



# **Continental Motors**

## **ENGINE OPERATIONAL TEST**

### **REPORT**

<b>DATE</b>	July 24, 2014
<b>REGISTRATION #</b>	N7311U
<b>ENGINE MODEL</b>	TSIO-520-GcM
<b>ENGINE SERIAL</b>	216054-R
<b>INSPECTOR</b>	Phillip Grice
<b>SEARCH CODE</b>	15-12-68

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GENERAL INFORMATION	
DATE OF RUN:	July 24, 2014
FACILITY:	Continental Motors
ADDRESS:	[REDACTED]
TELEPHONE:	[REDACTED]

ENGINE INFORMATION			
MAKE:	Continental Motors		
MODEL:	TSIO-520-GcM		
SERIAL NO.:	216054-R	POSITION:	Single Engine
BUILD DATE:	04/08/1999	DATE IN SERVICE:	05/03/1999
TIME SINCE TOP OVERHAUL:	Not reported	DATE OF TOH:	Not reported
TIME SINCE MAJOR OVERHAUL:	475.1	DATE OF MOH:	3/29/2011
TOTAL TIME:	5092.9		
REMARKS:	All times are taken from the last inspection entry in the engine logbook.		
AIRCRAFT INFORMATION			
ACCIDENT DATE:	05/10/2014	LOCATION:	Page, Arizona
MANUFACTURER:	Cessna	MODEL:	T207A

ATTENDEES	
NAME:	Phillip Grice – Manager, Product Field Performance Johnny Little – Mechanic/Inspector Greg Eastburn – Mechanic/Inspector Kurt Gibson – Air Safety Investigator
ORGANIZATION:	Continental Motors
ADDRESS:	[REDACTED]
TELEPHONE:	[REDACTED]
NAME:	Joshua Cawthra
ORGANIZATION:	IIC National Transportation Safety Board
NAME:	Andrew Hall
ORGANIZATION:	Textron Aviation
NAME:	
ORGANIZATION:	

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ENGINE COMPONENT INFORMATION			
COMPONENT	MANUFACTURER / OVERHAULED BY	PART NUMBER	SERIAL NUMBER / DATE CODES / WORK ORDER #s
Alternator	Plane Power	AL24-F60C	46-94000
Crankcase	CMI	Casting # (L/H): Inaccessible Casting # (R/H): Inaccessible	B269
Crankshaft	CMI	Part #: Inaccessible Forging #: Inaccessible	Serial #: N031A222 Heat Code: Inaccessible
Cylinders	CMI	Part Number: Inaccessible	Serial Number: Inaccessible Head Date: Inaccessible
Fuel Pump	CMI /	646768-1A1	J06?214BR
Fuel Manifold Valve	CMI /	634326-12A1	D129406CR
Fuel Metering Unit	CMI /	Inaccessible	Inaccessible
Fuel Nozzles	CMI	Size: Inaccessible	Not Applicable
Magneto - Left	Slick	6310	10091044
Magneto - Right	Slick	6310	10091043
Prop Governor	McCauley	C290D4-K7T2	812588
Spark Plugs	Champion	RHB23E	N/A
Starter	Kelly Aerospace	646275-1R	H-K121903
Starter Adapter	CMI	Illegible	Not Applicable
Oil Cooler	NDM	20617A	C992752843
Vacuum Pump	Airborne	216CW	58607
Turbo Controller	Kelly Aerospace	470688-7	ID0129
Wastegate	Kelly Aerospace	470908-11	BC0113
Turbocharger	Kelly Aerospace	406610-9005	HCR0168
Overboost Valve	Kelly Aerospace	470944-9012	YD001094

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## ENGINE HISTORY

The engine had undergone a 50 hour inspection on 05/03/2014; the entry indicated the mechanic tightened a loose hose clamp on the #4 cylinder intake coupler.

## EXTERNAL EXAMINATION

The engine exhibited impact damage concentrated at the bottom of the engine. The oil sump sustained impact damage and was crushed. The intake elbow going into the throttle body displayed impact damage and was cracked. The exhaust tailpipe displayed impact damage and was bent. It was noted that two of the intake coupling clamps were only partially secured to the coupling.



