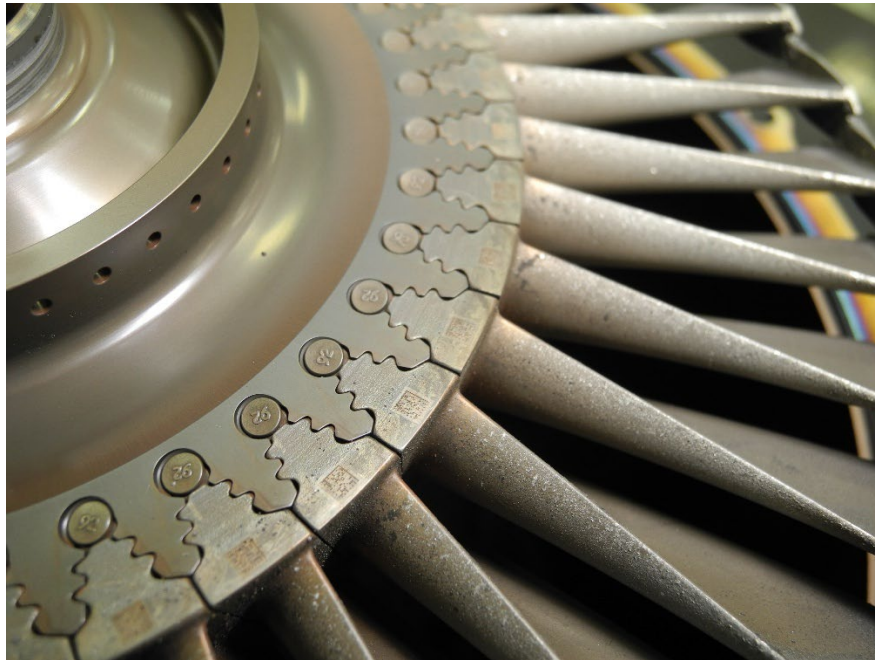


Photo 25 - PT Blades - Leading Edges Eroded

The outer PT blade platforms were all intact but were rubbed (**Photo 26**), consistent with contact against the outer abradable seal (**Photo 27**).



Photo 26 - Outer PT Blade Platforms - Rubbed



Photo 27 - PT Honeycomb Abradable Seal - Rotationally Scored

2.2.3 Compressor Turbine, Combustor Liner and GG Case

The CT wheel was intact. The blades were all present; however, the tips were rubbed and thermally distressed (**Photo 28**), consistent with contact against the shroud. The downstream platforms were rotationally scored, consistent with contact against the PT vane ring upstream platform. The leading edges of the CT blades were undamaged.

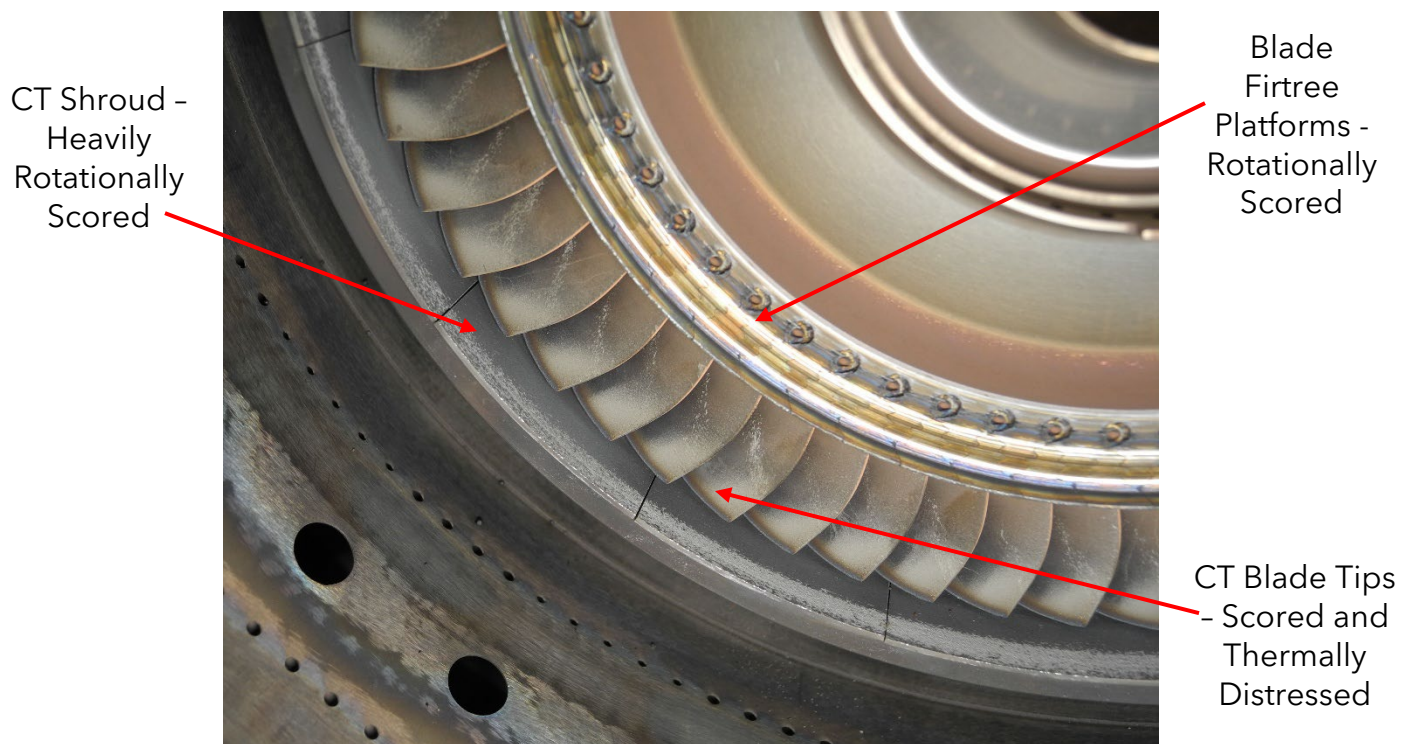


Photo 28 - CT Blades, Hub, and Shroud

The CT shroud was heavily scored at the 3 to 6 o'clock location (**Photo 29**), consistent with contact against the CT blade tips.

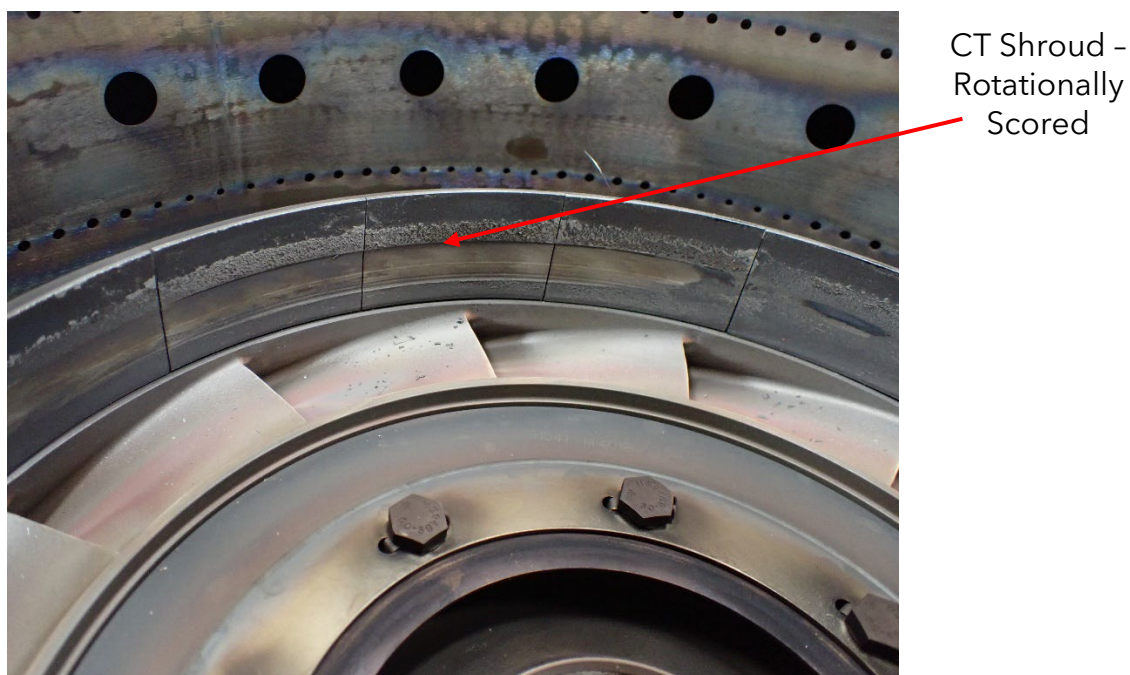


Photo 29 - CT Shroud - Heavy Rotational Scoring

The CT vane ring was intact and undamaged (**Photo 30**). The combustor liner was intact and undamaged.

