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FAA Designated Airworthiness Representative

November 20, 2013

BEEHCRAFT BARON E55 N138TL

ENGINE TEARDOWN TECHNICAL INSPECTION REPORT

Victor Sloan of Victor Aviation Service, Inc. asked me to observe and document the teardown and inspection of two Teledyne Continental Motors Engines Model IO-520-C serial numbers 267738-R (Left Engine) and 267651-R (Right Engine).

The subject engines were overhauled on December 8th, 2000 by Victor Aviation Service, Inc. under work orders #12457 (S/N 267651-R) Left Engine and #12458 (S/N 267738-R) Right Engine as "Power-By-Victor" Black Edition Engine Series thirteen years ago on December 8th, 2000.

Engines were installed in Beechcraft Baron Model E55 registration number N138TL serial number TE1076 for the aircraft owner - Kenneth Copeland, in Fort Worth, Texas on January 22nd, 2001. The aircraft is currently owned by Tracy Harris from Texarkana, Arkansas. Since the engines were installed they have been operated for 1,879.5 hours and thirteen calendar years with no major repairs performed to them. The engines are now in the process of being overhauled by Victor Aviation for the second time and are being upgraded to Victor's XR Black Edition VII Engine Series under Work Order numbers #16891 and #16892.

From inspection of the aircraft engine log book records these engines have not been removed from the aircraft or disassembled since the original date of installation on January 22nd, 2001. No modifications to the engines from their original type design have been performed with the exception of a Bracket Air Filter S.T.C. ASE09217SC and Flowed Fuel Injectors S.T.C. SA71GL.