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## ENGINE PREPARATION PRIOR TO OPERATIONAL TEST

There were a number of airframe related items removed in preparation for operation on the CMI test bed.

Items removed:

1. Alternator
2. Cooling baffles.
3. Crankcase breather tube and associated hoses and clamps.
4. Propeller governor.
5. Vacuum pump.
6. Air filter and air box assembly

The following substitute or repaired parts were required for engine operation:

1. Fuel system - Fuel lines.
2. Induction system – Elbow going to throttle body.
3. Oil sump.
4. Exhaust – Tail Y–pipe

The cylinders were borescoped and the following was observed:

- Cylinder #1 – There were combustion deposits present in the combustion chamber and on the piston head. There was oil present on the cylinder bore. The cylinder head combustion chamber, intake and exhaust valve faces, piston head and cylinder bore exhibit normal operating signatures.
- Cylinder #2 – There were combustion deposits present in the combustion chamber and on the piston head. There was oil present on the cylinder bore. The cylinder head combustion chamber, intake and exhaust valve faces, piston head and cylinder bore exhibit normal operating signatures.
- Cylinder #3 – There were combustion deposits present in the combustion chamber and on the piston head. There was oil present on the cylinder bore. The cylinder head combustion chamber, intake and exhaust valve faces, piston head and cylinder bore exhibit normal operating signatures.
- Cylinder #4 – There were combustion deposits present in the combustion chamber and on the piston head. There was oil present on the cylinder bore. The cylinder head combustion chamber, intake and exhaust valve faces, piston head and cylinder bore exhibit normal operating signatures.
- Cylinder #5 – There were combustion deposits present in the combustion chamber and on the piston head. There was oil present on the cylinder bore. The cylinder head combustion chamber, intake and exhaust valve faces, piston head and cylinder bore exhibit normal operating signatures.
- Cylinder #6 – There were combustion deposits present in the combustion chamber and on the piston head. There was oil present on the cylinder bore. The cylinder head combustion chamber, intake and exhaust valve faces, piston head and cylinder bore exhibit normal operating signatures.

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A pre engine test cylinder leakage test was performed in accordance with the latest revision of CMI Service Bulletin SB03-3 on each cylinder prior to operation and with the engine at room temperature with the following results: Master orifice reading – 39 PSI

Cylinder #1 - 70/80 PSI (exhaust valve)	Cylinder #2 - 12/80 PSI (exhaust valve)
Cylinder #3 - 72/80 PSI (exhaust valve)	Cylinder #4 - 46/80 PSI (exhaust valve)
Cylinder #5 - 69/80 PSI (exhaust valve)	Cylinder #6 - 6/80 PSI (exhaust valve)

(\*) – Leakage Source

Magneto to Engine Timing CMI Spec. - 22° BTDC	Left Magneto: 25° BTDC	Right Magneto: 23° BTDC
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The engine was not disassembled prior to the engine run.

The crankshaft end-play measured .017” and the crankshaft flange run-out was .003”

The engine was then prepared for operation by installing the appropriate thermocouples, pressure lines and test pads for monitoring purposes.

The engine was then moved to CMI test cell number 43 and mounted for operation.

The engine was fitted with a test club propeller for the TSIO-520-GcM engine model.

### DESCRIPTION OF OPERATIONAL TEST

The engine experienced a normal start on the first attempt without hesitation or stumbling in observed RPM. The engine RPM was advanced in steps for warm-up in preparation for full power operation. The engine throttle was advanced to 1200 RPM and held for five (5) minutes to stabilize. The engine throttle was advanced to 1600 RPM and held for five (5) minutes to stabilize. The engine throttle was advanced to 2450 RPM and held for five (5) minutes to stabilize. The engine throttle was advanced to full open position and held for five (5) minutes to stabilize. The engine throttle was rapidly advanced from idle to full throttle six times where it performed normally without any hesitation, stumbling or interruption in power.

