



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety

Western Pacific Region

December 3, 2019

ENGINE EXAMINATION REPORT

WPR19LA195

This document contains 19 embedded photographs

Hurricane, Utah

July 15, 2019

1430 PST

Cessna T210 – N6330N

PARTICIPANTS IN THE EXAMINATION

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HISTORY OF FLIGHT

On July 15, 2019, about 1430 Pacific daylight time, a Cessna T210N, N6330N, was substantially damaged during a forced landing near Hurricane, Utah. The private pilot and pilot-rated passenger were not injured. The airplane was registered to and operated by the pilot as a personal flight, conducted under the provisions of Title *14 Code of Federal Regulations* Part 91. Visual meteorological conditions prevailed and a flight plan was not filed, for the local flight that was originating from Grassy Meadows Airport in Hurricane, Utah at the time of the accident.

According to the pilot, the engine had received a top overhaul about 1.5 hours prior to the accident. His subsequent maintenance flights in the airport traffic pattern showed recurring oil temperature problems accompanied by power issues. The pilot notified his mechanic who then replaced the oil cooler gasket and an oil temperature sensor; however, the pilot continued to receive high oil temperature indications. He informed the mechanic of the result who then accompanied him during the engine run-up and accident flight. The pilot and pilot-rated passenger (mechanic) did not observe any abnormal temperature indications during the takeoff roll, but once the airplane entered its initial climb the engine started to lose power. The pilot was unable to maintain altitude and made a forced landing to an area of sage brush and dirt.

Postaccident examination of the airplane by the Federal Aviation Administration revealed substantial damage to the forward fuselage.



Photograph 1: Airplane at Accident Site



Photograph 2: Engine at Accident Site

ENGINE INFORMATION

Engine Manufacturer: Continental Motors, Inc.

Engine Model Number: TSIO-520-R (9B)

Engine Serial Number: 294278-R

Recent Inspection: 100 hour – June 19, 2019

Recent Recorded TSMOH: 630 hours – Recorded at 100 hour inspection

Time Since Inspection: 1.5 flight hours

Date: 07/09/2019 Hours: Act TT: 3973.20 Eng TT: 630.20 Eng TSMOH: 630.20 Tail: N6330N

Make: Continental Model: TSIO-520-R (9) S/N: Eng s/n: 294278-R

Name: Arthur E. Granger

Cert: [REDACTED]

Co: Color Canyon Aviation LLC

Signed: [REDACTED]

After maintenance check flight was C/W, pilot indicated high oil temperature during a 15 minute flight. Uncowled engine and noted an oil leak on aft bottom side of engine oil cooler. Remove oil cooler to install new gaskets due to oil leak at bottom aft corner. *note: Oil cooler to engine oil cooler adapter plate gasket is incorrect P/N as evidenced by the oil cooler inlet port almost completely covered over by the gasket.

Removed engine oil cooler adapter plate after determining oil cooler thermostat was not working (no oil in oil cooler, just a minor amount). Took bracket and thermostat back to the shop to test. Found thermostat does respond to heat appropriately when heated in a can of oil, however the sealing surface of the oil thermostat shows evidence of not closing properly i.e., surface wear on the sealing face shows improper seal, not sealing all the way around it. Placed new thermostat on order thru Aviall. To Sky Ranch, began reinstallation of oil cooler, noted that oil cooler gasket does not fit flat on mating surface of oil cooler adapter, determined that all 3 bottom adapter retaining studs are too long by about 1/2 thread (original cause of oil leak at the lower aft corner of the oil cooler) also old gasket shows where the "too long" studs had destroyed the original gasket, also evidenced by marks from the studs digging into the oil cooler mating surface). Using a dremel tool, ground studs down until the gasket and the oil cooler fit properly. Reinstalled the oil cooler and torqued attachment bolts. Installed the new oil temp sensor P/N639305 & gasket P/N 627496.

Received new oil temp regulator P/N 639305 to install. To Sky Ranch to install the new part and reinstall the air induction tube and associated hardware on the RH side of the engine. Reinstall all engine cowling

Ground run engine at idle then at 1500 rpm for 5 minutes to check oil temperature control, no defects noted.

