EXPERIMENTAL AIRCRAFT ASSOCIATION 245 OTTAWA

NEWSLETTER

Carb Heat

Hot Air and Flying Rumours
Vol 27 No. 2

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February 1997

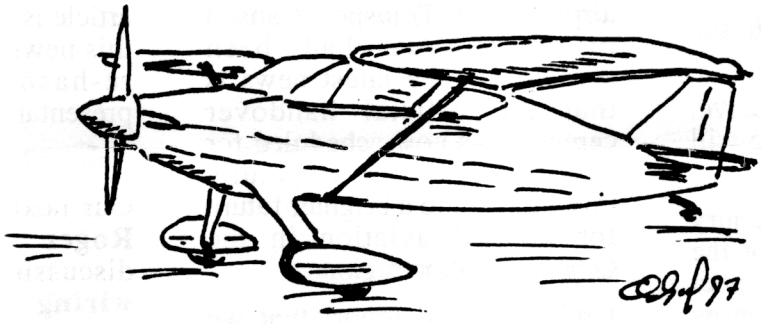
Next Meeting: Thursday 20th February 2000hrs

Bush Theatre
National Aviation Museum

Program: **Regular monthly business**

Inside: **Presidents Page by Gary Palmer**
My W10 Tailwind by Lionel Robidoux
The Jug Jungle Part 2 by Mike Busch (mbusch@avweb.com)

Guest Speaker: **Roger Grant will discuss Aviation wiring practices**



Withman W10 Tailwind

The arrival of Winterlude in the Ottawa area always signals the approach of spring in an Aviator's heart. While many of us and our birds remain snow bound, some of our members are enjoying some superb winter flying. I was fortunate this past weekend to spend some time aloft with Win Cotnam in his recently acquired C-150. Conditions were CAVU, and the flight was smooth as silk. Maybe one of this years I'll try to get airborne in my own bird to enjoy this time of year.

Mazda Rotary Status

Les Staples, continues to make steady progress on his ambitious **Mazda Rotary** Conversion project. The engine rebuild is complete, and the engine is now completely installed on the mount.

All the various engine accessories are also in place on the engine and mount assembly with just three major subsystems to be completed.

The exhaust system will probably be complete by the time you read this, with the intake manifold next in line.

After that the reduction drive, which is already well along will be the order of the day.

The cooling system will be jury rigged on the test stand for the initial test runs. I still expect first smoke before the snow departs.

If you drop out to the club house on weekends you will generally find Les more than willing to share a bit of time and display his pride and joy. I continue to dream of all that smooth power in my Lancair someday.

Bill Argue's Pegasair

I was fortunate to get a look at Bill Argue's Pegasair project, and was pleased to see Bill well on the way to completion of his project. The Wings, Tail Feathers, and Fuselage frame seem nearly complete. The workmanship, not surprisingly, is at a very high level. In fact I understand the Pegasair designer has rated it the best he has seen under construction.

The automatic leading edge slats operate very smoothly, and promise to deliver outstanding STOL performance. Coupled with a Lycoming O-235, it should be airborne in a few plane lengths.

Bill is now moving into the systems installation phase, the infamous 90% complete, 90% to go stage. Given Bill's dedication, I fully expect to see him airborne next year in a first class bird.

Carp Airport Status

In my last column (January) I mistakenly reported that transfer of ownership of the airport from Transport Canada to the RMOC had been completed. The latest news is that the official handover ceremony is now scheduled for March 14th, 1997. Hopefully this will lead to a brighter future for general aviation in the Ottawa Carleton region.

I wish I could report that we have been successful in winning over the WCAA to our concerns with the proposed new lease structure, but alas no such luck.

We will continue our negotiations, and I encourage you to let us know your preferences as requested in last month's newsletter.

Nav Canada

If you have been following the news in COPA, you will know that we will have to become ardent activists if we are to keep Nav Canada's greedy hands out of our pockets. It seems every time you turn around, some new level of government or related agency is levying fees on the poor guys at the bottom of the ladder. When it comes to aviation, that's us.

While the exact cost recovery proposals are not yet known, our meeting a couple of month's back on the Ottawa airspace fiasco reinforced our lowly status in Nav Canada's hierarchy.

If you haven't kept your COPA membership active, now is the time to re-enlist, we gain strength in numbers.

