EXPERIMENTAL AIRCRAFT ASSOCIATION 245 OTTAWA

Carb Heat

Hot Air and Flying Rumours

NEWSLETTER

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JANUARY 1993

NEXT MEETING: THURSDAY 21st JANUARY

TIME: 1930 HRS

PLACE: BUSH THEATRE

NATIONAL AVIATION MUSEUM

TOPICS:
- BUSINESS
- ANNOUNCEMENTS
- VIDEO - OSHKOSH 1992

FEATURE SPEAKER:
-Gary Fancy on Getting started in Homebuilding
The Regulations.

Dick Moore - A few word about the importance of proper engine preheating. (see the article inside)

Garry Fancy
8 Sicard Way
Kanata, ON
K2L 2X6

President's Corner

It was very encouraging to see the large turnout at our November meeting; I'm not sure if it was the coffee and donuts, or the fact that tthere was no longer the danger of being coerced into serving on the executive. At any rate I want to thank everyone for the standing room only turnout and welcome our new members.

As those of you who made it to the meeting saw, we were the "stars" of a local television production done by CJOH and shown on the "Regional Contact" show. This was a well balanced seven minute segment featuring five of the current fleet of active aircraft, and two of our projects under construction. Thanks are due to each of the participents who showed up on short notice and flew in cold snow squall weather, particularly Rod Emerson in his open cockpit Teenie Two. The stars were:

Rod Emmerson	Teenie Two
George Elliot	Zenith CH-300
Andy Douma	Davis DA-2
Luc DeSadeleer	Vans RV-6
Gary Palmer	Lancair 235
Marc Guay	RV-6 project
John Lukes	RV-6 project
Luc Martin	SE-5A project
Chris Fauquier	Camera ship

A special thanks to Lars Eif for catching the fly-bys on video for those of us who have never seen nor heard our planes in action, and didn't get enough on the CJOH video.

Chapter improvements continue with the addition of a new 6 KW Honda generator located by Andy Douma, and installed by Laurent Ruel. This provides us more than adequate power for our facility (50 amps) at an affordable cost. Hydro installation is simply too expensive particularly given some of the uncertainties surrounding our long term location at the airport. The new unit is not currently set up for remote start, since it has a manual choke. Laurent ensures us this is only a short term limitation to be solved by next spring. In the meantime he has modified it to use fuel from our external tank for improved safety.

We have also added a new snowblower in addition to some snow fencing for those stalwart types that hope to operate during the winter. See Dick Moore if you are planning winter ops to get checked out on our new machine.

Just a reminder that if you haven't renewed yet, Manfred will be glad to take your money at the next meeting.

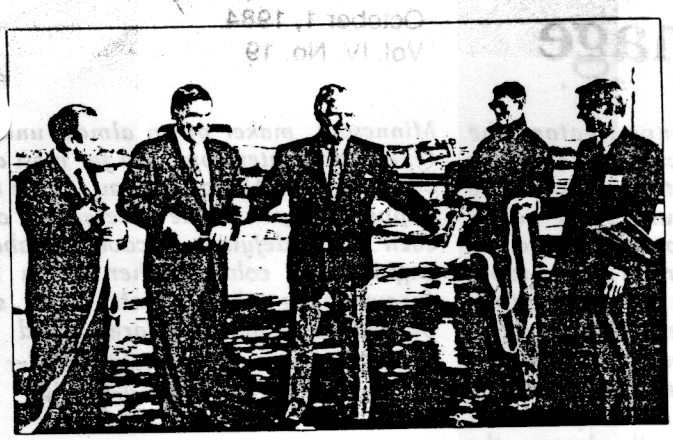
We are planning to open our "getting started in home-building" series with a discussion of the current regulations by Gary Fancy, followed by a video of Oshkosh 1992. We will follow with a series of sessions focussing on the most popular types of construction, and are still looking for volunteers.

Our plans for the next meetings are:

Feb 18	Traditional Construction
Mar 18	Aluminum Construction
Apr 15	Composite Construction
May 20	Formation Flying Basics

I hope you all had a safe and enjoyable holiday season, and look forward to seeing you at our next meeting Thursday January 21st, 1993 at the National Aviation Museum.

See you at the meeting!



Carp Airport opening on anniversary

The Carp Valley Press
December 10.1992

The West Carleton Airport Authority celebrated the official opening of the apron and other works on the occasion of the 50th anniversary of the Carp Airport on December 9. Above, from left to right are: Kamal Hanna, president of First Air; Paul Dick, MP for Lanark-Carleton; West Carleton Mayor Roland Armitage; Andy Douma, EAA Chapter 245; and Anthony Taylor, president of Westair Aviation.

General meeting notes Nov 92

Welcome to guest and new members who joined us at the last meeting.
George , Bob, Stan, Dan, Eric, and, Luke
Our generator is working just fine the electrical work has been put on the back burner for the time being.
We now have a snowblower to clear away our snow.
Andy, Eric , and Laurent have been experimenting with snow fencing in the back forty.
We took pictures of everyone at the last meeting to help put faces on the names .
Tim the toolman is working on the tool crib, he mentionned that Witneys in Chicago make a good oil sump heater.
Irving Sloane and Eric Taada gave a short presentation on inhibiting your engine for the winter.
They recomend
(a) use storage spray oil (canadian tire).
(b) insert silica gel plugs.
(c) tape all the openings on the engine.
(d) top up the tank then replace with fresh gasoline before use.
For those interested in purchasing inhibiting oil contact Tim .

