

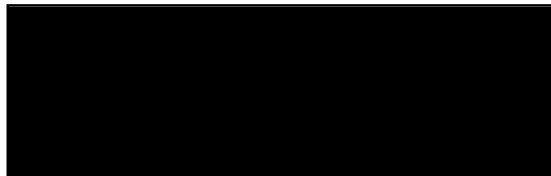
Service Investigation
Accident / Incident Report

P&WC 8114 (11-98)

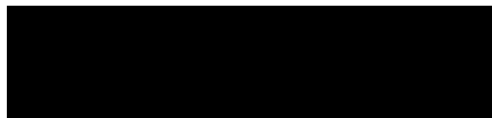


Report No.: 17-108

**C & C Flying Service
Air Tractor AT-802 Registration # N816FF
Reyno, Arkansas
18 July 2017
PT6A-65AG
S/N PN0314**



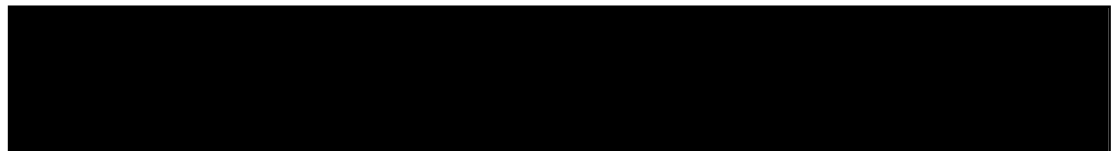
Written By: [Redacted]
Service Investigation Department



Approved By: [Redacted]
Manager, Service Investigation Department

Date of Issue: 11 April 2018

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I ANALYSIS

1.0 ACCIDENT SYNOPSIS

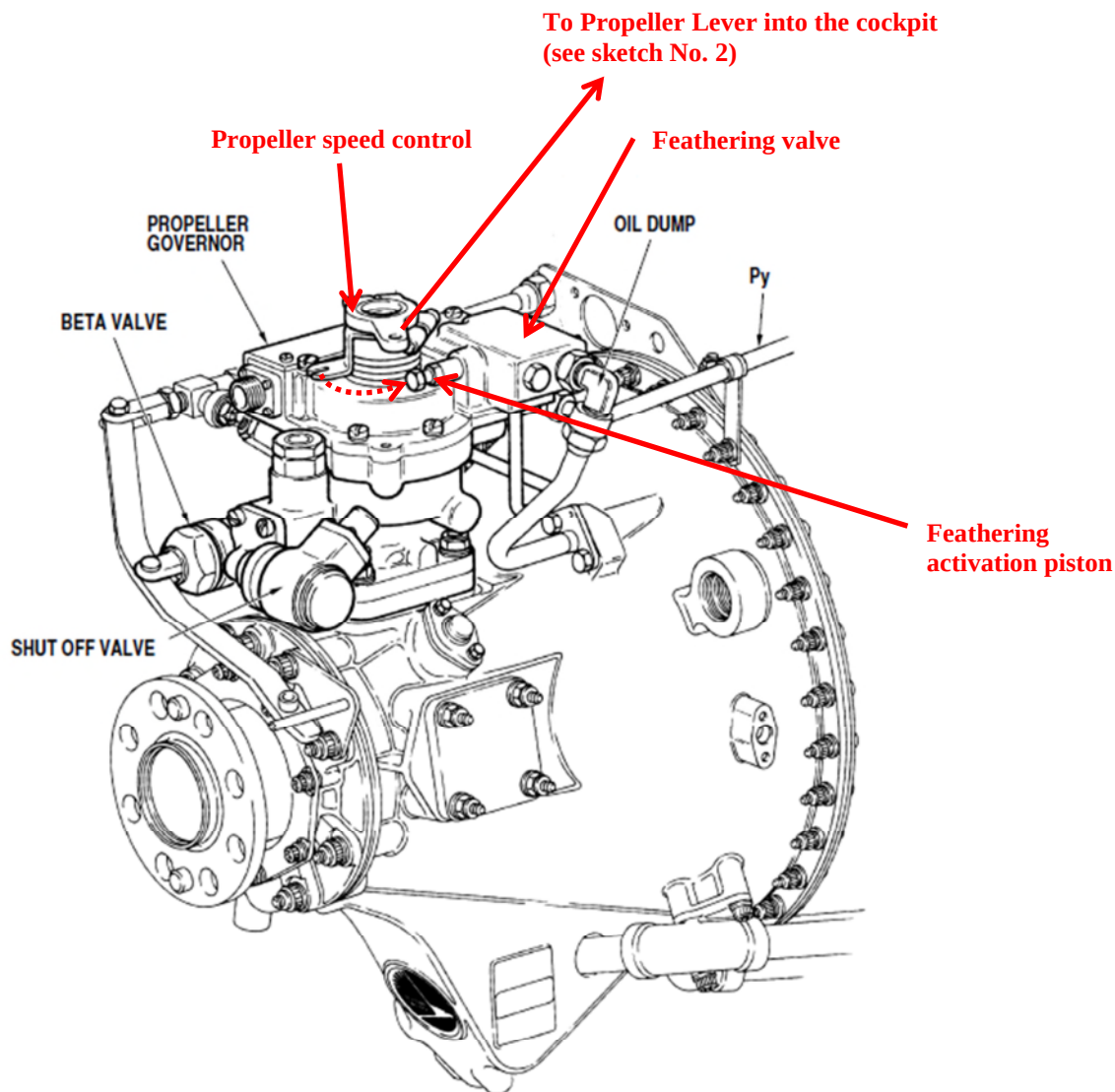
On July 18, 2017, an Air Tractor AT-802A, N816FF, sustained substantial damage during a forced landing near Reyno, Arkansas. The pilot was not injured. The pilot reported that he was unable to control engine torque or propeller speed as he maneuvered to land after completing an aerial-application flight. The pilot stated that the engine torque exceeded 6,000 ft·lbf with a propeller speed of about 700 rpm. As requested by the National Transportation Safety Board (NTSB), the engine was sent to P&WC for investigation.

2.0 SUMMARY OF FINDINGS AND DISCUSSION

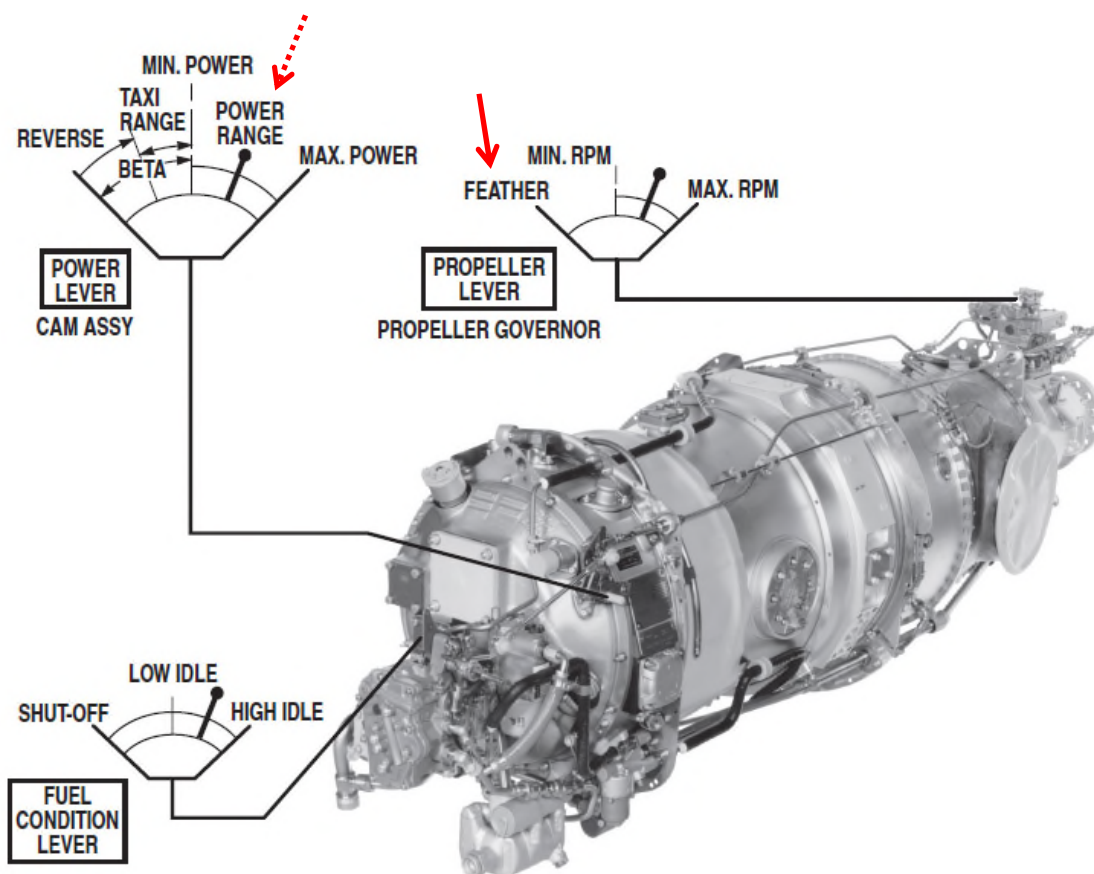
- 2.1 During tear down, all hardware showed normal operation condition.
- 2.2 The front reduction gearbox was disassembled to inspect internal oil passages which supply oil to the Propeller Governor (Also referred as the Constant Speed Unit (CSU)) and the Overspeed Governor (OSG). All passages were not obstructed.
- 2.3 The fit between the propeller shaft and the propeller sleeve meets the drawing requirement. All fits between the propeller shaft and the internal oil transfer tube/oil jet meet the drawing requirements and the packings were unremarkable. This confirms that a normal operation of the oil supply to the propeller and governor was present.
- 2.4 The fuel pump, the flow divider, the Fuel Control Unit (FCU) and the Compressor Bleed Valve were visual inspected and tested at P&WC. Propeller governor (CSU) and the Overspeed Governor (OSG) were sent to [REDACTED] for inspection and test. Observations from the supplier acceptance test specification were due to permissible field adjustments.
- 2.5 As per [REDACTED] flight data recorder analysis, the torque (Tq) rate of change (slope #3 on the graph No.1 from P&WC Accessories Accident report 18ECN00120) increased rapidly at 62% propeller speed and the propeller speed (Np, slope #3) rate of change decreased rapidly at the same moment (time stamp 25:09:14). As per [REDACTED] CSU test results, the propeller speed control lever activated the feather valve at 62% propeller speed position (dotted arrow, Sketch No.1). This observation indicates the feather valve was activated by a movement of the Propeller Lever from the cockpit (arrow, Sketch No. 2). Consequently, going towards feather position, the engine thrust was reduced.



- 2.6 The flight data recorder analysis (graph No.1 from P&WC Accessories Accident report 18ECN00120) showed a sudden fuel flow increase at time stamp 17:09:25. This observation indicates that the pilot moved the Power Lever (dotted arrow, Sketch No. 2) to increase thrust. Consequently, the Tq increased up to 6920 ft-lb.



Sketch No. 1
Propeller Governor



Sketch No. 2
Levers into the cockpit

3.0 CONCLUSIONS

- 3.1 No engine anomaly was found to preclude normal engine operation prior to the event.
- 3.2 As per Woodward Inc. CSU test data and flight data recorder analysis, it is believed the feather valve was activated by a movement of the Propeller Lever from the pilot. Consequently, the torque increased, the propeller speed and the thrust decreased.
- 3.3 Subsequently, the pilot moved the power lever to attempt to increase thrust. Because the propeller was into feather position, instead of getting a thrust increase, the torque exceeded the limit.



3.0 ENGINE EXAMINATION

3.1 External Condition

When the propeller shaft was rotated by hand, looking through the exhaust outlet, the 2nd stage Power Turbine (PT) rotated freely and smoothly without binding.

Continuity between the Accessory Gearbox (AGB) and the compressor was confirmed by rotating the airframe alternator pulley drive by hand and looking through the air intake, the 1st stage axial compressor was observed rotating smoothly and no binding was noted.