January highlights

The January meeting featured **Lionel Robidoux**, who will described his construction, and test flight experiences with his recently completed **Wittman W10 Tailwind.** Lionel 's article is published elsewhere in this newsletter so I won't try to re-hash his interesting presentation.

Feb. 20th Mtg. at NAM:

Our next meeting will feature **Roger Grant** who will be discussing proper **Aviation wiring practices**. This is a topic that we have received many requests for, so I look forward to seeing you on Thursday February 20th at the **Aviation Museum**, 8:00 PM sharp start.

Gary 

MY W10 TAILWIND by Lionel Robidoux,195 Crestview Rd,Ottawa, Ontario K1H5G1 EAA18643 (613)738-1066

During the past 30 years I have built or restored over 10 aircraft, the first was a Thorp T18 2 place all metal aircraft in the 150-170 mph class, followed by a succession of factory built Piper Tripacers and Citabrias. However, I found all the factory builts burned too much fuel for their cruise performance. Steve Wittman came to the same conclusion in the fiftys so he designed the Tailwinds, first the W8 and then the W10 for which plans are still available.

In 1992 I learned that a W10 project was available locally so I took a look at it. It was a pretty bare-bone project,i.e. the skeleton fuselage was there and two partially started wings and many fabricated small parts. I thought, " with all my building experience, I should have this in the air within a year". However, it turned out to be one of those projects that some builders describe as "90% finished, 90% to go" but I have no regrets as it flew on September 23, 1996 and I now have 22 hrs flown off of the initial 25 hr restriction.

The W10 is a 2 place side by side high wing aircraft with a gross weight of 1425 lbs, and can use engines up to 150 hp. The fuselage is steel tube and fabric covered. The wings have wood spars, wood ribs and covered with plywood and then finally with fabric.I installed a Lycoming 290D2 140 hp engine with a 4" prop extension, and Ed Sterba Propellers' wood 68X70 propeller. Empty weight is 848 lbs which leaves a payload of two 170 lbs people, 29 gallons fuel plus 60 lbs baggage. This combination of engine, propeller, and light weight is supposed to give a potential top speed of 190 mph at the higher altitudes.

From a building standpoint, the Tailwind is a very labour intensive aircraft to construct, and I guess that is why Piper doesn't make Super Cubs anymore. It is my opinion and also the view of other Tailwind builders that unless you are an accomplished aircraft welder(or have the willpower to become one) choose another design. The drawings are fully adequate from a structural standpoint but very skimpy with respect to finishing details.

Now comes the good news! The W10 is much stronger and a bit longer than the W8, and has an extensively flight tested wing and wing tip. Steve Wittman wanted speed for the fuel burn and he got it in the W10 design. My W10 flys as expected and is very stable in pitch and wants to fly level. It flys slightly left wing heavy but that is with only myself on board. I am sure it will fly nice and level without effort with 2 people. As for stalls, the aircraft simply mushes as speed is reduced in flight (all the way to 40 mph) with just myself and 3/4 fuel. I don't know if the nose will drop when stalled at gross weight.

While the ailerons are relatively small, they are very adequate in flight as well as during all phases of landing including side slips. I have experimented with the flaps but prefer to not use them for takeoff nor landing so far as I am very light with only one person aboard. I feel at that weight I don't need the added lift for takeoff nor the drag for landing. I prefer to exercise speed control instead as dictated by wind conditions.

The Tailwind is one of the cleanest steel tube aircraft designed. The high wing has a single strut and, believe it or not, a significant amount of lift is generated by the flat top and bottom fuselage. My W10 lifts off as it passes through 60 mph and seems to want to touch down at about the same speed with the tailwheel touching first. A W10 was used in a CAFE 400 test in 1994 and the test pilot tried both wheel and "three point" landings, and he also found that the three point landing with the tailwheel touching first as speed bleeds off was the preferred technique since the main gear is so soft.

Overall, the W10 is a good proven design and gives excellent performance for the fuel burn. I particularly like the W10 wing and its tip as this is the first powered aircraft I have ever flown that wasn't a serious "land lover" when you reduced power. When the aircraft is clean and over 90-100 mph, it has a fine glide ratio. However, the glide ratio seems to deteriorate when speed is reduced to 80 mph or below but this condition is probably attributable to the combination of increased angle of attack and the nearly symmetrical airfoil.