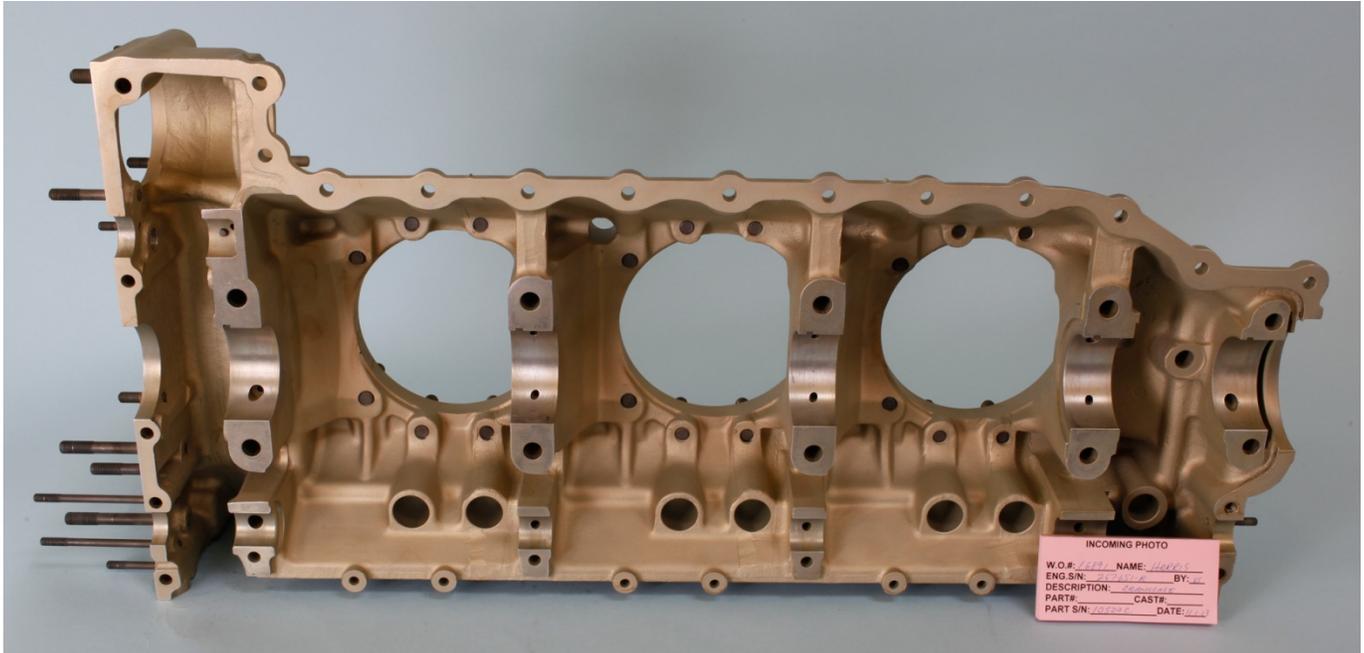
#12457 (S/N 267651-R) Left Engine



#12458 (S/N 267738-R) Right Engine

Observations

1. Prior to the engine disassembly the condition of the exterior of the engines were documented in the as removed condition. Signs of cosmetic wear to engine cylinder baffling, installation hoses, and some chaffing marks were noted which is normal to an engine installation. General condition of engines exterior enamel paint and black electrostatic powder coating on engine crankcases, cylinders, and valve covers was above average with no signs of corrosion. The black electrostatic powder coating material that was originally applied at overhaul was not chipping or faded and showed superb bonding to the aluminum engine surfaces still reflecting a gloss finish. All twelve of the engines cylinder assemblies are the original cylinders that were installed by Victor Aviation and have never been replaced or rebuilt since overhaul of the engines were performed on December 8th, 2000.
2. Inspection and observation of the disassembled engines were impressive. The engines crankcases, cylinders and pistons showed no defects, signs of overheat or cracking. Engine crankcases were in good condition with no cracks or corrosion observed and no fretting on the crankcase parting surfaces or indications of any bearing movement. Piston rings were free and rotating in all piston ring lands and some cylinders still showed the machined barrel surface cross hatch marks from the original cylinder machining at Victor Aviation with minimum barrel wear observed.

