



Continental Motors, Inc.

ENGINE EXAMINATION REPORT

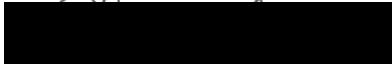
ENGINE MODEL: IO550N

ENGINE SERIAL: 686258

AIRCRAFT MODEL: LC42-550

SERIAL NUMBER: 42003

REGISTRATION: N6506L

Examiner	Signature	Date
Phillip Grice		April 30, 2013

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GENERAL INFORMATION			
EXAMINATION		ENGINE RECEIVED	
Date	April 30, 2013	Date	04/22/2013
Facility	Continental Motors Inc.	RGA #	253296
Address	2039 Broad Street	FROM	Anglin Aircraft Recovery
City	Mobile	NTSB/FAA Tagged	Yes
State and Zip	Alabama 36615	Box Sealed	Yes
ENGINE INFORMATION			
Make	Continental Motors Inc.		
Model	IO550N		
Serial No.	686258		
Total Time	1088.4 from Air Care Aviation services logbook copies dated 02/11/2013		
Time SOH	N/A		
Build Date	03/31/2002		
In Service Date	Not reported		
Removal Date	Not reported		
AIRCRAFT / ACCIDENT INFORMATION			
Aircraft Make	Lancair		
Aircraft Model	LC42-550		
Aircraft Serial No.	42003		
Registration No.	N6506L		
Accident Date	03/31/2013		
Accident Location	Winston – Salem, North Carolina		
Significant logbook information: An Air-wolf oil / air separator was installed on March 28, 2007 that required use of an air-syphon pump and a pushrod shroud tube oil return. On October 20, 2009, the pushrod tube oil return hose was replaced due to being cracked and distorted.			
Report Summary:		Search Code:	15-12-40
The inspection of this engine revealed the engine suffered an oil starvation event. The number three, four, five and six connecting rods released from the crankshaft. The number six connecting rod departed the crankcase and was not returned with this exhibit. MFD data indicated a loss of oil pressure over the course of the accident flight.			
Disposition of engine following exam: Per instructions from the NTSB IIC, the engine was shipped to Anglin Aircraft Recovery Service in Clayton, DE.			

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Inspection Witnesses			
Inspector	Phillip Grice	Mechanic	Johnny Little
Organization	Continental Motors	Organization	Continental Motors Inc.
Witness	Aaron Sauer	Mechanic	Gregory Eastburn
Organization	NTSB	Organization	Continental Motors Inc.
Witness	Jan Smith	Witness	Chris Lang
Organization	Cessna Aircraft Company	Organization	Continental Motors Inc.

EXTERNAL INSPECTION OF ENGINE: The engine exhibits extreme thermal damage as a result of the post-crash fire. The crankcase is breached above the number four, five, and six cylinders.



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AIRFRAME PARTS RETURNED WITH ENGINE: Cooling baffles, air conditioning compressor, propeller governor, induction port drain valve and hoses, fuel flow transducer and portions of wiring harnesses, hoses, and tubing and control cables.

ENGINE COMPONENT EXAMINATION

Magneto to Engine Timing
TCM Spec. - 22° BTDC

Left Magneto: Degrees No rotation

Right Magneto: Degrees No rotation

Exhaust System

Condition: Partial exhaust system components were returned with the engine.



Starter Manufacturer: Illegible

Part Number:

Serial #:

Condition: The starter exhibited thermal damage and the drive did not rotate by hand.



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Starter Adapter Part Number: Illegible.

Date Code: Illegible.

Condition: The starter adapter was intact, turned freely by hand and exhibited thermal damage.



Ignition Harness Manufacturer: Illegible

Model/Part Number: Not Marked

Serial #: Not Marked

Condition: All leads exhibited thermal damage.

L/H Magneto Manufacturer: TCM

Model/Part Number: S6RSC-25

Serial #: D05EA210

Condition: The left-hand magneto exhibited thermal damage turned freely with impulse coupling engagement. The magneto was disassembled and the internal components exhibited thermal damage.



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R/H Magneto

Manufacturer: TCM

Model/Part Number: S6RSC-25

Serial #: D03JA169

Condition: The right-hand magneto exhibited thermal damage and turned freely with impulse coupling engagement. The magneto was disassembled and the internal components exhibited damage.



