Gascolator On Steroids

Cliff Cady - I have found a pretty good fuel filter made by Russell Performance Products Inc., P. O. Box 6253 Carson, CA 90749-0990, Customer Service 1 (800) 334-8231. It is an all aluminium unit that looks like a gascolator on steroids! It is 6 1/4" long and about 4 1/4" wide. This 2.5 pound unit has a spin on aluminium bowl that is tapped for a water drain. The neat part of it is it has a built in AN6235-4A fuel filter element. This part should be able to be used as a gascolator and fuel filter, thus saving firewall space.

I got one mail ordered from Summit Racing Equipment, 580 Kennedy Rd., Akron, Ohio 44398-6177, (216) 798-9440 for $44.69. You should see their catalog. They have many interesting items.

EZ Cylinder Head Cooling

Jimmie Hays via Al Coha (AZ) - Through the good offices of Al Coha, I discovered a terrific idea for making cylinder head baffling.

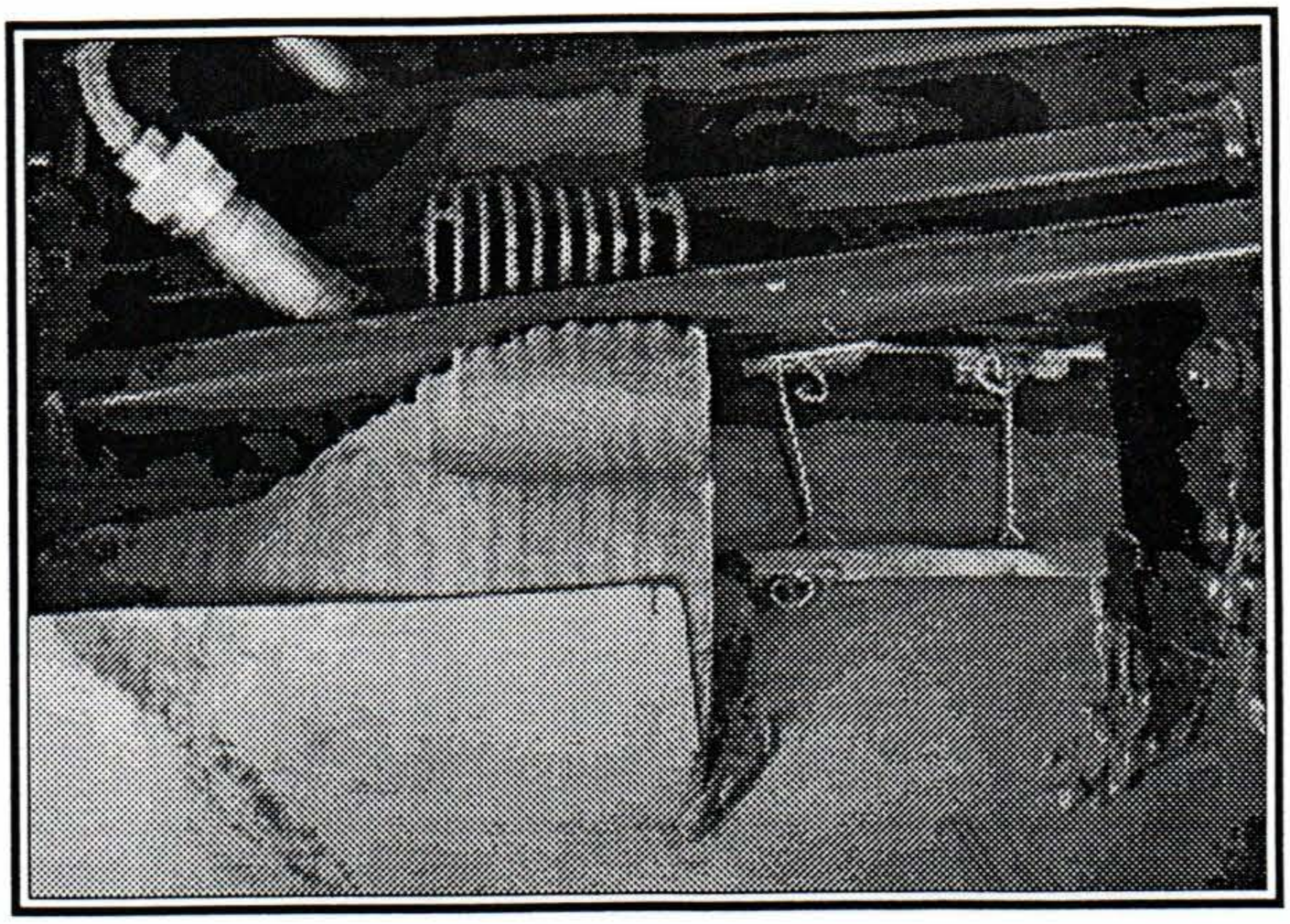
As we all know, baffling the barrel of the cylinder is fairly simple, since it is nice and uniform. Getting metal to conform around the head though is beyond me. Try this - Lay a single piece of thin, lightweight fiberglass on Saran Wrap, thoroughly impregnate with RTV squeegeed all the way through, then build up the RTV to about 1/16" above the fiberglass. Lay against the cylinder with the Saran Wrap side out, trim to fit, and simply massage onto the fins with your hand, then peel off the Saran Wrap. The layer of RTV which stood up adheres to the fins.