Removed engine cowlings R/L and front to check for oil leaks, no leaks were noted. Reinstalled all engine cowling.

This engine is returned to service Arthur E. Granger A [REDACTED] end.

Photograph 3: Recent Inspection

INITIAL EXAMINATION AS RECEIVED

The engine was shipped from a maintenance facility in St. George, Utah to CMI's facilities in Mobile, Alabama via crate and bonded shipment. Upon receipt the engine was immediately logged and placed in bonded/secure storage and was not opened. The crate was viewed by the IIC as unopened and subsequently photographed and opened for examination. The oil sump was partially crushed. The waste gate controller mounting bracket was fractured and the alternator bracket was broken. Additionally, the "B" nut at the mixture control/throttle body was loose.



Photograph 4: Crated Engine as Received



Photograph 5: Engine after Crate Removed

DETAILED EXAMINATION

After removal of the rear accessory drive rotation was achieved from the propeller flange to the rear of the engine utilizing a wrench and rotating by hand. Rotation was smooth and unremarkable. Crankshaft end play was 0.009 inches as measured at the propeller flange. Minimum range is 0.005 inches with a maximum of 0.025 inches. Deflection was 0.0012 inches and runout was 0.003 inches. The engine condition was optimal for testing and did not require any replacement of parts.

Compression Test

	Pre-Engine Run	Post Engine Run
Cylinder No. 1	35/80	47/80
Cylinder No. 2	55/80	56/80
Cylinder No. 3	29/80	61/80
Cylinder No. 4	58/80	70/80
Cylinder No. 5	40/80	39/80
Cylinder No. 6	66/80	65/80
Master Orifice	43 psi	43 psi

Each cylinder showed an exhaust leak with the exception of no. 6, which showed both intake and exhaust leaks during the pre-engine run compression. The engine was borescoped to examine the valves, pistons, and cylinder walls. The examination revealed no anomalies with the intake and exhaust valves.

Starter Motor

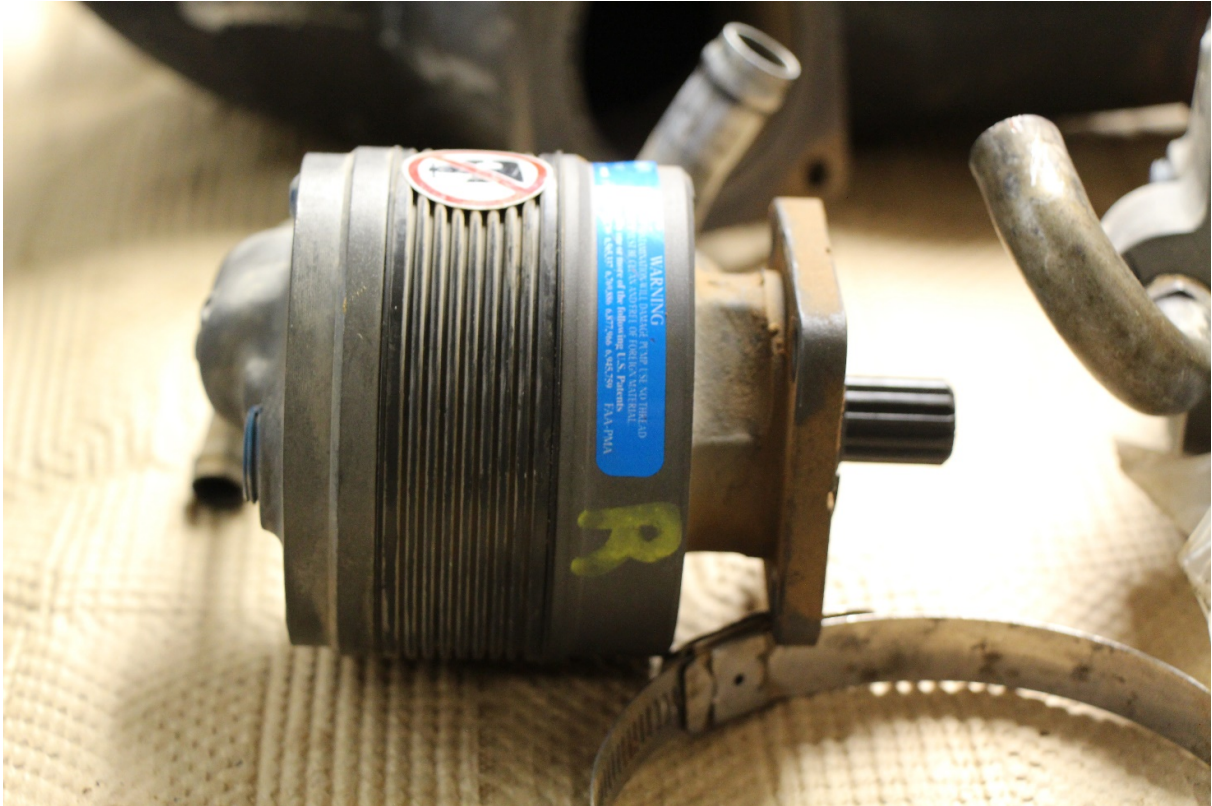
The starter motor was manufactured by Teledyne Continental Motors; part no. 646275, serial no. T-080113.