After struggling along at 90-95 mph @ 2400 rpm for 14.5 hrs to Oshkosh this year in a Cherokee 140 with only 2 people on board, it sure is a pleasure flying along at 130-135 mph at 2200 rpm(and 10 less horsepower) and enjoying the scenery with minimum fuel burn. After that power level, your speed is proportionate to the amount of fuel you choose to burn. So far it seems to give at least 160 mph at 3000 ft. at 2600 rpm. I'm told that wheel pants and gear leg fairings on the W10 will add 10 mph.

I find the spring steel gear very soft and flexible after the rigid Thorp T18 "A" frame design. I will have to dampen it with a formed wood tapered piece at the trailing edge like called out in the Hiperbipe design. The only major problem I haven't fixed yet completely is controlling oil temperature at higher power setting when OAT is above 60 degrees. The fix is simple-get more air going through the oil cooler. I have been " dragging my heels" on this fix because it involves relocating the oil cooler and I'd prefer to fly as long as it is safe to do so.

In summary, the project involved twice the time I had anticipated but it was well worth it. I have a good flying aircraft and have acquired(perfected) three new skills-aircraft welding,silver soldering and brazing and that's a big part of the EAA movement.

Editors Note

You may have noticed on the masthead that I've started to include a volume and number. I have gone through the Chapter archival material and discovered that the first issue of Carb Heat came out in 1970. That makes this the Chapters 27th year of existence. For interest sake I will produce a listing of Chapter officers from past to present in a later issue

The Jug Jungle

Whether you're approaching major overhaul or just dealing with one jug with a mid-life crisis, you face a bewildering array of cylinder choices: factory new, oversize, rebarrel, nitrided, through-hardened, channel chrome, Cermicrome, Nu-Chrome, Cermisteel, IFR, Freedom, and now CermiNil and Millennium cylinders...whew! Here is our survival guide for sorting through this maze and choosing replacement cylinders wisely. **This originally appeared in The Aviation Consumer.**

by Mike Busch (mbusch@avweb.com)

Part 2

Cold Starts

Cold starts spell disaster for cylinders. A single unpreheated cold start (particularly at temperatures below 20 F) can inflict more cylinder damage than a thousand hours of cruise flight! Contrary to popular belief, cold start damage isn't caused by lack of lubrication, but rather by loss of piston-to-cylinder clearance. This requires some explanation.

When an engine is cold, there is quite a lot of clearance between the piston and the cylinder walls--usually more than .010" of clearance. This is necessary because as the engine heats up to operating temperature, the aluminum piston will expand about twice as fast as the steel cylinder barrel will, and the piston-to-cylinder clearance will get a good deal tighter. And that's okay. But it's crucial that there always be at least a few thousandths clearance between the piston and the cylinder wall, so that the the oil film is not breached and metal-to-metal contact is avoided.

During a cold start, the piston heats quite quickly, but the cylinder warms up much more slowly because it has vastly greater thermal mass and is covered with cooling fins and bathed in frigid air. Consequently, there is often a period of time--where the piston is up to temperature but the cylinder hasn't caught up yet--when the piston-to-cylinder clearance can actually go to zero and result in metal-to-metal scuffing of the piston and cylinder walls. That's why cold starts can be so devastating to cylinders.

Ultra-Low Oil Consumption

Every time a group of aircraft owners get together, it is inevitable to hear at least one or two bragging about ultra-low oil consumption. "I'm using a quart in 40 hours!" These super-low oil consumption figures are often associated with Cermicrome cylinders, and/or with Continental engines equipped with the late-style center-vented oil control ring.

The owners who are doing this bragging probably don't realize that they probably won't make it to TBO without a costly mid- term top overhaul! It turns out that ultra-low oil consumption is often a bad omen when it comes to cylinder longevity.

Here's why. The maintenance of the critical oil film on the cylinder walls is acomplished by the oil control ring, a fancy spring-loaded perforated double-ridge ring that receives a supply of oil through small holes drilled through the piston wall and spreads it into a thin film as it moves up and down over the cylinder walls. The oil control ring is installed in the third piston groove, below the two compression rings that are resonsible for maintaining the dynamic seal of the combustion chamber. Consequently, the oil control ring lubricates most of the cylinder wall, but it never reaches the topmost inch or so where the compression rings reverse direction at top-dead-center--the so-called ring-step area. Lubrication of this critical region can only take place if sufficient oil is allowed to flow past the oil control ring. A certain amount of this oil is inevitably burned up in the combustion process.

