ENGINE OPERATIONAL TEST

REPORT

DATE	December 02, 2014
REGISTRATION #	N147MP
ENGINE MODEL	IO-550-N16B
ENGINE SERIAL	687928
INSPECTOR	Phillip Grice
SEARCH CODE	15-12-68

GENERAL INFORMATION	
DATE OF RUN:	12/02/2014
FACILITY:	Continental Motors
ADDRESS:	[redacted], Mobile, AL 36615
TELEPHONE:	[redacted]

ENGINE INFORMATION					
MAKE:		Continental Motors			
MODEL:		IO-550-N16B			
SERIAL NO.:	687928		**POSITION:**	Single Engine	
BUILD DATE:	11/17/2003		**DATE IN SERVICE:**	Not reported	
TIME SINCE TOP OVERHAUL:		52.6	**DATE OF TOH:**		10/09/2013
TIME SINCE MAJOR OVERHAUL:		N/A	**DATE OF MOH:**		N/A
TOTAL TIME:	967.3 (time at last annual)				
REMARKS:	All times were the times at the last annual inspection.				

AIRCRAFT INFORMATION			
ACCIDENT DATE:	07/30/2014	**LOCATION:**	San Diego, California
MANUFACTURER:	Mooney	**MODEL:**	M20L

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], Mobile, AL 36615
TELEPHONE:	[redacted]
NAME:	Tom Little
ORGANIZATION:	IIC National Transportation Safety Board
NAME:	Millicent Hoidal
ORGANIZATION:	National Transportation Safety Board
NAME:	
ORGANIZATION:	

ENGINE COMPONENT INFORMATION

COMPONENT	MANUFACTURER / OVERHAULED BY	PART NUMBER	SERIAL NUMBER / DATE CODES / WORK ORDER #s
Alternator	CMI	646843	003JA160
Crankcase	CMI	Casting # (L/H): 653922 Casting # (R/H): 653921	R03JA356
Crankshaft	CMI	Part #: Inaccessible Forging #: Inaccessible	Serial #: N03JA137 Heat Code: Inaccessible
Cylinders	CMI	Part Number: Inaccessible	Serial Number: Not recorded
Fuel Pump	CMI	655921-1A5	B03JA075
Fuel Manifold Valve	CMI	646433-5A2	C03JA058
Fuel Metering Unit	CMI	653353-5A1	A03JA061
Fuel Nozzles	CMI	Size: Inaccessible	Not Applicable
Magneto - Left	CMI	10-500556-1	D10HA027R
Magneto - Right	CMI	10-500556-1	D03KA010
Prop Governor	McCauley	C290D8 /T1	040106
Spark Plugs	Champion	RHB32E	N/A
Starter	CMI / Kelly Aerospace	655566F24V	03 174 0023
Starter Adapter	CMI	Illegible	Not Applicable
Tachometer Generator	N/A	N/A	N/A
Vacuum Pump	N/A	N/A	N/A

ENGINE HISTORY

The last annual inspection was performed on 06/18/2014 at a tachometer time of 2522.9. The engine had a top overhaul on 10/09/2013 at a tachometer time of 2470.3.

EXTERNAL EXAMINATION

The engine exhibited impact damage concentrated at the bottom of the engine. The oil sump was crushed and breached, the oil filter had broken free from the oil filter adapter, three of the four engine mounts were broken, the exhaust was bent and crushed, the #2 intake push rod housing was bent, and the oil cooler was dented.


FLAMMABLE
KEEP FIRE AWAY

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. Cooling baffles.
2. Crankcase breather tube and associated hoses and clamps.
3. Propeller governor.

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

1. Fuel system - Fuel lines.
2. Mounts, engine – all of the engine mounts were replaced.
3. Exhaust stacks
4. Oil sump (hard sump was installed for engine mounts).
5. Oil return lines: 1, 3, 5 side
6. #2 intake pushrod housing
7. Oil filter and oil filter adapter fitting

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.