Photograph 6: Starter Motor

Vacuum Pump

The engine was equipped with two vacuum pumps. The right side vacuum pump was manufactured by Tempest, part no. AA3216CW, serial no. 049F19. The left side vacuum pump was manufactured by Tempest, part no. AA3216CW, serial no. 049F12.



Photograph 7: Right Vacuum Pump

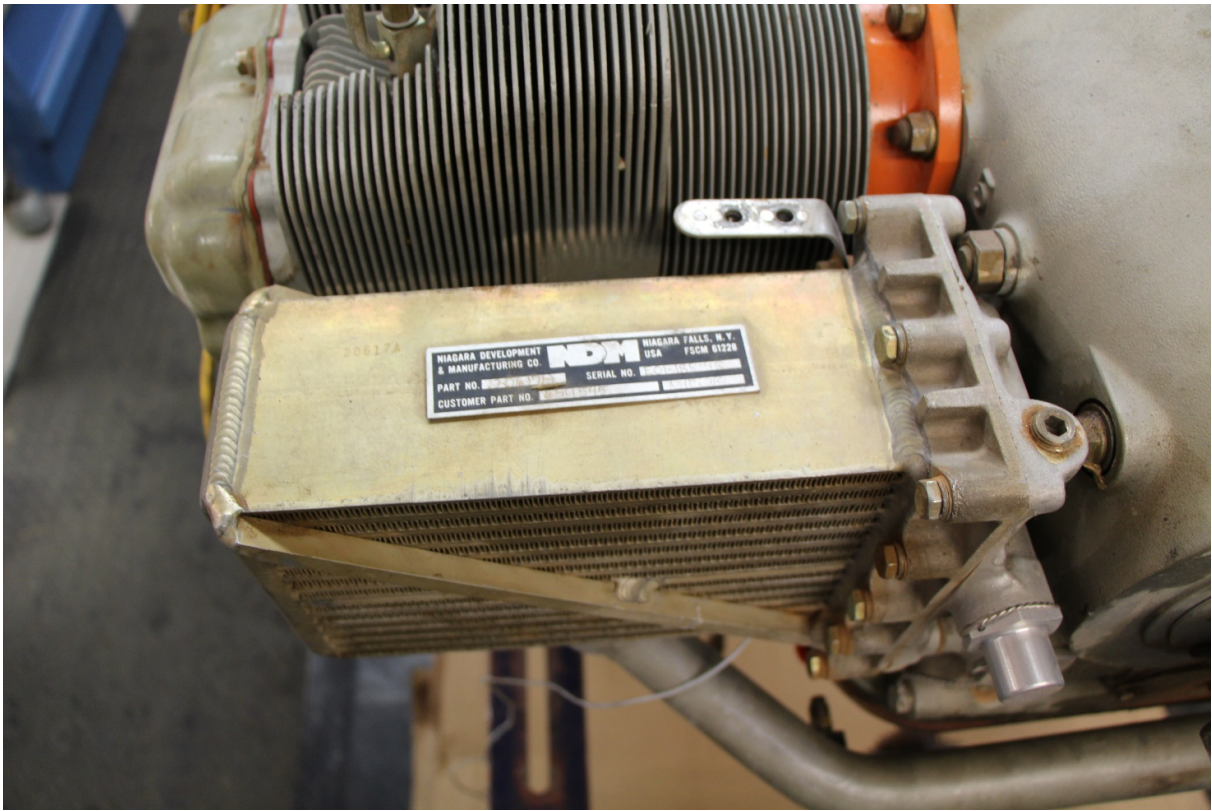


Photograph 8: Left Vacuum Pump