3.1.1 External Cases

Reduction Gearbox (RGB): No damage was observed (Photos No. 1 to 3).

Exhaust Duct: No dent, nicks and metal splatted were observed on the surface of the exhaust gas path. No damage was observed on the external (Photos No. 1 and 2).

Gas Generator Case (GGC): No damage was observed (Photos No. 1 and 2).

Accessory Gearbox (AGB): No damage was observed (Photos No. 1, 2 and 4).

Inlet Case / Oil Tank: No damage was observed and the inlet screen was intact (Photos No. 1, 2 and 5). Data plat showed the engine S/N (Photo No. 6).



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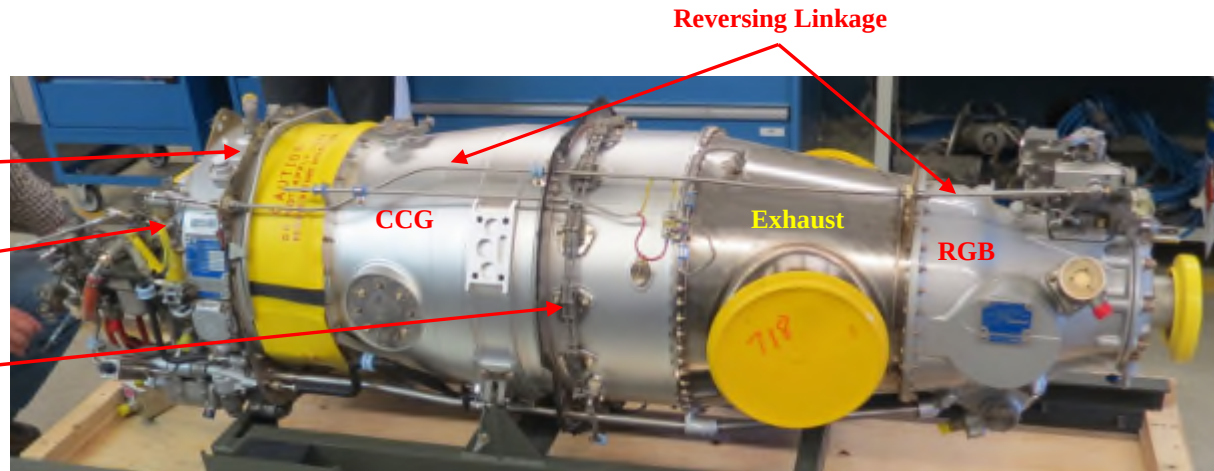


Photo No. 1
Right hand view

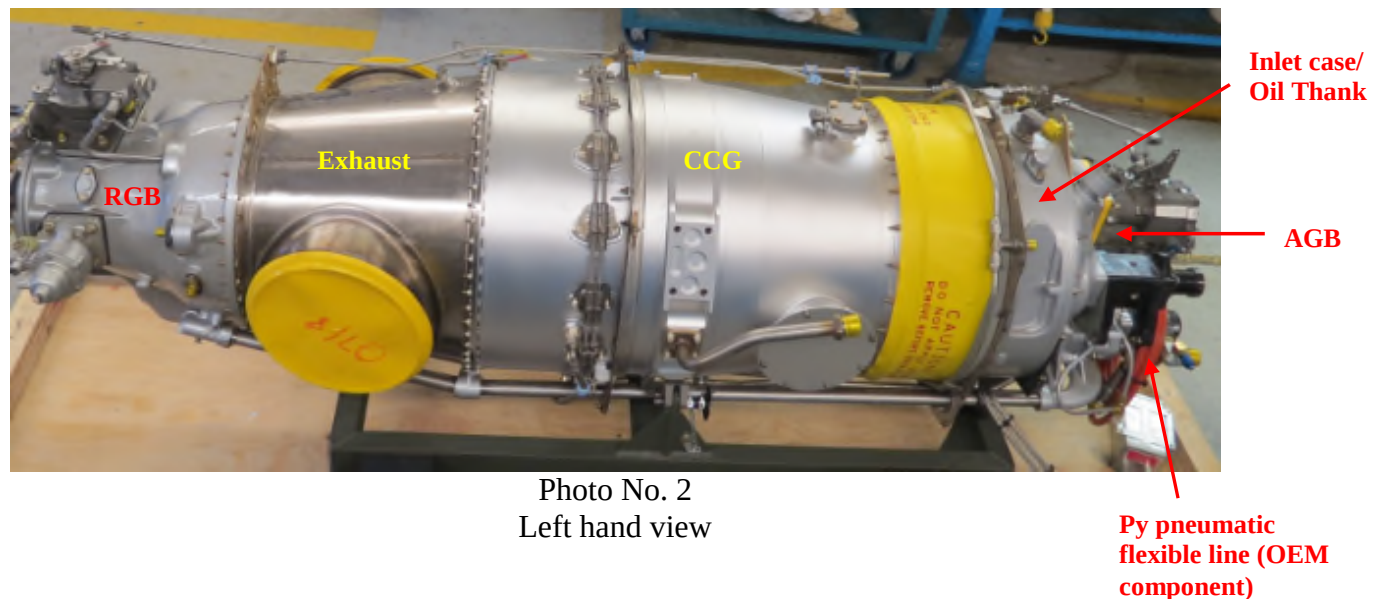


Photo No. 2
Left hand view

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Propeller Governor (CSU)

Propeller speed tachometer (OEM component)

Overspeed Governor (OEM component)

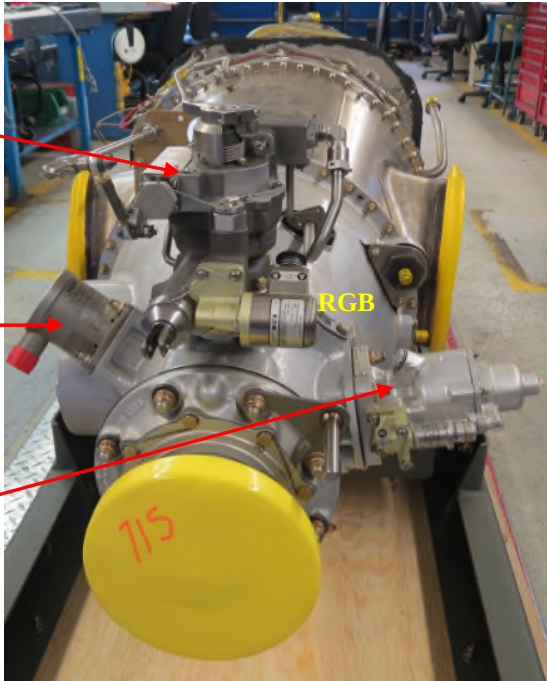


Photo No. 3
Front view

Alternator pulley drive (OEM component)

Fuel boost pump (OEM component)

Compressor speed tachometer (OEM component)

Py pneumatic flexible line (OEM component)

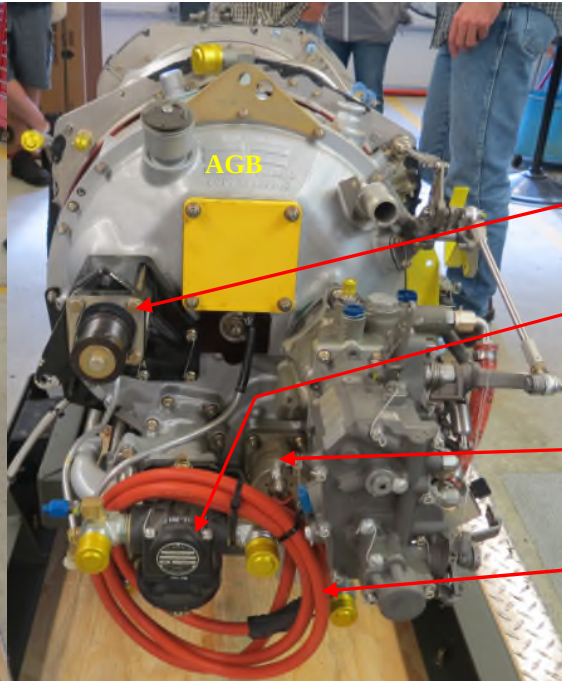


Photo No. 4
Alf view

Inlet case/ Oil Tank

Inlet screen

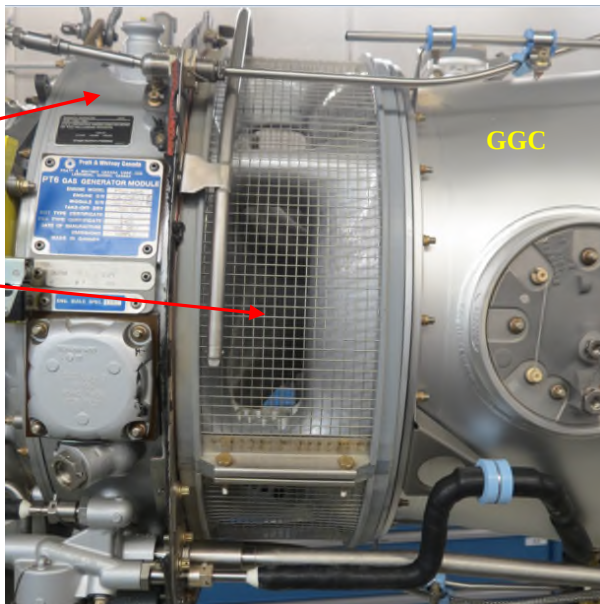


Photo No. 5
Inlet case and screen



Photo No. 6
Data plate

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Oil was drained from the RGB and it was collected. The oil was observed to be greenish in color and had no acrid smell (Photo No. 7). The oil appeared to have a watery consistency, less viscous than normal oil. Chemical analysis revealed the oil met all specifications. The greenish appearance was due to the residual oil from P&WC production test which bleu dye was added to facilitate the oil leak inspection.

Components from the OEM were removed from the engines (Photo No. 8).

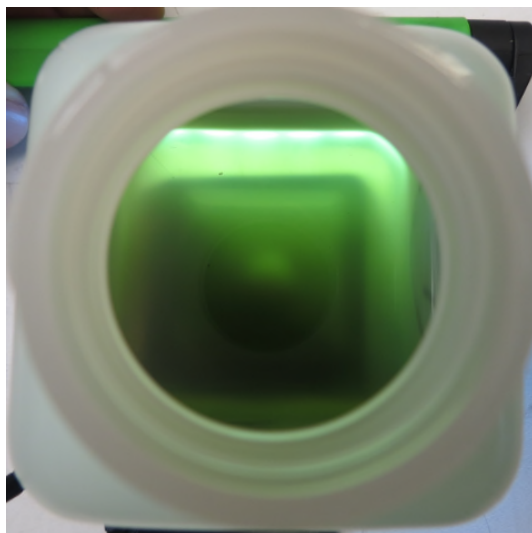


Photo No. 7
Engine oil



Photo No. 8
Removed OEM components

3.1.2 Power Control and Reversing Linkage

Reversing linkage was intact and continuous from the reversing cam up to the propeller governor (Photos No. 1 and 9).

The power control was intact and continuous from the Fuel Control Unit (FCU) up to the reversing cam (Photo No. 9).

When the fuel control power lever arm was moved from ground idle to flight and reverse, the control rods moved freely without binding or sticking and in the proper direction/response.