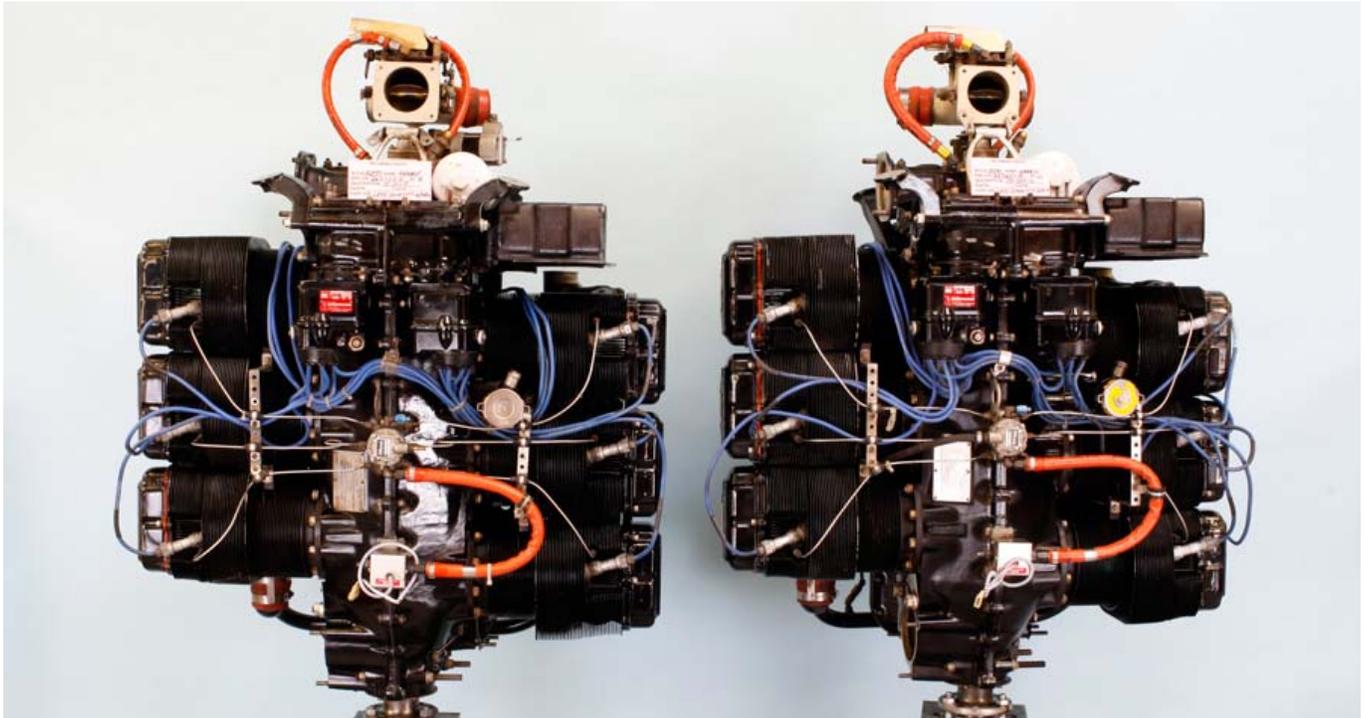


After Black Electrostatic Powder Coating Removed - Crankcase ENGINE S/N 267651-R



After Black Electrostatic Powder Coating Removed - Crankcase ENGINE S/N 267651-R

- 3. Both of the engine’s crankshafts, counterweights, counterweight bushings, counterweight pins and plates dimensions were measured and checked and still remain within the engine manufacturer’s new parts limits and wear was minimally detectable. This would indicate a very high degree of engine balancing was performed on these engines.



LEFT ENGINE S/N 267651-R 1,879.5 hours SMOH

RIGHT ENGINE S/N 267738-R 1,879.5 hours SMOH

Dimensional Inspection of Internal Engine Parts

Crankshaft Connecting Rod Journals

Factory New Parts Limits: Maximum 2.250 Minimum 2.249 Service Limit 2.247

Connecting Rod Journal Measurements: Engine S/N 267738-R Crankshaft S/N 860632U

#1 - 2.2491 #2 - 2.2492 #3 - 2.2493 #4 - 2.2493 #5 - 2.2492 #6 - 2.2493

Connecting Rod Journal Measurements: Engine S/N 267651-R Crankshaft S/N C219702N

#1 - 2.2495 #2 - 2.2495 #3 - 2.2495 #4 - 2.2494 #5 - 2.2494 #6 - 2.2494

Crankshaft Main Bearing Journals

Factory New Parts Limits: Maximum 2.375 Minimum 2.374 Service Limit 2.372

Main Journal Measurements: Engine S/N 267651-R Crankshaft S/N C219702N

#1-2.3741 #2-2.3741 #3-2.3742 #4-2.3741 #5-2.3741 #6-2.3741

Main Journal Measurements: Engine S/N 267738-R Crankshaft S/N 860632U

#1-2.3742 #2-2.3743 #3-2.3744 #4-2.3745 #5-2.3744 #6-2.3744

Crankshaft Counterweight Bushing Inside Diameters

Factory New Parts Limits: Minimum .622 Maximum .626 Service Limit .6265

Counterweight Bushing Measurements: Engine S/N 267651-R

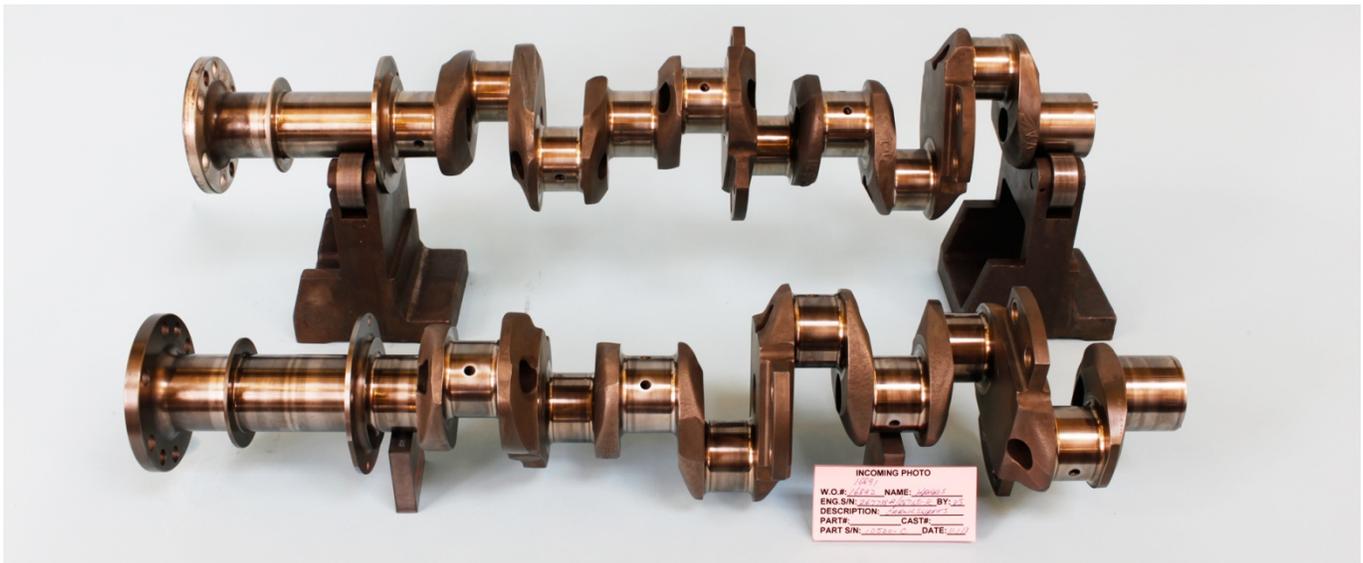
Counter Weight #195 - .6245 .6247 .6242 .6242 .6250 .6245 .6247 .6245