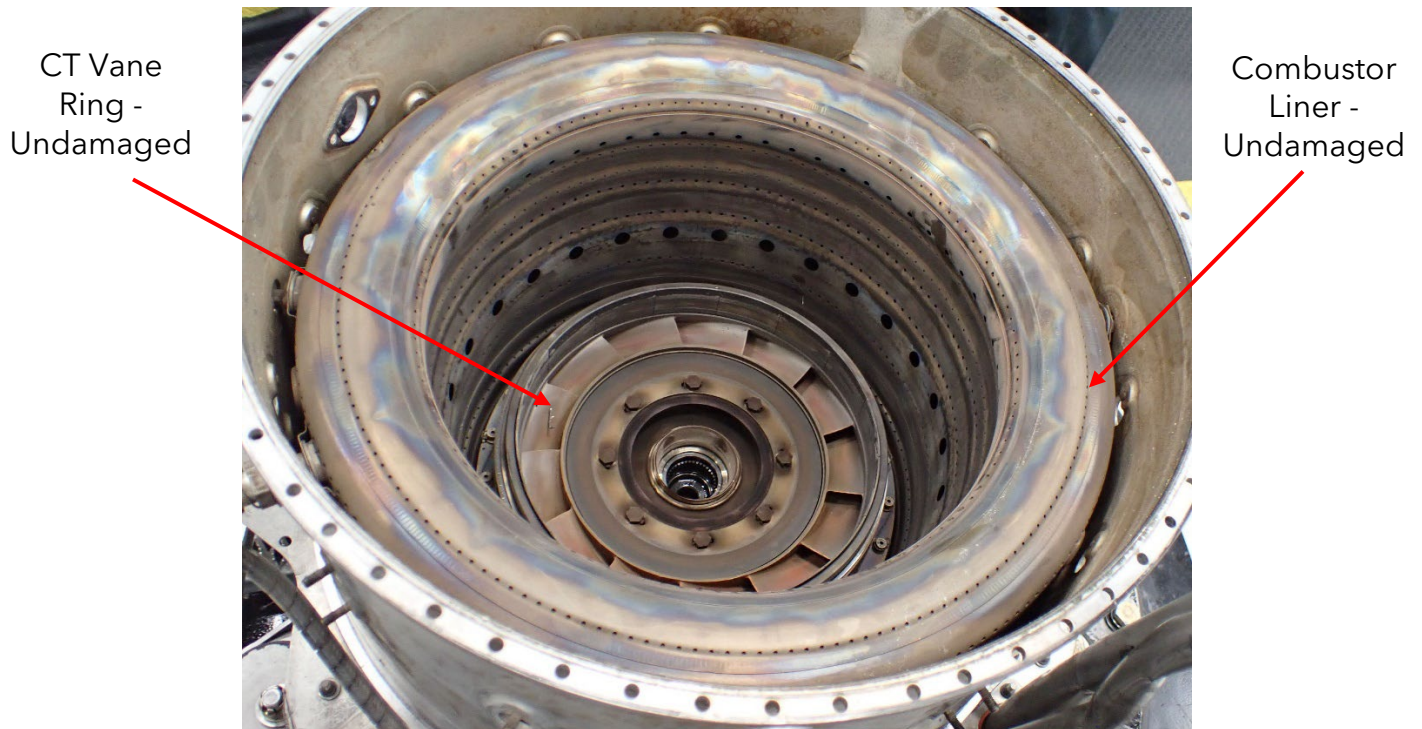


Photo 30 - CT Vane Ring and Combustor Liner in GG Case

The gas generator (GG) case was intact; however, it was buckled near the 12 o'clock location (**Photo 31**). The fuel nozzle assemblies were all present and intact. Two transfer tubes were impact damaged. A visual examination of the fuel nozzles revealed clean nozzles. The diffusers were intact and undamaged (**Photo 32**).

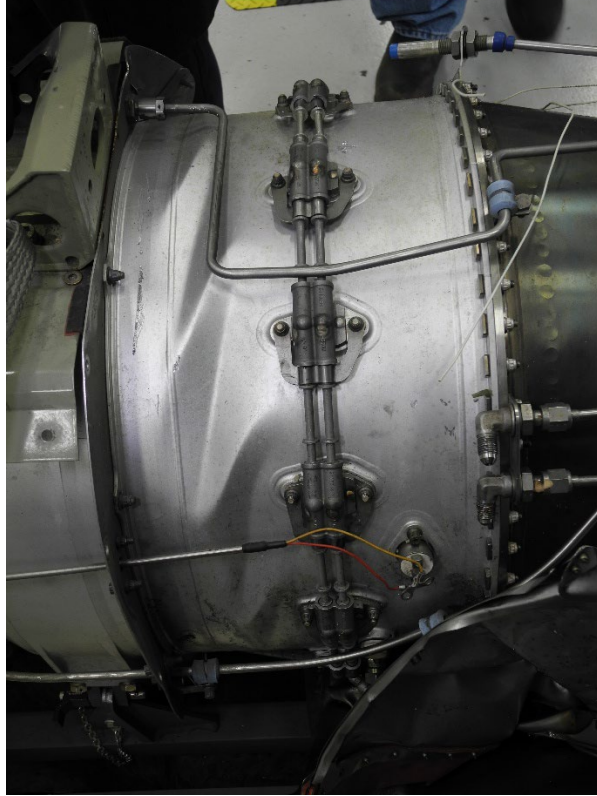


Photo 31 - GG case - Buckled



Photo 32 - GG Case Diffusers - Intact

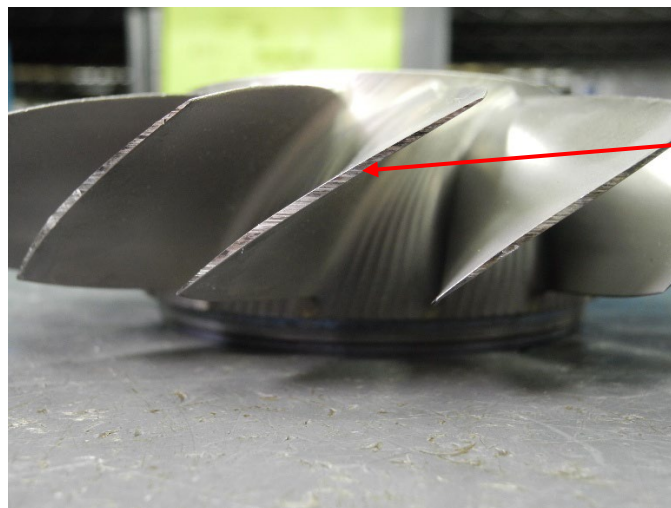
2.2.4 Compressor and Bleed Valve

The compressor assembly was intact (**Photo 33**). The No. 1 and No. 2 bearings rotated and were oil wetted.



Photo 33 - Compressor Assembly - Intact

The 1st stage compressor rotor was intact; however, the blade tips were rotationally scored and thermally distressed (**Photo 34**), consistent with contact against the shroud (**Photo 35**).



1st Stage
Compressor
Rotor Tips
Rotationally
Scored

Photo 34 - 1st Stage Compressor Rotor - Intact



Photo 35 - 1st Stage Compressor Shroud - Scored at 3 - 6 O'clock Position

The 2nd stage stator vanes (**Photo 36**) were rubbed, consistent with contact against the 2nd stage spacer hub (**Photo 37**).



Photo 36 - 2nd Stage Stator Vanes - Rubbing on Inner Tips

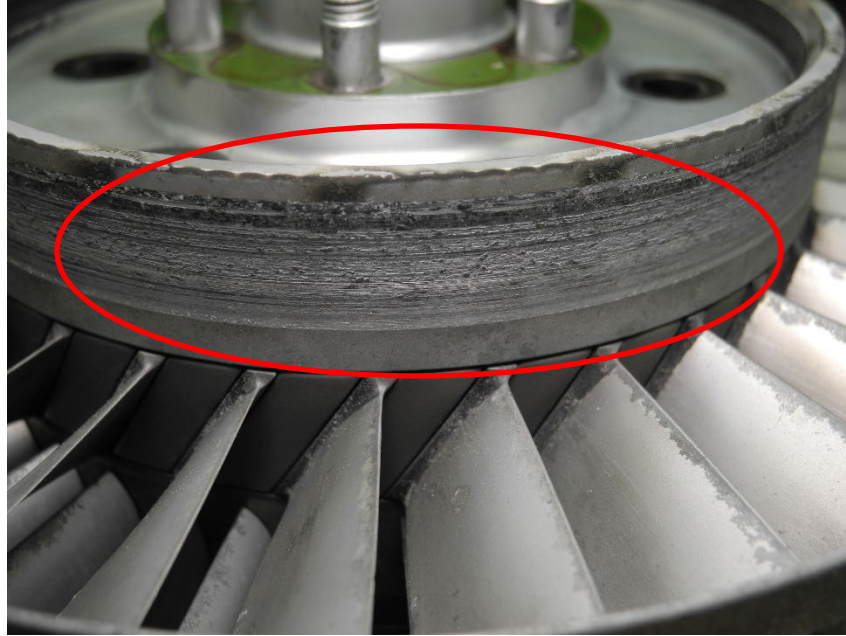


Photo 37 - 2nd Stage Spacer Hub - Rotational Scoring

The 2nd and 3rd stages axial compressors, stators and hub spacers had similar rubbing in the approximately 3 to 9 O'clock locations.

