EXPERIMENTAL AIRCRAFT ASSOCIATION 245 OTTAWA

NEWSLETTER

June 10/98 Young Eagles fly-day

Carb Heat

Hot Air and Flying Rumours

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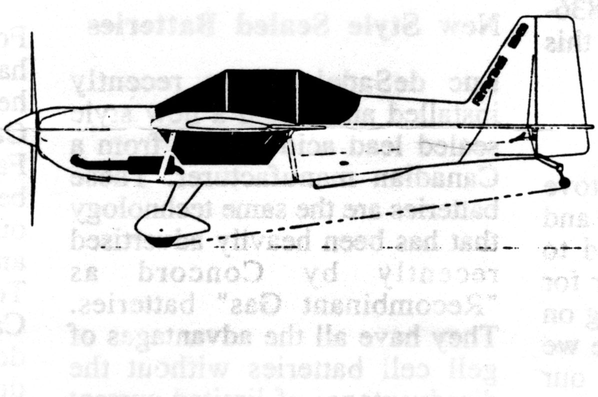
January 1995

Next Meeting: Thursday 19th January

BUSH THEATRE
NATIONAL AVIATION MUSEUM

Program:
-Business
***-Meeting Topic:* the Baby Belle helicopter developed by Canadian Home Rotors**
-Article: Cold starts (reprint)



RANS S-9 CHAOS

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President's Corner

The weather gods have been very kind to us this fall, with good flying available each weekend right through until Christmas. Those of us who tucked our birds away at the end of November missed some beautiful, totally atypical December weather.

The new year however has delivered enough snow to keep the skiers amongst us (both two legged, and winged varieties), happy, and the rest of us focussed on building projects, hopefully of an aviation kind.

I hope the new year finds all of our members both healthy, and full of enthusiasm for the year ahead.

Those who have been out to the chapter lounge recently, will know that we now have real electric power available, and have started on a project to insulate and finish the workshop area so that it is usable year round. Dick Moore has been his usual stalwart self in heading up this latest improvement and would welcome some willing workers to come out on weekends to help finish up; Please give Dick a call at 836-5554 to sign up for a bit of this R&R.

Hot Stove League:

As with last year, the Hot Stove League is in full operation, and all members are encouraged to drop out to the Carp hanger for some top notch hanger flying on weekends. It even looks like we will get to see a couple of our members flying off of skies this winter, as Luc Martin's Challenger, and Garry Fancy's Husky Cuby are raring to go, and the snow has finally arrived.

Meeting Speakers Needed.

Just a reminder that we are always interested in new speaker ideas, particularly volunteers that are actively involved in a new project area. So if you want to share the status of your project, or know someone with an interesting story to tell, please let anyone on the Executive know.

Currently, we are looking forward to a discussion on the DABI program from the local inspector Dale Lamport, as well as a session on the new Katanas and Zlin Aerobatic aircraft in use at Ottawa Aviation Services. So please keep feeding us ideas so that we can meet your needs better.

Membership Renewals:

With the arrival of the new year, the membership renewal process is in full swing, and Barney de Schneider will be eagerly waiting to accept your cheques and hand out '95 membership cards. Please remember to include your EAA number and expiry date on your application form.

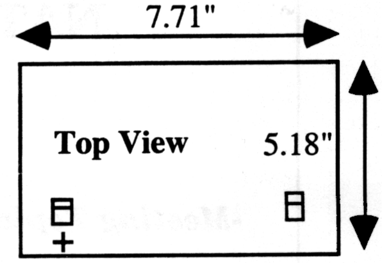
New Style Sealed Batteries

Luc deSadeleer has recently installed and tested a new style sealed lead acid battery from a Canadian manufacturer. These batteries are the same technology that has been heavily advertised recently by Concord as "Recombinant Gas" batteries. They have all the advantages of gell cell batteries without the disadvantages of limited current and life. Luc says it really spins his high compression O-320, and is used by many IO-360 aerobatic ships. Best of all the battery is only $105 Canadian from Ontario Battery Service in Toronto.

Contact: Paul Olsen
Tel: (416) 675-7671
Specifications:
Model # PRC-12-35X
Capacity: 35 amp hours
Cranking Current: 200 Amps sustained for two minutes before voltage drops to 9 volts
Weight: 27 lbs
Length: 7.71"
Width: 5.18"
Height: 7.16"

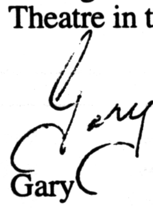
The terminal layout is the same as Gell Cells and the opposite of normal aircraft batteries as shown in the diagram. Note that this is not approved for certificated aircraft use.

U1 format case



January 19th Meeting Topic:

For our January meeting we will have a speaker on the Baby Belle helicopter being developed by Canadian Home Rotors in Ear Falls, Ontario. The Baby Belle is being vibration and flight tested at our Carp hanger by Ted Slack and the Canadian Aerosport Technical Committee, leading to Canadian approval for this new design based on a 30 year old design originally called the Commuter II I look forward to seeing everyone at the Bush Theatre in the NAM.