Fuel Pump

Manufacturer: TCM

Part Number: 646921-1A4

Serial #: B09EA013

Condition: The fuel pump exhibited thermal damage and turned freely. The fuel pump drive was intact and undamaged. The fuel pump disassembled with no anomalies noted except thermal damage.



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Oil Pump

Part number: Illegible

Lot number:

Condition: The oil pump drive was intact. The oil pump cavity contained evidence of hard particle passage. The oil pump gear teeth exhibited normal operating signatures. The oil pressure relief valve and seat contained no obstructions and exhibited signatures of proper seating.



Oil Filter

Manufacturer: Champion

Part number:

Condition: The oil filter housing was cut open using the Champion cutting tool and the filter element was cut from the canister to allow examination. The oil filter element was examined and contained flakes and slivers from the damaged internal engine components.



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Spark Plugs

Manufacturer: Champion

Part number: RHB32E

Condition: The top and bottom sparkplugs had normal wear signatures in accordance with the Champion aviation check-a-plug comparison chart.



Alternator

Manufacturer: Illegible

Part Number: ALX6526

Serial #: J050652

Condition: The alternator exhibited thermal and impact damage and the drive did not rotate.



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Oil Cooler

Manufacturer: Illegible

Model/Part Number: Illegible

Serial #: Illegible

Condition: The oil cooler exhibited thermal and impact damage.



Oil Sump

Condition: The oil sump drain plug was safety wired. The oil sump exhibited impact and thermal damage. The oil sump contained metal and a residual amount of oil.



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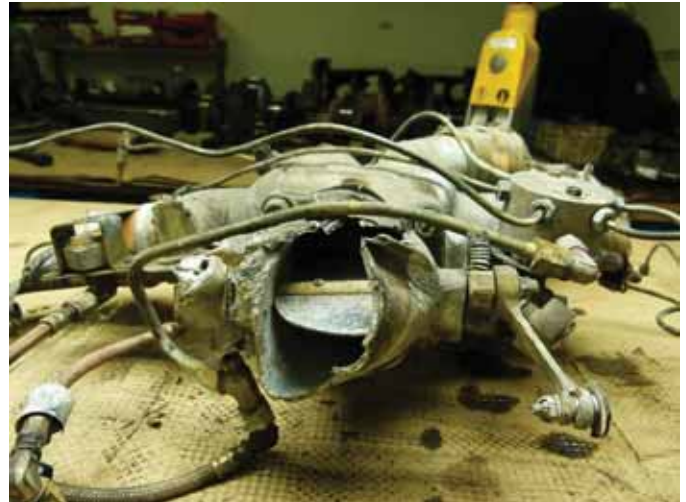
Oil Pick-up Tube & Screen

Condition: The oil pick-up tube was undamaged. The oil suction screen was unrestricted.



Induction System

Condition: The induction risers and exhibited impact and thermal damage.



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Cylinder #1 Part Number: 655465 Head Date: 8-10 Barrel Surface: Steel
Serial #: AC10EB035 Work Order Numbers: None

Condition: The spot putty was not evident on the cylinder hold-down nuts. The cylinder combustion chamber had a normal amount of combustion deposits and the bore condition was free of scoring and undamaged. The cylinder skirt exhibited damage from the internal components of the engine. The intake and exhaust valve heads exhibited normal deposits and operating signatures. The rocker box area had an oil residue indicating lubrication to the overhead. The cylinder overhead components (valves, rocker arms, guides, springs, retainers and shafts) exhibited thermal damage.



Cylinder #2 Part Number: 655465 Head Date: 11-08 Barrel Surface: Steel
Serial #: AC08JC691 Work Order Numbers: None

Condition: The spot putty was not evident on the cylinder hold-down nuts. The cylinder combustion chamber had a normal amount of combustion deposits and the bore condition was free of scoring and undamaged. The cylinder skirt exhibited damage from the internal components of the engine. The intake and exhaust valve heads exhibited normal deposits and operating signatures. The rocker box area had an oil residue indicating lubrication to the overhead. The cylinder overhead components (valves, rocker arms, guides, springs, retainers and shafts) were lubricated and undamaged.