The centrifugal compressor impeller (**Photo 38**) was intact; however, the vane shroud lines were rotationally scored associated with deformed and rolled material (**Photo 39**), consistent with contact against the impeller shroud (**Photo 40**). The impeller shroud was rotationally scored, predominantly near the inducer (**Photo 41**).

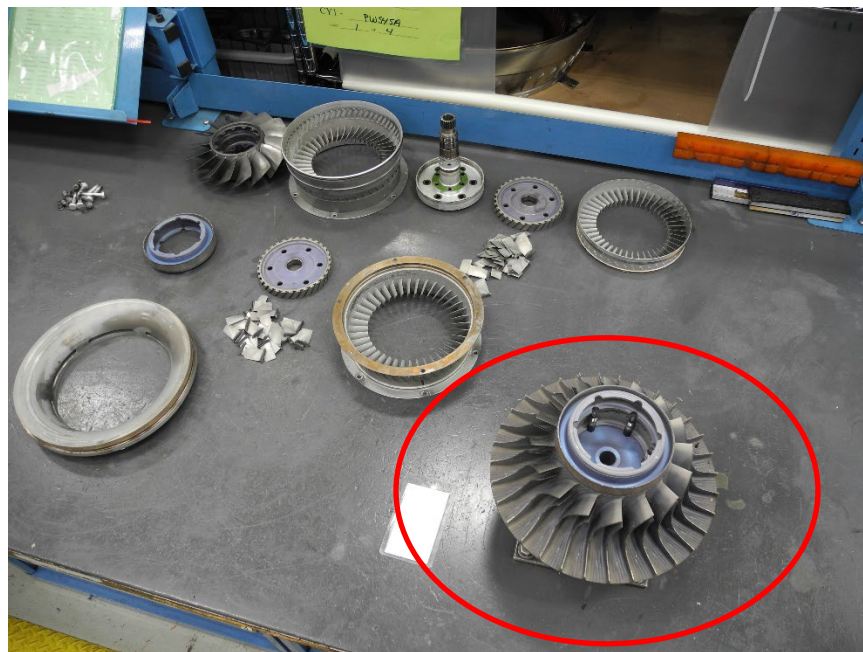


Photo 38 - Impeller - Intact



Photo 39 - Impeller Shroud Line - Rotational Scoring and Deformed, Rolled Material

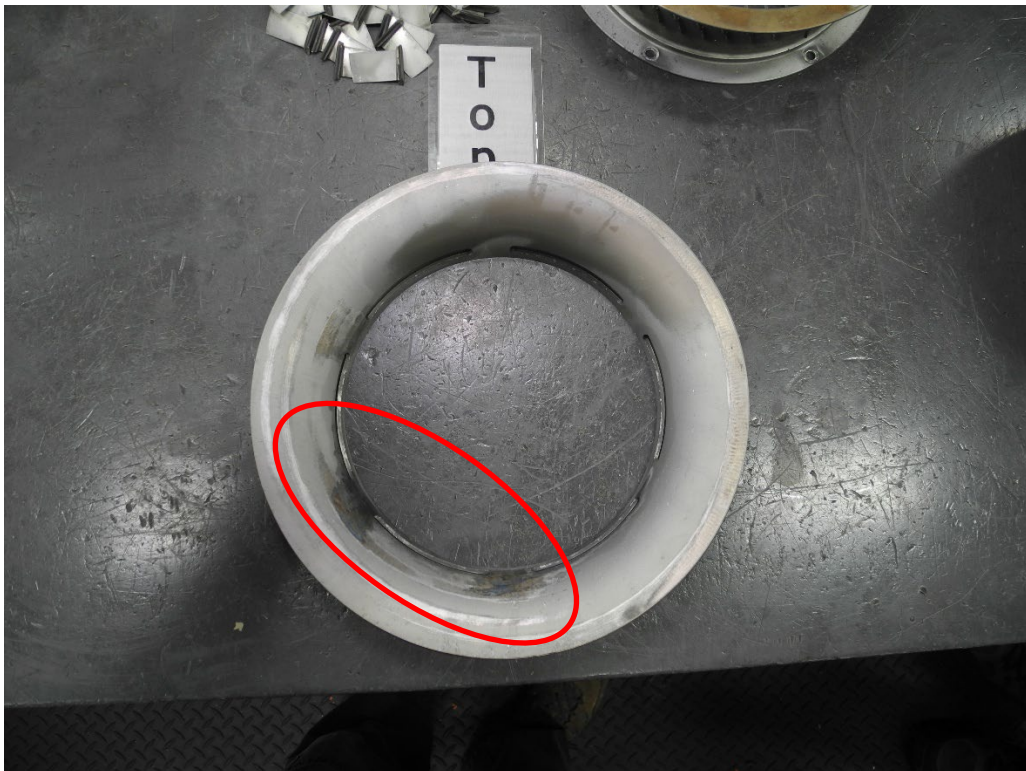


Photo 40 - Impeller Shroud - Rotational Scoring at 4 to 6 O'clock Location



Photo 41 - Detail of Rotational Scoring on Impeller Shroud near Inducer

The bleed valve was removed and manually cycled and was found to operate smoothly (**Photo 42**).



Photo 42 - Bleed Valve - Operational Confirmation

2.2.5 Accessory Gearbox (AGB)

The AGB (**Photo 42**) was intact and undamaged.

Oil
Scavenge
Pump
Spline

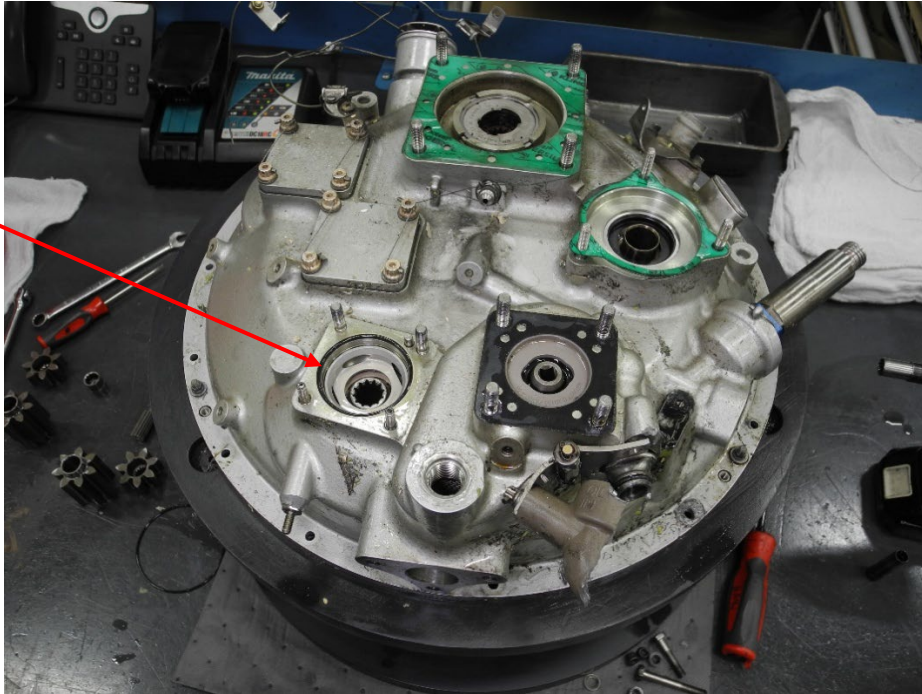


Photo 43 - AGB - Intact

The external oil scavenge pumps were removed and examined, revealing intact housings and pump elements (**Photo 44**).



Photo 44 - External Oil Scavenge Pumps

The RGB housing scavenge pump inner surface was scored from contact with the pumping gears (**Photo 45**).



Photo 45 - RGB Housing Scavenge Pump

All the accessory drive splines rotated smoothly in unison with the rotation of the AGB coupling shaft except for the oil scavenge spline. The AGB was disassembled (**Photo 46**), revealing intact, undamaged and oil wetted gears and bearings.

