January 2021

SKYWRITINGS

HAPPY NEW YEAR?

Newsletter of the Kent Strut

Light Aircraft Association

HAPI SF-2A Cygnet G- CYGI Peter Kember

In the Summer of 2019 I had my annual Class 2 medical with an examiner new to AME status, my previous AME having retired. He was very thorough (too thorough some have said) but alarmed me by pointing out that my eyes were suffering from "age related accommodation", that is the delay in refocusing from long to short range and vice versa.
I have built and flown two Europae from 1995 to date and although people that I fly with say that

Nigel Read - Editor

January 28th AGM

Zoom 19:30 hrs

www.laakentstrut.org.uk

my eyesight is good I am aware that charging around the skies at 140 mph gives me less chance of taking avoiding action if needed than if I were cruising at 90 mph.

I saw the advert for the Cygnet, a 90 mph aeroplane, in the November edition of Light Aviation magazine and with a fellow Europa pilot we travelled to Enstone Airfield where I met Ben Syson from the LAA. He explained that the builder, a retired Rolls Royce-trained design engineer had started building the Cygnet and won an award for the best part-completed homebuilt at the PFA Rally in the early 1990s. Over the past ten years he had been diagnosed with severe Alzheimer's and could no longer work on the aeroplane.

The Cygnet is a strange looking device, with a SUV type cockpit suited to aircraft carrier landings. It is nowhere near as sophisticated as the Europa or other aircraft that I have owned. But apparently it is nice to fly and has STOL capability, particularly with the Rotax 912 engine. That currently interests me living in a rural area with some farming friends.

The quality of the workmanship of G-CYGI impressed me greatly and I made an offer which was accepted. Paul Ponsoby, aircraft shippers, delivered the Cygnet to my home workshop in early December 2020.

Plans-built aircraft are new to me so I ordered a new set of plans from Viking Aircraft in the USA (£173) and worked out a programme to complete the aircraft this year. The lockdown situation at present suits me as I have the ability to work on the aircraft at home. I am enjoying every moment.

In the month that I have owned the Cygnet I have removed the Rotax 912 UL engine, removed the engine mount and corrosion treated it, and replaced the mount and engine. I have nearly finished the connection of all of the engine systems, electrical, fuel, coolant, throttle and choke. I have also redesigned the panel to accommodate lightweight modern instruments, transceiver and transponder and fitted a gell battery.

The only problems that I have encountered so far are related to hardware supplies over the holiday period and finding the best place to buy them. Where does one obtain the artificial stall warner required by the LAA?

I must thank Gary Smith for explaining to me how to put a permanent curve into duralumin to form the engine cowls. My inspector is Dave Watts, but like me he is not supposed to travel to carry out inspections during lockdown.

If anybody needs a new Terra avionics pack, transceiver, transponder and encoder and a complete Whelans strobe lighting set please let me know. I also have a full set of flight and Rotax engine instruments, leads and thermo couples should anyone be using 10 year old technology.

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Committee member Kevin Marks noticed an interesting article in the Devon Strut newsletter that would be of interest to Kent members, which was originally in the AOPA magazine and Mike Mold, the Devon strut newsletter editor kindly forwarded the article.

Your Engine's Lifeblood by Mike Busch

(with acknowledgement to AOPA Pilot October 2020)

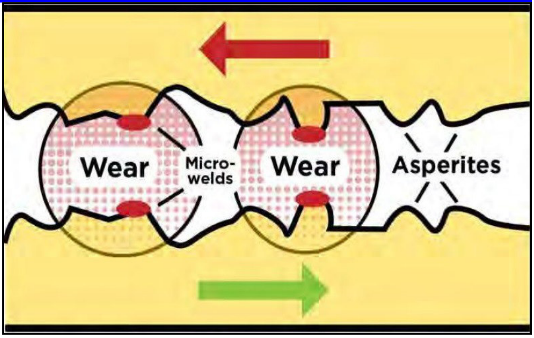
There's a lot more to piston aircraft engine oil than you might think. When it comes to piston aircraft engines, the role of engine oil is complicated. It lubricates moving parts to reduce friction and wear, but that's only one of six key functions it performs, and perhaps not even the most important one. The lubrication requirements of slow-turning direct-drive Continentals and Lycomings that most of us fly behind are really quite modest compared to the high-revving engines in our automobiles. Lubrication demands tend to vary with the square of rpm, so a car engine with 7,000 rpm redline has vastly more demanding lubrication requirements than does an aircraft engine with a 2,700 rpm redline.

Lubrication Vs Friction and Wear

Friction occurs because even the smoothest metal surfaces have microscopic peaks and valleys known as asperities. Whenever surfaces come in contact, these asperities adhere to one another via tiny micro-welds. If those surfaces are in relative motion, the micro-welds constantly fracture and reform, resulting in friction and wear. Friction is the resistance to relative motion and wear is the loss of material. Both are due to the fracture of the micro-welds.