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 – 37 PSI

Cylinder #1 - 9/80 PSI (exhaust valve) Cylinder #2 - 15/80 PSI (exhaust valve)
Cylinder #3 - 10/80 PSI (exhaust valve) Cylinder #4 - 15/80 PSI (exhaust valve)
Cylinder #5 - 11/80 PSI (exhaust valve) Cylinder #6 - 38/80 PSI (exhaust valve)

(*) – Leakage Source

Magneto to Engine Timing CMI Spec. - 22° BTDC	Left Magneto: 25° BTDC	Right Magneto: 24° BTDC

Prior to the engine run the propeller governor was removed and disassembled for a visual inspection. The flyweights, spring, pump gears, valve, and associated components displayed normal operating signatures.

The engine was not disassembled prior to the engine run.

The crankshaft end-play measured .007", the crankshaft flange run-out was .003" the deflection was .002"

It was noted during the oil sump removal there was several large pieces of orange material consistent with the alternator drive coupling; it was noted that the installed alternator drive coupling was intact with no missing portions.

The #2 intake push rod was removed and visually inspected for possible damage resulting from the impact damage to the push rod housing; there was no damage noted. The push rod was installed in a serviceable push rod housing.

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 IO-550-N 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.

It was noted that there was an oil leak in the left rear of the engine; the oil leak was consistent with the impact damage to the oil filter adapter and the oil cooler.

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

Engine Operational Test Log

Time		RPM	MP "Hg	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	12.2	60	112	31	6.7	15.5	64	64	212	219	225	198	165	156
2	5	1600	16.5	56	152	48.5	7.0	19.5	64	64	256	266	270	228	193	186
3	5	2100	21.8	50	172	81.3	10.4	24.5	67	67	313	310	319	271	229	206
4	5	2450	25.8	52	188	119	15.2	28.5	68	68	334	359	363	313	242	242
5	5	F/T 2676	29.1	50	207	156.3	22	29.8	69	68	386	409	404	342	267	263
6	5	Idle 780	15.4	27	211	21.1	6.3	12.3	66	67	273	301	279	246	182	167
7	5															

Ambient Air Temperature °F	Ambient Air Pressure	Transfer Collar Δ P		Maximum Rated Power Engine Operational Parameters				
		In	Out	RPM	" Hg MP	Fuel Flow Lbs/Hr	Metered PSI	Unmetered PSI
62.7	30.29	35	22	2700	N/A	160	19.0-21.3	N/A

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

Engine Performance Test				
Test RPM	Left Magneto RPM	Left Magneto RPM Drop	Right Magneto RPM	Right Magneto RPM Drop
2100	2084@2148	64	2072@2120	48

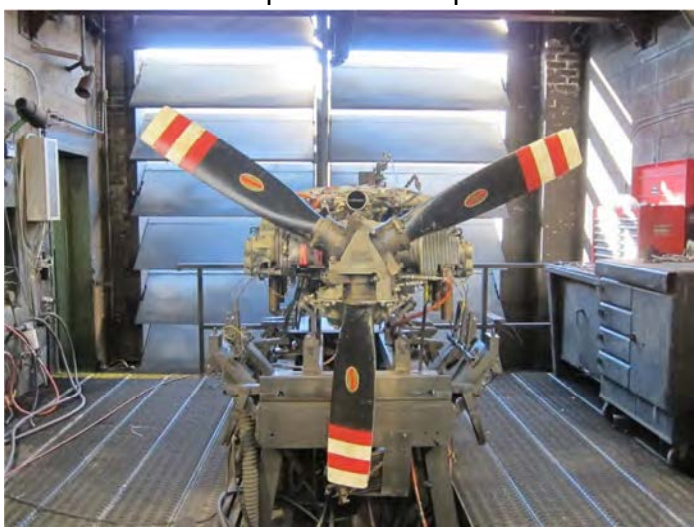
A post engine test cylinder leakage test was performed in accordance with the latest revision of CMI Service Bulletin SB03-3 on each cylinder with the engine hot. The results are as follows:
Master orifice reading – 39 PSI

Cylinder #1 - 75/80 PSI (rings)
Cylinder #2 - 71/80 PSI (rings)
Cylinder #3 - 74/80 PSI (rings)
Cylinder #4 - 72/80 PSI (rings)
Cylinder #5 - 73/80 PSI (rings)
Cylinder #6 - 69/80 PSI (rings)

(*) – Leakage Source

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.



ENGINE DISPOSITION

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

Air Transport Recovery
[redacted]
Phoenix, AZ 854009