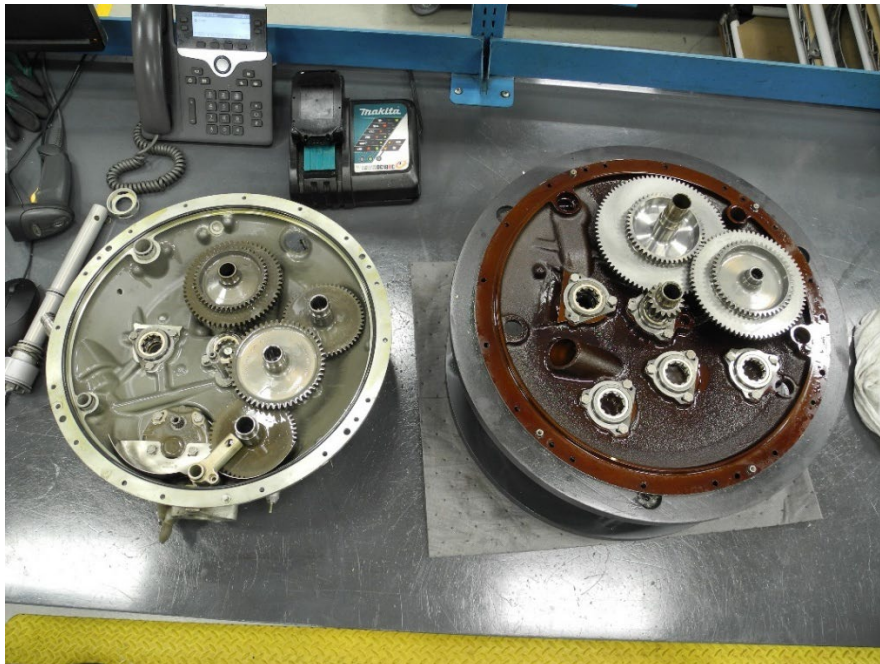


Photo 46 - AGB - Disassembled

An examination of the internal oil scavenge pumps revealed a sheared coupling shaft (**Photo 47**). The fracture surface was smeared, consistent with continued rotation after the fracture occurred.



Photo 47 - Oil Pump Coupling Shaft - Sheared

The internal oil scavenge pumps (**Photo 48**) were examined, revealing intact, undamaged and oil wetted housings, gears and journal bearings.

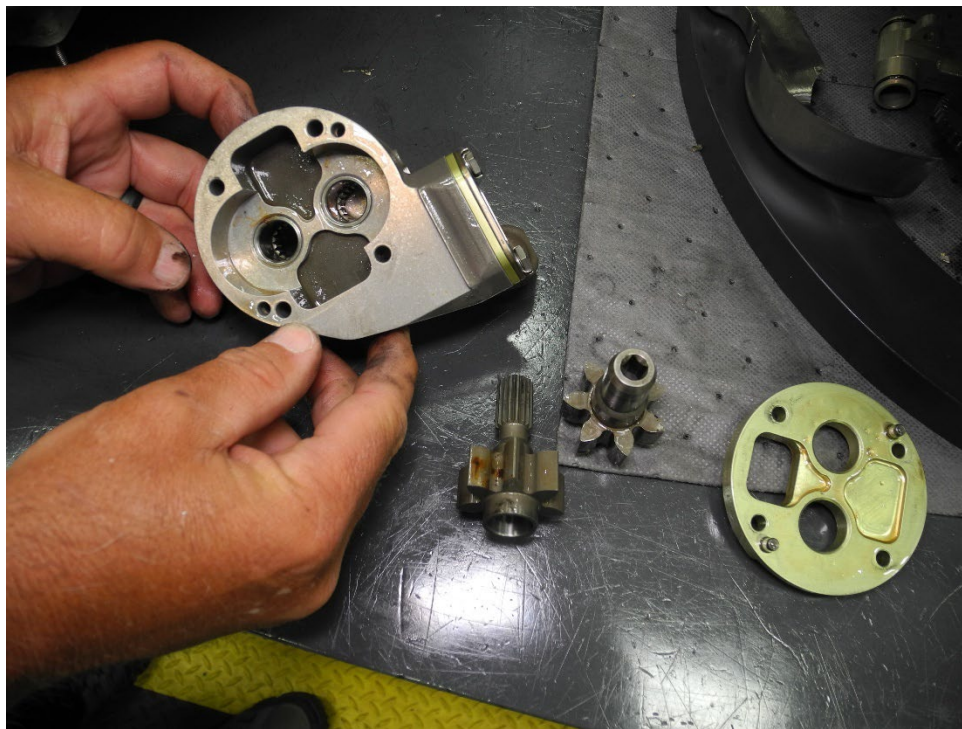


Photo 48 - Internal Oil Scavenge Pump

3.0 Engine Controls Accessories

3.1 Receiving

The FCU and the CSU were received at the Woodward facilities in Loves Park, Illinois on June 10 – 11, 2025 in one cardboard box. They were protected, separately wrapped, and undamaged by shipping (**Photo 49**).



Photo 49 – FCU and CSU in Shipping Container

3.2 Propeller Governor (CSU)

3.2.1 Propeller Governor (CSU) Description

The Woodward CSU (**Figure 2**) is a single acting propeller governor used to control hydraulic constant speed propellers. The pitch of the propeller blades is varied by the CSU to maintain a preset RPM speed. The CSU uses oil pressure to decrease propeller blade pitch by providing oil pressure to the dome of the propeller. The governor is only capable of decreasing propeller blade angle. To increase the propeller blade angle, the propeller incorporates internal springs and counterweights. Additionally, aerodynamic pressure on the propeller blades also increases the blade angle.

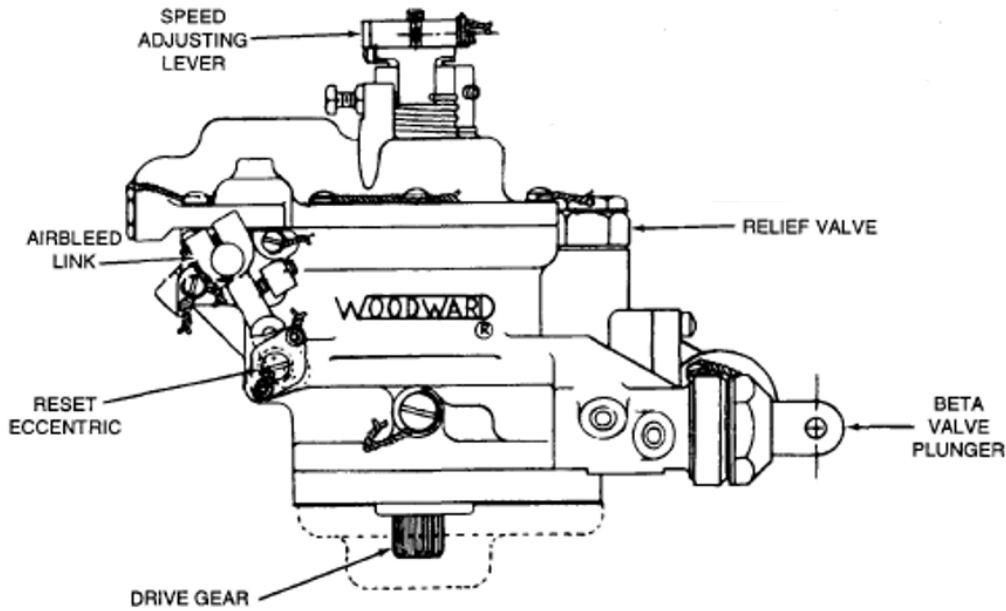


Figure 2 - Woodward CSU - Courtesy Woodward

3.2.2 CSU History

The CSU was Woodward part number (P/N) 8210-002-01 and serial number (S/N) 22275591 and was built in August 2020.

Woodward recommends the time between overhaul for the CSU is 4500 hours.

3.2.3 CSU General Condition

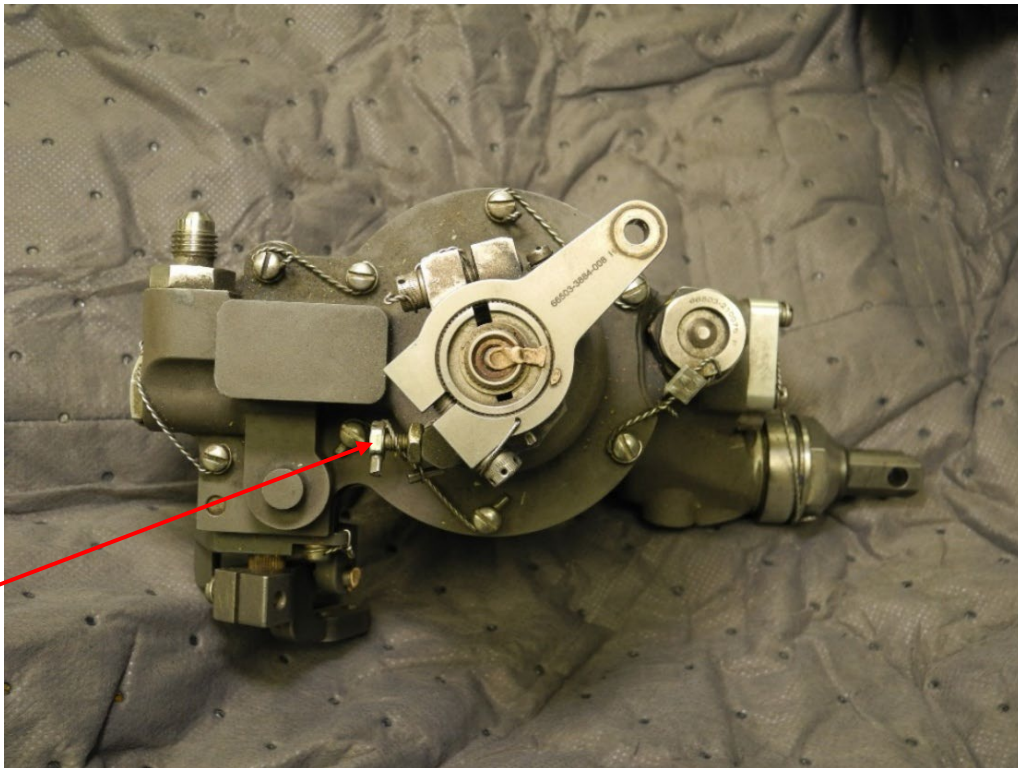
The CSU was inducted by the Woodward receiving department. It was intact and undamaged (**Photo 50** and **Photo 51**). The lock wire on the beta valve and on the air bleed link lever was the original installed by Woodward (**Photo 52** and **Photo 53**).