Throughout the test phase, the engine accelerated normally without any hesitation, stumbling or interruption in power and demonstrated the ability to produce rated horsepower.

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## Engine Operational Test Log

Time		RPM	MP "Hg / Turbo Pressure	Oil		Fuel				Cell °F	Cylinder Head Temperature °F					
Reading	Minutes			PSI	°F	Lbs/Hr	Nozzle PSI	Pump PSI	Fuel °F		# 1	# 2	# 3	# 4	# 5	# 6
1	5	1200	14 / 29	59	112	28	1.8	10.8	80	78	247	279	252	243	209	208
2	5	1600	20.6 / 29.8	54	163	47	2.3	13.3	81	78	310	321	315	279	250	217
3	5	2100	27 / 33	54	171	104	3.6	19	83	79	326	346	332	300	279	255
4	5	2450	33 / 38	50	191	162	10.4	33.3	87	79	289	326	318	341	299	302
5	5	F/T 2620	37.3 / 37.8	47	200	180	13.3	32.6	87	80	313	414	356	374	327	332
6	5	Idle 1000	12 / 29	60	102	20	1.8	9.7	78	78	222	250	228	222	197	187
7	5															

Ambient Air Temperature °F	Ambient Air Pressure	Transfer Collar ΔP		Maximum Rated Power Engine Operational Parameters				
80.9	30.00	In	Out	RPM	" Hg MP	Fuel Flow Lbs/Hr	Metered PSI	Unmetered PSI
		45	40	2700	N/A	170-186	16.9-19.9	33-37

Notes: Operator – Johnny Little, 30524. Transfer collar pressure delta measured at full throttle power setting.

Engine Performance Test				
Test RPM	Left Magneto	Left Magneto	Right Magneto	Right Magneto
	RPM	RPM Drop	RPM	RPM Drop
2100	2004@2100	96	1976@2094	118

A post engine test cylinder leakage test was performed in accordance with the latest revision of CMI Service Bulletin SB03-3 on each cylinder with the engine hot. The results are as follows:

Master orifice reading – 39 PSI

Cylinder #1 - 72/80 PSI (rings)

Cylinder #2 - 68/80 PSI (rings)

Cylinder #3 - 72/80 PSI (rings)

Cylinder #4 - 66/80 PSI (rings)

Cylinder #5 - 78/80 PSI (rings)

Cylinder #6 - 77/80 PSI (rings)

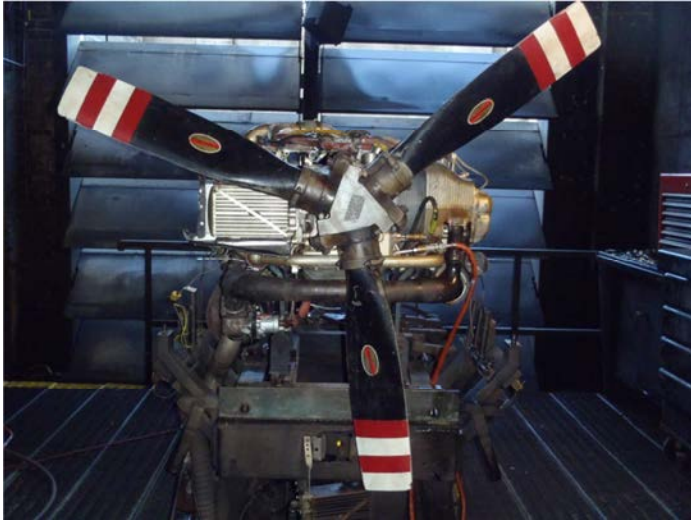
(\*) – Leakage Source



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## ENGINE OPERATIONAL TEST CONCLUSION

The operation of this engine was normal and did not reveal any abnormalities that would have prevented normal operation and production of rated horsepower. An inspection of the spark plug electrodes after the engine run displayed normal operation signatures.



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**ENGINE DISPOSITION**

The engine was shipped to the following address per the NTSB IIC upon the completion of the operational test:

Air Transport



Phoenix, AZ 85009