Gary

Chilly starts may cause unreckoned engine damage

As autumn's nippy weather turns to winter's chill each year, it's unfortunately only too predictable that certain aircraft will have engine-failure accidents due to the operator's failure to prepare the airplane properly for cold-weather flying.

Common knowledge has it that the major duty before sub-freezing weather hits is to change engine oils, putting in a lighter-weight oil (or perhaps one of the new multi-viscosity aviation oils) because of the widespread belief that heavy oil congeals and clogs the oil cooler or causes the oil pump to cavitate. This has been a simple and welcome answer, when an accident begs for a cause-effect relationship to explain a catastrophic engine failure.

For instance, there was the crash on February 12, 1984, in which a California pilot visiting Crested Butte, Colorado lost power two minutes after takeoff in a Piper Comanche. He and his three passengers were uninjured in the emergency landing.

The pilot told investigators that the airplane had been given about 25 minutes of preheating in an ambient temperature of 2 degrees Fahrenheit. It was started and run 10 to 15 minutes to "warm it up." The pilot said all engine instruments were normal at takeoff.

However, investigators found that the Comanche had been carrying straight 50-weight oil at the time of the crash—far heavier viscosity than recommended for cold-weather operations. In addition, line personnel said that due to the cowling configuration, they had been unable to insert the preheater duct underneath the engine so that it would blow hot air around the crankcase and cylinders, and thus had to lay it across the top of the engine.

In somewhat similar vein was the crash of a Piper Aztec on January 10, 1982 at Palwaukee Airport, Wheeling, Illinois. The 1,640-hour commercial pilot and his passenger escaped injury when the plane lost both engines within a couple of minutes after takeoff into IFR conditions and the pilot had to return to the field in conditions of an indefinite ceiling and blowing snow.

The pilot told investigators he estimated the engines were preheated for 35-45 minutes before startup, and there was a 10- to 15-minute delay before takeoff while waiting for a clearance. All engine instruments were in their proper range upon takeoff, he said. By the time the plane crashed a few minutes later, both engines had broken connecting rods and gaping holes in their crankcases.

Investigators found that the plane had last been given an oil change the previous October, when 40-weight oil had been installed. Oil of 20-weight is recommended for the Aztec's engines when operating below 10 degrees F. The temperature at the time of the crash was -15 degrees.

And there was the case of the 178-hour private pilot and his two passengers who escaped without injury after crashing a Beech S-35 Bonanza while returning to the airport with a failed engine after takeoff from Jackson Hole, Wyoming on January 6, 1982.

The pilot told investigators that the engine was preheated for 30 minutes before startup and that all instruments were in the green as the flight launched. Witnesses said the plane's takeoff came only about three minutes after engine start, however. Investigators found 55-weight oil had been installed in the engine. Temperature at the time of the crash was -19 degrees Fahrenheit.

While a common thread is undeniably the grade of oil in use, there is another element that may link these accidents—the duration and quality of the preheating service the planes did (or did not) receive.

There's a possibility that some engine failures in cold weather are laid to chance when investigators discover that proper oil was indeed installed. And there's a possibility that cold-start damage done to an engine in the dead of winter may not show up until spring or summer, when the cause-effect connection may not be discernable.

One person who has studied the issue of preheating about as thoroughly as it can be studied is Peter G. Tanis, head of Tanis Aircraft Services in Glenwood, Minnesota, maker of an almost unique type of preheater approved for most aircraft engines. Along the way, Tanis has happened upon some interesting and even myth-defying discoveries about engines and cold weather. With the forewarning that Tanis does sell preheaters and therefore could be biased, we invite readers to consider the points he raises and judge for themselves.—Ed.

By Peter G. Tanis

In the book *Stick and Rudder* Wolfgang Langeweische pointedly differentiated airplanes from cars: "It may sound like one and smell like one and it may have been interior-decorated to look like one: the difference is—it goes on wings." Langeweische's point also applies to an airplane engine—it's not like a car's either.

The reason an aircraft engine needs different treatment from a car's lies in the basic construction of the engine. In an auto, the engine block is usually cast iron and the crankshaft is steel: these metals expand at approximately the same rate when heated. In contrast, the horizontally opposed aircraft engine has an aluminum crankcase supporting steel components such as the crankshaft and camshaft. The cylinder barrels are steel with aluminum cylinder heads tightly attached.

The rate of expansion for aluminum, as it is heated, is twice that of steel. This also applies as it cools—aluminum shrinks in size twice as much as steel.

Because the engine was designed and assembled at room temperature, its clearances between parts can shrink dramatically when the severe cold of winter sets in. At temperatures as "high" as -11 degrees Fahrenheit, one popular engine can completely lose crankshaft bearing clearance. No wonder they turn over hard when they're cold! Even warm oil can't help when there isn't any bearing clearance.

