BLACKSTONE LABORATORIES

The Oil Report
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The Fine Art of Comments

by Kristin Huff

We were knee-deep in reports on a Wednesday afternoon when the phone rang, someone wanting to speak with us about a report. "Who's calling, please?" It was Continental on the line — that's right, the same Continental that built half the general aviation engines in use in the United States. The call, understandably, went to Ryan Stark, Blackstone's president.

Over the course of the call, a technical advisor on the other end let Ryan know that they did not appreciate this report, which we sent out over the summer of 2010. The report was on an IO-550 in a Cirrus, and it was making a lot of metal (see Figure 1).

"This guy just spent $600,000 on this aircraft!" said the technical guy. "Now he's demanding a new one because his wife is afraid to fly in it! And there's nothing wrong with his engine!"

A Balancing Act

The comments section is what sets us apart from most of the other labs out there (well, in addition to our good looks and winning personalities, that is). Most of you probably use us because of the comments section: it's where we offer our opinion about what's going on and let you know if the data looks like a problem or not.

We have used comments from the very beginning. Blackstone's founder, Jim Stark, had seen a two-line comments section in reports from fuel labs, but when he started Blackstone he found that two lines sometimes wasn't enough room to say what he wanted to say. He expanded the section to six lines, though those early comments -- back in the 1980s when Jim was the only analyst and typed each one on a typewriter and corrected errors with white-out by hand -- were sometimes brief. (Here's one from 1994: "RAY: Exxon Turbine oil in this sample was clean and dry. No significant wear or additive found in the oil.") Writing reports is, of course, easier these days, but we're still true to Jim's original vision for reports. "We can talk to customers as if we're having a conversation with them," he explains.

But it's a fine line we walk when the data is nebulous. Sometimes wear is bad, and we aren't sure whether that's because of a problem or because of some unknown factor that we aren't aware of. Maybe the owner lost their medical, so the engine's been inactive. Maybe the engine has new cylinders wearing in but the owner didn't mention it. Or maybe, just maybe, the engine has a problem.

When the Report is "Bad"
When we report that metals are higher than average, we often don't know why they're out of line. If the data looks really weird we will have the sample re-run, just to make sure there has not been an error on our end. If the data is correct and the engine is not looking good, we'll generally give you a call to see if there's something we need to know and to give you a heads up about the results. These calls are usually illuminating for us: we can find out if metal is present in the filter, the aircraft has been inactive, the engine has just had an overhaul, or if there's some other mitigating factor that will change what we say in the comments section.

ELEMENTS IN PARTS PER MILLION			UNIT/ LOCATION AVERAGES			UNIVERSAL AVERAGES
	MI/HR on Oil	49		11	40	
	MI/HR on Unit	940		849	837	
	Sample Date	08/03/10		04/23/10	03/26/10	
	ALUMINUM	7	6	5	8	7
	CHROME	23	15	13	21	9
	IRON	102	76	47	88	48
	COPPER	26	17	9	16	6
	LEAD	8618	5913	3377	6882	6176
	TIN	3	5	2	2	1
	MOLYBDENUM	6	5	3	5	4
	NICKEL	42	25	23	33	11
	POTASSIUM	0	0	0	0	1
	BORON	0	1	2	0	1
	SILICON	7	5	5	7	5
	SODIUM	1	1	0	1	1
	CALCIUM	2	2	0	2	34
	MAGNESIUM	2	1	0	1	1
	PHOSPHORUS	833	818	1118	1045	668
	ZINC	13	6	4	8	7
	BARIUM	0	0	0	0	0

Figure 1: That's a lot of metal. Enough to warrant a new engine? Maybe. Or maybe not.

If the reason for the metal isn't obvious, a "bad" report might be just the start of an investigative process on your end to see what's going on. The Report of the Month (page 4 of this newsletter) is a good example. The owner of the GO-300 in that Cessna had noticed a drop in one cylinder's compression from 74/80 the year before to 65/80 this year. Not a huge drop, and not really all that worrisome, but then he got his report back, saw the metal, and decided to check into it further. (Read the caption on the Report of the Month to see what went wrong in that case.)