Counter Weight #196 - .6245 .6250 .6252 .6246 .6240 .6245 .6245 .6247

Counterweight Bushing Measurements: Engine S/N 267738-R

Counter Weight #195 - .6245 .6247 .6242 .6242 .6250 .6245 .6247 .6245

Counter Weight #196 - .6245 .6250 .6252 .6246 .6240 .6245 .6245 .624



Top - Crankshaft S/N C219702N

Bottom - Crankshaft S/N 860632U

Main Crankshaft Bearing Thickness

Factory New Specification: .094

Main Bearings Measured: .0936 - .0933 Engine S/N 267651-R

Main Bearings Measured: .0936 - .0933 Engine S/N 267738-R



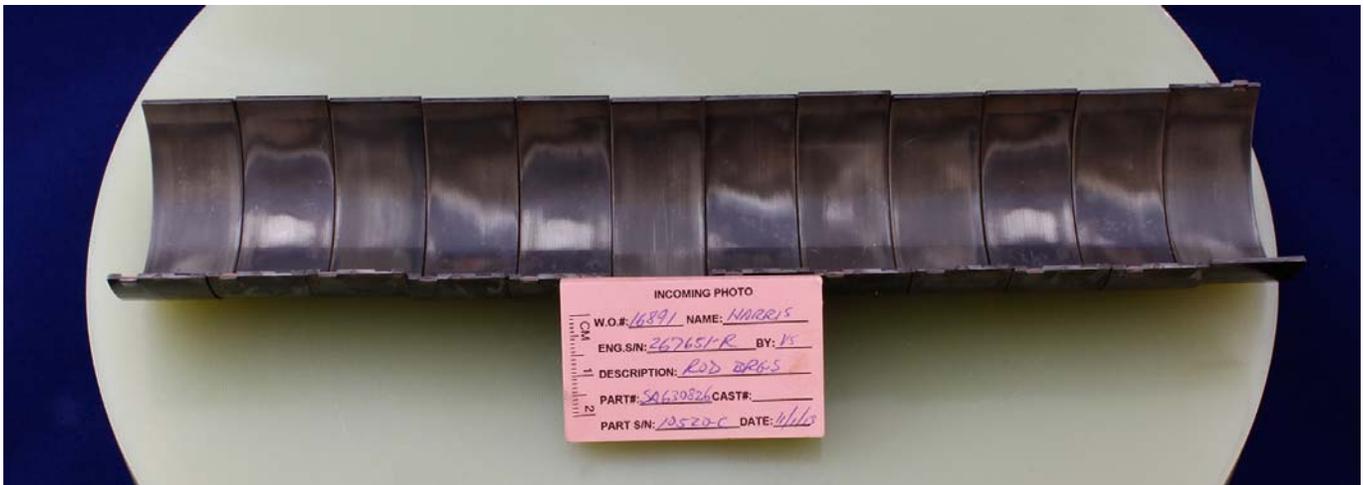
Main Crankshaft Bearing Part # SA-642839 ENGINE S/N 267738-R