Many pilots have ideas on how to operate their engines in cold weather that come from their experience with their automobiles. As a result, there are some popular misconceptions.

Misconception: If You Can Start It ...

Myth: "The main purpose of preheating is to start the engine: therefore, if you can start it, you don't need preheating."

Fact: An automobile engine survives quite well when cold-started, but an airplane engine can be severely damaged.

Because of poor fuel vaporization, an engine with cold cylinders is hard to start. But if it is started while they are cold, the cylinders are easily damaged. The top end of the cylinder bore is smaller than the base end—this is called "choke." It's designed to allow a nearly straight cylinder wall once the engine is at operating temperature. The choke has little effect at start-up in moderate ambient temperatures. But the colder the temperature, the more the cylinder is choked. When the cold engine is turned over, the piston is forced into the smaller-than-normal top end of the cylinder.

Another thing happens when the cylinder is cold. It concerns the wristpin, which in normal operation floats freely, axially within its bore in the piston. But the differences between metals in cold weather may change that. The piston, being aluminum, grips the steel wristpin. When a piston which last stopped at the bottom of its travel cools down, the wristpin end may be locked against the cylinder wall. When this engine is started, the wristpin end may wear against the cylinder wall.

The piston-to-connecting rod juncture also becomes stiff in a cold engine, causing the piston to tip at an angle as the engine is started. The first few times the piston travels in the cylinder, it may do so with its piston rings cocked at an angle and the piston skirt contacting the cylinder wall.

As if this weren't enough damage to the cold cylinder, one more thing occurs—once the engine starts, the aluminum piston grows at a faster rate than the cylinder diameter. The result is scuffing of the cylinder wall by the piston until the temperatures equalize.

This all might be enough to make the owner of $12,000 aircraft engine grimace to think of the pain his engine already may have undergone. But there are worse effects from cold-starting. Starting the engine with cold cylinders may result in excessive wear—starting with a cold crankcase could cause main bearing failure.

Misconception: Warm Oil Equals Warm Engine

Myth: "When preheating, the most important thing is warm oil." This idea is similar to some early preheating methods in automobiles, which even in autos were not too successful. The "dipstick heater" heated automobile oil but didn't help greatly in producing the start.

Fact: Warm oil may not even help if the rest of the engine is cold. Looking again at the automobile engine, the most successful means of preheating is the "in-block" type of heater, which heats the coolant. This automobile preheater heats only the cylinders and the block areas—the oil isn't heated at all. It relies on multi-viscosity oil to flow once the engine start occurs. If oil heat were the only significant thing in an aircraft engine, then the new multi-viscosity and synthetic oils would be the only precaution need. But actually, the aircraft engine, with a cold crankcase, may have reduced bearing clearance which won't accept any oil at all—hot, cold, or synthetic. The bearings and journals may be in metal-to-metal contact at the first instant of motion.

Consider the damage that might be done by someone who pulls the prop through a few times on a cold engine to "free it up."

Cozy Cylinders

Myth: "If the cylinders are warm, you're preheated." Some methods of preheating heat only the cylinders. These engines start easily and it appears that the plane is "home free."

Fact: while a car lives quite well this way, an airplane may be in trouble because it has reduced bearing clearances due to that cold crankcase.

Many failures have occurred in aircraft engines over the years that have been the result of improper preheating. It's my belief that most of these may have been blamed on other things because the nature of the problem was not understood. Some types of failures that are caused or aggravated by improper preheating are as follows:

Cold crankcases may "burn" or excessively wear main bearings even though the engine has warm oil or cylinders. This is usually incorrectly blamed on "stiff oil" or a congealed oil cooler. In extreme cases the bearing insert may rotate, blocking oil flow to the entire crankshaft and thereby causing a massive failure of the engine. In less severe cases, the engine may exhibit poor propeller control due to oil pressure losses in the worn main bearings. Twins might demonstrate this by propellers that won't stay "in synch" and won't respond to cures such as overhauling the props and governors. Other clearance-related problems may occur within an engine with a cold crankcase, such as improper fit of the camshaft and the valve lifter bodies.

If an engine has a warm "top end" and cold oil, this may create its own problem. When using a straight grade of heavy "summer" oil, the oil system may not be able to draw oil to lubricate the engine once start-up occurs. The newer multi-viscosity and synthetic oils do a much better job in this respect.

Drier Consequences

Myth: "Since the engine is a closed system, moisture is not a problem in preheating."

Fact: The engine is not a closed system. Moisture is produced whenever the engine is run, and any preheater vaporizes this moisture. Regular flying of the aircraft is necessary to clear out moisture whether it is summer or winter.

This is an area not commonly understood. If only the engine's lower end (oil sump) is heated, the moisture vapor rises and condenses on the cold parts such as the crankshaft and cam. (One can see the same thing occur on basement water pipes in the summer.) This moisture will produce rust and acids.

