Report # EPA 1-2008
Aviation Oil Lead Content Analysis

January 2, 2008

Todd L. Petersen
Petersen Aviation, Inc.
Minden, Nebraska
todd@gtmc.net
308-832-2200

In November and December 2007, samples of used aviation oil were collected at three Nebraska airports. The samples were taken from airplanes using 100LL exclusively. Ten samples were obtained and subsequently analyzed for lead at the end of December. Sample eleven consisted of new, unused Aeroshell 100W. Aviation Labs in Kenner, LA did the analysis. Results of the analysis may be reached on the Internet by going to: http://avlab.com/analysis/login/default.asp The Customer Code is "ptrav". Insert "ptrav-a" for engine serial number.

Results of the analysis are shown on the attached graphs. The oil is delineated by engine type, number of hours on the oil since the previous oil change, and by the engine sump capacity.

Sample J, from a Lycoming 0-320-D2J-160hp engine with 100 hours reported since the previous oil change showed the highest lead content at 10286 ppm. Sample G, a Lycoming 0-235-L2C, also with 100 hours on the oil, tested out at 5797 ppm. The engine with the least amount of lead was sample C, a Lycoming 0-320 with 20 hours on the oil. This sample tested out at 1726 ppm. The unused oil contained only 226 ppm of lead.

Lead and lead by-products both in the exhaust blow-by gas and in raw fuel eventually work their way into the oil. Variations in lead content of the samples discussed herein may be attributed to a number of factors. How the pilot leans the mixture and when has an impact on how much lead is retained within the engine as opposed to being ejected through the exhaust. Elevation and density altitude are among the factors that influence how a pilot leans the mixture. Location within the flight envelope, climb, cruise, decent for landing, also dictate leaning procedures. These factors change constantly. Mixture and throttle settings used between landing and engine shutdown and during engine warm up before flight, also influences the amount of lead retained within an engine and therefore the amount of lead that ultimately is transferred to the oil.

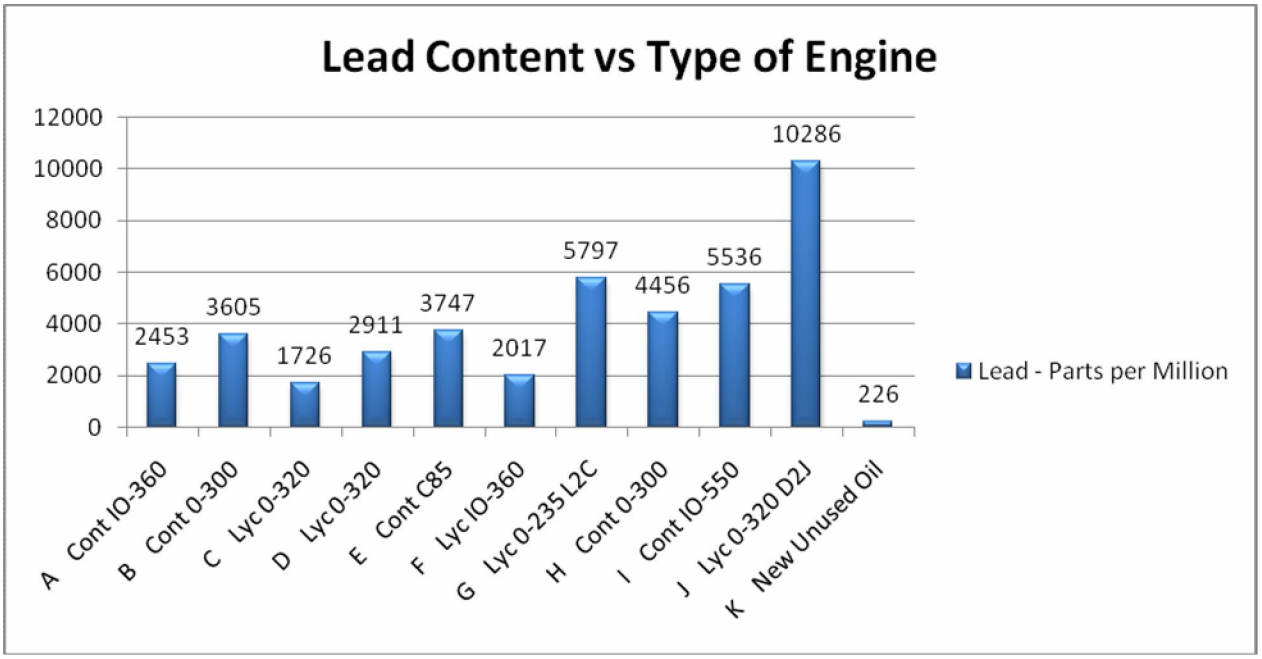
Some pilots use a gasoline additive made by Alcor called TCB to reduce spark plug fouling when using 100LL. TCB laden fuel therefore contains more lead scavenger than what is included in a standard gallon of 100LL. Hence it is expected that less lead would be retained in an engine consuming this additive. It is unknown whether or not any of the oil sampled was used in engines consuming TCB laden 100LL.

It should be noted that samples J and G, are both flight school airplanes. Student pilots are considered less likely to properly lean the engine since they are still learning. Students will also be shooting numerous takeoffs and landings and for the most part, this will be done with the mixture full rich. Flight schools frequently have their airplanes on a 100-hour maintenance rotation and will therefore change oil at 100-hour intervals because it is convenient. The standard recommendation however is 50-hour interval oil change and filter replacement for engines using a full-flow filtration system and 25-hour intervals for pressure screen systems.