Oil Cooler

The oil cooler was manufactured by Niagara Development and Manufacturing, part no. 20617A, serial no. E01-188-98.

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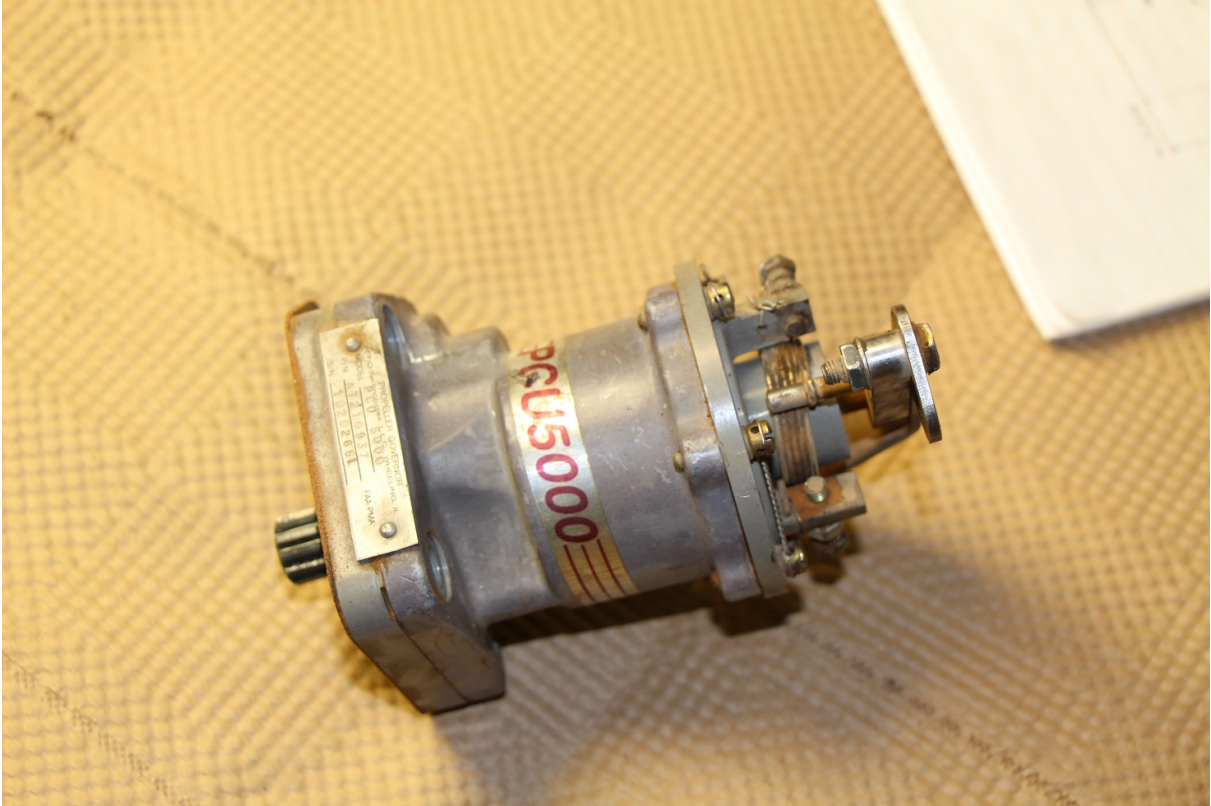


Photograph 9: Oil Cooler

Propeller Governor

The propeller governor was manufactured by Aero Technologies, part no. AT210937, serial no. 10202651.