The feature speaker of the evening was Mr. Wayne Chapin, who gave a presentation on the GPS system.
Wayne who hails from Brandon Manitoba, is also a new member of our chapter. (way to start off Wayne)
He also has a lot of bush flying experience He now flies a BD5D (Big desk 5 drawers) for the MTO.
The GPS chain presently has 19 of 24 satelites in orbit , a GPS receiver, uses four to read, position, track, groundspeed, altitude, The whole system is kept in sync, thanks to, atomic clocks. Accuracy is within 100 feet .
The ICAO and the FAA are developing GHPS to meet ILS standards .
GPS is now the survey standard for most countrys .
All in all, a most interesting evening. To close out this part of the newsletter, the crest, (artwork by Mr. James Oliff) I talked about will be on sale at the next meeting, for the once only, super special, not to be missed, price of, 6,50$. Get one, for your cap, your jacket, your hat, your wife, your cousin Bob,that good looking woman next door will like one of these. The list is endless, but not this article, so
I will see you at the next meeting.

7 Jan 1993

Luc Martin (SLS)
Semi literate secretery

STOL CH 701

See NEW!!! ad in the classifieds

EAA 245 Winter/Spring 1993 Agenda

The following table outlines the winter/spring agenda for EAA chapter 245. All meetings are held on the third thursday of each month at the National Aviation Museum, 19:30 hrs.

Date	Subject
January 21	Getting started in homebuilding, the regulations Speaker: Gary Fancy Video: Oshkosh 92
February 18	Traditional Homebuilt Construction Speakers: Lars Eif Tube and Fabric Luc Martin et al Wood
March 18	Aluminum Homebuilt Construction Speakers: Luc DeSadeleer -RV-6 Dominique Gravel -Murphy Rebel George Elliot -Zenith Floats
April 15	Composite Aircraft Construction Speakers: Wally Belinski -Velocity Stan Ironsides -Glasair III Nigel Field -Cozy
May 20	Formation flying basics Speaker: CF-18 pilot friend of Rod Emmerson
June 17	Awards night
July 15	Flying to Oshkosh Procedures and Video

Chilly starts may cause unreckoned engine damage

Aviation Safety
October 1, 1984
Vol. IV, No. 19

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 universal 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, horizontally opposed aircraft engines have 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.

The above article was supplied by Mike Radford of Aircraft Accessories makers of the SureStart IV (see COPA for add) 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.

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 changes of energy, and transfers heat 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.

Continued - next page

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? □

CHAPTER NOTES AND NEWS

from the Editors desk

December and January have seen the usual winter decline in activity at our Chapter facilities at Carp. However, snow has not been a big problem yet this year. Yet.

FLYING:
- Rodney Neufeld is our most active winter flyer. He is staying sharp because of his involvement with CASARA. Dick, George and I flew in December and I put in some time on that mild day of the 23rd. Other folks have been active judging by the tracks in the snow. The extremely icy conditions after Christmas turned the airport into a very long skating rink. Subsequent mild weather has cleared off the ice.

BUILDING:
- Luc Martin has been quite busy with work so the SE5 has not seen much company.

MAINTENANCE:
I need to do some work on the Davis but time and weather have not been co-operative.

MISHAPS:
Bruce Nally's Ercoupe had a forced landing on the Russel Road on Sunday January 10th. A car that slowed down to watch him ended up right at his touchdown point and he opted for the guard rail. The aircraft sustained substantial damage. He and Bob MacDonald his passenger were unhurt. The officialdom and news media that subsequently descended on them turned out to be a bigger problem.

WINTER STORAGE AND OPERATIONS:
- Our new super duper 12 hp snowblower arrived about December 5th. The snow bore down on the 11th. Dick and I were real busy on Saturday morning. After adjustments to the drive belt the blower worked very well as it carved it's way through the meter deep drifts that had swept across our taxi way. Laurent performed the necessary 2 hour service work and by sunday we had full access to all the active aircraft.

IMPROVEMENTS:
The 180 feet of snow fence erected the week before the storm seems to be doing it's job.

USEFULL INFORMATION:
See this month's article on preheating your engine It has some very good information.
I have ordered the book "How to choose your Homebuilt project" from B.C. I hope it arrives before the meeting.

ELECTRICAL:
- Laurent has installed the Honda 6.5 kW generator and it works great. Dick recently picked up the exotic electrical plugs it still needed.

OTHER NEWS:
- on wednesday December 9th your editor represented the Chapter at the official opening of the apron and other works on the occassion of the 50th anniversary of the Carp Airport. The ribbon cutting ceremony was attended by Kanal Hanna, president of First Air; Paul Dick, MP for Lanark-Carleton; West Carleton Mayor Roland Armitage; Tony Taylor, president of Westair Aviation and me, your lowly scribe.
- At Westair's Christmas party on the 18th I learned that our member Ray Jones has almost completed his Zenith CH701 project. He is also nearing completion of his PPL training.
The Christmas gorilla cooking the BBQ steakes looked remarkably like Tool man Tim Robinson. The steakes, pies and pastries were delicious.