Connecting Rod Bearing Thickness

Factory New Specification: .0623

Rod Bearings Measured: .0617 - .0622 Engine S/N 267651-R

Rod Bearings Measured: .0617 - .0622 Engine S/N 267738-R



Connecting Rod Bearing Part # SA-630826 ENGINE S/N 267651-R

Valve Rocker Shafts Dimensions

Factory New Specification: .749 - .7495
 Shafts Measured: .7487 - .749 Engine S/N 267651-R
 Shafts Measured: .7487 - .749 Engine S/N 267738-R



Rocker Arms S/N 267651-R



Rocker Arms S/N 267738-R

Camshaft Journal Dimensions

Factory New Limits: .096 - .097
 Journals Measured: .096 - .0965 Engine S/N 267651-R
 Journals Measured: .096 - .0965 Engine S/N 267738-R



Top - Camshaft S/N 267651-R

Bottom - Camshaft S/N 267738-R

Connecting Rod Bushing Clearance

Factory New Limits: Minimum .0022 Maximum .0026 Service Limit .004

Clearance Measurements: Engine S/N 267651-R

#1 - .0025 - .003	#2 - .0025 - .0035	#3 - .0025 - .0035
#4 - .0023 - .003	#5 - .0025 - .0035	#6 - .0025 - .0035

Clearance Measurements: Engine S/N 267738-R

#1 - .0025 - .003	#2 - .0025 - .0035	#3 - .0025 - .0035
#4 - .0023 - .003	#5 - .0025 - .0035	#6 - .0025 - .0035

Cylinder Bore Internal Diameters - Superior Part #SA5H52000-A1

Factory New Limits: Minimum 5.251 Maximum 5.253 Service Limit 5.256

(Engine S/N 267651-R)

Bore Diameters: #1- 5.253 #2- 5.253 #3- 5.253 #4- 5.253 #5 5.253 #6- 5.253

(Engine S/N 267738-R)

Bore Diameters: #1- 5.2525 #2- 5.2525 #3- 5.2525 #4- 5.2525 #5 5.2525 #6- 5.2525

Exhaust Valve Stem Diameter

Factory New Limits: Minimum .4335 Maximum .434

(Engine S/N 267738-R)

Valve Stem Measurements: #1- .4332 #2-.4331 #3- .4331 #4- .4332 #5- .4331 #6-.4333

(Engine S/N 267651-R)

Valve Stem Measurements: #1- .433 #2- .4334 #3- .4331 #4- .4334 #5- .433 #6- .4332



Exhaust Valves S/N 267651-R



Exhaust Valves S/N 267738-R

Intake Valve Stem Diameter

Factory New Limits: Minimum .4335 Maximum .434

(Engine S/N 267651-R)

Valve Stem Measurements: #1- .4336 #2- .4337 #3- .4337 #4- .4336 #5- .4337 #6- .4337

(Engine S/N 267738-R)

Valve Stem Measurements: #1- .4337 #2- .4337 #3- .4336 #4- .4337 #5- .4337 #6- .4336



Exhaust Valves S/N 267651-R



Exhaust Valves S/N 267738-R

4. Hydraulic lifters, engine gears, camshaft and all internal engine bearings showed little wear. No spalling, pitting or corrosion was found on the engine's camshaft or hydraulic lifter assemblies. No corrosion or pitting was observed on the engine's gears. Valve rocker arms were in good condition with no wear indications and smooth rocker tip machined surfaces.



Camshaft Part #649322 Lifters Part # 653877, 653888 ENGINE S/N 267738-R

5. Dimensional check of all internal engine parts were measured to still be within the original manufacturers new parts limits listed under Teledyne Continental Motors Overhaul Manual X30039 dated October, 2013.
6. Connecting rods were all in good condition with no signs of wear, fretting or misalignment.



Connecting Rods S/N 267651-R



Connecting Rods S/N 267738-R

- As a wear comparison reference, internal engine parts removed from three randomly selected and previously field overhauled and factory new Teledyne Continental Motors Model 520 engines with varying engine hour times were used.

A side by side comparison was performed with the same part numbers from the randomly selected 520 model engines with the parts removed from the IO-520-C engines observed. The difference was apparent. The two IO-520-C engines I was asked to observe showed little wear in comparison to the randomly selected comparison parts of the same part numbers on engines that came from other suppliers and factory engines.