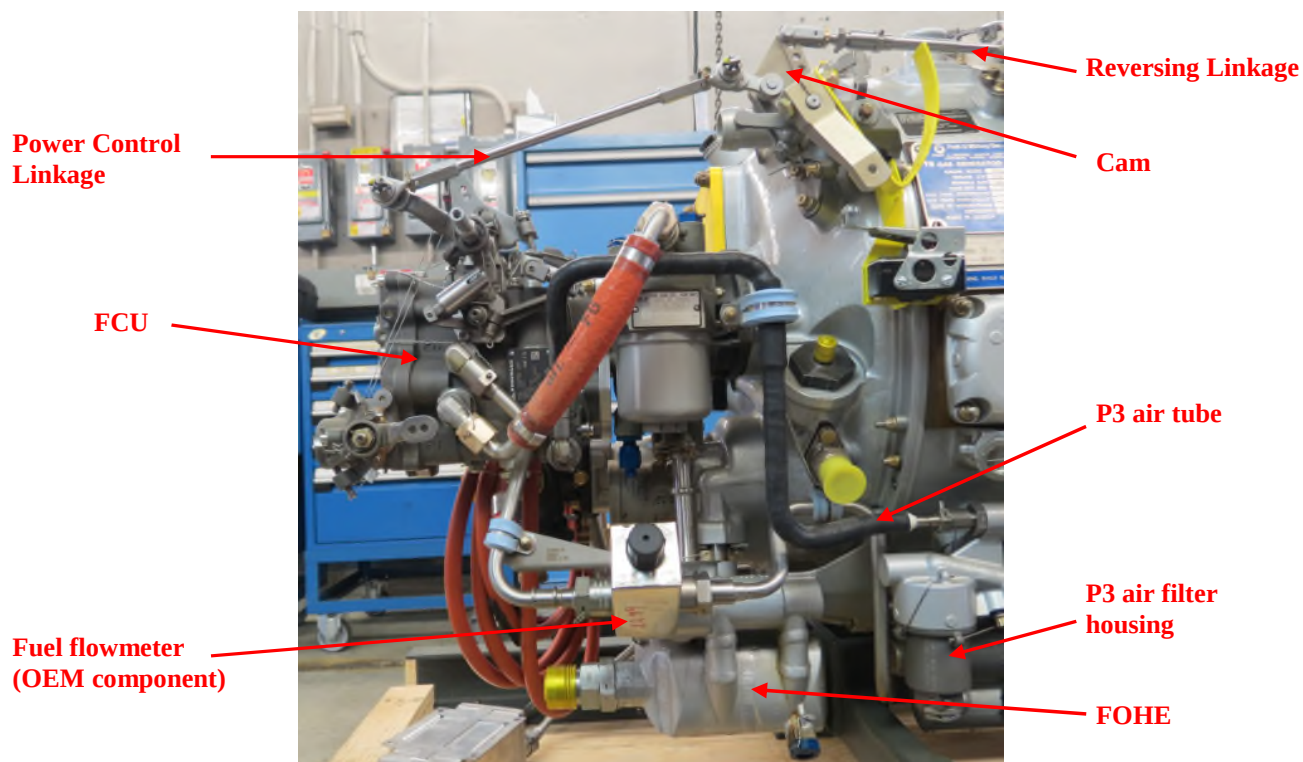


Photo No. 9
AGB Right view

3.1.3 Pneumatic Lines

Compressor Discharge Air (P3): The P3 air tube was intact and continuous from the FCU up to the P3 air filter housing (Photo No. 9). The P3 air tube was intact and continuous from the P3 air filter housing up to the GGC (Photo No. 10).

Power Turbine Control (Py): As received, the OEM Py flexible line was not connected to the propeller governor and no water was observed inside the OEM flexible tube (Photos No. 2 and 4).



Photo No. 10
GGC Right view

3.1.4 Chip Detectors and Filters

RGB Chip Detector: The Magnetic Chip Detector (MCD) was removed from the reduction gearbox; it was found clean (Photo No. 11).

AGB MCD: The MCD was removed from the accessory gearbox; it was found clean (Photo No. 12).

Oil Filter: Oil filter was removed and found clean (Photo No. 13).

P3 air Filter: P3 air filter was removed and found clean (Photo No. 14).

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Photo No. 11
RGB MCD



Photo No. 12
AGB MCD

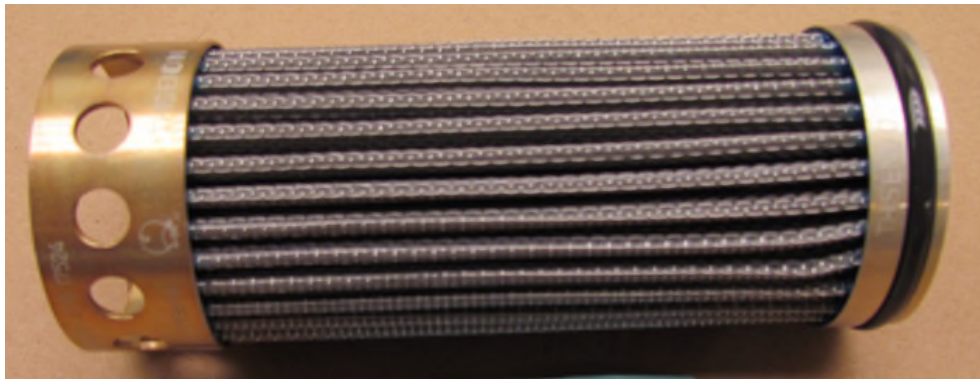


Photo No. 13
Oil filter



Photo No. 14
P3 air filter



3.2 Disassembly Observations

The engine was split at the “C” flange and the GGC was separated from the power section.

3.2.1 Compressor Section

A borescope inspection was performed on the compressor. No further disassembly or examination of the GGC section was performed.

Compressor 1st to 4th Stage Discs and Blades: Through the air inlet case, all the 1st stage axial compressor rotor blades were intact (Photo No. 15). The 2nd to 4th stages axial compressor rotors were not assessed.

Compressor 1st to 4th Stage Stators and Shrouds: Through the air inlet case, all the 1st stage stator vanes and shroud were intact (Photos No. 15 and 16). The vanes showed light grey dust deposit at the leading edge (Photo No. 16). The 2nd to 4th stages stator vanes and shrouds were not assessed.

Centrifugal Impeller: The impeller compressor exducer and diffuser apex were inspected with a boroscope through a diffuser pipe and no anomalies or damaged was noted (Photo No 17).

Centrifugal Impeller Shroud: Not assessed.

Front Stub Shaft: Not assessed.

No. 1 Bearing and Airseals: Not assessed.

No. 2 Bearing and Airseals: Not assessed.

3.2.2 Combustion Section

Grey dust was found at the bottom of the GGC drain valve near the combustion liners (Photo No. 18).

Combustion Chamber Liner: No damage was observed on the inner and outer liner (Photos No. 19 and 20).

Small Exit Duct: Not assessed.



**1st stage
stator
shroud**

**1st stage
rotor blade**

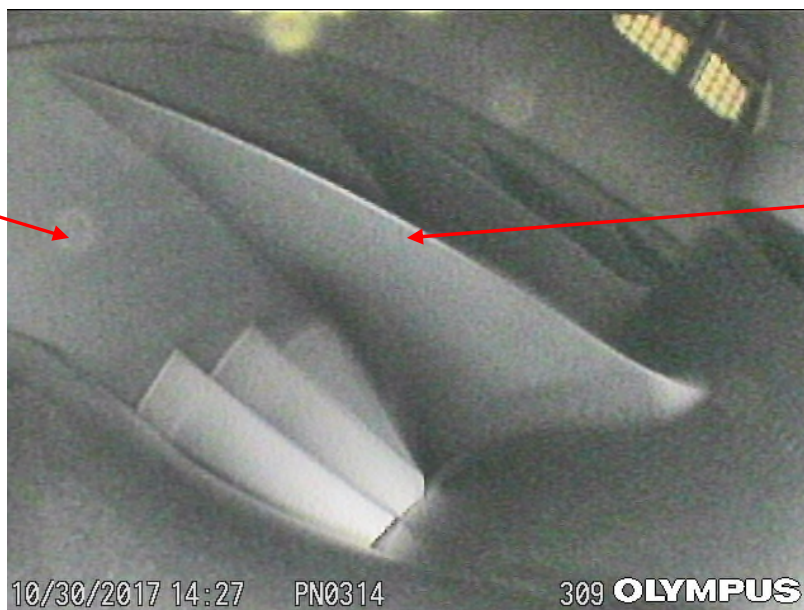


Photo No. 15
1st stage compressor rotor blades
Boroscope inspection

**1st stage
stator vane**

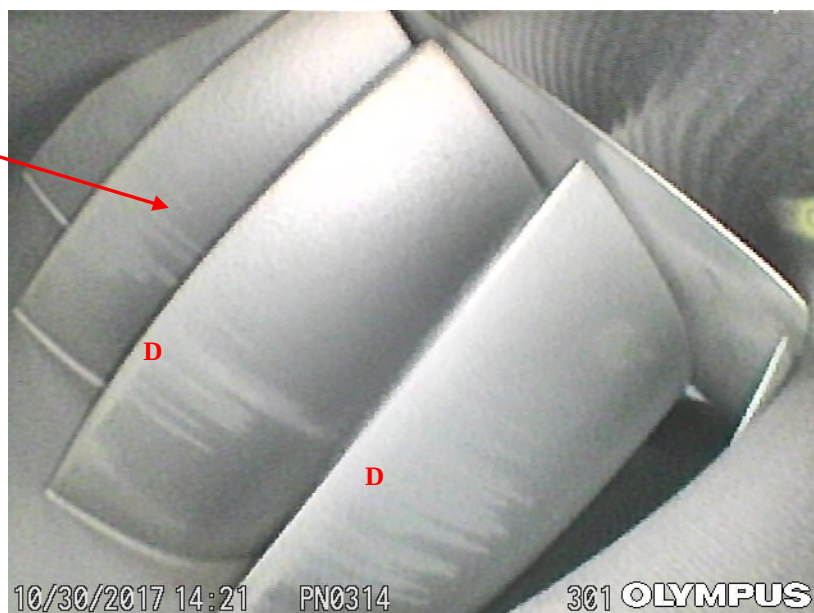


Photo No. 16
1st stage stator vanes
Boroscope inspection
Dust deposit (D)



**Impeller compressor
exducer**

Diffuser apex

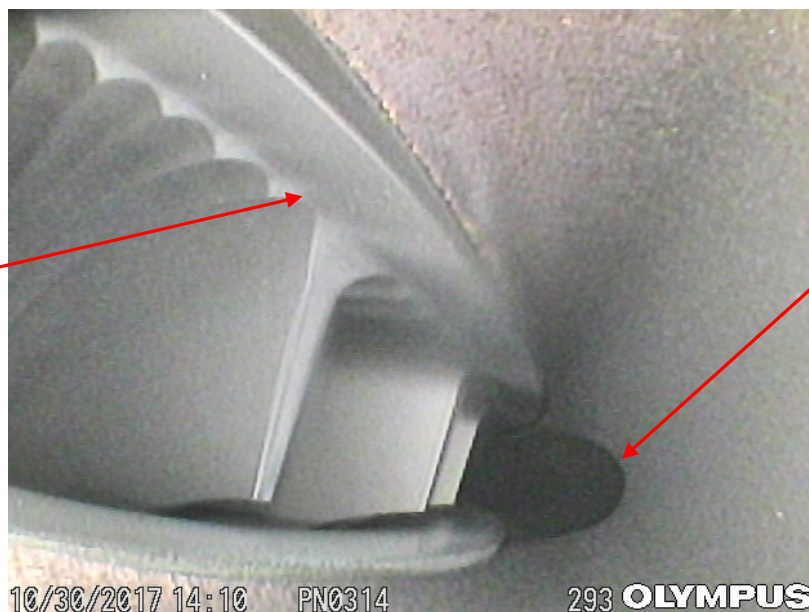


Photo No. 17
1st stage stator vanes
Boroscope inspection



Photo No. 18
GGC drain valve
Grey dust (arrow)

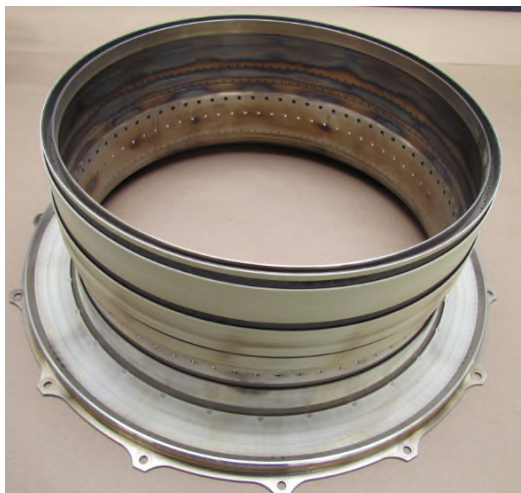


Photo No. 19
Inner liner

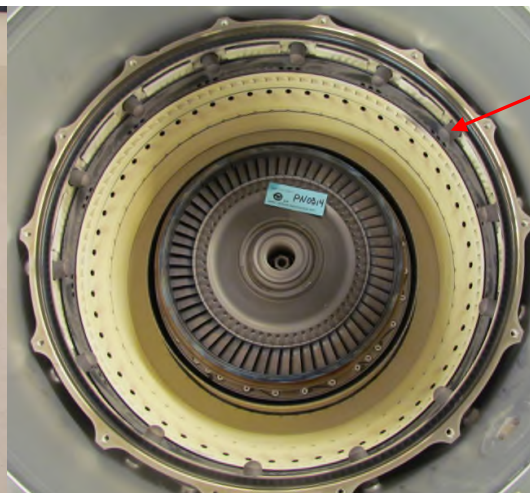


Photo No. 20
Outer liner

Fuel nozzle shield

3.2.3 Turbine Section

Compressor Turbine Guide Vane Ring: Not assessed.