It was noted that the torque stripe of the speed setting lever (**Photo 54**) was fractured, and the lever had been moved from its original position. According to Woodward, there are no instructions for moving or adjusting the speed setting lever. A check of the Textron Aviation manuals found adjustment guidance for adjusting the lever in the field in the Cessna maintenance manual 76-12-05.

The speed setting lever, the maximum speed setting stop screw, and the eccentric screw had non-Woodward lockwire. The torque stripe was missing on the eccentric screw.



Photo 50 - Woodward CSU P/N 8210-002-01, S/N 22275591 - Side View



Maximum
Speed
Setting
Stop Screw

Photo 51 - Woodward CSU P/N 8210-002-01, S/N 22275591 - Top View

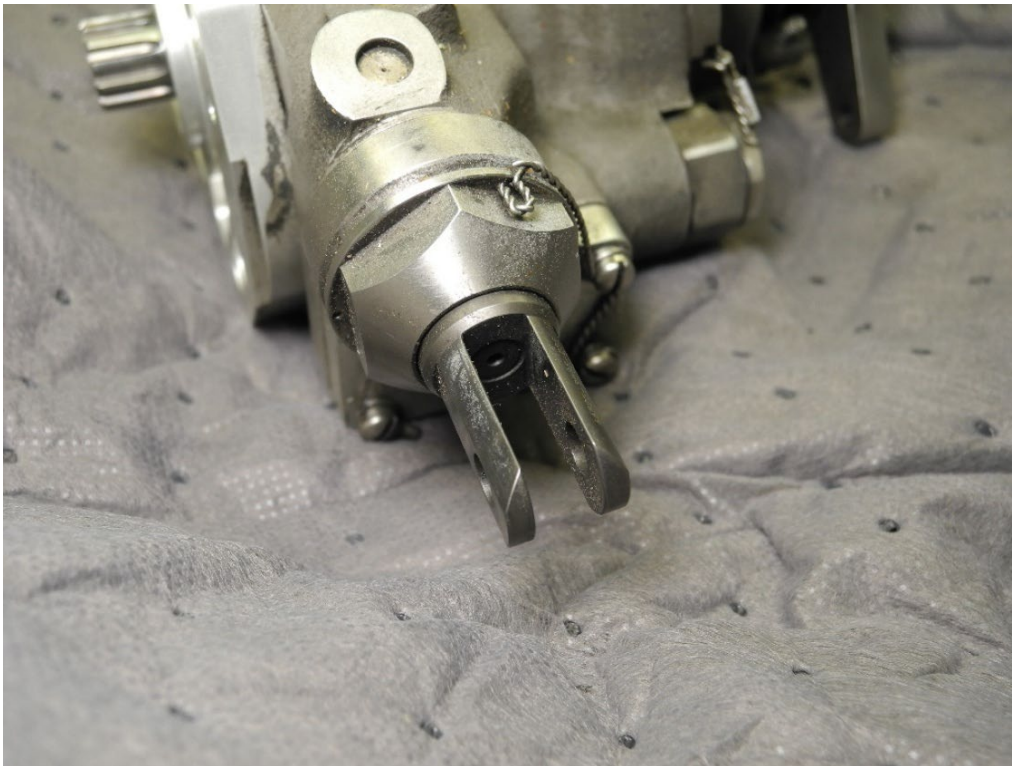


Photo 52 - Woodward CSU - Detail of Beta Valve - Undamaged

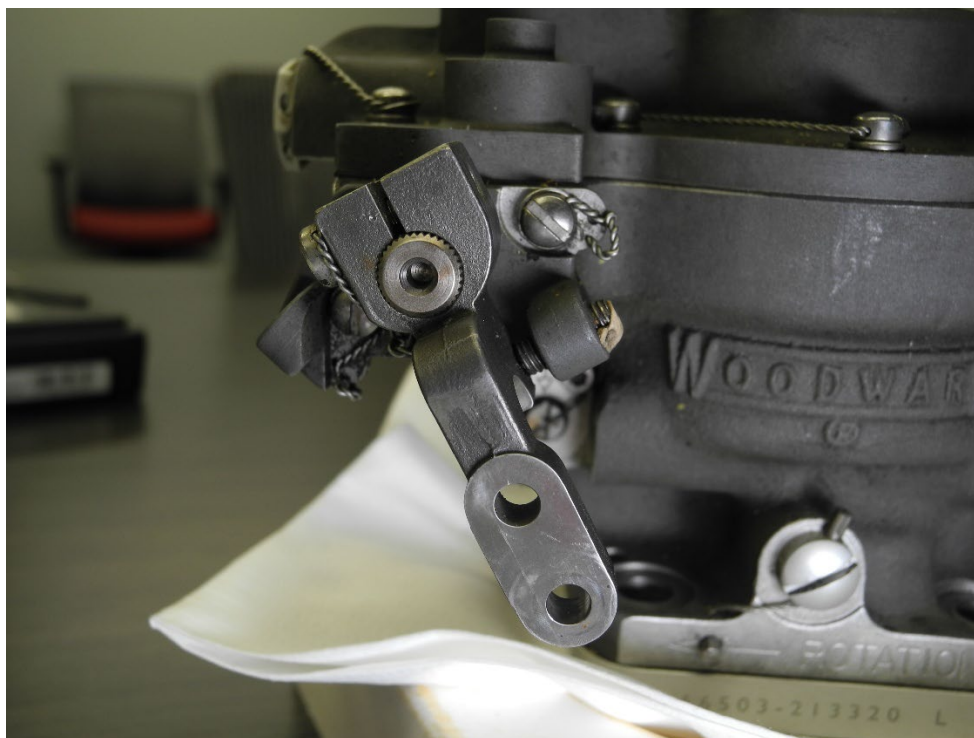
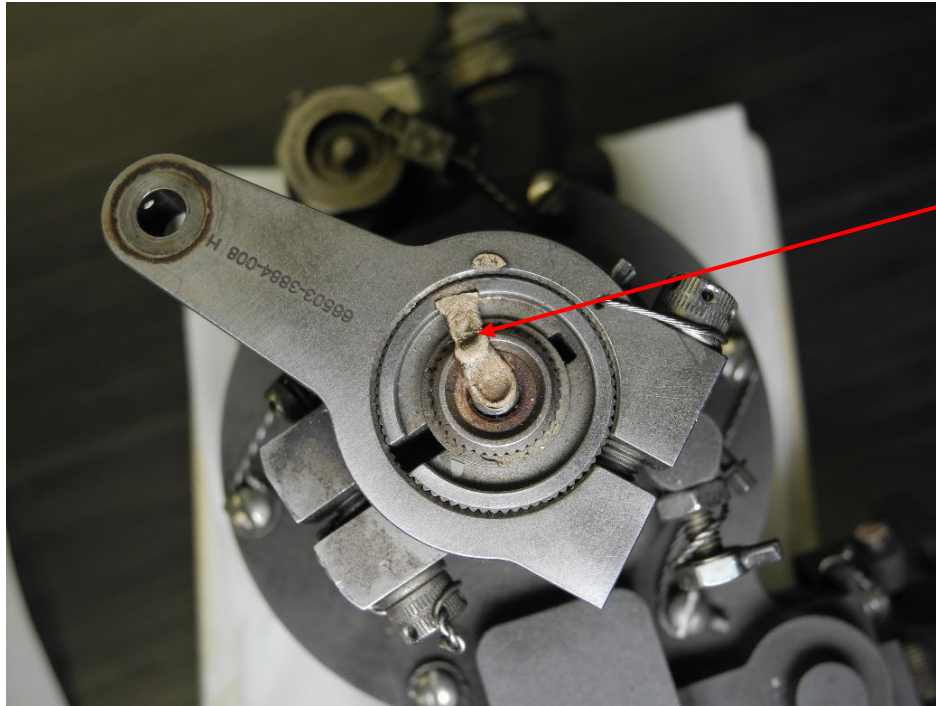


Photo 53 - Air Bleed Link Lever



Note
Fractured
Torque Stripe

Photo 54 - Detail of the Speed Setting Lever - Note Torque Stripe was Fractured

3.2.4 CSU Testing

The CSU was installed in the Woodward production test stand (**Photo 55**) and tested to the Woodward factory acceptance test procedure (ATP).