Use separate pieces around the front of # 1 and # 2 and back of # 3 and # 4 and another across the top between the cylinders. Leave a 2" gap at the top of each cylinder and bring down the front and the back far enough to be below the front and back baffle bulkheads.

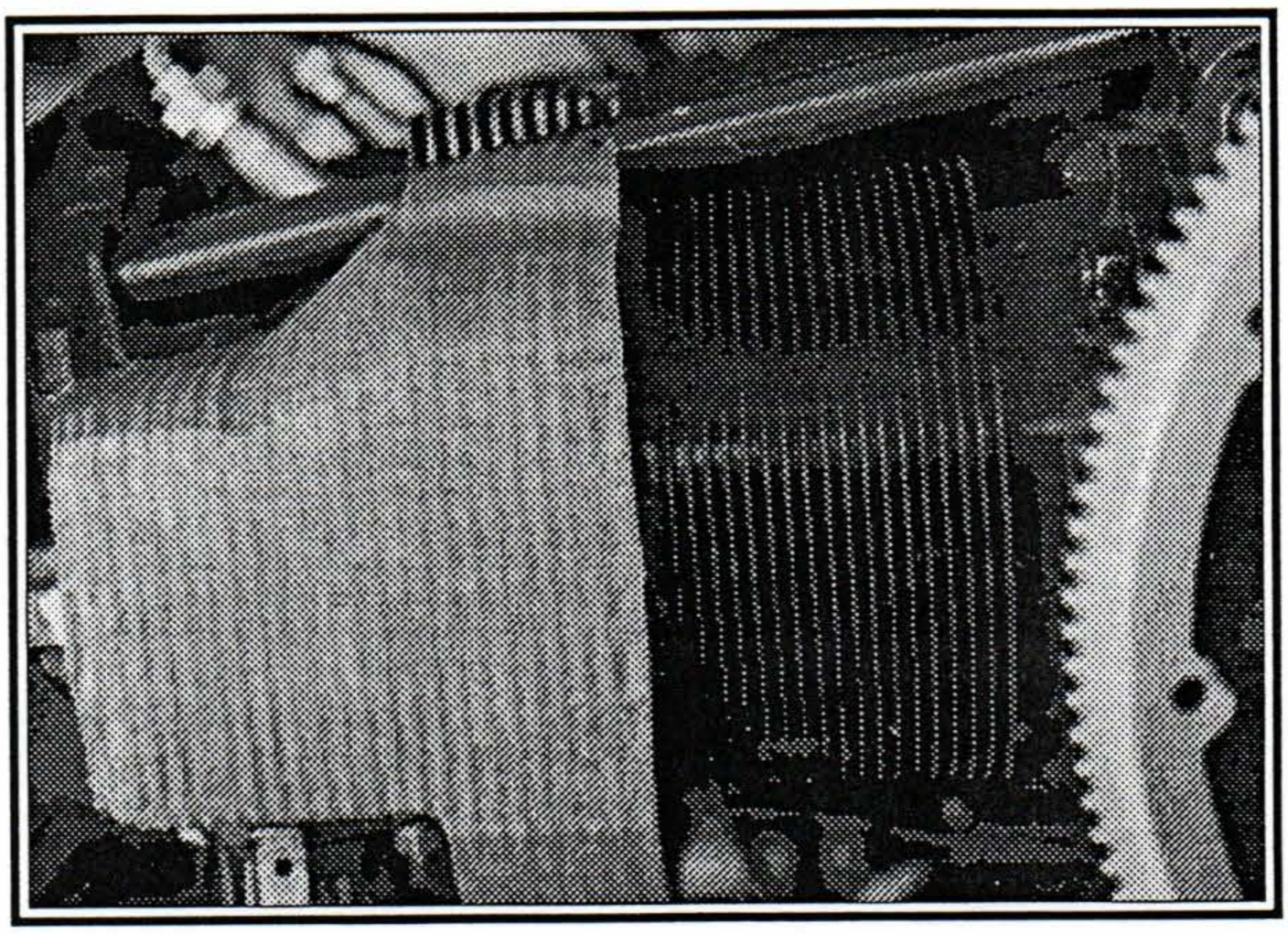
Let the RTV cure over night and you're ready to go. This can be manually lifted off but, it will stay put with normal air flow.

I used High Temp RTV, but Al used normal RTV and his has been on for years.

I'm sure this method could be used to replace the metal baffle around the cylinder barrel fins as well. The really neat part is that all the baffling around the cylinder fins can be done in an hour or so. I used this idea here in Phoenix and flew with a freshly overhauled engine when the OATs were well over 100 degrees. I never saw any CHT climb over 435 degrees.



Well contoured, very close, lightweight baffles



This should answer the baffle leak problem

Mark IV Parts For Sale

Brock-Cozy Mark IV rudder pedal set. Paid $295, yours for $250, new condition. Never used.

Contact Jim Cullen
9456 Mast Drive
Las Vegas, NV 89117
(702) 254-8815

Remote Oil Filter For Sale

Lycoming setup as supplied by Mel Hinson. Never used $250.

John Vukos
7386 Darrow Road
Neenah, WI 54956
414-725-4252

Crankshaft Oil Seal Loss

In recent months there seems to have been an increase in the number of crankshaft oil seal losses. This, as Australian Magna Liset discovered, causes loss of all lubricating oil resulting in a siezed engine. Fortunately Magna had just completed the long over water flight from Australia to New Zealand before the seal poped out.