Compressor Turbine Shroud: No damage was observed (Photos No. 21 and 22).

Compressor Turbine: CT disk assembly was intact (Photo No. 21).

ITT Probes, Busbar, and Harness: No damage was observed (Photos No.23 and 24).

Power Turbine Housing: No damage was observed (Photos No.23).

1st stage Power Turbine Guide Vane Ring and Interstage Baffle: No damage was observed (Photos No. 25 and 26).

1st stage Power Turbine Shroud: No damage was observed (Photo No.27).

1st stage Power Turbine: No damage was observed (Photos No. 28 to 30).

2nd stage Power Turbine Guide Vane Ring and Interstage Baffle: No damage was observed (Photos No. 31 and 32).

2nd stage Power Turbine Shroud: No damage was observed.

2nd stage Power Turbine: No damage was observed (Photos No. 33 to 35).

Power Turbine Shaft and Shaft Housing: Not assessed.

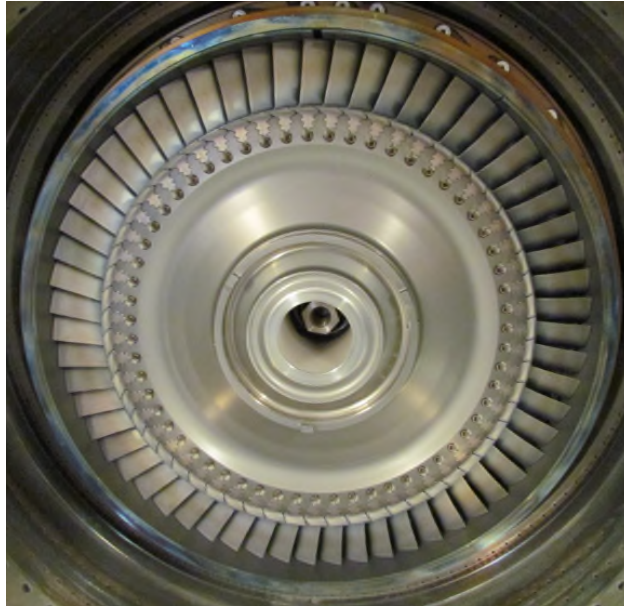


Photo No. 21
CT disk assembly in situ

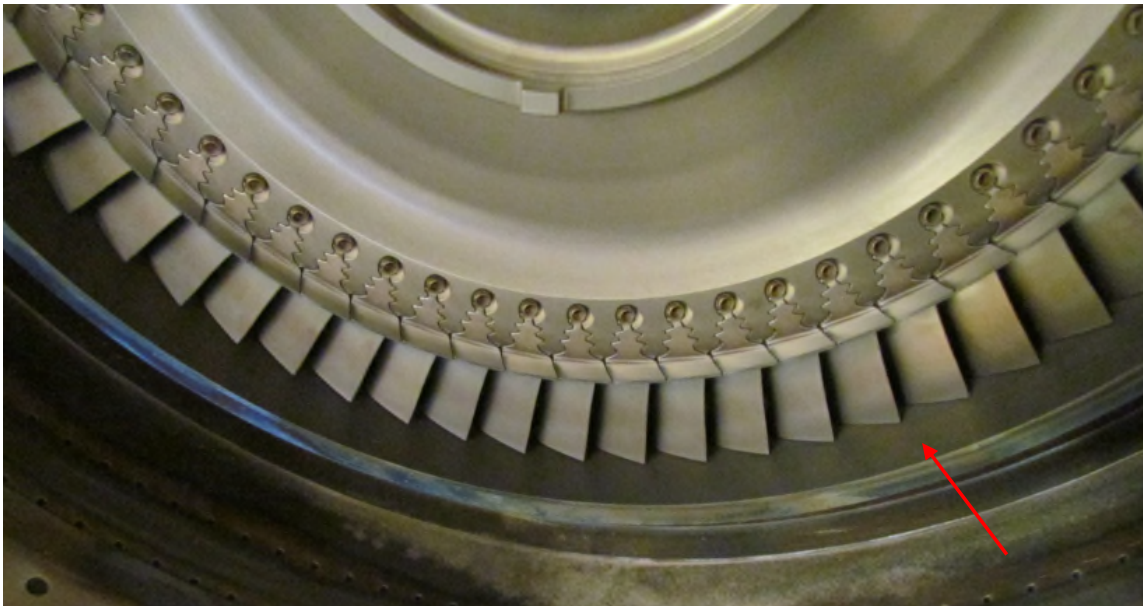


Photo No. 22
CT shrouds (arrow)

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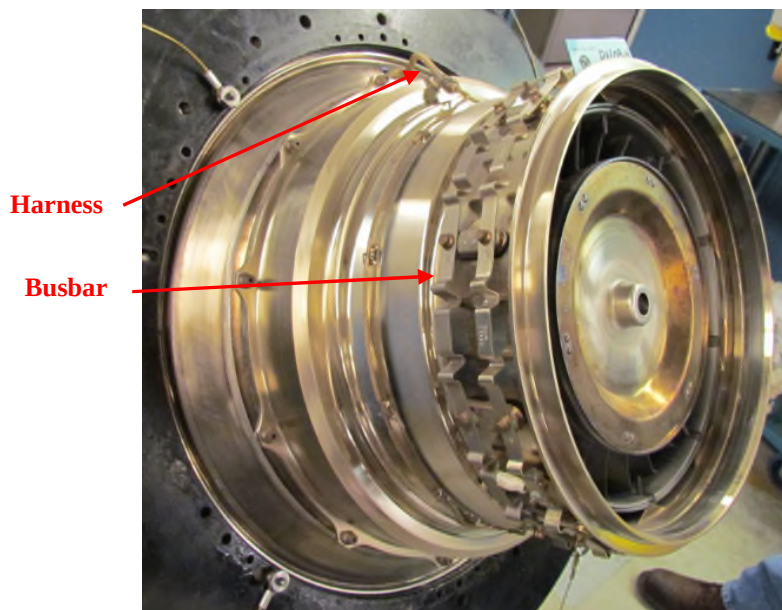


Photo No. 23
Power turbine housing assembly

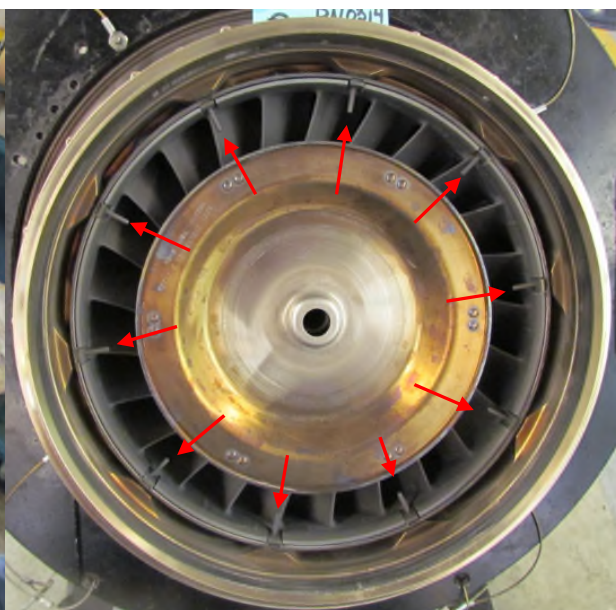


Photo No. 24
ITT probes (arrows)



Photo No. 25
PT1 vane upstream side



Photo No. 26
PT1 vane downstream side



Photo No. 27
PT1 shroud



Photo No. 28
PT1 disk upstream side



Photo No. 29
PT1 disk downstream side

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Photo No. 30
PT1 blades shroud



Photo No. 31
PT2 vane upstream side

Photo No. 32
PT2 vane downstream side

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Photo No. 33
PT2 disk upstream side



Photo No. 34
PT2 disk downstream side



Photo No. 35
PT2 blades shroud



3.2.4 Reduction Gearbox

The front housing was separated from the rear housing to gain access to the 1st and 2nd stage planetary reduction system. The front housing assembly was disassembled. The rear housing was not disassembled.

Rear Housing: No damaged observed (Photo No. 36).

1st Stage Sun Gear: Not assessed.

1st Stage Planet Gear Carrier: No damaged observed (Photo No. 36).

1st Stage Planet Gears: No damaged observed (Photo No. 36).

1st Stage Ring Gear: No damaged observed (Photo No. 36).

Torque Meter: Not assessed.

2nd Stage Sun Gear: No damaged observed (Photo No. 36).

2nd Stage Planet Gear Carrier: No damaged observed (Photos No. 37 to 39).

2nd Stage Planet Gears: No damaged observed (Photos No. 37 to 39).

2nd Stage Ring Gear: No damaged observed (Photo No. 37).

No. 5, 6 and 7 Bearings: No damaged observed.

Propeller Shaft: The propeller shaft where the propeller oil transfer sleeve was located exhibited a 360° thin circumferential score line between the oil inlet port holes and the servo pressure holes (Photo No. 40). The score mark was visual and could be felt tactilely by finger nail. Another 360° thin score line was visible, which could not be felt, forward of the servo pressure holes (Photo No. 40). The fit between the propeller shaft and the propeller sleeve was measured and met the drawing requirement. The internal oil transfer tube/oil jet was in good condition and no debris or obstructions were noted (Photos No. 42 and 43). The o-rings and the seals were all present and in good condition (Photo No. 43). The fits between the propeller shaft and the internal oil transfer tube/oil jet were measured and meet the drawing requirements.

Propeller sleeve: The propeller shaft oil sleeve was in good condition except for light scoring marks noted on the running lands (Photo No. 41).