But also, under the right conditions, it may freeze in the oil breather tube, blocking the breather. If this occurs, the crankshaft nose seal can in many cases be blown out of the engine, followed by the entire supply of oil.

The only way to avoid such problems is to assure that the preheater system preheats the entire engine and that the pilot has taken the proper precautions to winterize the engine.

A list of winterizing items should include winter grade oil, an oil cooler cover, an insulated breather tube with an alternate hole, and an check to see that the engine's baffle strips are in place. A winter front should also be used if approved for the airplane. (This is also a good time to check the cabin heater for exhaust leaks!)

Certification

Myth: "Since the airplane is FAA approved, it should operate well under any temperature condition." How could such an expensive device as an airplane engine exhibit such poor characteristics? Didn't FAA approval require it to operate in these conditions?

Fact: The FARs under which the engine was certified didn't require it to meet standards for low-temperature operation. This isn't all bad, but the engine's operator should be aware and take some precautions.

In below-zero weather, the engine develops more horsepower than it was certified to develop—possibly as much as 15 percent more! To counteract this, it's the practice of many cold weather pilots to add carb heat once the throttle is opened full (and to remove it when they reduce power). Also, they don't sit on the runup pad with the carb heat on for long periods, since it may raise the temperature just enough to cause frost in the induction system. This could cause the engine to die when the throttle is opened.

'One Heater's Like Another'

Myth: "Any preheater that is FAA-approved or that has 'No Hazard Approval' will preheat my engine properly." When a preheater is advertised as FAA-approved, doesn't that mean that it will do a proper job of heating?

Fact: Since the FAA has no regulatory standards for cold weather operations, to gain approval a preheater may not have to meet any standards—it may not even work. Many preheaters don't have any kind of "approval," nor are they required to, because they are not installed on the aircraft.

The crankcase, the part of the engine most critically in need of preheating, is also the most difficult part to preheat. This is because of a kind of "wind chill factor," analogous to what people experience in cold, windy weather, which is transmitted through a not-so-obvious mechanism—the propeller.

Typically, the propeller accounts for the largest heat loss on an engine being preheated. It sits outside the cowling in the wind, drawing heat from the crankshaft and case. While this "wind chill" can't cool an engine to lower than the outside air temperature, it will demand more heat output from the preheater to warm the engine to a given temperature. Because of this, an insulated cover for the cowl and propeller is desirable when trying to preheat.

Every preheater has limits as to how much wind chill it can handle. At a given sub-zero temperature, some preheaters don't have enough output to heat properly on a calm day—when wind chill is added, even the best at some point will no longer do the job. When a aircraft owner is shopping for a preheater, he should find that the reputable manufacturer of the unit is able to discuss what temperatures his unit will produce—as measured at the crankcase of the particular engine—and the effect wind chill will have on this performance.

Manufacturers of preheaters make many claims in their advertising—some claim BTU's of heat, others watts of power, and still others that you can "start in only 10 minutes" (or 15, or 20). But considering that the information really needed is whether the preheater will produce safe starting temperatures, it's enlightening to compare preheaters by the same standard.

One can try converting manufacturers' claims to the same measurements. Conversion factors are available in any high school physics book for such things as watts to BTU's. (One BTU equals about 0.293 watt-hours.) One thing to remember is that there are losses every time energy changes form or is transferred to some other object.

Obviously, the best standard to use would be temperature within the core of the engine. In the absence of the ability to measure this precisely, spending more *time* preheating, assuming adequate preheater output, can be like buying extra engine insurance.

Once the threshhold of output has been met, there are some other differences among types of preheaters.

Most preheaters sold today are of the "air blower" type. Through one means or another, air is heated and then blown around the engine compartment. Since heat rises and it's often hard to position the blower to be sure that hot air travels by all the cylinders as well as the crankcase, there are often parts of an engine that are extremely cold after what seemed to be a hearty preheating session. Sometimes, the blown air is simply mis-applied, and never gets to the critical engine parts. If it's applied without proper engine covers in windy conditions, the blown hot air just blows uselessly away. But the most common mistake is to believe that all that hot air applied for 15 minutes equals a warm engine, when it could take *hours* to do the job, with some heaters.

Provided these pitfalls are avoided, there are some hot air preheaters which can do a reasonable job, when properly employed.

Another type of heater being sold today heats the oil pan electrically. However, it does nothing for the "upper" engine, particularly the cylinder heads. There are also dipstick-style heaters, which we can dismiss for reasons mentioned above.

And there is the Tanis pre-heater, in which electric heating elements are installed at strategic places around the engine—not only an element on the oil sump, but other elements on each cylinder—and the airplane is simply "plugged in" to a 110-volt outlet for about 5-6 hours prior to being started. (It can be left plugged in continuously, keeping the engine constantly ready for starting.)