Some old narrow deck Lycoming engines have a sheet metal retaining washer screwed to the crankshaft end of the case. This covers the oil seal thus holding the seal in place, even if it tries to slip out. It seems that later model tractor application of these engines don't require any retainer. Pusher applications may not follow the same rule, however. (Lycoming disagrees with the statement and says neither pusher nor tractor applications need the retainers, see below) The next time you are at your airplane see if your engine has the retainer. I have an O-235-C and there is no retainer plate or screw holes on it.

The oil seal retainer installation is covered by Lycoming Service Instruction No. 1073A. It seems Lycoming made a crankshaft oil seal retaining plate safety kit, part number 74034. This kit included 2 oil seal retaining plates PN 74026, 4 # 10-24 capscrews PN 74330, and 4 plain # 10 washers PN STD-425.

All Lycoming engines, that I can recall, have cast bosses in place on the crankcase. These bosses are, sometimes, drilled and taped for screws to hold the oil seal retainer ring. Perhaps it would be wise to install such a seal retaining method on all our engines.

If your engine is down for overhaul it would be a simple matter to drill and tap the bosses for a small screw (perhaps #10-24?) to hold the retaining washer. Such a washer could be easily made from flat thin aluminium stock (perhaps .032 2024T3 ?). If your engine is not apart you might consider cleaning the end of the crankcase **VERY CAREFULLY** and RTV - ing two haves of a split washer to the end of the case to retain the seal. **Caution:** be sure to use a fuel and oil proof type of RTV. Those of you who are running the B & C style of alternator drive pulley may be already covered. My pulley is so close to the crankcase that I don't see how the relatively wide seal could sneak by it.

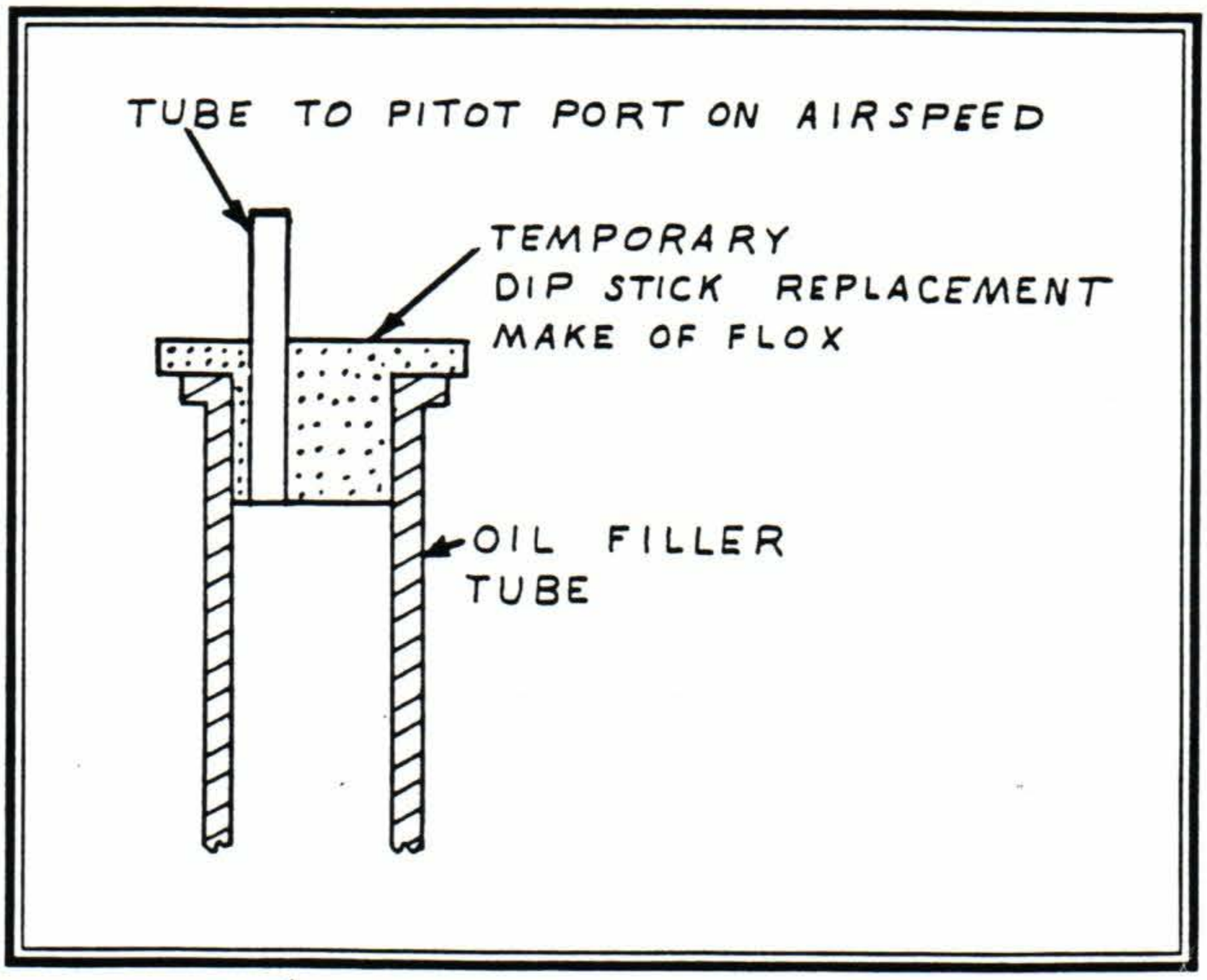
Of course no engine discussion is complete without a little CYA. To that end I called Gary Earon of Lycoming at (717) 327-7096. He said that the above idea would require field approval and the usual official paper chase. I indicated these were in experimental aircraft and he said it didn't make any difference because they were certified engines. He wouldn't offer any suggestion or feeling about the above retainer plate so I thought I'd find out what causes oil seals to "pop out".