The purpose of lubrication is to reduce friction and wear on the engine's moving parts. There are several different kinds of lubrication. One important kind is called hydrodynamic lubrication. It occurs when one fluid, most commonly a liquid like oil, is interposed between the moving parts. The relative motion of the parts creates sufficient pressure in the lubricant to keep the parts from touching. Think of a water skier being supported by their relative motion to the lake and the resulting pressure of the interposing water that prevents the skier from sinking. Or, consider a car hydroplaning on a rain-slicked road, its locked tyres being separated from the road surface by water pressure.

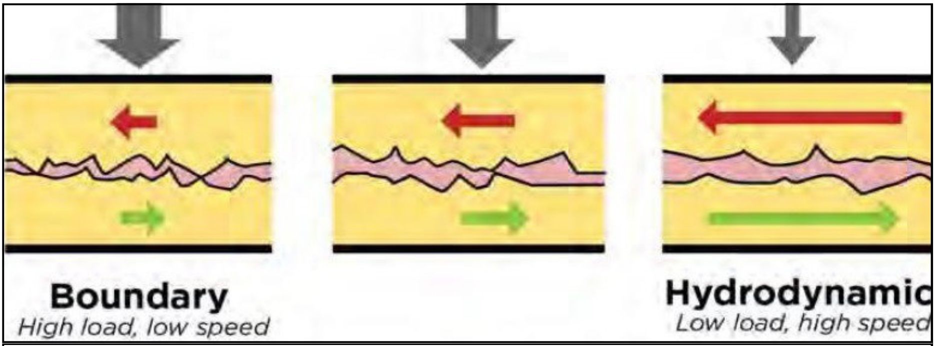
Hydrodynamic lubrication works well if the relative speed of the parts is high enough to overcome the load pushing them together. If the relative speed is not high enough, then there will not be enough lubricant pressure to keep the parts separated. (Think of the towboat slowing down until the skier sinks.) If hydrodynamic action cannot keep the parts separated, we must rely on another form of lubrication known as boundary lubrication. Boundary lubrication relies on a thin, soft solid film deposited on the moving parts, typically by chemicals called "extreme pressure additives" that reduce friction and wear by chemically interfering with micro-weld formation.



FRICTION AND WEAR are caused by fracturing of "micro-welds" between moving surfaces.

Rub your hands together vigorously and you'll feel the friction between your palms in the form of heat and resistance to movement. Believe it or not you've created and then fractured a few zillion micro-welds on the surface of your palms. You can reduce the friction in several ways: for instance, by coating your palms with Vaseline, or by dusting them with talcum powder. Think of the Vaseline as hydrodynamic lubrication and the talc as boundary lubrication.

Engine oil has to keep the engine clean. Compared to car engines, piston aircraft engines are positively filthy creatures. They burn leaded fuel and allow large quantities of lead salts, carbon, sulphur, water, raw fuel and other nasty combustion by-products to blow by the rings and pollute the bottom end of the engine. The oil has to be able to keep these contaminants dispersed and hold them in suspension so that they can be drained away at the next oil change and don't accumulate on internal engine parts in the form of sludge. Oil cools engine components like pistons that can't be air-cooled. The only thing that keeps aluminium pistons from going into meltdown is oil that is splashed and squirted onto their bottoms to carry heat away. Engine oil typically gains about 40 degrees Fahrenheit as it circulates through the engine. It may then pass through an oil cooler or radiator (if fitted) to dissipate that added heat via the airflow through the cooler. Oil also acts as a sealant to prevent the leakage of gases and liquids past piston rings, O-rings, gaskets, and other kinds of seals. If your aeroplane has a constant-speed propeller, oil serves as the hydraulic fluid that is used to adjust the blade pitch.



OUR ENGINES depend on both hydrodynamic and boundary lubrication.

An enormously important function of engine oil is protecting expensive steel components like crankshafts, camshafts, lifters and cylinder barrels from rusting during periods when the aircraft is not being flown. Because we tend to fly our aeroplanes far less often and far more irregularly than we drive our cars, the preservative requirements of aircraft engines are vastly more demanding than for automotive engines.

Oil is made up of giant molecules called polymers. Some are natural like mineral oil (from dead dinosaurs!) whilst others are man made synthetics like polyalphaolefin (PAO) and polyalkylene glycol (PAG). These various polymers have differing shapes. The molecules of mineral oil have a lot of side branches, while the molecules of synthetic oil are smoother and less “branches”.

Mineral oil degrades the longer it remains in service. The little branches gradually shear off, a phenomenon known as polymer shearing, and that causes viscosity to decrease. Because synthetic oil is less branchy, it suffers far less from polymer shearing and retains its viscosity better, so it can go longer between oil changes (at least in automotive applications).

Mineral oil’s branchy molecules do a much better job of holding particulate contaminants in suspension so that they can be drained out at the next oil change instead of settling out as sludge. In fact the fully synthetic Mobil AV1 was withdrawn from the market in the late 1990s (in a hail of litigation from aircraft owners in the USA) because so many engines were ruined by lead sludge deposits. Synthetic oil simply doesn't deal with filth as well as mineral oil.