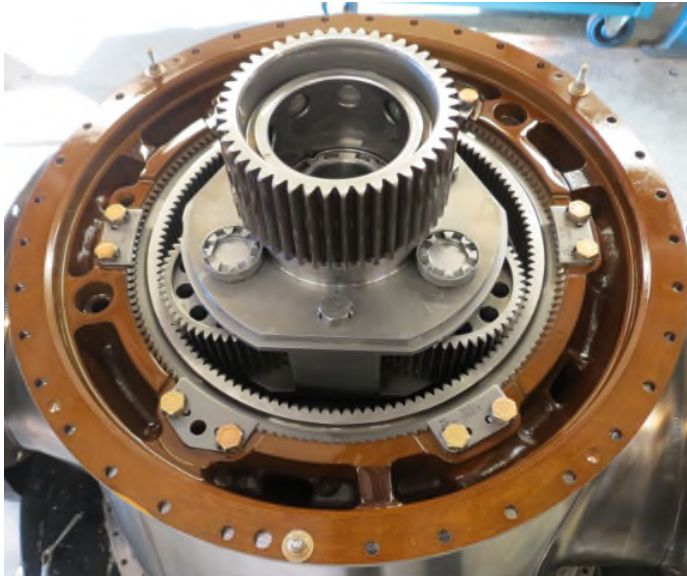


Photo No. 36
1st stage planet gear assembly in situ

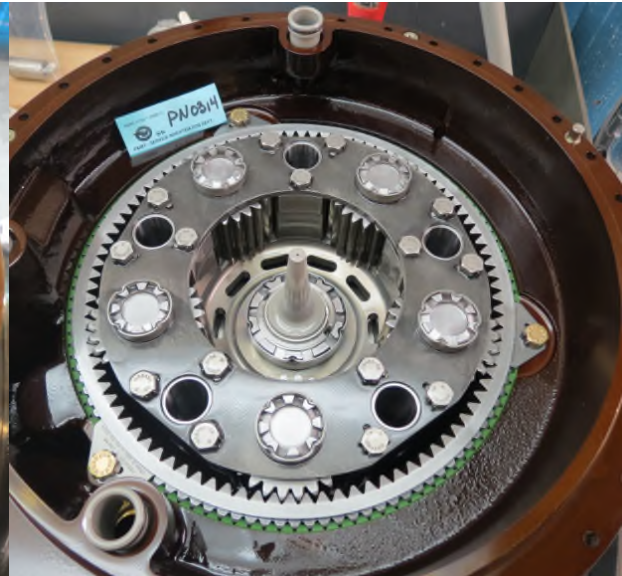


Photo No. 37
2nd stage planet gear assembly in situ



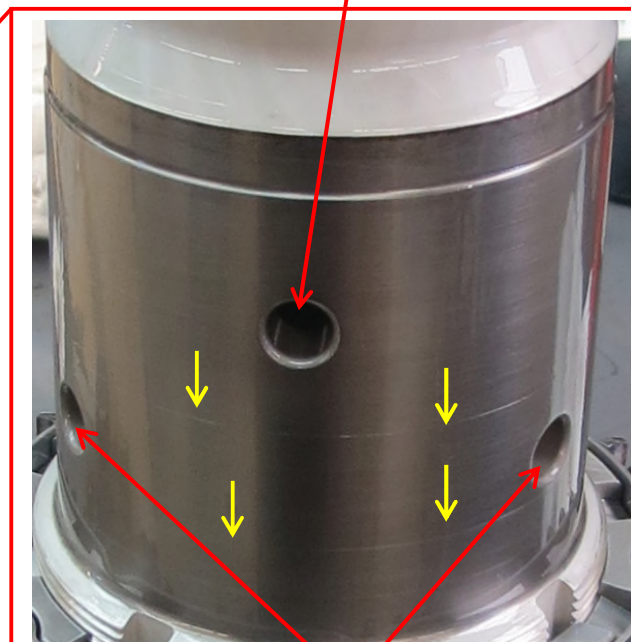
Photo No. 38
2nd stage planet gear assembly



Photo No. 39
2nd stage planet gear assembly



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Oil inlet port hole

Servo pressure holes

Photo No. 40

Propeller shaft - propeller shaft oil sleeve contact face
Scores (yellow arrows)

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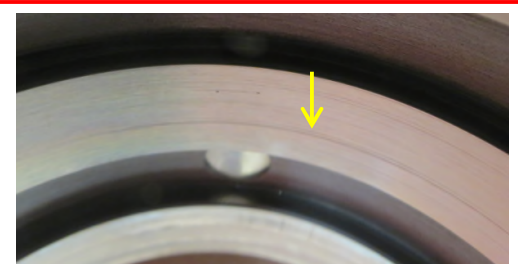
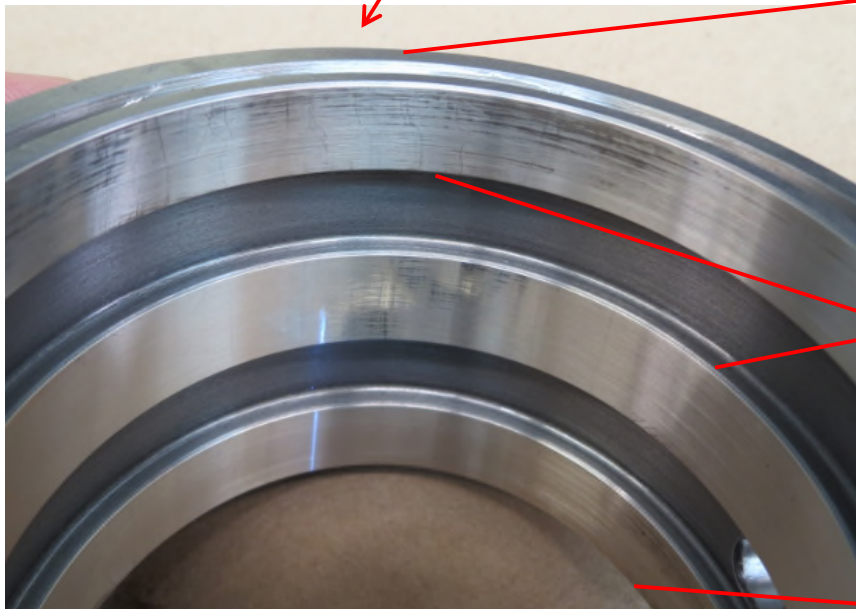


Photo No. 41
Propeller sleeve
Score marks (yellow arrows)

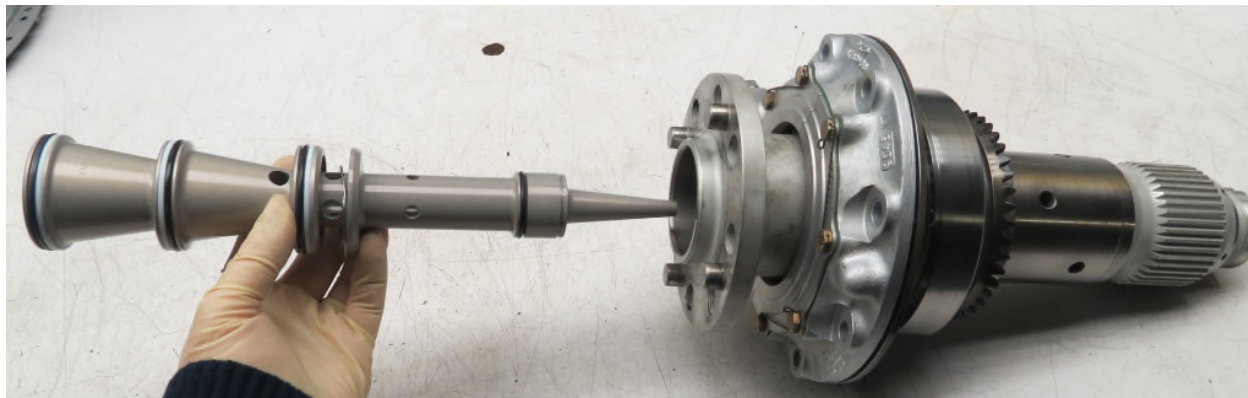


Photo No. 42

Propeller shaft and the internal oil transfer tube/oil jet



Photo No. 43

Internal oil transfer tube/oil jet

Front Housing: All internal oil passages for the propeller governor (CSU) and the overspeed governor (OSG) in the front RGB housing were visually examined and no obstruction was observed (Photo No. 44).

3.2.5 **Accessory Gearbox:** Not assessed.



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The oil passing at the external of the oil transfer tube is going to the OSG.

The oil passing at the internal of the oil transfer tube is going to the propeller shaft cavity.

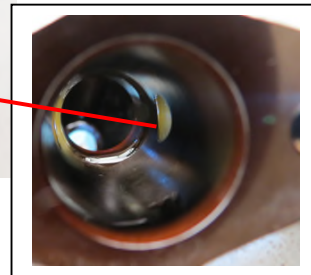
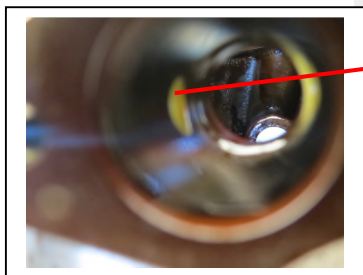
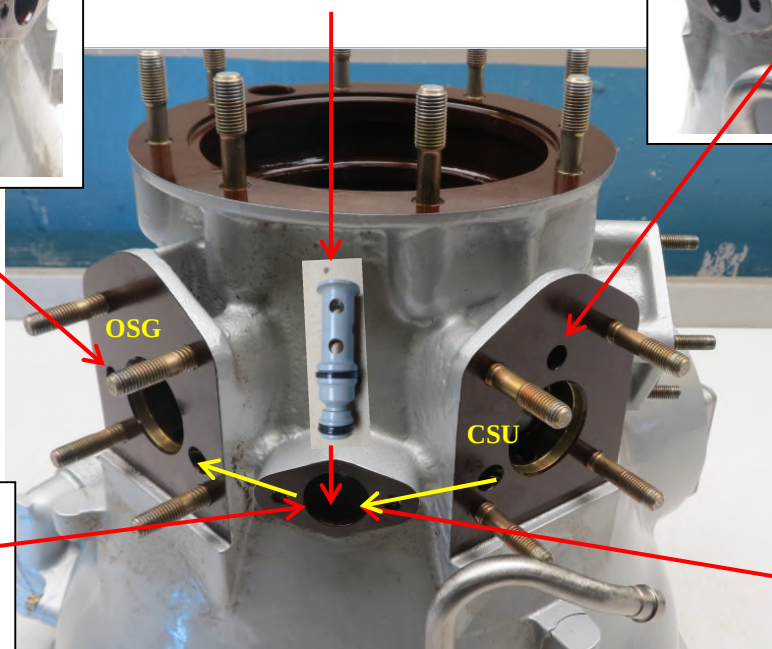
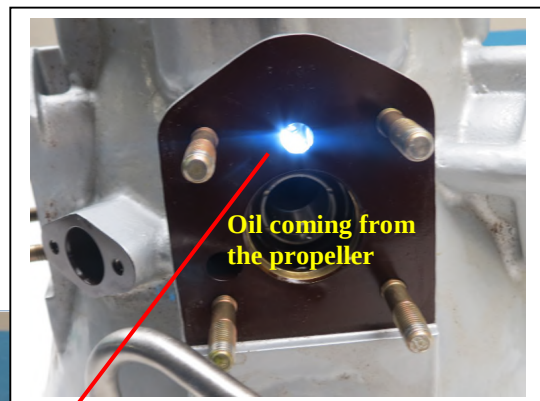


Photo No. 44
Front RGB housing
Oil passages (yellow arrows)
for the propeller governor
and overspeed governor



3.3 Controls and Accessories Evaluation

Fuel Nozzles were not removed from the GGC. No damage was observed on the fuel nozzles adapters and transfer tubes (Photos No. 1 and 2). No Carbon deposit was observed on the fuel nozzle shield (Photo No. 20).

The Fuel Oil Heat Exchanger was not removed. No damage was observed on the external (Photo No. 9).

The fuel pump, the flow divider, the Fuel Control Unit (FCU) and the Compressor Bleed Valve were visually inspected and tested at P&WC. The propeller governor (CSU) and the Overspeed Governor (OSG) were sent to [REDACTED] for inspection and test.
See reference "A" for accessories accident report.

4.0 REFERENCE LISTING

- (A) P&WC Accessories Accident report 18ECN00120.

REFERENCE “A”

ACCESSORIES ACCIDENT REPORT

Date issued: 2018-April-11

To: [REDACTED]

Customer: C&C Flying Service
Engine Model: PT6A-65AG
Engine S/N: PN0314

This report is to support the engine review regarding an accident that occurred on Jul 18, 2017.

1.0 Event:

During aerial application, the aircraft force landed in a field, 3 miles from Reyno, Arkansas. The engine has 8 hours' Time Since New (TSN). Prior to the event the engine was reported to have power fluctuations.