Gary said, "There are only two reasons for oil seal loss: excessive crankcase pressure and improper oil seal installation."

I asked how one might check for excessive crankcase pressure and he indicated pressure should be measured using an air speed indicator as a pressure gage. The "air speed" should fall between 45 and 60 mph at full throttle. (For those of you using a water manometer that means no more than 1.7")

The "airspeed" indicator would be connected with the static port going to ambient air pressure and the pitot port going to the oil filler tube. He suggested making a plug that fits the filler tube and temporarily replaces the dip stick. This plug would have a tube installed that allows attachment to the pitot side of the "air speed" indicator. The static port would be connected to the normal static ambient air pressure

The correct method of oil seal installation is listed on Lycoming Service Instruction #1324A which Gary said would be available from any mechanic. I contacted 3 different A & Ps to find they did not have such a thing. Lycoming's official answer was to contact Avial for a copy. I called the closest one, which is in Columbus, Ohio at (614) 258-3477, and requested a copy of the bulletin. They indicated they would send me one at no charge.



Prop Extension Failures

While at OSH I heard of an alarming event. The new, O-360-A2A powered, E-Racer of Jimmie and Ferne Hays had an off field landing due to prop extension failure. The occupants escaped without injury but, as you can see in photo one, the E-Racer was severely damaged.

The photos were provided by Bill Oertel who went on to explain that this was known to be the third prop extension to have failed. He said he didn't know the names of the other pilots but that Bruce Tifft did.

Thanks to Jimmie's skill they both walked away

I contacted Bruce and found there had been three failures, all on O-360 engines. The first two, on Bob Beard's 180 hp O-360-A4K powered Two EZ and Danny Maier's 200 hp Velocity, were purchased from John Queener's Sport Flight after Herb Sanders had sold the company. They were both 8" extensions and were made of 6061, an aluminum alloy weaker than 2024 which is prefered for prop extensions. The 6" prop extension with 7" diameter flange on the Hays 180 hp E-Racer was manufactured by Brock.

Examination of the second photo, at the top portion of the failed area, shows what looks like a peened surface. The lower separated area looks to have been ripped away.

A recent letter from Gary Hertzler indicated he had the company metallurgy department look at the failed Hays prop extension. They could find nothing in the way of defective material or abusive machining to have caused the failure. The part failed in what is known as high cycle fatigue up to a point where a large chunk was torn out. There was not enough left of the radius to determine if it was excessively small, but looking at the other end of the extension, and without being biased by the failure, the radius looks to be normal for the part.

Gary and Nat Puffer both pointed out that crankshaft flange runout could be a contributor to this failure. Lycoming permits a .005" runout on the prop flange. This dimension would be OK if there were no propr extension. With an extension, however, the magnitude of runout will be exagerated depending upon the extension's length. This flange runout will cause additional prop runout which will increase the vibration and will add to the mean stress on the extension. When the cyclic loads are applied over the top of a possibly elevated mean stress, fatigue crack initiation and propagation may occur.

Gary offered two suggestions for improving the design.

1. Increase the fillet radius to be as large as possible without having to back spot face to the drive lug bushings.

2. Continue the bore which excepts the crankshaft prop pilot only as deep as necessary to axially clear, continuing the rest of the way with a smaller diameter bore. This will provide added wall thickness at the high stress points.

If you are using a 6" or longer prop extension, especially on the O-360 engine, please check for cracks in the radius area. Gary Hertzler has suggested that we **all** (regardless of engine size) examine our prop extensions at each oil change. Three failures is enough!

The Hays airplane had 73 hours on it so high time is not necessarily a factor in these failures.

•

I talked to Burt Rutan at an OSH bull session. He suggested the failure might be caused by prop vibration in resonant frequency. If a pilot were to operate at the resonate RPM the extension would soon fail.

I asked Burt how we might determine what this frequency was on our airplanes so we don't operate in it. He explained it was **simply** a matter of hooking up an accelerometer and oscilloscope and interpreting the wave form to determine resonant frequency. Until that frequency was determined he felt we should ground our airplanes!

I indicated that wasn't likely to happen and would appreciate RAF developing a portable device that CSA could borrow/purchase and run frequency evaluations at our three fly-in events per year. He indicated he would investigate that idea and see what could be developed.

Mike and RAF are working on the problem, which is not a simple thing to do. The results may not be conclusive as probably every airplane will be different. All testing, so far, has been done on Mike Melvill's Long-

EZ, N26MS after work hours. This aircraft was chosen because it has exactly the same engine and prop extension that Jimmie Hays had. Jimmie had a B&T prop while Mike's prop is a modified Great American with 10 plies of carbon wrapped on each blade.