If oil consumption is reduced to an ultra-low level by means of a tight-fitting oil control ring (like the new-style center-vented Continental ring) or a super-smooth cylinder wall finish (like Cermicrome), it's very likely that the ring-step area won't receive adequate lubrication, and there's a high risk of metal-to-metal contact between the compression rings and the cylinder wall. A "blued" ring-step area is a sure sign of such lubrication failure.
Experience seems to indicate that oil consumption lower than about a quart in 20 hours may not bode well for long cylinder life. Barrel wear in the ring-step area becomes likely, leading to rapidly deteriorating compression and accelerating oil consumption at 500-1000 hours. Once again, this tends to occur most often in hot-running high-horsepower turbocharged engines.
While low oil consumption has always been acknowledged as a sign of a tight, well-broken-in engine, there is strong evidence that a quart in 30 or 40 may well be too much of a good thing.
Cermicrome cylinders are particularly vulnerable to such ring-step wear. This is because the ceramic-impregnated layer of a Cermicrome barrel is extremely thin--a thousandth of an inch (.001") at best. Once this very thin ceramic-impregnated layer has been worn through, what's left is mirror-shiny chrome which is not oil wettable. Once this happens, there's no oil film in the ring-step area, so there's nothing to prevent metal-to-metal contact between the compression rings and the cylinder wall. Naturally, things go to hell rather quickly after that.

Stuck Rings

Bad things also happen if too much oil is allowed to reach the compression rings due to a loose oil control ring or an excessively rough cylinder barrel. The compression ring grooves may fill up with oil, the oil may be cooked into varnish by the heat of combustion, and ultimately the compression rings may become stuck and unable to flex or rotate.
Stuck rings are usually revealed as a sharp and sudden increase in oil consumption, and often accompanied by oily top spark plugs. If caught early, rings can sometimes be unstuck without cylinder removal by means of a penetrant soak. Sometimes pulling the cylinder is unavoidable.

Exhaust Valve Leakage

If you are fortunate enough to avoid metal fatigue and barrel wear problems, your cylinders will ultimately be done in by exhaust valve leakage. This is unavoidable. Exhaust valves are the most thermally stressed components of the engine. They operate at rediculously high temperatures, so they have to be manufactured from the most exotic and expensive high-temperature alloys (such as Inconel and Nimonic-80).
What's worse, exhaust valve stems must slide back and forth in their guides with extremely close tolerances and virtually no lubrication. Any oil introduced into the guide would quickly be fried into varnish by the extreme heat. Lubricant would also interfere with the critical stem-to-guide heat path through which the exhaust valve sheds its heat.
Consequently, metal-on-metal contact between the valve stem and guide can't be avoided, and guide wear is simply a fact of life.
As the guide wears, it can no longer hold the valve in perfect alignment with the seat. The valve starts to wobble and no longer seals perfectly against the seat every time it closes. Hot exhaust gas leaks between the valve and the seat, causing both to overheat and warp. The warpage allows even more exhaust to leak, which results in even more overheating and warpage. This condition is commonly referred to as a burned valve. Once leakage starts, compression deteriorates rapidly. If not detected in time, the valve may fracture and a catastrophic engine failure may result.
Continental and Lycoming have made numerous changes to exhaust valve and guides in order to increase TBOs. In the 1960s, valve guildes were usually made of bronze which was relatively soft and didn't wear well. Both manufacturers have switched to harder aluminum-bronze alloy and cast iron "ni-resist" guides, and Continental even tried super-hard nitrided steel "nitralloy" guides for awhile. Harder valve guides demanded harder valve stems, so exhaust valve stems are now often chrome plated.
These valves and guides are capable of making it to TBO and beyond if everything goes just right. But if it doesn't, they won't.
A common cause of premature valve problems is failure to lean sufficiently, particularly during ground operations. Rich mixtures and low combustion temperatures will cause a build-up of lead salts and other combustion byproducts on

the valve stem. This buildup tends to be crusty and abrasive, and it can quicly abrade the lower portion of the valve guide into a bell-bottom shape, allowing valve wobble, leakage, and burning.
If an overhaul or cylinder shop isn't meticulous about guide-to-seat concentricity or rocker arm geometry, the valve is sure not to make TBO. This seems to be a disturbingly common problem. We've even seen quite a few reports of Continental factory-new power assemblies with serious valve misalignment problems right out of the box. We've talked to several top-rated overhaul shops who tell us that they don't dare install a factory-new cylinder without first checking valve alignment. (Really makes you wonder about TCM factory remans, doesn't it?)