Pro



Photograph 10: Propeller Governor

Throttle Body Metering Unit

The metering unit was manufactured by TCM, part no. 640563-16A3, serial no. A07FA308R.



Photograph 11: Throttle Body

Fuel Pump

The fuel pump was manufactured by TCM, part no. 646768-1, serial no. B01FA369R.

Fuel



Photograph 12: Fuel Pump

Turbocharger

The turbocharger was manufactured by Kelly Aerospace and noted as a factory rebuild, part no. 6295001-0101, serial no. 406610-9005.



Photograph 13: Turbocharger

Waste Gate

The waste gate was manufactured by Garrett Turbochargers, part no. C165006-0105, serial no. 470908-9011.

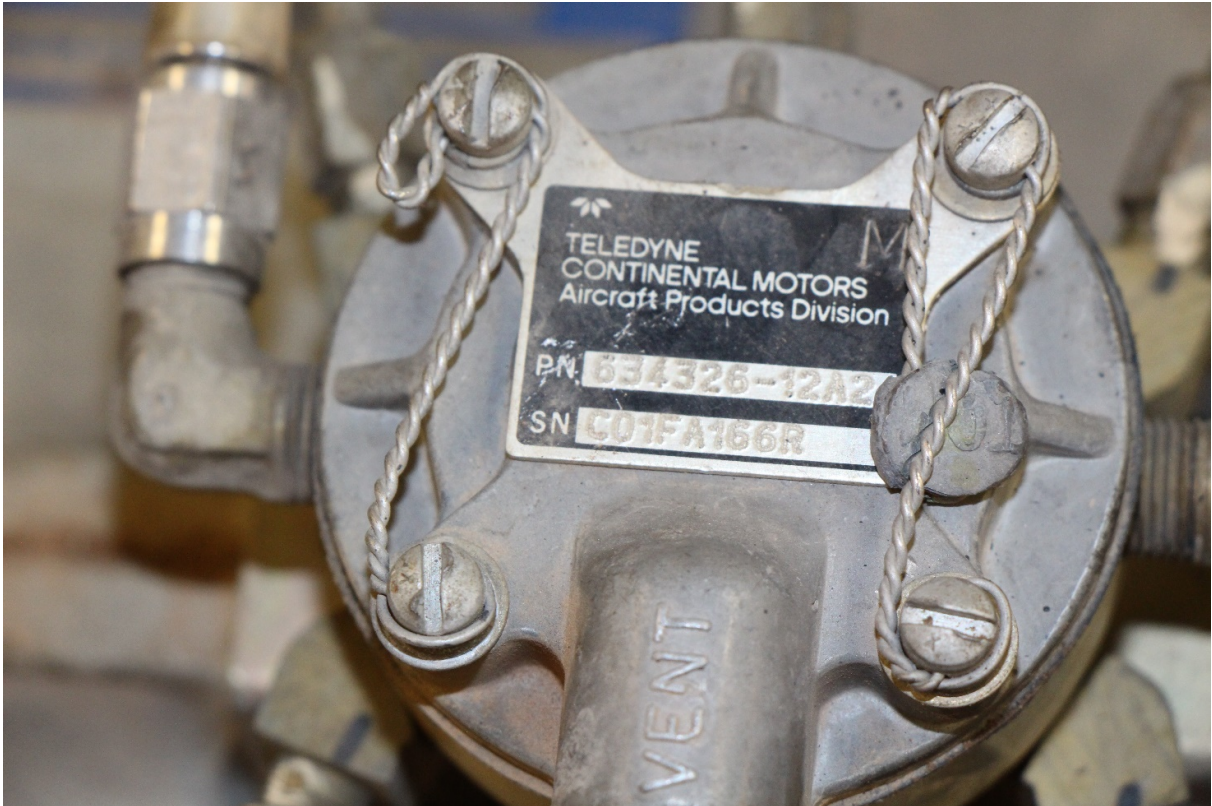
The waste gate from the accident airplane was tested with the factory unit that was used to run the engine. Air was directed through the oil inlet port to close the waste gate butterfly valve and the pressure level was recorded. The pressure level for both units to close the valve was 35 psi.