This morning (8-10-94) I got a call from Mike Melvill with an update on his progress. He had spent an hour talking with Jimmie Hays and found Hays was returning from the Jackpot Race when the failure occured. Jimmie felt a slight vibration at 2,600 RPM cruise and slowed to 2,300. The vibration was still there so he decided to try 2,400 RPM, but at that moment the vibration became extreme, and with a loud bang the prop departed the aircraft.

Jimmie reported slowing down to 90 knots and was on left base leg trying for a dirt road, when a control problem was encountered. Initially full right aileron (all the way to the stop) was sufficient to level the airplane. Then he had to re-enter the bank to get lined up with the road. This maneuver took full opposite aileron and rudder to level the wings. At no time did the bank ever exceed 30-40 degrees nor did the speed fall below 90 knots. This caused an over shoot of the very short road section and touchdown was made on the front slope of a fairly gentle hill covered with reasonably low sage brush. The left main gear failed shortly after touchdown. The right main and nose gear didn't fail until just about the end of the slide. The aircraft was substantially damaged, but no one was hurt.

Jimmie's inspection found the left aileron wing root push rod had failed at the threads of the aft rod end, and surmised it may have failed when the prop departed. That event may have caused the continued wing drop that Jim experienced when he re-entered the bank to get lined up with the road.

Just before the flight to Jackpot Jimmie had torqued and tracked his B & T "Monster Prop". He said he had never had a prop that tracked so perfectly and that the engine was running smoothly.

The phone call further revealed that Mike has completed static testing with the accelerometer and oscilloscope on his O-360-A4A powered Long-EZ. He has borrowed a sophisticated large device for determining dymanic vibration in flight and is in the process of installing it now for fight testing. The device "looks at" the teeth on the starter ring gear to check for resonate vibration and records a trace of the vibration on paper. Any resonate vibration will show as a spike on the trace. Mike hopes to have the testing done by 8-14-94. He said he would send me copies of findings.

Mike also sent a drawing of a stiffer 8" prop extension that was desgined by Bob Beard in 1988. Bob, who has since passed away, indicated the new design with a 4.5" diiameter spool would be as stiff as a traditionally designed 4" prop extension and would have resonance occur above 4,000 RPM.

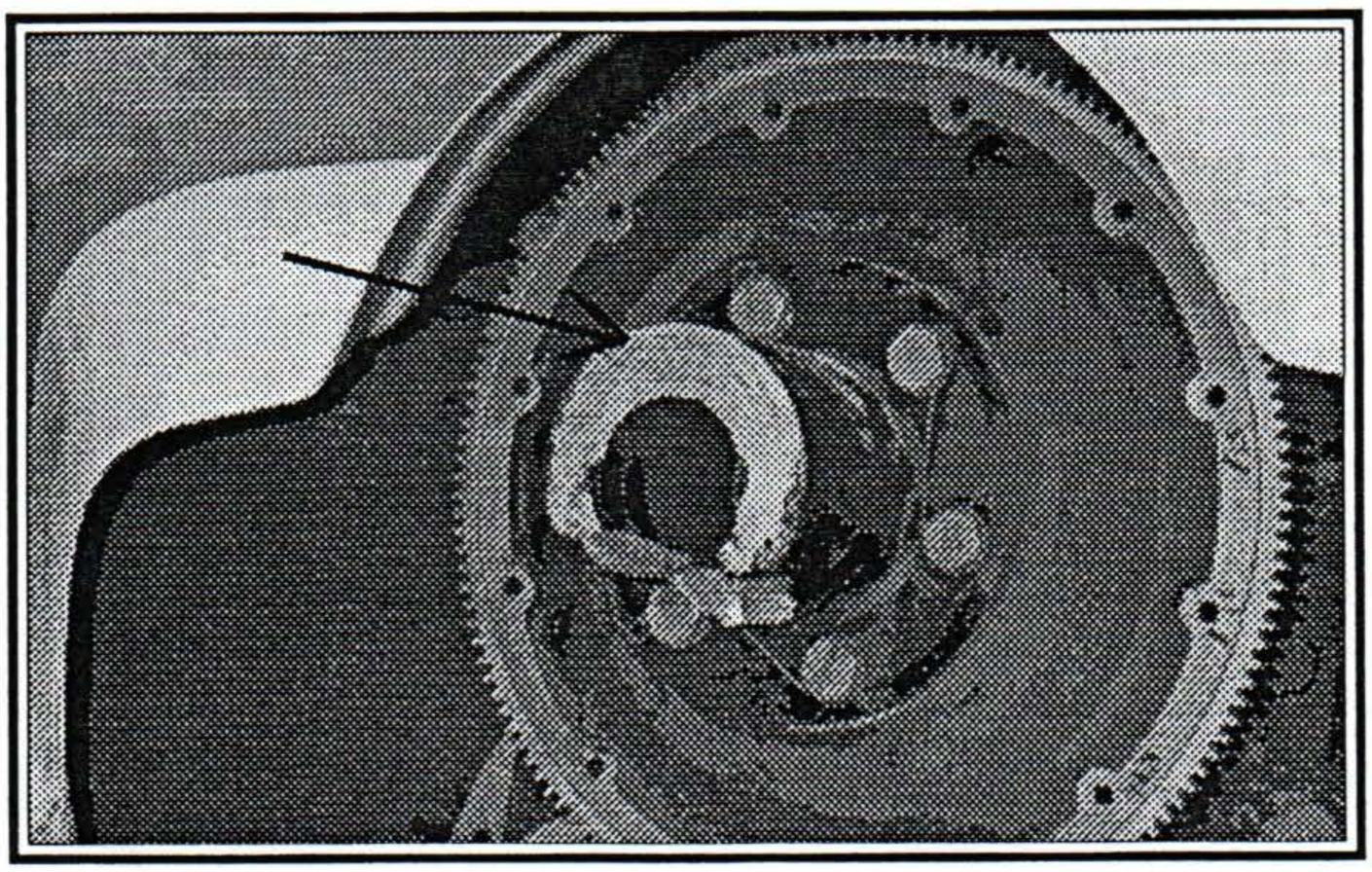
I always get concerned when someone says they had a "slight vibration" before an event occurred. I guess I don't know what a *slight vibration* is. Jimmie Hays recapped the incident in a recent letter.