We are giving you our opinion in the comments section, but even that is a balancing act. In the Continental-disputed report, Jim wrote that the engine might not make TBO at the rate the engine was producing metal. Now that's the kind of report that gets your blood going. But the point wasn't that we were telling him to try and get a new engine. Instead we wanted to draw his attention to a potential problem. We would rather err on the side of caution and have someone investigate something that doesn't turn out to be a problem, than let something slide that turns into a major headache or a serious catastrophe.

We've heard from lots of people who don't agree with our comments, so it's best to keep in mind that the comments are just our opinion. We got a call from Amsoil once (a high-end synthetic oil manufacturer) who took issue with my suggestion that a user try a different oil, in hopes that his wear would improve. It took me a long time to convince Amsoil that we weren't trying to bad-mouth their oil, but that in some cases a different oil might be warranted. I never did convince the guy, but at least Blackstone and Amsoil are still on speaking terms.

When the Report is Good
Good reports are easy to write, and fortunately for us, most of them really are good. Cars, trucks, and other land-borne engines don't usually have problems with corrosion and can typically run the oil a lot longer than they used to. Aircraft engines are a bit more sensitive, though those reports too are overwhelmingly positive. And good reports are fun to write.

We like to be creative, so any information you give us on the oil slip can be a launch pad for us to write something interesting back. Here's a sample I got back when I did the oil from my lawn mower (a Toro): KRISTIN: Este bull, late el corazón con la sangre de un guerrero. Puede vivir para siempre. Viva el Toro! (This bull beats the heart with the blood of a warrior. It can live forever!)

We tend to be more merciless with each other than we would be with our customers. I wrote this one for Alex when I found out his Honda Fit is named "Ivy Plumberry": ALEX: Ivy Plumberry sounds like the name of a Cabbage Patch Kid, or possibly someone from Barbie's Fairytopia. Admittedly, both are geared toward a younger set, so if you are unfamiliar with them I'll be happy to loan you my 8-year-old daughter for a couple of hours. Alternately, you could rename your car.

Information is Gold

So back to Continental. The owner dropped way back on his oil changes and as a result had less metal in the oil, though it never did settle down to average (see Figure 2). That engine is still making more metal than most, but it was still running as of last summer at 500 hours before TBO. But whether or not our comment was inflammatory is beside the point. We always have and always will strive to provide good information to our customers, and you know that you are not getting results that are biased in favor of any oil or company.

What we (and you) can take away from this is two things. One, high wear doesn't necessarily mean you need or deserve a new engine. In some cases it might, but as my grandma says, you catch more flies with honey than vinegar. And two, give us as much information as you can. If you or your mechanic is the sort who might be lucky to remember to write down your name but leaves everything else off the oil slip (time on the oil or engine, oil type, or any work or inactivity that might shed light on the report), try to remedy the situation. We do our best to provide accurate reports, but we do a lot better when we have all the information.

Ryan's conversation got a little heated that day in August. From the next office over, I could hear his voice, sometimes getting worked up, sometimes not. In the end, we call it like we see it. Engine and oil manufacturers might not agree with what we're saying, and heck, even you may or may not end up following our recommendations. "A lab's business is answering a question, either asked or implied," concludes Jim Stark. "The report answers that question, and usually it can be done in one line. That allows us five lines to talk, or explain what we're thinking." In the end, we try to give you the information you need -- in plain English -- to make an informed decision about your engine.