Photo 55 - CSU in Woodward Test Stand

The as-received test noted that the:

- The maximum speed RPM was 4210 RPM slightly below the factory specifications.
- The overspeed setting of the pneumatic control valve was higher than factory specifications.
- The underspeed setting was higher than factory specifications

The maximum speed stop screw and the eccentric screw were re-adjusted. The CSU tested again and found it to be within specifications, except for a minor pressure variation of the pneumatic control valve at the overspeed setting at 4590 RPM.

None of the discrepancies would have precluded normal governor operation. The CSU was not disassembled.

3.3 Fuel Control Unit (FCU)

3.3.1 FCU Description

The FCU controls the speed (RPM) of the gas generator of the PT6 engine as set by the throttle (**Figure 3**). The gas generator speed (N1) is compared with throttle setting and regulates fuel to the engine fuel nozzles. The FCU also senses compressor discharge pressure (CDP) which establishes acceleration and deceleration fuel flow limits.

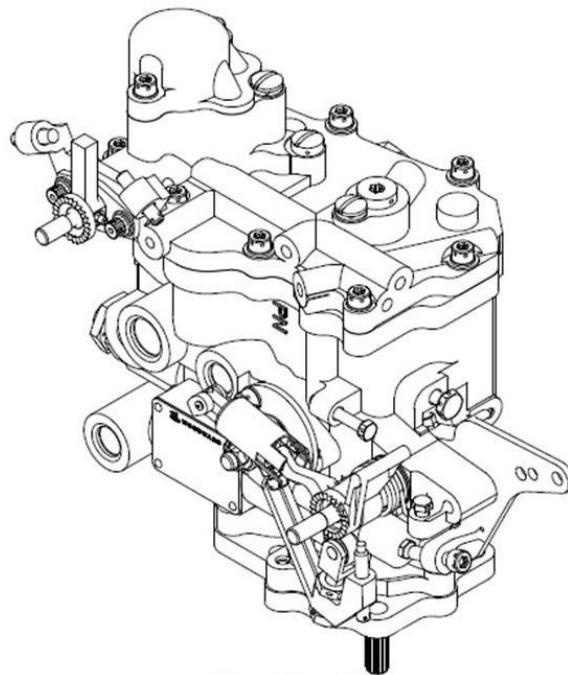


Figure 3 - Woodward FCU - Courtesy Woodward

3.3.2 FCU History

The FCU was P/N 8063-636, S/N 22255949 and had been manufactured in July 2020.

A preliminary review of the maintenance records indicated that the FCU had accumulated a total time of 4,333.7 hours. The operational and repair/overhaul history was not included with the CSU; however, it has been requested.

3.3.3 FCU General Condition

The FCU (**Photo 56** and **Photo 57**) was intact; however, there were various dents and scratches on the housing, consistent with impact damage. Most of the lockwire was not the Woodward original. The lock wire and safety cables in various locations were broken, consistent with impact damage.

The power lever (PL) shaft was bent (**Photo 58**). The PL maximum forward stop screw was bent and the PL was over-travelled (**Photo 59**) beyond the max stop screw. The PL could not be rotated; however, once the yield mechanism linkage was removed, the throttle lever could be rotated normally.

The MOR input shaft was bent (**Photo 60**), and O/R minimum stop housing boss was fractured. The input lever and vernier rings were displaced.

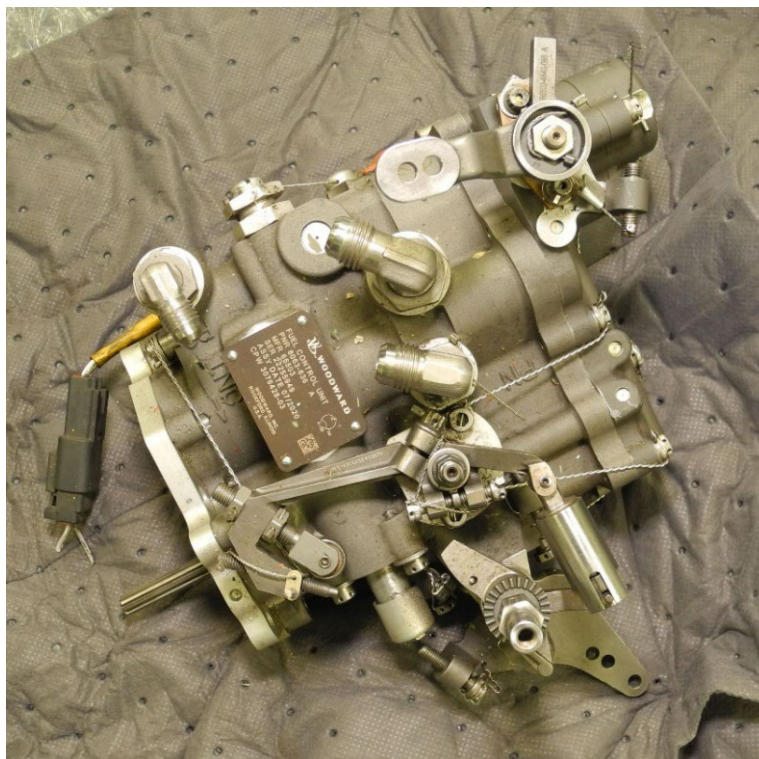
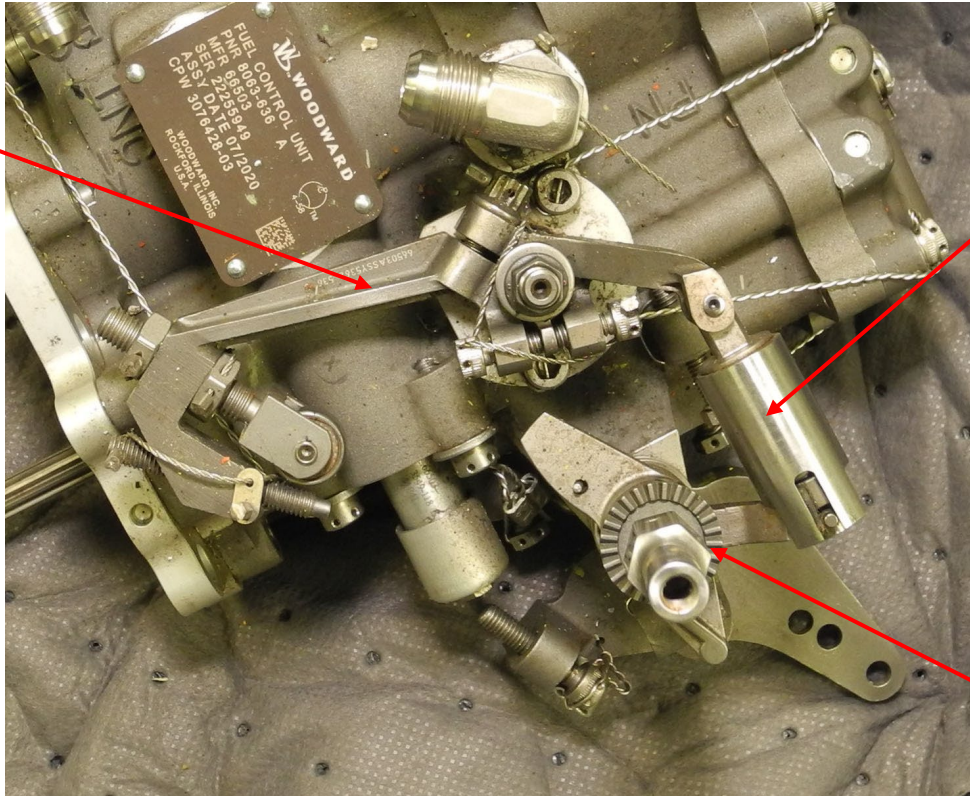