"The onset of the vibration was sudden and had a fairly high frequency, almost a buzz. The amplitude left no question that we had some sort of real problem. The reduction in power didn't seem to make any noticeable change. Altogether, I don't think there was more than 5 to 10 seconds of this vibration before a hard sharp jolt was felt, after which, the engine wound up to just over 4000 rpm. I immediately backed off the throttle to the idle position and the tach went to 0 rpm. Both my passenger and I recognized immediately that the prop had gone it's own way.

Had the gear not been down there is no doubt in my mind that my passenger and I would have had at least significant injury or WORSE!! There would have been significantly more aircraft damage as well, in my opinion. Having the nose gear extended in a previous off field landing in a Long-EZ was also instrumental in getting by with NO DAMAGE or INJURY."

Nat Puffer called (9-13-94) and told how he and Mike Melvill had independently reached the same conclusion on the Hayes prop extension failure. The Brock 6" extension, when mounted on an O-360, has a resonant frequency of 2750 RPM. Apparently Jimmie ran in the resonant range of the Brock extension possibly causing the extension failure.

Remains of the failed extension shows a peened surface



Mike is presently reported to be testing a Woofter/Saber prop extension to determine resonant frequency. It is believed to be much higher because of a stiffer design. **No Woofter extension failure** is known and many are running on the O-360 which has severe power impulses.

The most recent contact with RAF, 10-4-94, found no final answer to the O-360 vibration problem. **The O-235 with 6" extension and the O-320 with 6" extension have no vibration problem.** Presently, it may not be true of the O-360. A finite element analysis is planned but the facts are not presently known. If you are intending to purchase an O-360 for your pusher RAF will recommend you buy one with a 5th order damped crank. Counter weighted crankshafts have their own problems too, so be sure to check all the AD notes before flying over shark infested waters.

More on this discussion will be found in the Cozy Newsletter and the Canard Pusher as it all develops. The O-360 is recommended for the Cozy Mark IV and the Defiant so both these publications will have something to say, I'm sure.

The latest Cozy Newsletter (10-4-94) indicates you should do all things possible to not over speed your engine and possibly get into the resonant RPM range: Check prop flange run-out. Keep it under .002". Check and balance the prop. Check the prop to see if the blade profile is symetrical from blade to blade. I have seen prop airfoil sections that varied considerably from one blade to the other. That causes uneven thrust from blade to blade and hence creates vibration. Mike Melvill limits his cruise RPM to 2600, well under the resonant frequency

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Oil Cooler Outlet Location

Bill Freeman (KS) - Builders looking for an oil cooler air outlet will find the top of the cowl outlet to be more efficient than the bottom exit.

Nylaflow Brake Line Upgrade

Bill Freeman (KS) - It is good to replace old Nylaflow lines that may be getting brittle from age and heat. Replace them with 1/8" OD X .028" wall 3003-O aluminum tube. The neat thing about that size is it slides up inside the old Nylaflow that you glued to the aft edge of the strut. No cutting and repainting of the strut is needed.