Photograph 14: Waste Gate

Fuel Manifold

The fuel manifold was manufactured by TCM, part no. 634326-12A2, serial no. C01FA166R.



Photograph 15: Fuel Manifold

Alternator

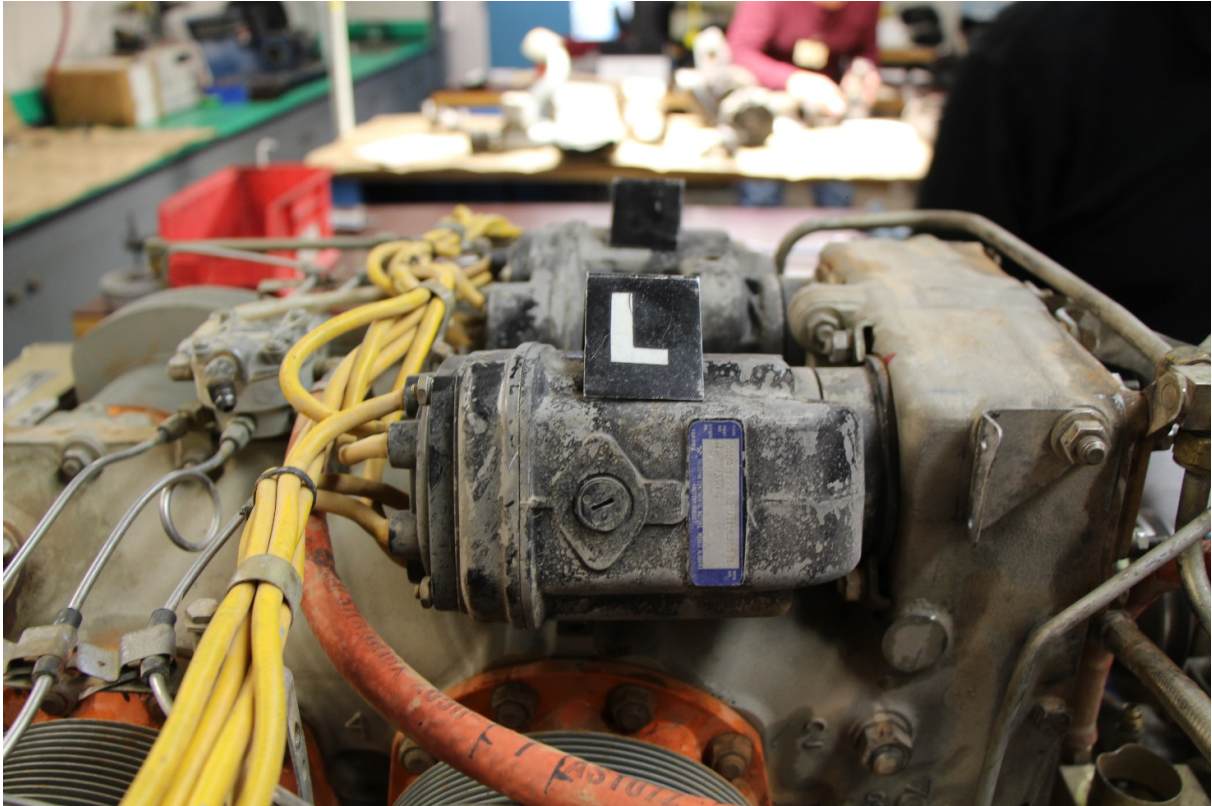
The alternator was manufactured by National Airparts, Inc., part no. F424R, serial no. F003831.



Photograph 16: Alternator

Left Magneto

The left magneto, a TCM unit (part no. BL-349350-4, serial no. F01FA365 R), remained attached the engine case. The magneto was timed to 19° BTDC. There were no signatures on the magneto to indicate that it had been moved during the impact sequence.



Photograph 17: Left Magneto

Right Magneto

The right magneto, a TCM unit (part no. BL-349350-5, serial no. F01FA339 R), remained attached to the engine case. The magneto was timed to 19° BTDC. There were no signatures on the magneto to indicate that it had been moved during the impact sequence.