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Cylinder #3 Part Number: 655465 Head Date: 3-02 Barrel Surface: Steel
Serial #: U218 Work Order Numbers: None

Condition: The spot putty was not evident on the cylinder hold-down nuts. The cylinder combustion chamber had a normal amount of combustion deposits and the bore condition was free of scoring and undamaged. The cylinder skirt exhibited damage from the internal components of the engine. The intake and exhaust valve heads exhibited normal deposits and operating signatures. The rocker box area had an oil residue indicating lubrication to the overhead. The cylinder overhead components (valves, rocker arms, guides, springs, retainers and shafts) were lubricated and undamaged.



Cylinder #4 Part Number: 655465 Head Date: 3-02 Barrel Surface: Steel
Serial #: T709 Work Order Numbers: None

Condition: The spot putty was not evident on the cylinder hold-down nuts. The cylinder combustion chamber had a normal amount of combustion deposits and the bore condition was free of scoring and undamaged. The cylinder skirt exhibited damage from the internal components of the engine. The intake and exhaust valve heads exhibited normal deposits and operating signatures. The rocker box area had an oil residue indicating lubrication to the overhead. The cylinder overhead components (valves, rocker arms, guides, springs, retainers and shafts) were lubricated and undamaged.



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Cylinder #5 Part Number: 655465 Head Date: 8-10 Barrel Surface: Steel
Serial #: EB024 Work Order Numbers: None

Condition: The spot putty was not evident on the cylinder hold-down nuts. The cylinder combustion chamber had a normal amount of combustion deposits and the bore condition was corroded and exhibited thermal damage. The cylinder skirt exhibited damage from the internal components of the engine. The intake and exhaust valve heads exhibited normal deposits and operating signatures. The rocker box area had an oil residue indicating lubrication to the overhead. The cylinder overhead components (valves, rocker arms, guides, springs, retainers and shafts) were lubricated and undamaged.



Cylinder #6 Part Number: 655465 Head Date: 3-02 Barrel Surface: Steel
Serial #: T722 Work Order Numbers: None

Condition: The spot putty was not evident on the cylinder hold-down nuts. The cylinder combustion chamber had a normal amount of combustion deposits and the bore condition was free of scoring and undamaged. The cylinder skirt exhibited damage from the internal components of the engine. The intake and exhaust valve heads exhibited normal deposits and operating signatures. The rocker box area had an oil residue indicating lubrication to the overhead. The cylinder overhead components (valves, rocker arms, guides, springs, retainers and shafts) were lubricated and undamaged.



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Rocker Arm and Shaft

Condition: The intake and exhaust rocker arms and shafts exhibited normal operating signatures and signs of thermal damage from the post-crash fire.



#1 Piston, Rings and Pin

Piston Part Number: 654857

Condition: The piston head exhibited a normal amount of combustion deposits and the piston skirt was impact damaged by the internal components of the engine. The piston pin and plug assembly was intact and exhibited damage.



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#2 Piston, Rings and Pin Piston Part Number: 654857

Condition: The piston head exhibited a normal amount of combustion deposits and the piston skirt was impact damaged by the internal components of the engine. The piston pin and plug assembly was intact and undamaged.



#3 Piston, Rings and Pin Piston Part Number: 654857

Condition: The piston head exhibited a normal amount of combustion deposits and the piston skirt was intact and undamaged. The piston pin and plug assembly was intact and undamaged.



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#4 Piston, Rings and Pin Piston Part Number: 654857

Condition: The piston head exhibited a normal amount of combustion deposits and the piston skirt was impact damaged by the internal components of the engine. The piston had dark soot indicating post-crash fire damage. The piston pin and plug assembly was intact and undamaged.



#5 Piston, Rings and Pin Piston Part Number: 654857

Condition: The piston head exhibited a normal amount of combustion deposits and the piston skirt was undamaged. The piston had dark soot indicating post-crash fire damage. The piston pin and plug assembly was intact and undamaged.



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#6 Piston, Rings and Pin Piston Part Number: 654857

Condition: The piston head exhibited a normal amount of combustion deposits and the piston skirt exhibited impact damage with the internal components of the engine. The piston was fractured below the piston pin and portions found in the oil sump contents.