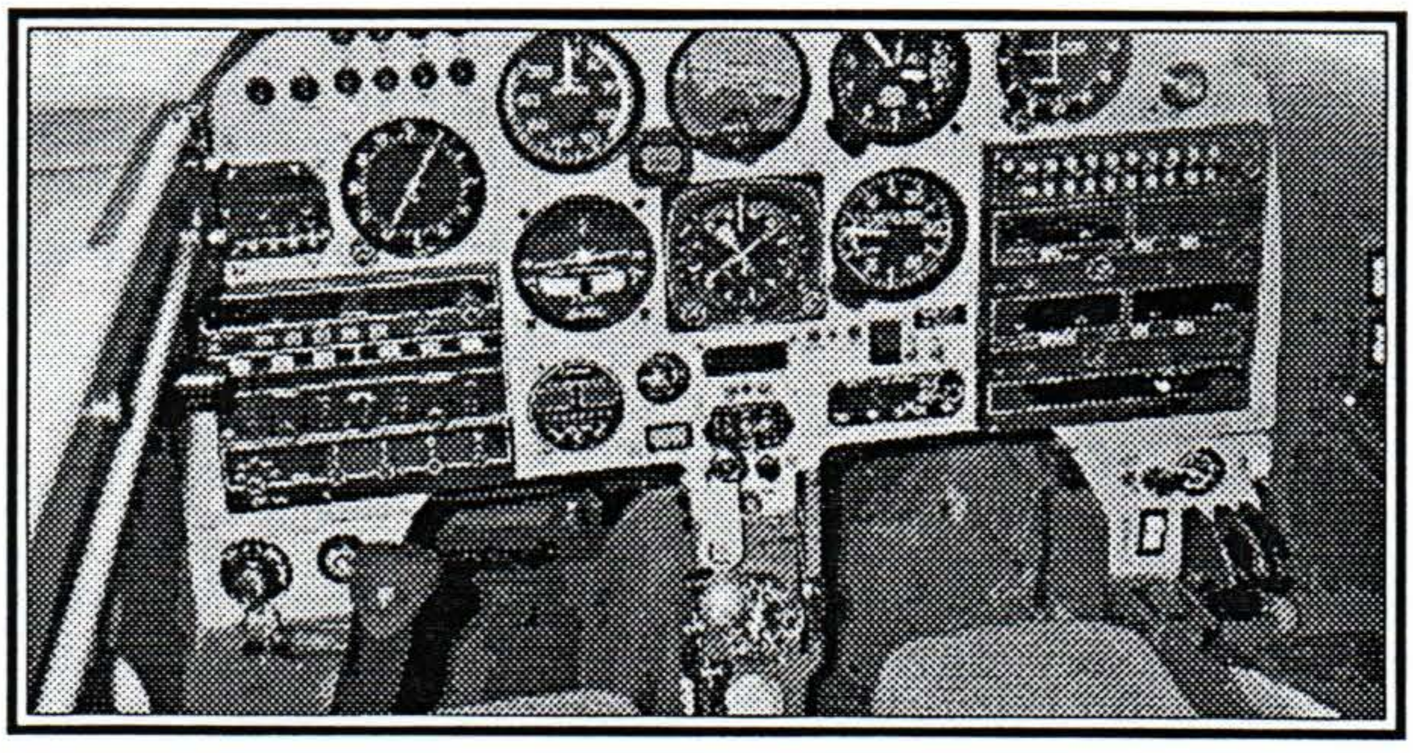
You should leave about a foot or so of Nylaflow outside the strut at the top (in the "hell hole" under the passenger seat) to protect the tube and keep it from kinking or chafing. You will need a piece of flexible hose (I am using Nylaflow, since it is away from heat and UV) to accommodate the large movement of the front mounted master cylinders. I have a parking brake valve mounted to a plywood hard point on each side of the fuselage about 6" ahead of the panel and 6" above the floor. The aluminum tube goes into the valve and the Nylaflow comes out.

You may have a little trouble flaring 1/8", but with a little practice on scrap tube it is not too bad. You will need a pair each of AN822-2D flared tube elbows, AN819-2D coupling sleeves and AN818-2D coupling nuts for the caliper end and probably a pair of AN816-2D flared tube nipples with sleeves and nuts for the other end. I have used mine for 5 years and 500+ hours without a problem.

I always wondered why everyone complained about standard brakes on the Long-EZ, since mine were fine. Terry Yake recently replaced his Nylaflow with the aluminum and reports much firmer and better brake action after about 7 years of Nylaflow. Apparently the Nylaflow was ballooning and using up much of the pedal stroke, decreasing the brake efficiency quite a bit.