It has been my experience that any "air blower" with less than 50,000 BTU is just too anemic to work well. Since the total BTU energy in a typical 16-ounce propane bottle sold with many air blower pre-heaters is approximately 8,700 BTU, there does not appear to be enough heat in the bottle to do the job—even if air transfer of the heat were 100 percent efficient (which is definitely not the case.)

Yet an installed system such as the Tanis TAS100 will do an acceptable job on as little as 250 watts. Why is this? This particular systems operates for a longer period of time, makes fewer exchanges of energy, and transfers heat by conduction, which is very efficient.

Whatever type of pre-heater is employed, its effectiveness can be vastly enhanced by using thermal blankets around the cowl to keep the heat from being blown right out of the engine compartment. Again, there are conditions of wind and temperature which can make it impossible to preheat the engine to the extent needed for a safe start.

Ultimate Question

At this point, one may consider another question: When the temperature or wind chill drops into the negative teens, should we really be flying? If a pilot had a forced landing, could he survive long enough to reach shelter? When the wind chill reaches -30 degrees and lower, a pilot who is normally systematic and safety-conscious can be turned into a madman whose only concern is to get the door closed, the engine started, and the cabin heater turned on. Some cold-country pilots don't fly much below -20 degrees unless it's an emergency. At these temperatures a pilot may have trouble keeping cylinder temperatures up, and as a result produce more cylinder wear.

To summarize, when the temperature is below 20 degrees, be sure to thoroughly preheat the engine. If you want to determine the "quality" of your preheat, the cylinders, nose case, and the oil should all be warm to the touch. If they aren't, don't start.

Not all cold days are bad. On some cold days we may climb into warm air and have a beautiful flight. Cold weather flying can be some of the most enjoyable of all flying. The air is smooth and the airplane will perform well. Cold moonlit winter nights can be great flying.

The beautiful thing about winter flying is that once we understand it, we can properly prepare for it. A pilot can dress properly for winter and be comfortable. Try that for hot weather—impossible!—I much prefer winter. □

Aircraft Engine Clearances at Low Temperatures

Report on tests by Tanis Aircraft Services, PO Box 117, Glenwood, Minnesota 56334;(612) 634-4772

The coefficient of thermal expansion of aluminum is approximately twice that of steel or cast iron. Herein lies the source of a problem for horizontally opposed piston engines. The steel or cast components are supported in an aluminum crankcase which "shrinks" at low temperatures and "expands" at operating temperatures. The cylinders are steel barrels with tightly installed aluminum heads. These cylinders "choke" at low temperatures and expand to a straight bore at operating temperatures.

Aircraft engines turn over with difficulty at low temperatures and most popular thought explains this by saying the "oil is stiff"—hence the difficulty with the engine. Some failures have occurred in these engines which showed signs of bearing failure and piston skirt and top ring land scuffing.

We set out to find out what actually happens in these engines at temperatures in the -15 to -20 degree (Fahrenheit) range. Tests were done in December of 1983 and January of 1984. We checked the dimensions of several engine components at room temperature and then again at the low temperatures. We checked the following parts:

Continental IO-520 crankcase and bearings.

The temperatures of the crankcases were determined by attaching a thermocouple to the case "backbone" through-bolts, which was connected to a digital instrument. Other parts were allowed to cold-soak for several hours alongside the crankcases and the crankcase readout was used as their temperature. The parts were allowed to soak at room temperature, and were then remeasured. When comparing crankcase diameter against crankshaft, note that different micrometers were used. They were not calibrated against a standard, but the same micrometer was used for both temperature readings. The following results were obtained:

Cont. IO-520 Crankcase

	Front Main Bearing Diameter	Front Main Bearing Support Diameter
At 70°F	2.3700"	2.5667"
At -20°F	2.3670"	2.5635"
Change	0.0030"	0.0032"

This crankcase was assembled with the large through-bolts torqued at 700 inch-pounds at room temperature. At -20 degrees, the through-bolt torque had dropped to 600 inch-pounds.

Cont. IO-520 Crankshaft

	Front Main Journal Diameter
At 70°F	2.3745"
At -20°F	2.3735"
Change	0.0010"

Lyc. O-360 Crankcase

	Front Main Bearing Support Diameter
At 70°F	2.5650"
At -10°F	2.5642"
At -26°F	2.5625"
Change	0.0025"

Lyc. O-360 Cylinder

	Top of Bore Diameter	Base of Bore Diameter
At 73°F	5.1230"	5.1260"
At -15°F	5.1168"	5.1255"
Change	0.0062"	0.0005"

Lyc. O-360 Piston

	Top Land Diameter	Skirt Diameter
At 70°F	5.0780"	5.1140"
At -20°F	5.0740"	5.1120"
Change	0.0040"	0.0020"

Cont. C-85 Piston Rod

	Wristpin Bore Diameter
At 70°F	0.9243"
At -20°F	0.9230"
Change	0.0013"

Cont. C-85 Wristpin

	Diameter
At 70°F	0.9220"
At 0°F	0.9217"
Change	0.0003"

The C-85 was assembled with a piston and pin, with the rod-to-pin fit being 0.0014 inches loose. The combination was cold-soaked at -15 degrees. The wristpin was found to be locked firmly in the piston and the pin-to-rod juncture was difficult to move.