MEMBERSHIP RENEWALS:
- Don't forget - Manfred will be taking renewals for 1993 at the January meeting, sign up now and you won't have to think about it latter.
This year we will again be issueing membership cards.

TOOL CRIB:
- Please note that Tim Robinson is now the Tool Crib chief, access to the lock-up may be obtained by phoning him at 824-5044 home or 839-5431 work. Dick Moore also has the lock up combination and he may be reache at 836-5554.

CLASSIFIEDS

12 Jan 1993

AIRCRAFT FOR SALE:

Zenith CH250TD taildragger, all aerobatic options, waiver applied for. 25 hours TT Lycoming O-320, 160hp. Quality built with solid rivets. $30,000.
Jim Robinson (613) 830-4317
Tim Robinson (613) 824-5044.

Piper PA-25 Pawnee - no engine.
Piper PA-22 Colt 108hp.
Stinson 108-1 150hp.
Cessna 172, 1956 straight tail.
Phone **Mike Sacoutis (613) 729-3774.**

Homebuilt Super CUBy. Completed 1988. 100 TTAF. Lycoming O-320, 100 hrs SMOH; set up for auto fuel. Full gyro panel; 2-20 gallon wing tanks. Excellent condition.
Henri Beaudoin (613) 749-9720.

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.**

NEW!!!!!

Zenith CH701 project. Scratch built by a machinist. All done but the engine installation, engine not included. Excellent workmanship. This is a great finishing project if you are interested in this super STOL aircraft. Price $8000.00
Phone - Albert St. Martin
1-705-277-1738H
1-416-723-6310W
Your Classifieds Editor has had a look at this project, ask him about it if interested.

Aeronca 15AC (Sedan) Project.

Cessna 140.
2500 TT, 85Hp Continental 1100SMOH, New paint Blue on white. Fabric wings need recovering.
Mike Sacoutis (613) 729-3774

Baby Great Lakes Project: Fuselage 90% complete; all **sold** ribs and spars; Some instruments
Mike Sacoutis (613) 729-3774.

PLANS:

PLANS for Davis DA2A.
Russ Robinson 831-4317.

PARTS FOR SALE:

Bellanca Scout for parts.

Engines:
Continental O-300C, 1365 hrs; O-300A, 1750hrs; O-300, 1200hrs.

Lycoming O-290 D2 135hp, 1000hrs TT

Engine Parts: for Lycoming, Continental, Franklin. Starters, generators, vacuum pumps, oil cooler and cylinder for a 165hp Franklin.

Engine Mounts:
Piper PA-12, Mooney M-20, Champion 7AC 90hp, Cessna 175 O-300.

Wheel Pants:
Cessna 172, Stinson 108, Aeronca Sedan.
Mike Sacoutis (613) 729-3774.

PROPELLERS:

Sensenich - M74DM-61; M74DM6-0-62 cut to 71"; M74DM6-0-48; M76A-M-2-52
Harzell - HC82VL-1D1.
McCauley - 1C172-7653; 1C172-EM7653; 1A175-FC8467, -DM7651, -DM7655; 1B90-CM7448
Pusher Prop, 76", suitable or a VJ-22
Mike Sacoutis (613) 729-3774.

FLOATS N' STUFF:

EDO Float Rigging:
- 89-2000 (deck fittings)
- C-172 (modern)
- C-140

Assorted struts.

EDO 1650,s with fittings and rigging for C-140, Piper, Aeronca.
Mike Sacoutis 727-3774

RADIOS:

Narco 122A VOR G/slope, Narco 810 COM, Terra TX720, Genave Alpha 600 N/C, Bendix ADF-F-12C
Mike Sacoutis 729-3774

Genave 100, $250.00
Phone Andy Douma 591-7622

INSTRUMENTS:

Altimeter, VSI, Tachs, DG, Horizon, Compass, Accelerometer, Turn and Bank (electric), CHT-EGT, Airspeed, Manifold Pressure.
Call Mike Sacoutis 729-3774.

Compass, Airpath C2400 L4P, pedestal mount, new & unused still in the box. $75.00.
Gord Standing 224-2879.

Vari Eze landing gear legs. New. Call **Peter Plaunt (613) 839-2283.**

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.

For the above items contact
Garry Fancy (613) 836-2829

Propeller, three bladed, gound adjustable, wooden blades, metal hub with spinner. Fits VW hub $250.00.
Guages, Westach 2 1/2 " square manifold pressure/ turbo boost. Brand new in the box $50.00.
Autopilot, Federal, new, 2-axis, STC included for installation in C-172 A.B.C., $250.00.

For the above items contact **Tim Robinson at (613) 824-5044** evenings.

WANTED:

OTHER:
The "Canadian Amatuer Built Aircraft Registry" is now available from CASTC. A registered version of shareware will soon be available for $30.00
Call Ted Slack at 226-8373.

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