2.0 Summary of findings:

The investigation comprise of visual inspection and testing of the fuel pump, the flow divider, the Fuel Control Unit (FCU) and the Compressor Bleed Valve at P&WC. Prior sending the Constant Speed Unit/propeller governor (CSU) and the Overspeed Governor (OSG) to [REDACTED] for testing and disassembly, a visual inspection was carried out at P&WC. There were no significant visual findings to report on any of the units listed in Table 1. Testing of the flow divider and the fuel pump was satisfactory.

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	ECCN(s)*	NSR
	P-ECCN(s)**	9E991
	USML(ITAR)*	NSR
	P-USML**	NSR
Date: 4/11/2018 Badge: B-bz29928		

[REDACTED]

ACCESSORIES ACCIDENT REPORT

Date issued: 2018-April-11

To: [REDACTED]

The leakage from the bleed valve piston ring was almost inexistent. The FCU testing showed deviation from the test specifications only on the permissible field adjustments. From the [REDACTED] investigation report, the CSU was tested satisfactorily. Only the field permissible adjustments showed deviation from the test specification. At the request of the NTSB, [REDACTED] reviewed the Flight Data Recorder (FDR) data and concludes that the propeller speed changes were induced by the movement of the propeller speed control lever input to the CSU. Thus, the CSU operated properly during the event. Disassembly of the CSU revealed no anomalies. From the [REDACTED] investigation report, the OSG was working properly and no evidence of functional issues was found at disassembly.

3.0 Conclusion:

There were no defects or damage evident that would have prevented normal operation prior to the event.

4.0 Investigation:

Conducted at: P&WC Plant 5 Date Started: 31 October 2017

In attendance:

[REDACTED]

The following accessories were removed from the engine for investigation:

Accessory	P&WC P/N	Manufacturer	Supplier P/N	S/N	Times/cycles
Fuel pump	3040760	[REDACTED]	825601-5	015244	8.0hrs.
Fuel control unit (FCU)	3055142-05	[REDACTED]	8063-641	20786730	8.0hrs.
Flow divider valve (FDV)	3019906	[REDACTED]	25536-4	L1443	8.0hrs.
Compressor bleed valve (BOV)	3059831-02	[REDACTED]	3059831-02	AHX0800295	8.0hrs.
Propeller governor (CSU)	3036014	[REDACTED]	8210-034	20708948	8.0hrs.
Overspeed Governor (OSG)	None	[REDACTED]	210960-01	20847964	8.0hrs.

Table 1

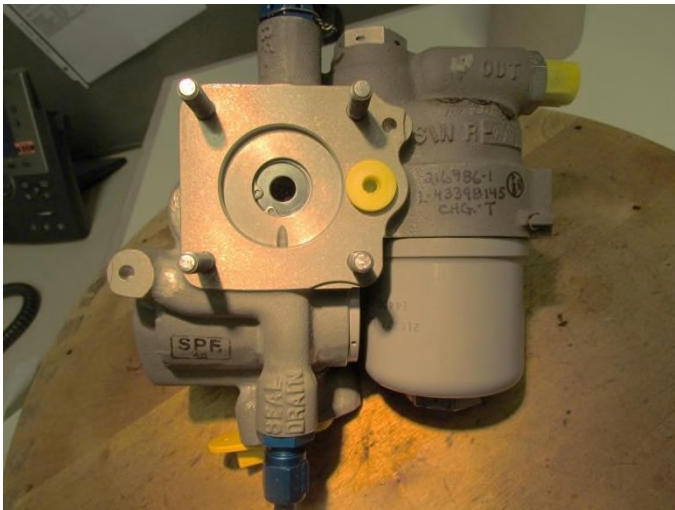
ACCESSORIES ACCIDENT REPORT

Date issued: 2018-April-11

To: [REDACTED]

Fuel pump Note: This unit was on the engine at delivery

The fuel pump was in good condition (picture 1). The input shaft was rotating without restriction. The lockwire of the filter bowl was missing. Remaining Lock wires/safety cables were present and intact. The lockwire between the motives flow fitting and the cap plug on the filter upstream pressure port looked different. The lockwire was measured and meet the drawing requirement. Prior testing, the filter bowl was removed. The remaining fuel was collected and placed into a plastic container (Picture 2). The fuel within the container was water free. The fuel filter was removed and visually inspected. The filter appeared clean (Picture 2). Examination of the filter bowl revealed traces of dark debris suspended in the fuel (Picture 3). This is not an unusual condition. The inlet screen port cover was removed to allow access to the inlet screen assembly. The screen meshing was clean with the exception of a small piece of black debris. This is not an unusual condition. The debris was collected and placed in a container. The fuel pump was reassembled and was tested satisfactorily (Picture 4). The pressure port plugs and fittings were removed to allow fuel pressure monitoring in the course of the fuel pump fuel filter bypass test (Picture 5). After testing, the fuel pump was returned to its as received condition. As agreed with the NTSB representative, the fuel pump disassembly was not performed.



Picture 1

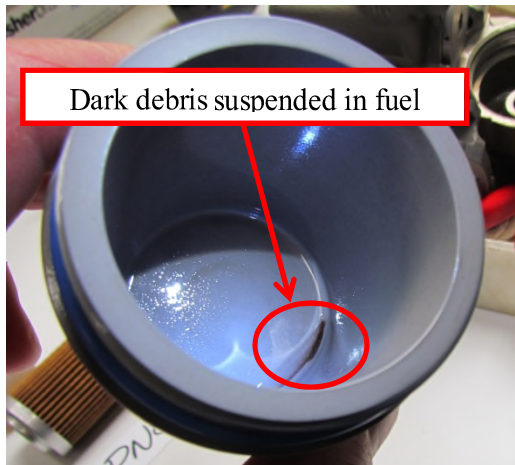


Picture 2

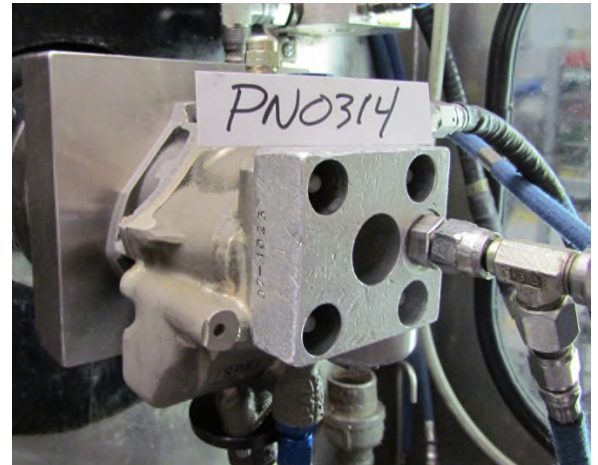
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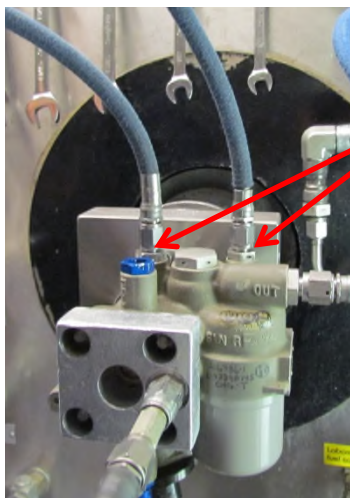
To: [REDACTED]



Picture 3



Picture 4



Picture 5

Blanking plugs were removed and replaced with fittings to allow pressure monitoring for the fuel filter bypass test

Fuel Control Unit Note: This unit was on the engine at delivery

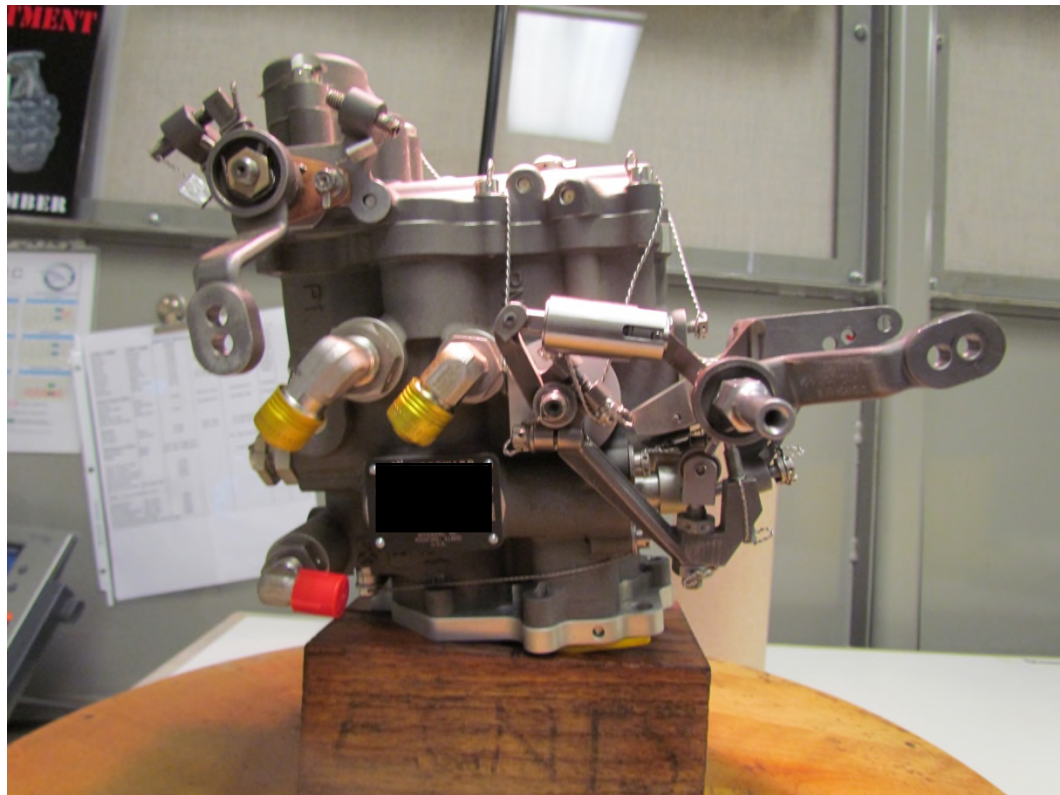
The FCU was in good condition (Picture 6). The input shaft was rotating with typical resistance. The manual override lever was lockwired on the normal position stop. The throttle and condition levers were moving freely. The cut off valve was moving freely on its full travel. Lockwires and safety cables were present and intact. The lockwire seal on the cut off adjustment was stamped with the letter W. There were seals stamped with the letter (W) on the manual override normal and maximum position adjustment screws, on the Fuel valve port adjustment cap plug. There was white paint on the bolts head of the base plate, on the bellow adjustment and on the cut off valve adjustment. The P3 (compressor discharge air) fitting was removed from the air inlet port.

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To: [REDACTED]

The P3 inlet port was clean (Picture 7). The P1 (fuel inlet) and PN (fuel nozzle flow) fittings were removed. The inlet fuel filter in the P1 port and the PN outlet port were both found uncontaminated (Picture 8). Picture 9 shows the hardware removed from the FCU for installation of the test fixtures (Picture 10). The removed hardware was kept in a seal bag with the FCU. The fuel control was tested in accordance with the [REDACTED]. The FCU operated normally within the test requirements except for the High idle, the maximum reverse and maximum forward speed setting, which were slightly above the maximum limit. These are normal field adjustments. As agreed with the NTSB representative, the FCU disassembly was not performed.