ELEMENTS IN PARTS PER MILLION								
	MI/HR on Oil	30	UNIT/ LOCATION AVERAGES		40	78	23	UNIVERSAL AVERAGES
	MI/HR on Unit	1,542				1,074	995	
	Sample Date	07/09/13		10/09/12	07/19/11	04/26/11	10/25/10	
	ALUMINUM	5	7	5	8	5	5	7
	CHROME	8	14	9	12	9	14	8
	IRON	62	78	77	70	69	66	48
	COPPER	16	16	21	17	15	13	6
	LEAD	6936	5993	6127	5188	4986	5030	5855
	TIN	0	4	1	0	25	0	1
	MOLYBDENUM	2	5	3	3	5	4	3
	NICKEL	18	25	22	21	15	25	11
	POTASSIUM	0	0	0	0	0	0	1
	BORON	0	1	2	2	2	0	1
	SILICON	3	6	3	11	5	4	5
	SODIUM	1	1	2	2	0	4	1
	CALCIUM	1	3	1	2	1	1	47
	MAGNESIUM	1	1	1	1	1	4	1
	PHOSPHORUS	1188	766	1098	1055	907	948	553
	ZINC	6	6	8	7	5	5	7
	BARIUM	0	0	0	0	0	0	0

Figure 2: The engine was still flying in July, at 500 hours TBO.

Report of the Month

Something is amiss in this GO-300-D. Can you tell what it is?

To learn more about where the elements are coming from, click here.

ELEMENTS IN PARTS PER MILLION								
	MI/HR on Oil	26	UNIT/ LOCATION AVERAGES	34	32	28	39	UNIVERSAL AVERAGES
	MI/HR on Unit	1,139		1,119	1,090	1,076	1,052	
	Sample Date	10/12/13		04/27/13	09/28/12	03/09/12	08/27/11	
	ALUMINUM	128	16	35	13	16	11	16
	CHROME	70	13	17	7	12	11	11
	IRON	115	64	69	45	63	59	61
	COPPER	12	8	9	6	7	7	13
	LEAD	3526	3385	3834	2650	3643	2987	2855
	TIN	0	0	0	0	0	0	1
	MO LYBDENUM	2	2	2	1	2	2	2
	NICKEL	5	3	3	2	3	3	3
	PO TASSIUM	2	1	0	2	0	0	1
	BORON	0	1	1	1	0	0	1
	SILICON	25	12	13	10	15	11	10
	SODIUM	1	2	5	2	1	0	1
	CALCIUM	7	6	7	6	6	6	5
	MAGNESIUM	4	2	3	1	1	2	3
	PHOSPHORUS	0	0	0	0	0	0	143
	ZINC	1	1	2	2	2	1	3
	BARIUM	0	0	0	0	0	0	0

PROPERTIES		Values Should Be*					
	SUS Viscosity @210°F	96.6	86-105	100.6	94.6	98.5	101.8
	cSt Viscosity @ 100°C	19.55	17.0 - 21.8	20.51	19.07	20.00	20.79
	Flashpoint in °F	480	>430	480	470	460	500
	Fuel %	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5
	Antifreeze %	-	-	-			
	Water %	0.0	0.0	0.0			
	Insolubles %	0.4	<0.6	0.3			
	TBN						
	TAN						
	ISO Code						

*THIS COLUMN APPLIES ONLY TO THE CURRENT SAMPLE

This engine was making steady wear trends through most of 2012, but as 2013 rolled in, it started to change. Aluminum is the most noticeable, and that's typically a piston metal. But chrome and iron were going up as well. The April report left us wondering if there might be a problem, but the subsequent report in October left no doubt. Aluminum, chrome, and iron are not only much higher than average, they're much higher than they'd been in the past. The owner followed up in December with what happened: "The only symptom I had seen prior to the oil report was a low compression reading during the annual. It was 74 the year prior and dropped to 65 this year. That is not a failing reading, so I didn't consider not flying because of a serious problem. The report itself alerted me to look deeper, and I'm sure glad I did. The number 5 piston broke the top ring and was beginning to come apart. That was the cylinder with the low compression during my annual. I changed out that whole cylinder, piston and all, with a new one from Continental. It's not known why the ring broke; probably just age."