Photo 56 - FCU P/N 8063-636, S/N 22255949

Throttle
Lever



Yield
Mechanism
Linkage

PL Lever

Photo 57 - Detail of Power Levers Arrangement

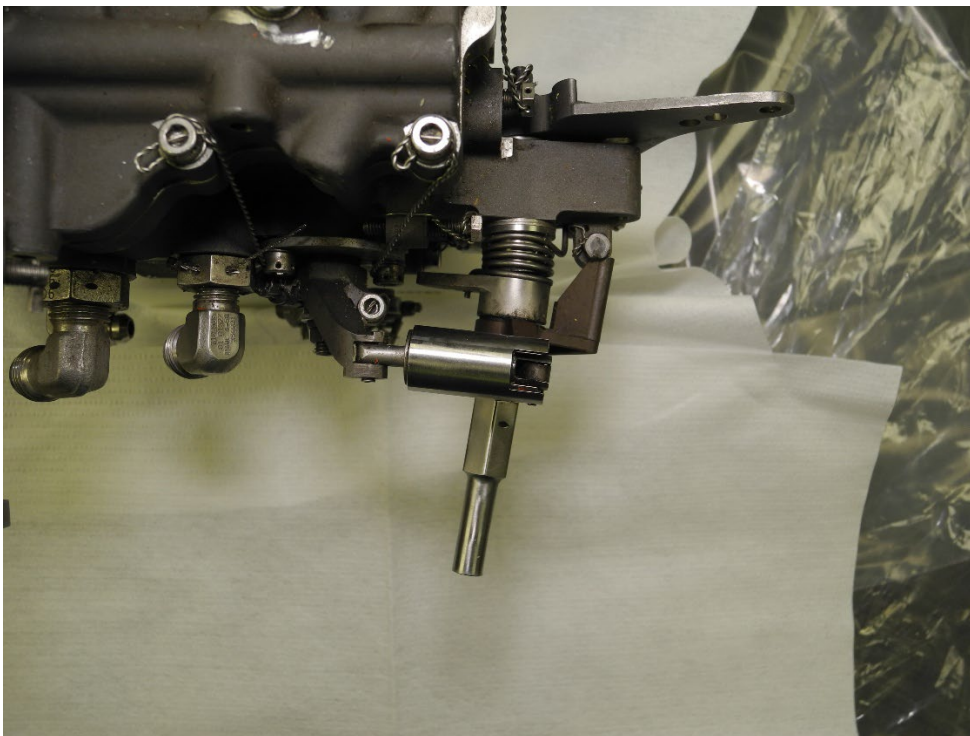


Photo 58 - Power Lever Input Shaft - Bent

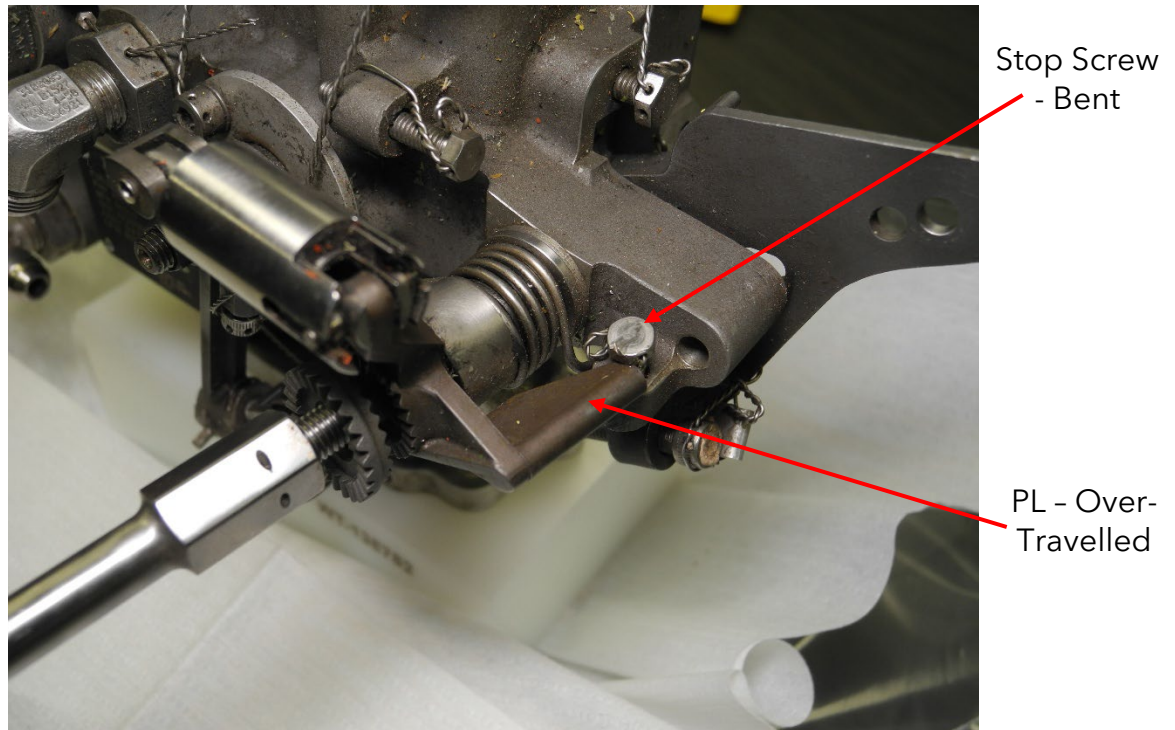


Photo 59 - PL was Over-travelled Beyond the Stop Screw

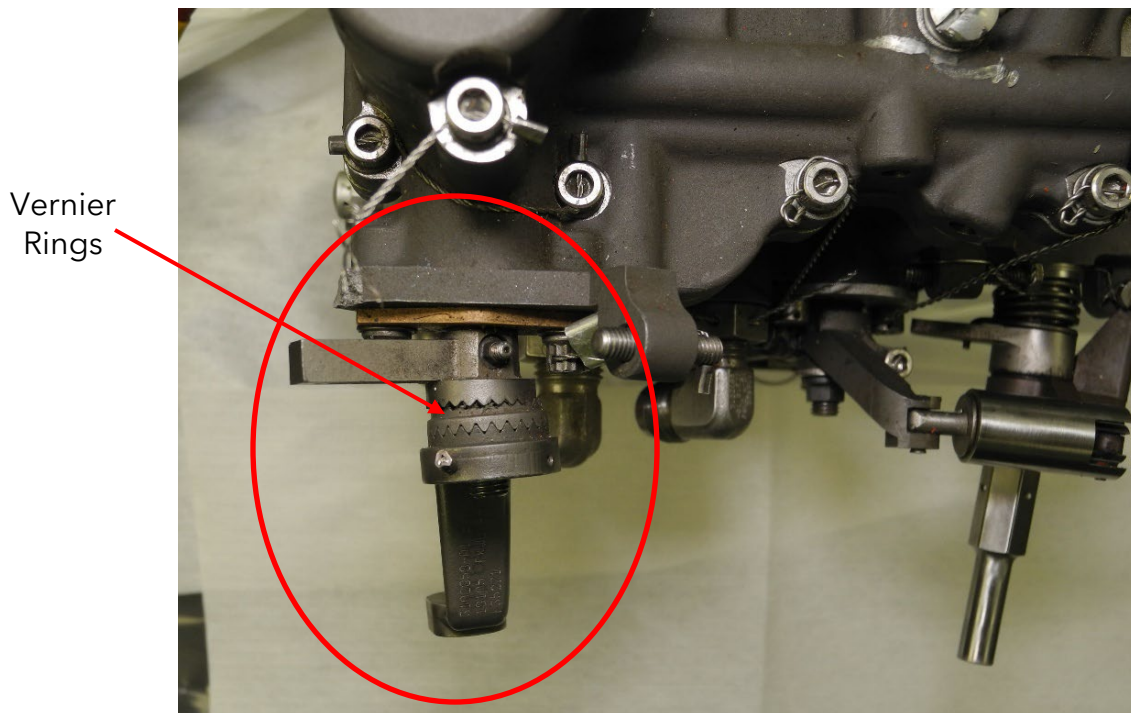


Photo 60 - MOR Lever - Bent and Vernier Rings Displaced

3.3.4 FCU Testing

The FCU was installed in the Woodward production test stand (**Photo 61**) and tested to the Woodward factory ATP.