Photograph 18: Right Magneto

Spark Plugs

The spark plugs, manufactured by Champion (part no. RHB-32E), were removed and examined. The plugs displayed normal wear and were slightly dark and sooty in appearance. The spark plugs were manufactured by Tempest.



Photograph 19: Spark Plugs

ENGINE TEST RUN

The engine was initially run with a replacement fuel manifold diaphragm and started normally, but would not achieve rated manifold pressure initially. It was determined that the turbo charger was not engaging when the throttle was advanced. Several operational adjustments were made while troubleshooting the turbo charger, which included bypassing the turbo controller, replacing a broken scat tube clamp, tightening of loose exhaust and intake valve bolts, repair of a hole in the scat tube, and subsequent replacement of the scat tubing with induction hose. However, none of these changes resulted in the engagement of the turbo during subsequent tests.

The waste gate was replaced with a factory unit prior to subsequent testing and a ram air inlet was installed on the turbo. The engine achieved rated manifold pressure at full power during all subsequent tests. An additional test was performed with the original fuel manifold diaphragm and without the ram air inlet, and the engine achieved rated manifold pressure when advanced to full power. It was noted that the cylinder heat temperature for cylinder no. 2 advanced beyond its red line temperature of 460° F during tests where the engine achieved rated manifold pressure

SUMMARY

The engine started normally during several engine runs and achieved rated manifold pressure when the throttle was advanced to full power.

Appendix A

ENGINE RUN PARAMETERS																
Record	RPM	MP/TDP " Hg	Oil		Fuel				Cell °F	Cylinder Heat Temp (CHT) / Exhaust Gas Temp (EGT) °F						
			PSI	°F	Lbs/Hr	Nozz PSI	Pump PSI	Fuel °F		# 1	# 2	# 3	# 4	# 5	# 6	
1	1200	14.6 / 30.7	65	125	32.4	3.6	9.2	66	64	274 / 1128	263 / 1220	300 / 1202	225 / 1178	261 / 1163	196 / 1260	
2	1600	21.6 / 31.1	57	155	48.5	4.4	11.3	67	65	310 / 1262	295 / 1285	340 / 1238	254 / 1256	295 / 1162	217 / 1253	
3	2100	29.7 / 31.7	48	179	107.6	8.9	13.9	67	66	350 / 1332	329 / 1309	386 / 1312	270 / 1241	340 / 1206	227 / 1231	
4	2450	33.1 / 37.4	48	179	150.5	15.6	26.6	51	61	362 / 1473	457 / 1456	374 / 1491	317 / 1377	372 / 1321	274 / 1341	
5	F/T 2630	36.3 / 38.6	51	169	150.4	20.6	31.7	56	63	326 / 1528	426 / 1498	359 / 1544	320 / 1432	356 / 1387	285 / 1407	
6	Idle 650	19.3 / 30.8	22	169	17.9	3.6	7.0	60	51	268 / 835	298 / 895	265 / 753	203 / 858	207 / 628	137 / 693	
7	2650	36.3 / 37.8	54	165	180	20.0	33.4	56	63	320 / 1561	422 / 1529	365 / 1584	331 / 1470	366 / 1430	298 / 1447	
Ambient Air Temperature °F			Ambient Air Pressure		Transfer Collar Δ P			Maximum Rated Power Engine Operational Parameters								
62.08			29.945		IN OUT		RPM		" Hg MP		Fuel Flow Lbs/Hr		Metered PSI		Unmetered PSI	
					36.1 49.2		2700		36.5		170-186		16.9 – 19.9		33.0 – 37.0	
Notes: Operator – Lisa Jersild. Transfer collar pressure delta measured at full throttle power setting. All recoded data was taken at 5-minute intervals except run 4 (3 minutes), run 5 (2 minutes) and run 7 (2 minutes) due to cylinder head temperatures.																
Engine Performance Test																
Test RPM	Left Magneto		Left Magneto		Right Magneto		Right Magneto									
	RPM		RPM Drop		RPM		RPM Drop									
2072	2012		60		2064		8									
Note: Runs 4,5,6,7 were completed with the slave waste gate assembly. Run 7 the original manifold diaphragm was installed and leak plumbed away from engine.																