- One significant observed difference stood out. The internal engine gears listed below on these two IO-520-C engines observed, had been put through a process that impregnates a black iron manganese phosphate to them at overhaul by Victor Aviation. Wear and corrosion to these gears was nonexistent compared to the other randomly selected gear samples from similar model 520 engines.



Magneto & Accessory Drive Gear
 Oil Pump and Tach Shaft Gear
 Alternator Drive Face Gear

Part # 641728
 Part # 631075
 Part # 632018

Governor Drive Bevel Gear
 Camshaft Bevel Gear
 Camshaft Gear

Part # 629748
 Part # 629747
 Part # 631845

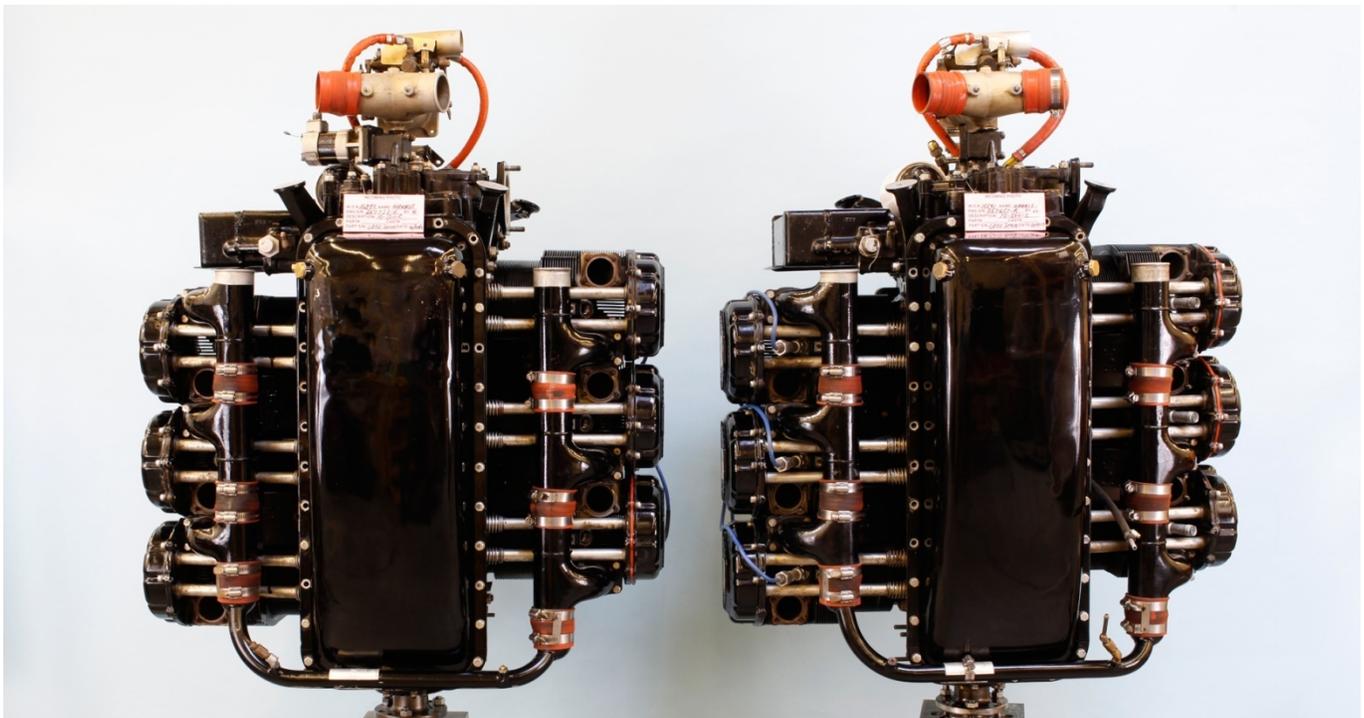
Engine log book information as follows:

- RIGHT HAND ENGINE: Engine manufacturer: TCM model IO-520-C. Serial number 267738-R.