From this we conclude the following: With respect to crankcases, the Continental and Lycoming showed the same characteristics, although the Continental diameter changed more. The crankshaft-to-main bearing clearance may deteriorate to an unsafe condition at these temperatures. The IO-520 lost 0.002 inches bearing clearance, and the overhaul manual lists a 0.0018 fit as minimum for a new engine. This would result in an interference fit. We would expect the Lycoming engine to do the same thing, since Lycoming lists a 0.0015 minimum fit for a new engine.

It's ironic that this indicates a brand-new engine, assembled as tightly as permitted, would suffer the most from the effects of extreme cold, as compared to an engine nearing TBO. And an overhauled engine assembled with a wider bearing clearance would possible shrink to less than the "minimum new" clearances by being exposed to these temperatures.

The Lycoming cylinder at room temperature had a 0.003 choke, which increased to 0.013 at -15 degrees. When the cylinder was warmed by use of a "preheater," the choke disappeared completely at about 120 to 140 degrees. The Lycoming piston lost 0.004 diameter on its top ring land at -20 degrees, while the skirt changed only 0.002. By comparing the piston and cylinder, one can see that the choke increases more than the piston diameter decreases, resulting in the piston being forced into a smaller bore as the engine is turned over while cold.

Another problem not well known can be seen in the test of the C-85 rod, piston and pin. The "small end" of the rod lost 0.0013 at -20 degrees, while the wristpin lost less. The result was that the rod-piston juncture was tight enough to cause scuffing of the piston skirt and top ring land.

From these tests we conclude that damage may result to an engine merely by pulling it through to "free it up" at low temperature.

Moreover, we believe there should be some standards for temperatures on preheated engines before starting. These should include crankcase temperature and cylinder head temperature, as well as oil temperature. We believe these tests should be done on installed engine-propeller combinations, due to large heat losses through the metal propeller.

Other areas not addressed, but which we believe are significant:

Is congealed oil under piston rings holding the ring out of the groove when the piston is at the bottom of the stroke?

What is the amount of oil pressure necessary to force congealed oil through the passages of the crankshaft at low temperatures?

What is the fit of lifter bodies in the crankcase and what are the resulting forces on the camshaft?

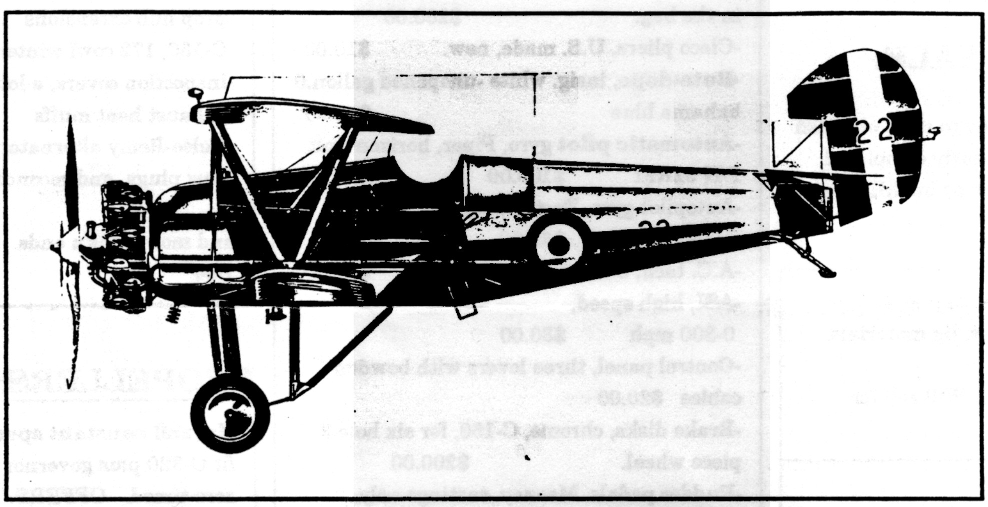
What is the fit of the camshaft in the crankcase bearings at low temperature?

What are the internal conditions of bearing fit and lubrication of accessories, such as propeller governors?

What is the proper temperature of oil in the sump to allow flow through the suction screen to the pump?

The above article was supplied by Mike Radford of Aircraft Accessoies makers of the SureStart IV as well as the Puff, Puff Wagon and the Firefli. Mike is a very cordial guy with a lot of cold weather flying experience, (he lives in Alaska), and would be happy to help you with your cold starting needs. He can be reached at 1-800-770-8108.

Here is the last issues cover mystery aircraft. Canada's front line fighter till 1939.



Armstrong Witworth Siskin IIIA no. 22 of 1 Squadron RCAF in 1938.