Monograde vs Multigrade

Monograde oil is simply mineral oil plus an additive package. It has viscosity (thickness) that varies considerably with temperature. At an operational temperature of around 200 degrees Fahrenheit it’s quite thin and flows freely. At room temperature, it's thick and gooey. If it’s cold enough, it won’t pour at all. Multigrade oils are much less thick and gooey at cool temperatures. They still get thicker as temperature decreases, just not as much. To make multigrade oil, you start with thin monograde oil and then add an artificial thickening agent called a viscosity index improver. This man-made polymer has the unusual property that it gets thicker and more viscous when heated—the opposite of what mineral oil does. Viscosity index (V1) is the rate at which viscosity changes as temperature increases. The higher the V1 the less the oil thins as it heats.

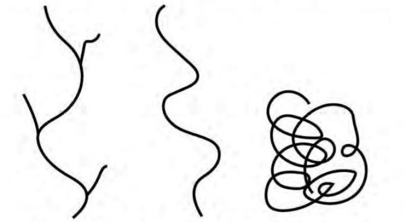
A multigrade aircraft oil rated at 15W-50, for example, is basically SAE 15 oil to which roughly 10 percent V1 improvers are added to obtain the viscosity of SAE 50 oil at 100°Celsius (212°F) whilst maintaining the pourability of SAE 15 oil at 0°C (32°F). At operating temperature Aeroshell W100 and 15W-50 have essentially the same viscosity. At room temperature or colder, the difference in viscosity is dramatic. The W100 pours like ketchup whilst the 15W-50 pours like tomato juice.

Additives.

Oil additives are vital for both lubricity and longevity. Without them, the oil would become contaminated, break down, leak out or not properly protect engine parts. We've already discussed two kinds of additives found in piston aircraft engine oils: V1 improvers modify base oil viscosity to create multigrade oil. Anti-wear and extreme pressure additives react with metal surfaces to create a protective barrier that inhibits micro-weld formation and facilitates boundary lubrication.

Another class of additives called friction modifiers improves lubricity by making the oil more slippery. Anti-foam agents modify the surface tension of oil to allow oil bubbles to burst more readily, minimising foaming.

Corrosion inhibitors also reduce rusting of steel engine parts (e.g. crankshafts, camshafts, lifters, cylinder barrels) by forming a chemical barrier to repel moisture from metal surfaces. Tackiness agents increase oil's adhesive properties to improve film retention and better protect these parts whilst acid neutralisers protect them from attack by acids that build up in engine oil when moisture and combustion by-products combine. Oxidation inhibitors protect the oil itself from premature aging due to oxidation at high temperatures.



Mineral Oil molecules are "branchy", synthetic oil molecules are smooth and viscosity index improvers roll up into a ball when cool and

Detergents and dispersants help keep engines clean and free of deposits by holding combustion contaminants in suspension and prevent them from forming sludge and varnish deposits inside the engine. Detergents are typically metallic-based chemicals and are often found in automotive oils but can cause problems in aircraft engines. Consequently, all modern piston aircraft engine oils use ashless dispersants instead of detergents, which is why they are referred to as AD oils.

Oil Recommendations

All modern piston aircraft engine oils are excellent and will do a grand job if you change the oil and filters regularly (at least every 50 hours or four calendar months, whichever comes first) and keep your oil temperature in the sweet spot (180 degrees F to 200 degrees F indicated) as much as possible. Personally, I recommend Aeroshell W100 unless you operate in cold temperatures where multigrade is required. I don't like synthetic or semi-synthetic oils (e.g. Aeroshell 15W-50) for engines that run on leaded avgas, although synthetics are great if you run your engine on unleaded mogas. Finally, I'm a fan of the aftermarket oil additive ASL Camguard because of its outstanding anti-rust and anti-wear properties. I've been using Aeroshell W100 with Camguard in my engines for decades and the longevity I've from these engines has been the stuff of legend.

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(In the UK, Rob Midgley of Aeroshell Oils recommends Aeroshell W80 Plus for engines that are infrequently used in the UK's colder ambient temperatures as it contains anti-wear and anti-corrosion additives at manufacture. Mike Busch believes straight Aeroshell with Camguard provides better protection than the Plus oils and it would be interesting to hear if our members have any experiences or opinions on the relative merits of these two alternatives. - Devon Ed)

(You can Google Camguard, for suppliers, check out the link to Pilots of America too. There is a YouTube link also to a webinar by Mike Busch if you have a couple of hours to spend. "All About Oil" which is basically this piece. Savvyaviation.com. *Kent Ed.)*

Next meeting is the AGM on 28th January. No need to go out in the cold as it is by Zoom. John will send the details before the meeting.

Note the time.

Dates for your Diary 2020/21

28th Jan AGM 19:30

25th Feb Typhoon old and new.