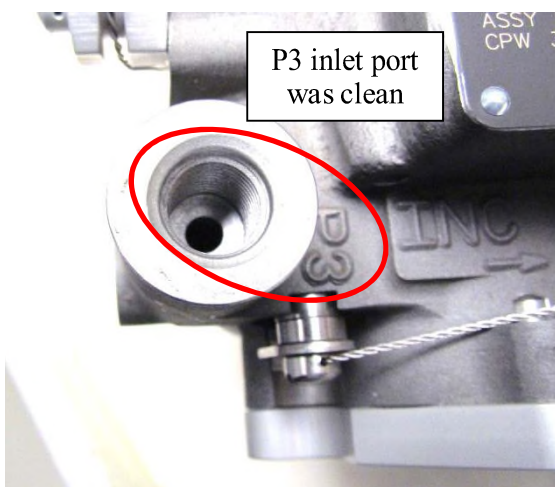


Picture 6

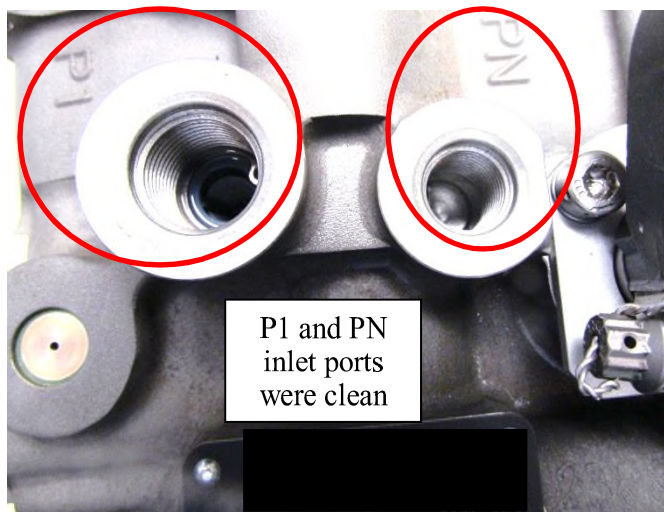
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To: [REDACTED]



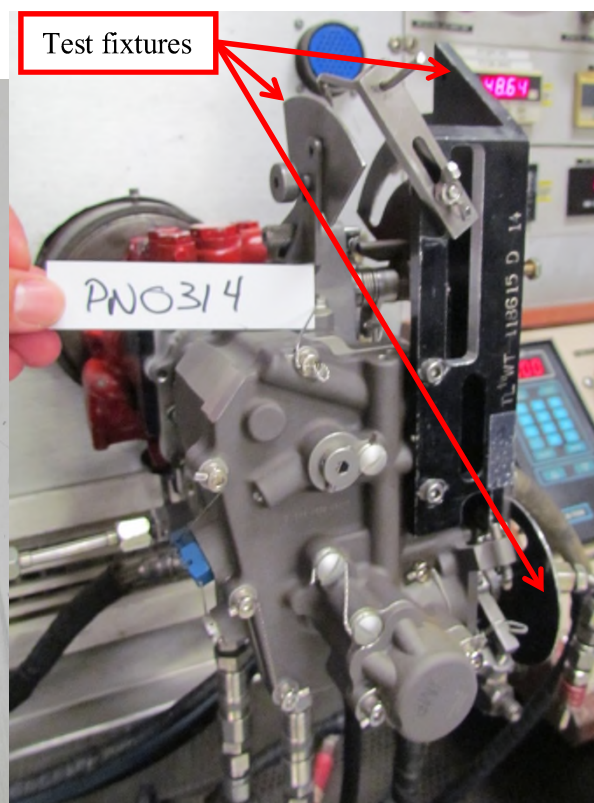
Picture 7



Picture 8



Picture 9



Picture 10

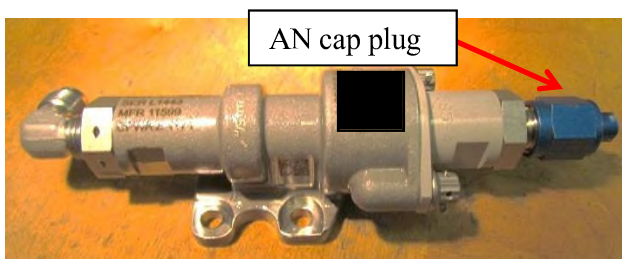
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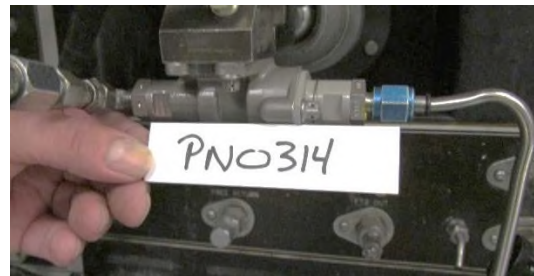
To: [REDACTED]

Flow divider Note: This unit was on the engine at delivery

The flow divider was in good condition (Picture 11). The dump valve fitting was capped with a blue AN cap plug. The safety wire was present on the bolts holding the dump valve housing to the main housing. The flow divider was tested satisfactorily per the [REDACTED] (Picture 12). As agreed with the NTSB representative, the flow divider disassembly was not performed.



Picture 11



Picture 12

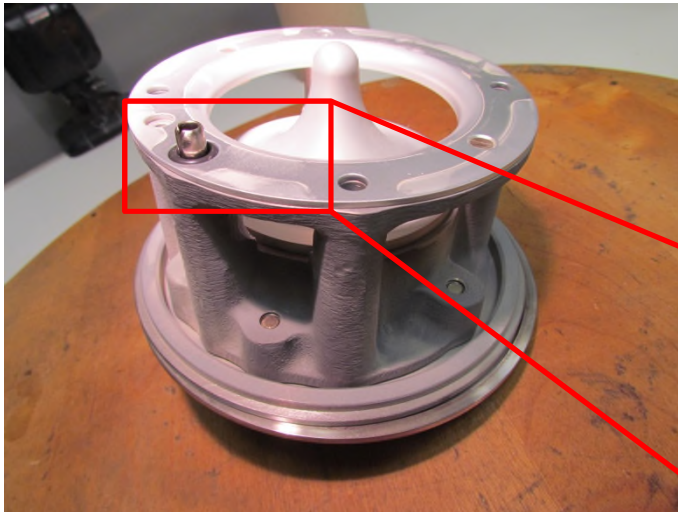
Bleed Valve Note: This unit was on the engine at delivery

The bleed valve was in good condition. Fine grey powder was present on the P2.5 path (Picture 13-14). The piston was moving freely. Lock wire was present between both plugs on the cover. Note, there is no specific bench test for the Bleed Valve. The bleed valve closing point is checked and calibrated while installed on the engine. The closing point of the bleed valve is matched with the engine compressor performance. The bleed valve closing point may require adjustment if the compressor performance changes. To evaluate the piston seal ring performance, the bleed valve was installed on a test fixture to monitor the differential pressure between the P3, air supply from the engine to the bleed valve inlet port, and PX, pressure acting on the piston (Figure 1). The differential pressure was measured to be 0.01 psid, thus indicating that the leakage from the piston sealing ring was minimal. Note, the PX chamber port plugs on the cover, was removed to allow pressure monitoring (PX) (Picture 15). The plug was reinstalled after testing. As agreed with the NTSB representative, the bleed valve disassembly was not performed.

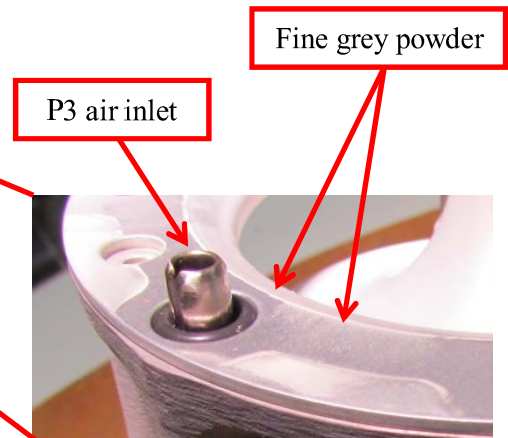
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To: [REDACTED]



Picture 13



Picture 14

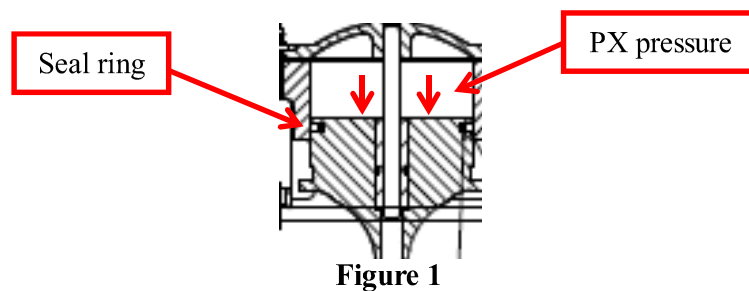


Figure 1



Picture 15

The cap plug was removed and replaced with a fitting to allow pressure monitoring

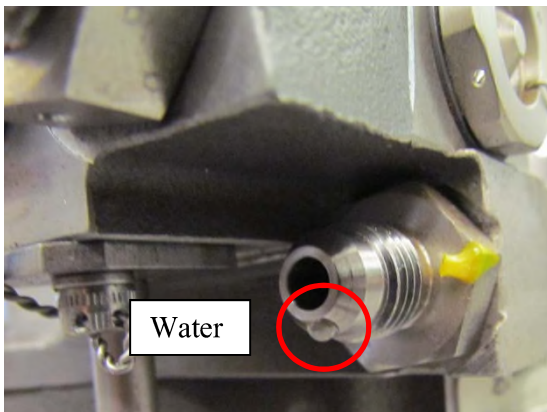
ACCESSORIES ACCIDENT REPORT

Date issued: 2018-April-11

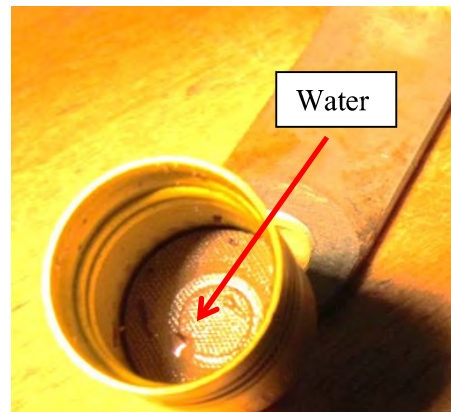
To: [REDACTED]

Constant Speed Unit (CSU) Note: This unit was on the engine at delivery

With the CSU installed on the engine, the cap on the PY port fitting was removed and a drop of water was observed on the edge of the fitting (Picture 16). Water was also observed inside of the removed cap (Picture 17). Once removed from the engine, the Constant Speed Unit (CSU)/Propeller governor looked in good condition (Picture 18). The solenoid valve assembly connector was capped with a black plastic cap. The cap was secured in place with a lockwire. The on-site accident pictures were reviewed by the NTSB representative and confirmed that the cap and lockwire were in the same condition as viewed on the accident site (Picture 19). The input shaft was turning freely. The reset arm was moving freely. The feathering piston was free to move on its entire stroke. The speed control lever was moving freely and was returning to the maximum speed stop with its own spring tension. Lockwires were present and intact. The seal on the regulating valve adjustment was present and intact. Torque seal on the feathering valve adjustment and to the reset arm adjustment was present and intact. With the NTSB agreement, the CSU was shipped to [REDACTED] for testing and disassembly. [REDACTED] was created providing the instructions to investigate the CSU. The CSU was sent to [REDACTED] on the P&WC Delivery note [REDACTED] and the [REDACTED].



Picture 16

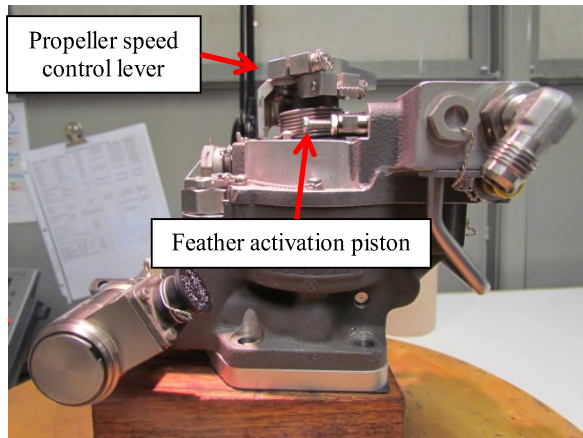


Picture 17

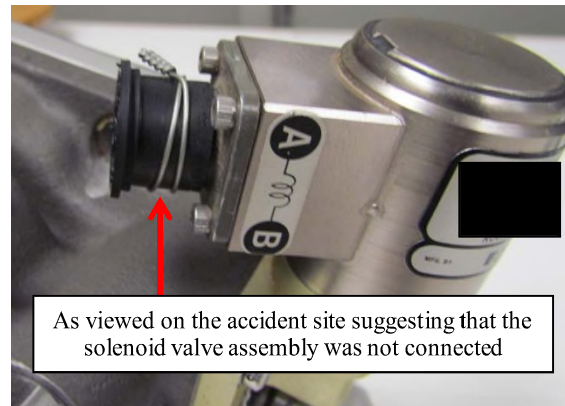
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To: [REDACTED]



Picture 18



Picture 19

The information that follows was extracted from the [REDACTED] investigation report. Minor corrections to the text performed. The graph format was modified for clarity of the data.