Lifter	#1	#3	#5	#2	#4	#6
Intake	653888	653888	653888	653888	653888	653888
Exhaust	653877	653877	653877	653877	653877	653877

Condition: The lifter faces were damaged and exhibited thermal damage from the post-impact fire.

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Crankshaft Forging number: 649878 Serial number: N02BA500 Heat code: KAAN

Condition: The crankshaft and counterweight assembly exhibited lubrication distress, thermal damage, and mechanical damage concentrated at the number three, four, five and six connecting rod journals. The crankshaft cluster gear was intact and exhibited normal operating signatures. The gear bolts were tight and safety wired and the gear teeth were undamaged. The crankshaft main bearing journals were intact, undamaged and exhibited thermal damage signatures. The front and rear set of counterweight assemblies were intact and exhibited thermal damage from the post-crash fire. All of the counterweight pins, plates and snap-rings were intact. The number four connecting rod journal exhibited thermal distress and scoring from lack of sufficient lubrication. The number five connecting rod journal exhibited signs of lubrication distress, thermal discoloration, mechanical damage and displacement of the journal material. The number six connecting rod journal exhibited signs of lubrication distress, thermal discoloration, mechanical damage and displacement of the journal material. Excluding the displacement of journal material on number five and six, the oil transfer passages were open and unrestricted. Alternator drive face gear teeth were intact and undamaged. The oil transfer collar was intact and undamaged. The oil transfer plug was tight and in position.



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#1 Connecting Rod Part #: 655911 Forging #: 646126F Serial #: AE02CA368

Condition: The connecting rod assembly was intact and exhibited thermal discoloration. The connecting rod nuts and bolts were intact.

#1 Connecting Rod Bearings Part #: 642398 Date Code: Not Reported

Condition: The connecting rod bearing exhibited lubrication distress and thermal smearing of the surface babbit, exposing the copper layer.



#2 Connecting Rod Part #: 655911 Forging #: 646126F Serial #: AE02CA386

Condition: The connecting rod assembly was intact and exhibited thermal discoloration. The connecting rod nuts and bolts were intact.

#2 Connecting Rod Bearings Part #: 642398 Date Code: Not Reported

Condition: The connecting rod bearing exhibited lubrication distress and thermal smearing of the surface babbit, exposing the copper layer.



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#3 Connecting Rod Part #: 655911 Forging #: 646126F Serial #: AE02CA376

Condition: The connecting rod exhibited extreme thermal and mechanical damage and was fractured through at the base of the I-beam, separating of both sections of bearing supports. Fragments of connecting rod cap exhibited thermal and mechanical damage. Fragments of connecting rod bolts and nuts were fractured through and exhibited mechanical damage and overload signatures.

#3 Connecting Rod Bearings Part #: *illegible* Date Code: *illegible*

Condition: Only fragments and the connecting rod bearing remained. These fragments of the bearing exhibited lubrication and thermal distress and were found in the oil sump.



#4 Connecting Rod Part #: 655911 Forging #: Serial #: AE02CA446

Condition: The connecting rod exhibited extreme thermal and mechanical damage and was fractured through at the base of the I-beam, separating of both sections of bearing supports. Fragments of connecting rod cap exhibited thermal and mechanical damage. Fragments of connecting rod bolts and nuts were fractured through and exhibited mechanical damage and overload signatures. Fragments from the oil sump could not be matched with their location in the engine.

#4 Connecting Rod Bearings Part #: *illegible* Date Code: *illegible*

Condition: Only fragments and the connecting rod bearing remained. These fragments of the bearing exhibited lubrication and thermal distress and were found in the oil sump.



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#5 Connecting Rod Part #: 655911 Forging #: Serial #: AE02CA413

Condition: The connecting rod exhibited extreme thermal and mechanical damage and was fractured through at the base of the I-beam, separating of both sections of bearing supports. Fragments of connecting rod cap exhibited thermal and mechanical damage. Fragments of connecting rod bolts and nuts were fractured through and exhibited mechanical damage and overload signatures.