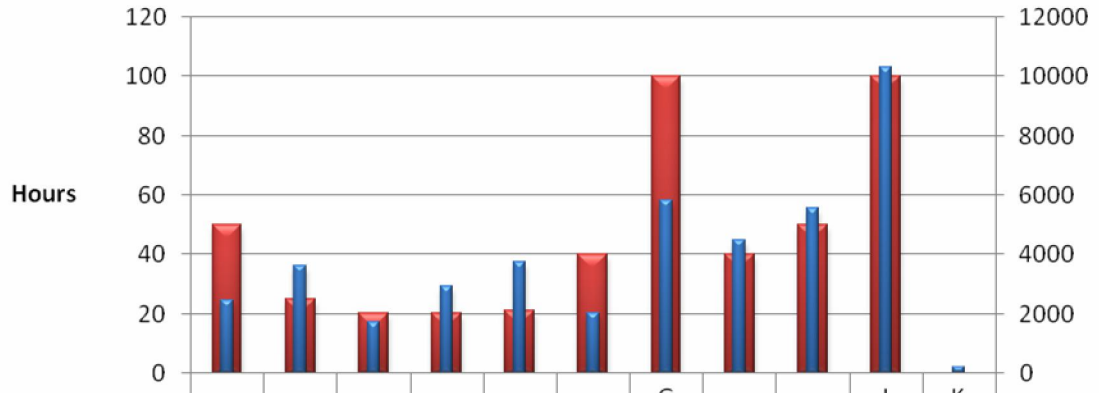
Engines originally rated on 80/87 octane will show increased amounts of lead in the oil when they are consuming 100LL. More frequent oil changes are recommended for these engines. Samples B, C, D, E, and H came from engines originally rated on 80/87 octane. The first four of these samples have relatively low hours since the previous oil change and this might be attributed to the pilots deliberately conducting more frequent oil changes as per the recommendations. Doing so is also intended as a means of reducing corrosion inherent in engines that are not operated frequently.

Respectfully submitted.
Todd L. Petersen
Petersen Aviation, Inc

Engine Model	Lead - Parts per Million	Hours	Sump Capacity - Quarts
A Cont IO-360	2453	50	8
B Cont 0-300	3605	25	8
C Lyc 0-320	1726	20	8
D Lyc 0-320	2911	20	8
E Cont C85	3747	21	4.5
F Lyc IO-360	2017	40	8
G Lyc 0-235 L2C	5797	100	6
H Cont 0-300	4456	40	8
I Cont IO-550	5536	50	12
J Lyc 0-320 D2J	10286	100	8
K New Unused Oil	226	0	0

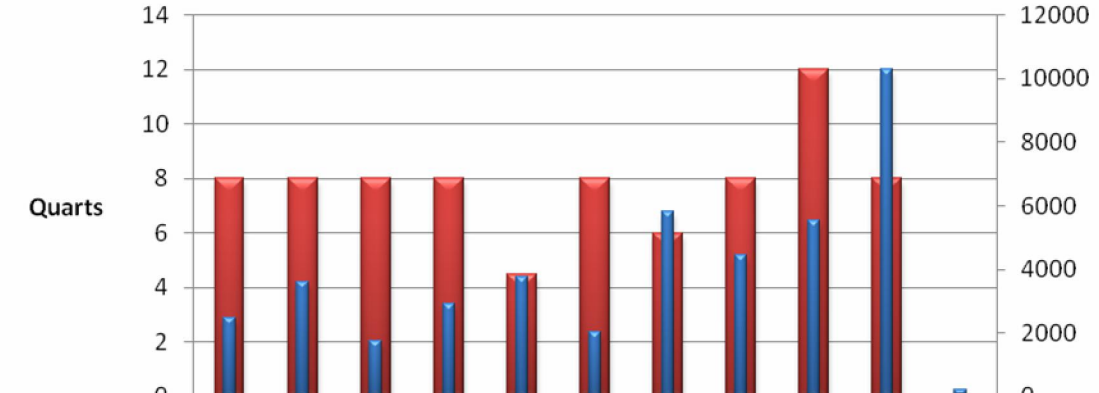


Lead Content vs Hours



	A Cont IO-360	B Cont O-300	C Lyc O-320	D Lyc O-320	E Cont C85	F Lyc IO-360	G Lyc O-235 L2C	H Cont O-300	I Cont IO-550	J Lyc O-320 D2J	K New Unused Oil
Hours	50	25	20	20	21	40	100	40	50	100	0
Lead - Parts per Million	2453	3605	1726	2911	3747	2017	5797	4456	5536	10286	226

Lead Content vs Sump Capacity



	A Cont IO-360	B Cont O-300	C Lyc O-320	D Lyc O-320	E Cont C85	F Lyc IO-360	G Lyc O-235 L2C	H Cont O-300	I Cont IO-550	J Lyc O-320 D2J	K New Unused Oil
Sump Capacity - Quarts	8	8	8	8	4.5	8	6	8	12	8	0
Lead - Parts per Million	2453	3605	1726	2911	3747	2017	5797	4456	5536	10286	226