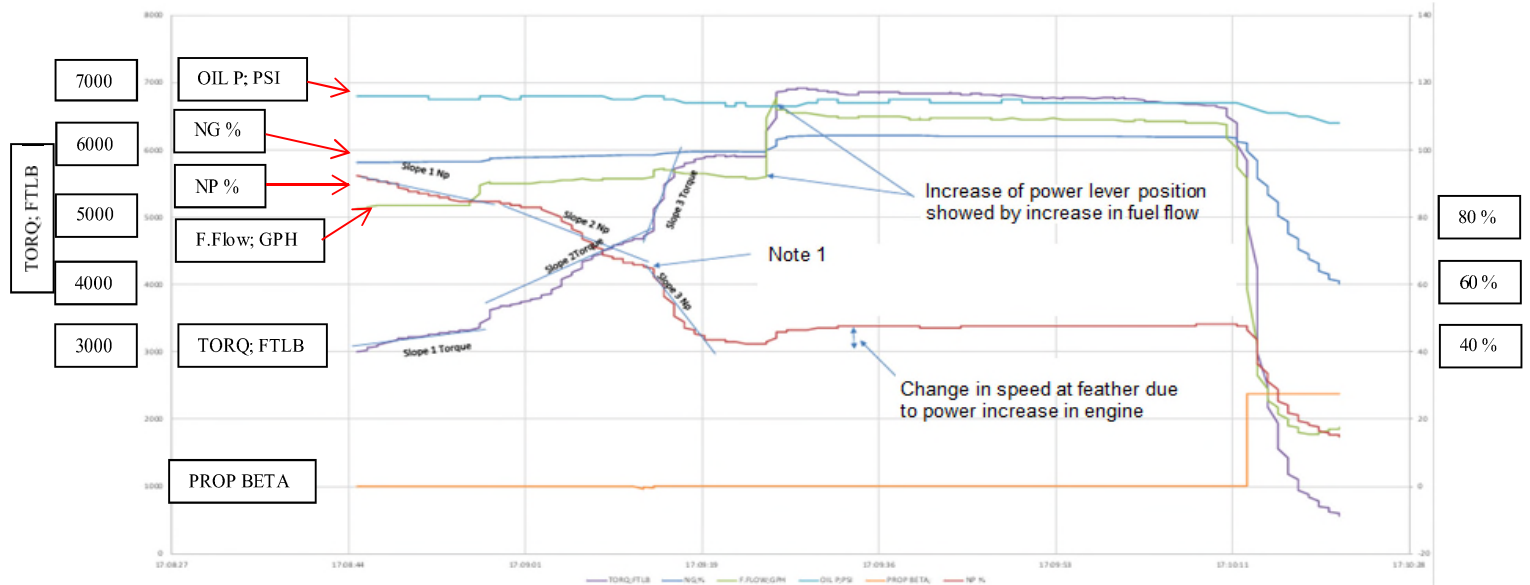
A visual as-received was performed on the unit. The following observations were noted. The unit was radiographically inspected to determine condition of unit. The inspection revealed the relief valve was in the normal (closed) position. The flyweights, springs, and bearings were intact and did not show any anomalies. The exterior of the unit appeared undamaged and the drive gear and the propeller speed control lever operated normally. The unit was mounted on a test stand at [REDACTED] and ran per the production acceptance test. The unit met all production acceptance requirements except the propeller speed control lever arm position was located in a different position and the maximum propeller speed condition was 4211 RPM (99.2%). This propeller speed control lever position is a field adjustment, allowing rigging to the aircraft. The propeller speed rigging which sets the maximum propeller speed condition is also an engine rigging adjustment to set the maximum RPM. The unit operated normally during the test and no anomalies were observed. The unit was run an additional 2 times to determine consistency of operation. The unit operated consistently with the first run. The maximum speed drifted slightly due to the oil temperature rising on the test stand. The maximum speed on the third run was 4180 RPM (98.4%). The unit was disassembled. No anomalies were observed. The flyweights, bearings, Speeder spring, and all other parts appeared properly assembled and in normal operating condition.

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The flight data recorder information was analyzed per the request of the NTSB and plotted in the chart below.



Graph No. 1

Note 1: The speed at the location is 62% or 1060 RPM Prop speed. This is the same speed position where the propeller speed control lever will activate the feather valve. Testing of the propeller governor showed the feather valve was activated at 62% speed (2644 RPM Prop Gov. Input speed). This also shows an increase in rate of change in propeller pitch indicating the feather valve was activated.

From the chart it was observed that the NP speed changed at 3 different rates between 17:08:44 time frame and 17:09:19 time frame. This indicates a change in propeller speed control lever position that changes at different rates. The three different slope areas are defined as;

Slope 1 Time frame 17:08:45 to 17:08:58

Slope 2 Time frame 17:08:58 to 17:09:14

Slope 3 Time frame 17:09:14 to 17:09:19

Power lever change Time frame 17:09:25

In the Slope 1 time frame, the engine NP dropped from 92 to 84% speed (1570 to 1440 Prop RPM). Torque increased from 3000 ft. lbs. to 3620 ft. lbs. From the Hartzell data regarding the thrust at this condition, very little change in thrust was observed in this range.

See Table 2 below on next page.

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To: [REDACTED]

	Time	Torque	Hp	Airspeed (KTAS)	RPM	Blade Angle	oil qty/sec	Thrust (lbs)
1000 ft.	17:08:45	3000.00	897	114	1570	23.46	0.32	1954
ISA +30	17:08:54	3300.00	911.1	116	1450	26.7		1941
	17:09:03	3800.00	1020.2	121	1410	29.3	1.106	2059
	17:09:09	4480.00	1015.1	121	1190	36.7		1895
	17:09:13	4720.00	997	129	1110	40.36		1734
	17:09:16	5720.00	936	130	860	58.07	3.12875	1064
	17:09:17	5800.00	883	128	800	63.3		895
fully feathered	17:09:24	5900.00	808	110	720	83.1		

Table 2

Slope 2 time frame, a similar condition occurred. NP dropped from 84 to 65%. However, the thrust only decreased by 10% in this time frame.

In the slope 3 time frame, a different situation occurred. It should be noted the start of the slope change occurred at 62% or 1060 RPM propeller speed. This is the same speed that the propeller speed control lever on the propeller governor is set to activate a feather activation piston. The rate of the oil flow out of the propeller piston increased from a rate of 1.1 to 3.13 in³/second. 3.13 in³/sec converts to about 3.24 quarts/min. This combined with the pump flow in this underspeed condition (62%) would be about 9.1 quarts/min that needs to be drained from the propeller piston. This flow rate (using the pressure drop value during the as received testing) roughly calculates to a pressure drop from the piston of about 170 psi. This is comparable to the pressure generated by the propeller spring and counterweights. Both the flow and speed activation point indicate the feather activation piston was activated by the propeller speed control lever causing a low thrust condition. In addition, the speed was decreasing at slower rates up until the feather activation speed, indicating the propeller speed control lever was moving during the incident and the propeller governor was operating as designed controlling this speed per the propeller speed control lever input.

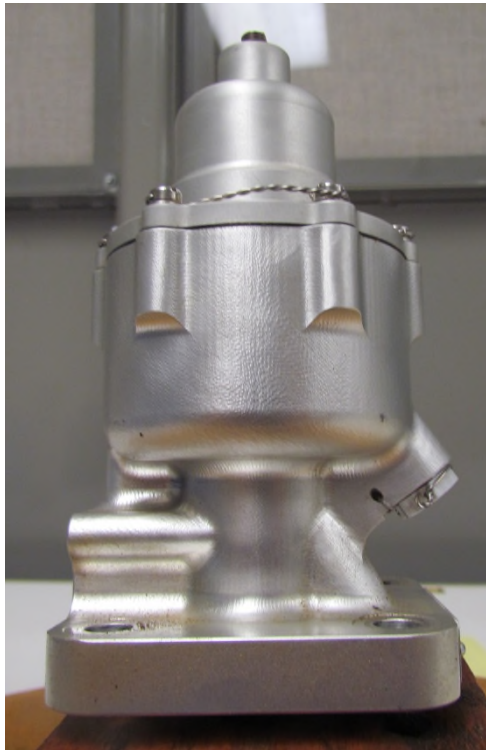
Overspeed Governor (OSG) Note: This unit was on the engine but unable to determine if it was present at initial delivery to the customer as this component is not supplied by P&WC

The Overspeed Governor (OSG) was in good condition (Picture 20). The input shaft was rotating without restriction. The electrical connector was clean but there was no protective cap on the connector (Picture 21). One of the contact pin was slightly damaged on the tip (Picture 22). Lockwires were present and intact. The solenoid body was properly secured. White paint was present on the speed adjustment. With the NTSB agreement, the OSG was shipped to [REDACTED] for testing and disassembly. [REDACTED] was created providing the instructions to investigate the OSG. The OSG was sent to [REDACTED] on the P&WC Delivery note [REDACTED] and the [REDACTED]

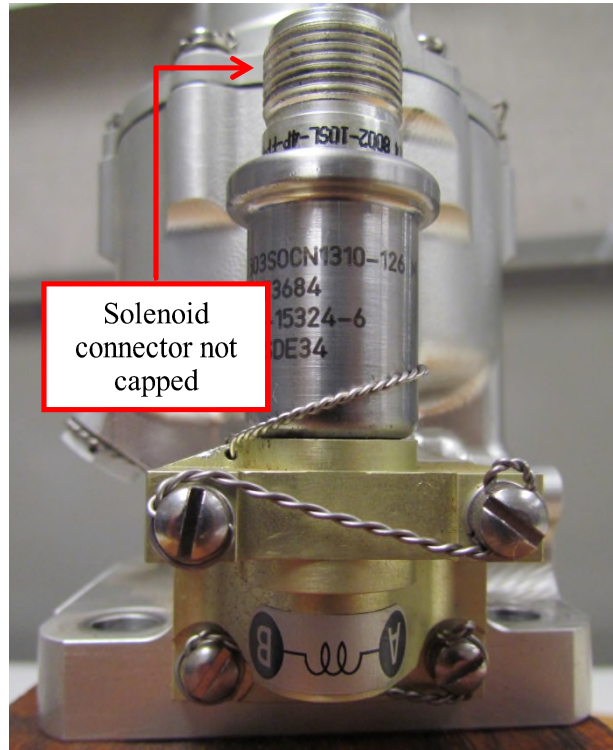
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To: [REDACTED]



Picture 20



Picture 21



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To: [REDACTED]

Picture 22

The information that follows was extracted from the [REDACTED] investigation report.

As-received visual inspection found the overspeed governor to be in good condition with [REDACTED] lockwire in place. There were scratches on the OD of the speed reset solenoid. There was non-metallic foreign material around the mounting flange. As-received test found the overspeed governor to be working properly. The overspeed governor was disassembled and all parts examined. No damage or evidence of any functional issues was found.

5.0 Closing Statement

This report collected at the time of the review may be altered or corrected on the basis of further information.

[REDACTED]

[REDACTED]

Air Safety Investigator
Engine Controls & Nacelles Technical Services
Mail Stop: 05AQ1