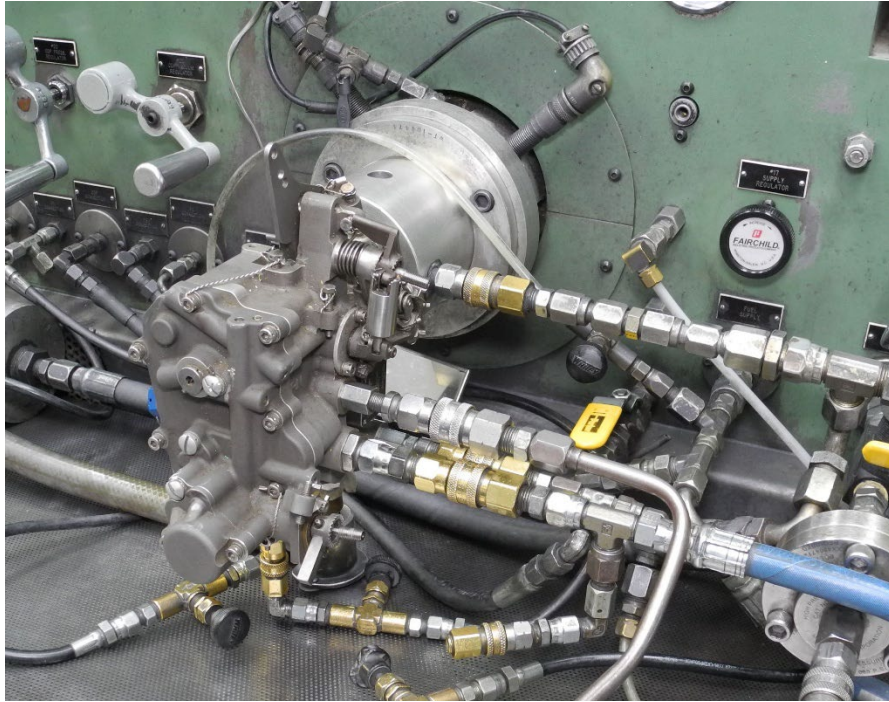


Photo 61 - FCU in Woodward Test Stand

The test began with the FCU PL in the as-received condition. PL was locked in the maximum forward position and all test points that required the PL to be in the maximum forward position were successfully tested.

The FCU could not be fully tested without being able to rotate the PL. Because the PL could not be turned, the yield mechanism linkage was removed so that the throttle lever could be rotated (**Photo 62**). It is to be noted that the PL is only an external motion transfer mechanism and does not connect to any internal FCU components. Only the throttle shaft connects to the FCU internal mechanisms.

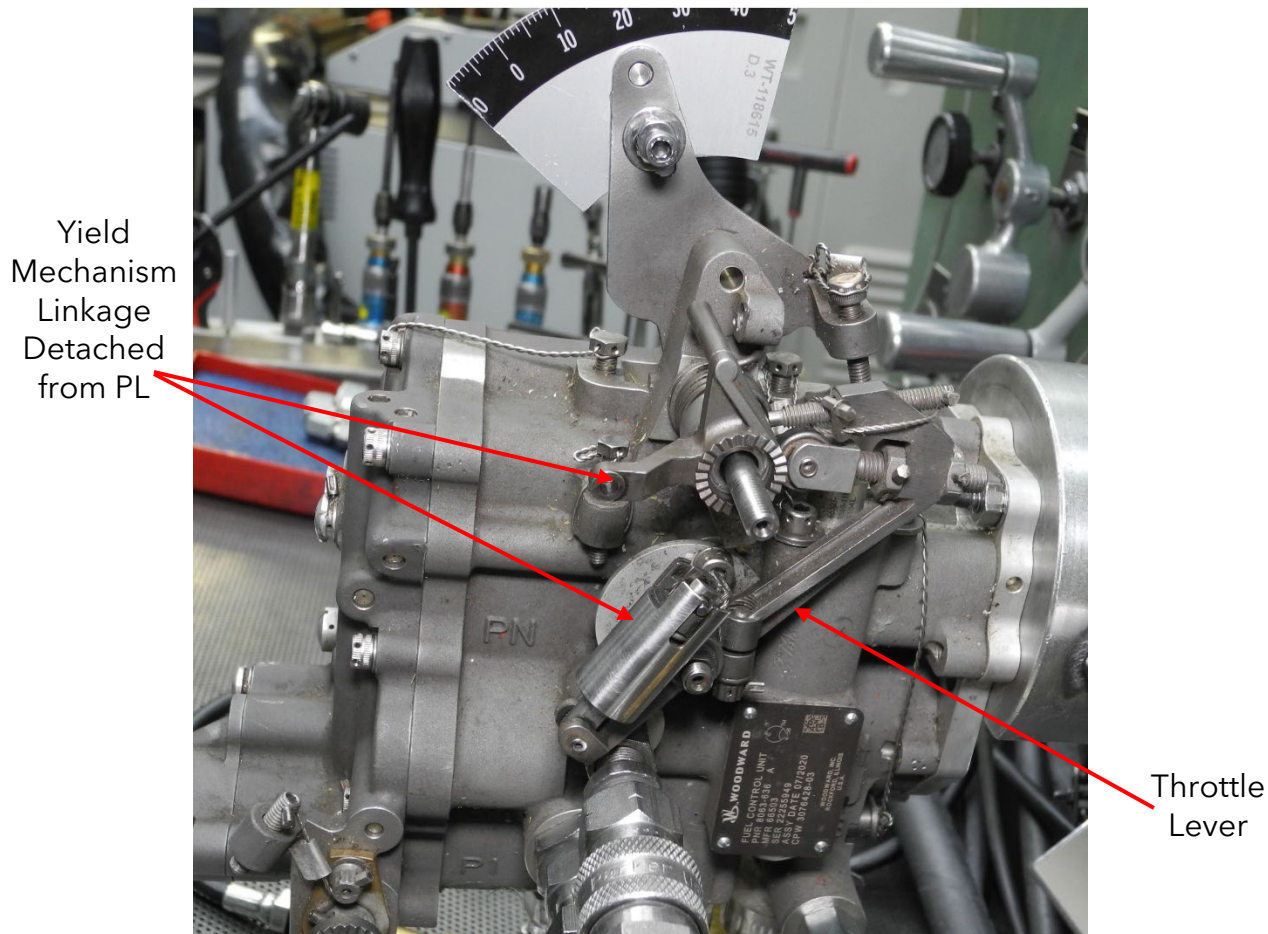


Photo 62 - PL and Throttle Lever Disconnected via Yield Mechanism Linkage

Because of the impact damage to the PL and the manual O/R lever, the full test procedure could not be performed.

The speed setting schedule high and low idle points were below the test specification limits up to 4%. The high and low idle points are field adjustable, and it was noted that the lock wire on the adjusting screws was not original.

The start and acceleration schedule was high by up to 3%. The CDP schedule had one low-flow test point out of limit high. Because of the high start and acceleration schedule the base plate was removed to inspect the CDP bellows and rod guide (**Photo 63**). A small wear mark was found on the carbide pad of the bellows and the rod guide. A measurement of the deformation revealed a wear depth of 0.0003 to 0.0005 inches, which is consistent with normal wear at the operational time of the FCU.

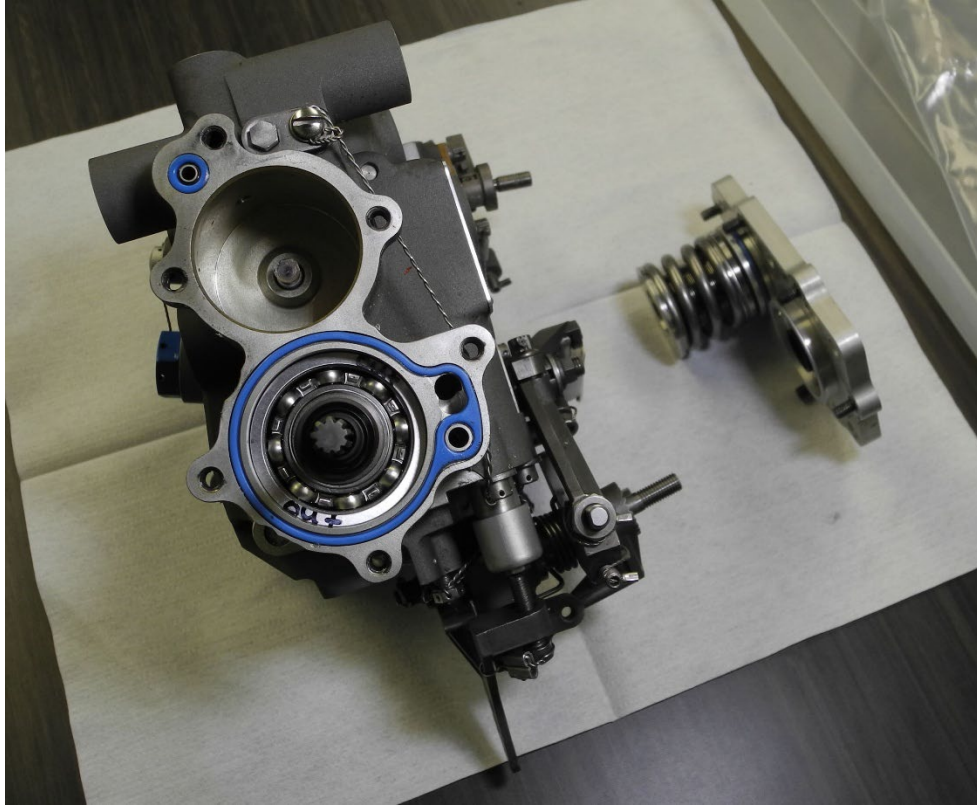


Photo 63 – FCU Base Plate – Removed for Inspection.

None of the minor discrepancies would have precluded normal FCU operation.

Submitted by:

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