This aircraft was taken on strength 26 Jul 1928 and struck off strength 22 Jul 1946.

The Siskin had a top speed of 156 mph and was Canada's front line fighter until 1939.

This type of aircraft equipped the "Siskins", the RCAF's first formal aerobatic team from 1929 to 1931. The team was disbanded in 1932 following an accident.

Armstrong Witworth Siskin IIIA no 22 de la 1 ère Escadrille de l'ARC en 1938.

L'aéronef est entré en service le 26 juillet 1928 et a été mis au rencart le 22 juillet 1946.

Le Siskin pouvait atteindre une vitesse maximale de 156 m/h et constituait le chasseur de première ligne du Canada jusqu'en 1939.

C'est ce type d'aéronef que pilotaient les "Siskins", la première équipe officielle de voltige de l'ARC, de 1929 à 1931. L'équipe a été démantelée en 1932 à la suite d'un accident.

CLASSIFIEDS

10 January 95

AIRCRAFT FOR SALE:

New from Mike!!!

Cessna 150, 1967, 2500hrs TT, 750 SMOH, factory reman, needs some paint, excellent $18,000.00

Cessna 150, 1966, 3500 TT, 1000 SMOH, recent paint, fresh C of A $18,000.00

Mike Sacoutis (613) 729-3774. 94/10

Zenith CH250TD taildragger, aerobatic waiver from DOT, 8G+-. Low total time, Lycoming O-320, 160hp. Quality built with solid rivets.

Jim Robinson (613) 830-4317
Tim Robinson (613) 824-5044.

PROJECTS FOR SALE:

!!! NEWCOMERS !!! Looking to start or finish a project? These partial to nearly completed projects **will save you years of building time and barrels of money.**

RV-4 Empennage Kit. With plans, dimpling and rivetting tools, jig materials, etc
Invested to date - $1600.00. Will sell for $1200.00. Offers?

Alex Clanner 736-0555

PLANS:

PLANS for Davis DA2A.

Russ Robinson 831-4317.

PARTS FOR SALE:

Fuel selector valves.
Parking brake valve.
Accelerometer (G-meter) 2 1/4 inch.
Randolph butyrate dope in unopened gallon containers; 1 gallons clear; 1 gallon Juneau white; 1 gallon Piper Lockhaven yellow (Maule yellow); 1 gallon insignia blue.
- 2 large oil coolers (~8x9")
- 1 hydraulic pump
- 1 vacuum pump
- 1 Lycoming dual accessory case adapter for above pumps.
- Spinner, pointed, 11" base.
- piston rings for Continental E-185-3.

Cylinders, four, Lycoming IO/HIO-360, wide deck, fresh chrome.
Propeller, Hartzell HC82XL-2C constant speed plus governor for 320 - 360 Lycoming engines.

Garry Fancy (613) 836-2829

From Tim's parts bin

-**Cowl cover**, winter, for Cessna 150. New in the bag. $200.00
-Cleco pliers, U.S. made, new. $10.00
-**Bute-dope**, insig. white -unopened gallon.0 bahama blue $40.00
-**Automatic pilot** gyro, Piper, horizon unit P/N 52R21 $100.00
-Autopilot gyro, Tactair, horizon $100
-Mach meter $50.00
-A.C. tach, 0-3500 rpm $30.00
-ASI, high speed, 0-300 mph $30.00
-Control panel, three levers with bowden cables $20.00
-Brake disks, chrome, C-150, for six hole 3 piece wheel. $200.00
-Rudder pedals, Mooney, castings only $20.00
-VSI, 0-6000 fpm $100
-Operators handbook, Beech Sierra 200 B24R $20.00

Tim Robinson 824-5044 94/10

Lots of parts; Throttle cable, mixture cable, cabin hot and cold air cables, electric flap motor c\w transmission Cessna 150, control yoke assembly, 2 sets of seat tracks & doublers from Cessna, main landing gear shims Cessna, 2 Grumman canopy tracks, COM and VOR antennae, inspection covers Cessna,

Ron McMillan 837-6865, 720-7521

Butyrate dope, 5 gallon pail, new $?

Mike Sacoutis (613) 729-3774. 94/10

I still have a few things left
DAVE STROUD 727-9304d 226-7889e

Extensive, miscellaneous selection of aircraft and engine parts, new and used, some with tags.
-Bendix navcom, overhauled
-C-150,172,180 gear legs
-Cessna master brake cylinder
-PA 18 exhaust pipes SS new
-2 Spinners, back plates,
-prop hub extensions
-C-150, 172 cowl winter covers
-inspection covers, a lot
-exhaust heat muffs
-Delco-Remy alternators
-new plugs, and reconditioned

and more odds'n ends
7/94

PROPELLERS:

Harzell constant speed - HC82VL-1D1 to fit O-320 plus governor and vernier control, zero timed. OFFERS.

Mike Sacoutis (613) 729-3774.