#5 Connecting Rod Bearings Part #: *illegible* Date Code: *illegible*

Condition: Only fragments and the connecting rod bearing remained. These fragments of the bearing exhibited lubrication and thermal distress and were found in the oil sump. Fragments from the oil sump could not be matched with their location in the engine.



#6 Connecting Rod Part #: 655911 Forging #: 646126F Serial #: Missing

Condition: The number six connecting rod was not returned with this exhibit.

#6 Connecting Rod Bearings Part #: *illegible* Date Code: *illegible*

Condition: Only fragments and the connecting rod bearing remained. These fragments of the bearing exhibited lubrication and thermal distress and were found in the oil sump. Fragments from the oil sump could not be matched with their location in the engine.



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Camshaft

Part number: 654084

Serial Number: Z02BA155

Condition: The camshaft lobes exhibited normal operating signatures. The camshaft had thermal damage from the post impact fire. The gear teeth were intact and undamaged. The gear bolts were tight and safety wire was present.



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Crankcase Casting Number 1-3-5 Side: 653921 2-4-6 Side: 653920 Serial number: R02BA311

Work Order Numbers: None

Condition: The crankcase exhibited exterior damage concentrated at the number four, five and six cylinder bays. The remaining cylinder bays were intact and exhibited mechanical damage. The main bearing support mating surfaces were intact and exhibited no signs of fretting or bearing tang lock-slot elongation. The main bearing support diameters were intact and exhibited no signs of bearing movement or rotation. The oil galleys and passages in the left and right crankcase halves were intact, clear and unrestricted.

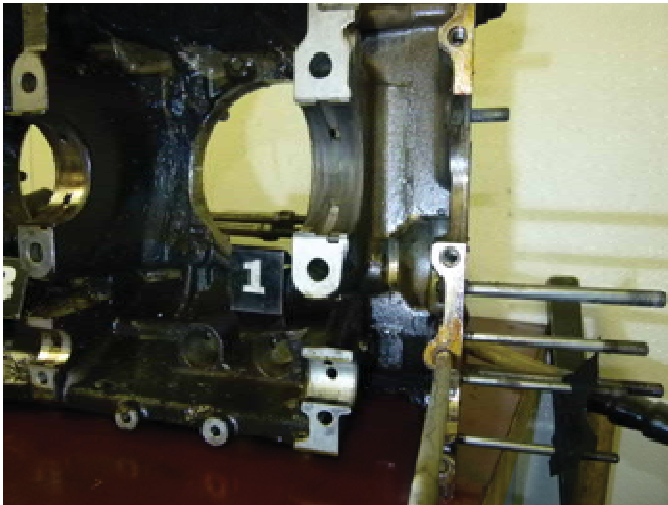


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#1 Main Bearings Part #: 634503

Date Code: Not recorded

Condition The #1 (rear) bearings exhibited contamination imbedded in the surface layer. The bearings exhibited lubrication distress and thermal smearing of the surface babbitt.



#2 Main Bearings Part #: 634503

Date Code: Not recorded

Condition The #2 (intermediate) bearings exhibited contamination imbedded in the surface layer. The bearings exhibited lubrication distress and thermal smearing of the surface babbitt.



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#3 Main Bearings Part #: 634503

Date Code: Not recorded

Condition The #3 (intermediate) bearings exhibited contamination imbedded in the surface layer. The bearings exhibited lubrication distress and thermal smearing of the surface babbit.



#4 Main Bearings Part #: 653547

Date Code: Not recorded

Condition The #4 (front) bearings exhibited contamination imbedded in the surface layer. The bearings exhibited lubrication distress and thermal smearing of the surface babbit.



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#5 Main Bearings Part #: 653547

Date Code: Not recorded

Condition The #5 (front) bearings exhibited contamination imbedded in the surface layer. The bearings exhibited lubrication distress and thermal smearing of the surface Babbitt.



Accessory Gears

Condition: Continuity was confirmed visually. The teeth were undamaged and exhibited normal operating signatures.



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Propeller Governor Part number: Illegible

Serial Number:

Condition: The propeller governor could be rotated by hand, was intact and exhibited thermal damage. The propeller governor gasket was removed and the oil screen was free of obstruction.