- Overhaul date by Victor Aviation: 12/08/00.
- Engine total time at overhaul: 1,004.8 hours.
- Overhauled engine Installed 01/22/01.
- Aircraft Hobbs time at installation: 863.8 hours.
- Aircraft Hobbs time at removal: 2,743.3.
- Engine total time at removal on 10/25/13: 2,884.0.
- Engine hours since major overhaul at removal: 1,879.5

- LEFT HAND ENGINE: Engine manufacturer: TCM model IO-520-C. Serial number: 267651-R.

- Overhaul date by Victor Aviation: 12/05/00.
- Engine total time at overhaul: 1,080.6
- Overhauled engine installed on 01/22/01.
- Aircraft Hobbs time at installation: 863.8 hours.
- Aircraft Hobbs time at removal: 2,743.3.
- Engine total time at removal on 10/25/13: 2,960.1
- Engine hours since major overhaul at removal: 1,879.5.



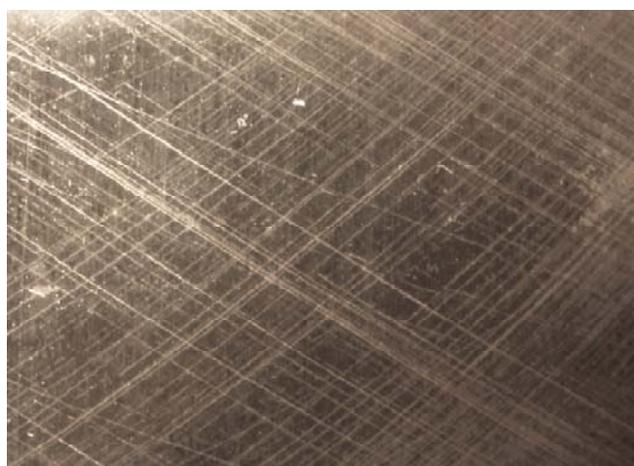
LEFT ENGINE S/N 267651-R 1,879.5 hours SMOH

RIGHT ENGINE S/N 267738-R 1,879.5 hours SMOH

9. According to Teledyne Continental Motors Service Instruction Letter #SIL98-9C, time between overhaul periods for an IO-520C engine model is 1,700 hours. These engines were operated beyond the manufacturers recommended (TBO) Time Between Overhaul.
10. Left and Right engines were documented to be 179.5 hours over TBO.
11. Left and right engine compression checks of all 12 cylinders were recorded normal throughout the 1,879.5 engine hours operated and within the manufacturers acceptable limit as per TCM03-3. The 12 cylinders have not had any replacement of valves, valve seats, springs, pistons or piston rings.



Superior Pistons Part # SA-648013 ENG S/N 267738-R



Above - Inside View - Superior Cylinder Barrel Wall Surface Part #SA5H52000-A1 (Magnified View)
Cylinder bore surface showing cross-hatch machine marks.

Left -
Superior Cylinder Part #SA5H52000-A1
ENG S/N 267651-R

12. Left and right engines had oil and oil filters changed on the average of every 40-50 hours. Aero Shell 100W oil was used for left and right engines.
13. An oil analysis was performed twice on both the left and right engines during the 1,879.5 hour period. The results of all analysis reports were considered normal.
14. Both engines had two Supplemental Type Certificates (STC's) incorporated: ASE09217SC fuel injectors and an SA71GL Bracket air filter.

Conclusion

In my opinion based my many years in the industry of inspecting Teledyne Continental Motors model 520 engines, the condition of these engines and the minimum wear level of parts observed by far exceeds what is generally found during an engine examination of engines that have been operated to the manufacturers TBO.

It appears that these engines could have been operated for a significantly longer period of time before engine overhaul would have been required. These engines included Victor Aviation's FAA accepted optional overhaul procedures under their FAA repair station certificate #BJ3R399L, including electrostatic powder coating, cylinder flow matching, iron manganese phosphate impregnation of gears and engine balancing. It appears that these procedures and the overall machine work applied to these engines have contributed to the increase in the durability and longevity of the engine parts observed.

Sincerely:



Reigh R. Granlund

FAA Principal Maintenance Inspector, San Jose Flight Standards District Office – Retired

FAA Airframe and Powerplant Mechanic – Current 11/20/13

FAA Designated Airworthiness Representative – Current 11/20/13