Cylinder Longevity Tips
Here's our advice about how to increase your odds of nursing those jugs to TBO without intermediate top-end work.
Be careful about what cylinders you have installed on your engine. Don't try to recondition a cylinder too many times. The likelihood of head cracks and separations increases after about two TBOs time in service. Avoid exchange cylinders like the plague--you have no way of knowing where those heads have been.
Be sure your overhaul or cylinder shop reams the valve guides to be precisely concentric with the seats. Concentricity needs to be checked even with factory new cylinders.
When you fly, become obsessive-compulsive about thermal cycles. Avoid rapid throttle and mixture changes. Throttle-up slowly and smoothly during takeoffs and go-arounds. Avoid high-speed low-power descents. Avoid going full-rich on final approach if your engine is fuel injected.
Fly often. Avoid extended periods of disuse. If you can't, hangar your airplane and consider using single-weight oil such as Aeroshell W100 for corrosion protection. There's nothing wrong with using multi-grade oil during the coldest months and switching to single-weight oil for the rest of the year. In fact, that's an excellent procedure.
Never cold-start without a preheat. Don't even consider it. An unpreheated start below 32 F is harmful. Below 20 F it's a capital offense. A night in a heated hangar is the best preheat. Sleeping late in the morning is also a useful technique.
If you need to reposition your airplane on the tarmac, don't taxi it if you can have it towed. Remember that most barrel wear occurs at engine start. So try not to start your engine unless you're going flying.
Lean aggressively. Particularly avoid full-rich mixture during ground operations. Rich mixtures and low combustion temperatures often result in accelerated exhaust valve guide wear.
Beware of ultra-low oil consumption. An engine needs to burn some oil in order to achieve needed lubrication of the critical ring-step area. 10 to 15 hours per quart is great. It's perfectly normal for oil consumption to increase toward the end of the oil change interval.
Shun new cylinder coatings, rings, valves, guides, rockers, and other wonderful-sounding innovations until you're sure that they've been in the field long enough to prove their ability to make TBO in your type of operation.

When to Replace a Jug
Sometimes it's necessary to pull a cylinder and rework or replace it. But such top-end work is often done unnecessarily. Top overhauls (replacing some or all cylinders at mid-TBO) is one of the most over-sold maintenance procedures in general aviation.
It is common practice at many shops to pull any cylinder that measures less than 60/80 on a differential compression check, and to recommend replacement of all cylinders if two or more cylinders measure that low. Some IAs simply refuse to sign off an annual if any compression reading is less than 60/80. Such procedures are simply unfounded and erroneous.
Never allow a cylinder to be pulled on the basis of a single compression test. For one thing, the standard differential compression test is notorious for giving non-repeatable results. A cylinder that tests 55/80 today might easily test 68/80 after two more hours in service.
Mechanics should treat compression readings the way doctors treat blood pressure readings: no conclusions should be drawn until at least three successive measurements have been taken to establish a baseline. In the case of aircraft engines, the measurements should be separated by at least a few hours of operation.
Furthermore, there's nothing magic about 60/80. It's quite common for some engines to operate quite happily with compression readings in the 50s. Anytime a questionable compression reading is observed, it's important to determine

where the compression is being lost. If air can be heard escaping from the exhaust pipe, then the exhaust valve is leaking...a potentially serious problem, and one likely to deteriorate fairly quickly. On the other hand, if air is heard coming from the breather line or oil filler cap, the leakage is coming past the rings...a much less worrisome situation. In fact, low compression readings due to leakage past the rings can probably be disregarded unless it is accompanied by an alarming increase in oil consumption.

If a cylinder exhibits a deteriorating compression trend over several readings, or if low compression is confirmed by at least one additional symptom (elevated oil consumption, rough running, anomalous EGT readings, metal in the filter, etc.), go ahead and pull it. But don't let the mechanic talk you into "topping" all the cylinders just because one has gone soft.

A complete top overhaul is seldom justified (unless part of a carefully planned TBO-extension program).

Top or Major?

Suppose you have a relatively high-time engine--let's say a few hundred hours from published TBO--and a cylinder goes soft. Should you repair the cylinder, or simply bite the bullet and pull the engine for major?