Propeller, Hartzell HC82XL-2C constant speed plus governor for 320-360 Lycomings

Garry Fancy
(613) 836-2829

Propeller, three bladed, gound adjustable, wooden blades, metal hub with spinner. Fits VW hub $250.00.

Tim Robinson (613) 824-5044 evng

Propellers, VW 48/30 & 60/38, wood plus adapter for 1600cc VW engine.

Jacques Pilon (613) 446-4175

ENGINES:

>>>>>NEW<<<<<!!!!

Lycoming 0235-C2C, 200hrs since new limits, cermichrome major. Avspark electronic ignition, 4Cylinder EGT/CHT, vacuum pump, oil cooler and everything but the engine mount.

Gary Palmer (613) 596-2172 9/94

O-300A 1750 SMOH, O-300C 1200 SMOH, C-85-12 Continental 1200hrs

Propellers for above
Exhausts for above

Mike Sacoutis (613) 729-3774.

Engines. VW 1600 cc, Continental 2 cylinder ground power unit 30 HP.

Jacques Pilon (613) 446-4175

RADIOS:

Genave 100, $250.00

Andy Douma 591-7622

AIRCRAFT SUPPLIES:

Steel, Aluminum, Plastic, Wood and Hardware.
Available from - Grass Roots Aviation
648 Adelaide Ave West, Oshawa, Ontario
(905) 434-4651

Sheet Aluminum - 2024T-3, 6061-T6 and other grades. Available from - Ridalco Industries Ltd.
1551 Michael Street, Ottawa, Ontario
745-9161

INSTRUMENTS:

Guages
-Altimeter $50.00.
-ASI $50.00
-Mach meter $75.00

Autopilot, Federal, new, 2-axis, STC included for installation in C-172 A.B.C., $250.00.

Tim Robinson (613)824-5044 evenings.

Flight controls from Piper Tomahawk: hanging rudder pedals with brake cylinders, control wheel yoke assembly.

Garry Fancy (613) 836-2829

Seats for C172 - Complete set of seats for 1963 C172. Will fit other models. New blue upholstery. $300.00

Jim Robinson 830-4317

Silica Gel packettes. Keeps the moisture out of engines in winter storage. $3.00 each.

Irving Slone 722-0359

WANTED:

Wanted; Back issues of Sport Aviation for the National Aviation Museum's collection.
1965 April V14/4
1983 March V32/3
1987 Nov. V36/11
1989 Jan. V38/1
1992 Feb.-Oct. V41/2-10

George Skinner 749-9582

OTHER:

CHAPTER CRESTS:
Sew-on, $6.50 each.

Luc 744-5347

Campers!!! one **large** tent for sale. Large outer with smaller suspended 5 person inner. Light weight cotton material. You can live in this one quite comfortably. $100.00

Garry Fancy 836-2829 7/94

Limited edition aviation & Military prints by Connolly, Taylor, Dietz etc. Custom framing and matting services also available.

Greg Merrill 591-3477 7/94

The "**Canadian Amatuer Built Aircraft Registry**" is now available from CASTC. A registered version of shareware will soon be available for $30.00

Ted Slack at 226-8373.

PLEASE NOTE:
ADS DEADLINE IS THE 5TH OF THE MONTH

PLACE YOUR ADS BY PHONING ANDY AT 591-7622
Classifieds Editor

MEMBERSHIP APPLICATION

EAA Chapter 245 (Ottawa)

Box 8412 Main Terminal, Ottawa, Ont., K1G 3H8

NEW:___ RENEWAL:___ DATE:______________

EAA NUMBER:______________ EXPIRY DATE:______________
>>See Annual dues note<<

NAME:______________________ PHONE: ____-________H
ADDRESS:______________________ ____-________B
______________________ ext ______
____________PC____________

***AIRCRAFT & REGISTRATION:** ______________________*
(or aircraft of interest) ______________________
____

OTHER AVIATION AFFILIATIONS:

RAAC:|__| COPA:|__| Other:______________________

***ANNUAL DUES:** January 1st to December 31st. (Prorated after March 31st for new members/subscribers).*
*>>> **Note**: Associate and Full Chapter members must also be members of the EAA parent body based in Oshkosh, Wisconsin - $35.00US.<<<*

*| | **Associate Member**: $30.00 Entitles one to the newsletter plus Chapter lounge privileges.*

*| | **Full Member**: $55.00 plus a "one time only" initiation fee of $200.00. This entitles the member to full hangar, workshop and tie-down privileges. (Tie-downs are billed extra at $20.00 per month).*

*| | **Newsletter subscriber**: $30.00. No requirement for parent body membership. Entitles the subscriber to the Chapter Newsletter.*

Make cheque payable to: EAA Chapter 245 - Ottawa
Mail to : Box 8412 Main Terminal, Ottawa, Ont. K1G 3H8

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EAA NUMBER:____________. EXPIRY DATE:____________.

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