One approach to answering this question involves simple arithmetic. If your airplane is a Skyhawk, your engine probably has a 2000-hour TBO and an overhaul cost of $8,000, which works out to $4/hour. To justify an $800 cylinder replacement, you'd need to be reasonably confident that it would buy you at least another few hundred hours. If, on the other hand, you're flying a P210 or Malibu with a 1600-hour TBO and an overhaul cost of $27,000 (which works out to $17/hour), then a $1,200 cylinder replacement could make sense if it delays the major overhaul by even 100 hours.

New or Reconditioned?

If you do decide to change out a weak cylinder, should you grind it oversize, have it plated, exchange it for a chrome or Cermicrome cylinder, or buy a factory new jug? The answer depends on exactly what you're trying to accomplish by the cylinder change.

If you're simply trying to buy another couple of hundred hours before springing for a factory reman engine, then it makes sense to do something cheap. Maybe a new exhaust valve and guide, some new rings, and a light hone is all you need. If your jug is beyond service limits, consider exchanging it for a cheap reworked jug. After all, that cylinder is going on the scrap heap in a few hundred hours.

On the other hand, if a cylinder problem arises at low- or mid-time, then you want to make sure the replacement cylinder will take you the rest of the way to TBO. Consider buying a new cylinder (factory or PMA), or having your first-run cylinder rebarrelled or chromed by a top-notch cylinder house.

The Bottom Line

As we pointed out at the outset of this article, Continental and Lycoming have become downright aggressive about pricing and marketing of their jugs. A factory-new complete power assembly for a big-bore engine costs about $1,100 or $1,200 these days. At these prices, it's hard to resist.

A new Millennium jug from Superior costs about $100 more than an OEM cylinder. If field experience proves Millenniums to be as durable as they look, they'll be worth the slight premium. Mattituck already offers Millenniums with a warranty pro-rated to TBO, something not offered with OEM cylinders. Other shops may offer similar extended warranties.

It looks like CermiCrome is gradually being phased out by ECI in favor of CermiNil. Costwise, a reworked CermiNil cylinder can save you around $400 apiece compared with factory-new, a savings of about 35% on a complete power assembly. (The same applies to NuChrome.) If you include the $300 or so in labor that it takes to remove and replace a cylinder, the cost savings becomes more like 25%.

If it's major overhaul time and you're replacing six big-bore jugs, CermiNil or NuChrome could save you $2,400 over new cylinders. That seems like a lot. But don't forget that a reworked cylinder is a good deal more likely to fail prior to TBO than a new one. Some failures can get downright exciting, while others are just costly. If you have to top two jugs on the way to TBO, your $2,400 savings just vanished (and then some if you include R&R labor). And although the early reviews of CermiNil jugs have been positive, we'd like to see some more real-world experience with them before we jump on the bandwagon.

If you do decide to go with CermiNil or NuChrome because of its lower cost and/or corrosion resistance, we think it makes sense to

have your own first-run cylinder core reworked. This will involve some downtime, but at least you'll know what you're getting. We'd steer clear of exchange cylinders--there's no telling how much time, abuse, or repair work they've accumulated before you get them. Be particularly wary of the bargain basement cylinder kits that you can find advertised in any issue of Trade-A-Plane. The quality of weld repairs, chroming, oversizing, rebarrelling, and other cylinder reconditioning techniques varies all over the map. As with most things, you usually get what you pay for. A low-ball reworked jug might make sense if you're just trying to buy another 100-200 hours until major.

Otherwise, it's hard to go wrong with a brand new Continental, Lycoming, or Superior cylinder assembly. New cylinders have never been a better bargain than they are right now.

(To be continued next month.)

Editor: Mike Busch editor@avweb.com
Publisher: Carl Marbach publisher@avweb.com

>>>>On the Horizon<<<<

February 20	EAA245 meeting	National Aviation Museum, Rockcliffe
March 15	Ski plane Fly-in and BBQ	Pendelton Airport contact Juergen Weichert 789-3242
March 20	EAA245 meeting	National Aviation Museum, Rockcliffe
April 17	EAA245 meeting	National Aviation Museum, Rockcliffe

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12 February 1997

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I am always interested in receiving submissions for this, **your,** Newsletter. You may bring articles to the monthly meetings or mail information to the post office box or send me an e-mail attachment at **adouma@ftn.net**

Editor *Carb Heat*

EAA Chapter 245 Membership Application

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Note Associate and full members must also be members of EAA's parent body in Oshkosh WI, USA

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