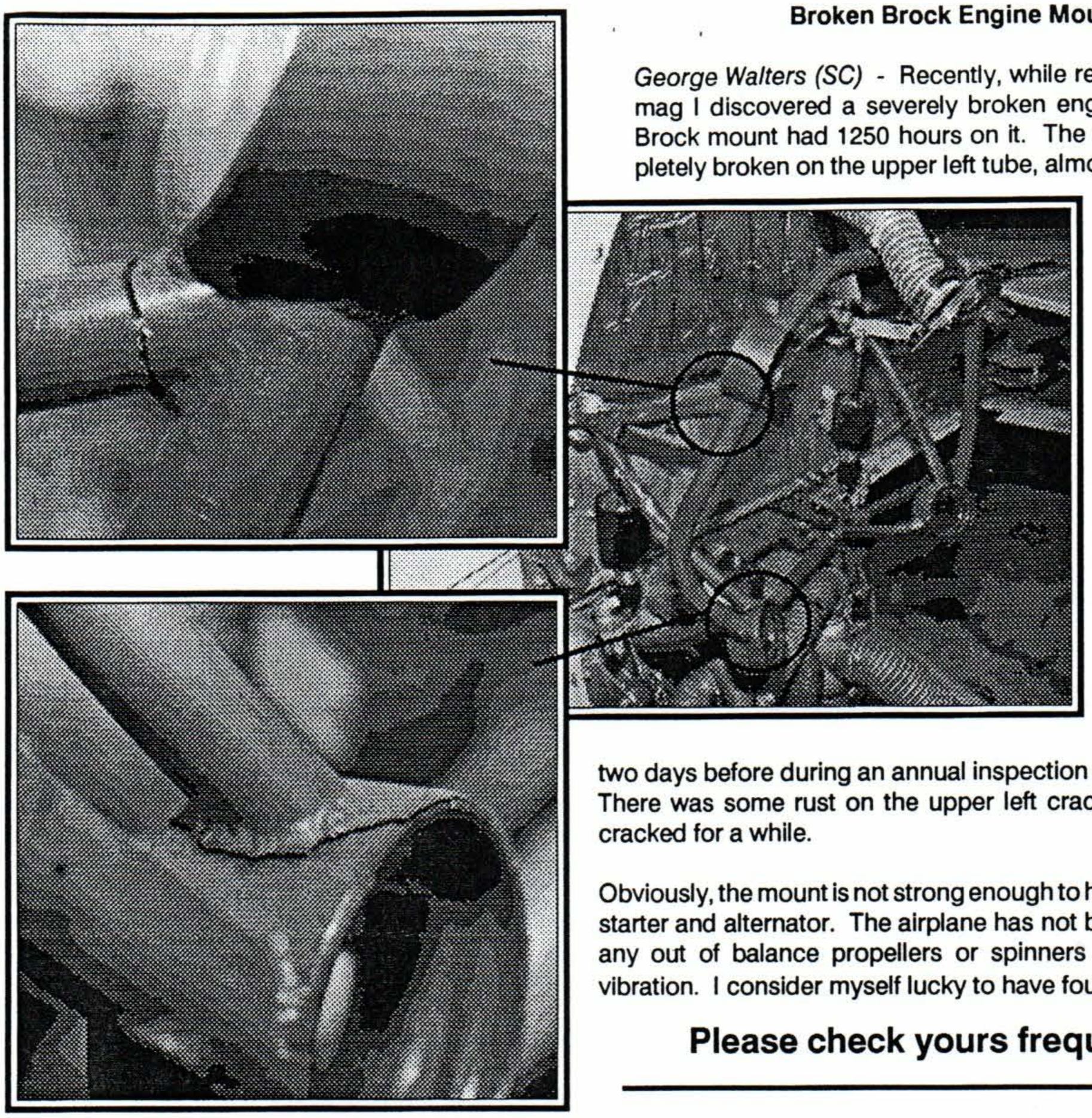
I see no need for a flex line at the caliper end since my two Cessna 150's have no flex line or strain relief loop in their aluminum brake lines. They are much larger 1/4" OD and, therefore, much stiffer. Some flex is required to let the caliper float on the caliper pins, however. Tuck the line away from the disc and protect it from direct heat with Fiberfrax and aluminum tape to ensure the fluid doesn't boil. I use DOT 5 spec (very high temp rating) which is compatible with all types of rubber and does not break down with age as does normal automotive brake fluid.

This is your last issue.
It's time to renew.



Check out the extra wide instrument panel on
Sam Kriedel's O-360 powered "Limo-EZ".
This outstanding airplane will be featured in the January issue

Broken Brock Engine Mount



George Walters (SC) - Recently, while repairing a bad left mag I discovered a severely broken engine mount. The Brock mount had 1250 hours on it. The mount was completely broken on the upper left tube, almost completely on the bottom left tube, and the upper right was cracked in half as well. Very shortly the engine would have left the airplane.

Being aware of another mount failure on Jack Fehling's Eze, I had looked at the mount two days before during an annual inspection and saw nothing. There was some rust on the upper left crack so it had been cracked for a while.

Obviously, the mount is not strong enough to hold an O-320 with starter and alternator. The airplane has not been subjected to any out of balance propellers or spinners to cause severe vibration. I consider myself lucky to have found this in time.

Please check yours frequently!

EZ Writers

Bill Theringer - CA Last summer I stopped at Owensboro, KY airport and was given a guided tour of the "P-38 in the ice" reconstruction project. The crushed aluminum is carefully removed, heat treated to T-O, reshaped, then re-annealed to original temper. They have all the original drawings of the plane, courtesy of the Smithsonian.

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Bruce & Bonnie Tifft - OR We were sorry to have missed Oshkosh but got some of Chevron's contaminated fuel and will be overhauling the engine, courtesy of Chevron. I was also having some neck/shoulder medical problems which we're working on getting fixed. We regret the erroneous rumors that spread around OSH and caused concern, but appreciate all the cards and calls.

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Donald & Bernadette Shupe - CA Your letter, responding to our retiring IVCHC, touched our hearts deeply, it brought joyful tears! We feel very fortunate to have people like you telling us that we made a contribution to some EZers' lives by founding the "Varieze Hospitality Club" and publishing the newsletter.

Since we retired IVCHC, we do not find it appropriate to call on anyone to visit as we tzavel. However, we will keep your personal invitation in mind should we find ourselves in your neighborhood.

Long-EZ For Sale

Long-EZ,160 hours total time. White pearl urethane paint, engine O-235-L2C, 160 SMOH, Ellison, 125 hp pistons, chrome jugs, balanced, Mode C X-ponder, Nav 30 LORAN, Becker comm 720 channel, full panel.

Call: Ken Humphreys
(816) 453-8020
Kansas City, MO

Editor note: I've seen this one; it is really sharp.

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3 Cheers!

Johnson County Industrial Avionics (913) 764-2126 in Olathe, KS gave Bill Brin special treatment on a transponder repair.

Is Blowby Killing Your Cam?

Vance Atkinson recently forwarded an article from July - August 1994 TBO Advisor that applies to all engine operators. The full article is excellent and well worth reading. I suggest you do it as I can only cover the highlights here.

Chevron Oil Company researchers, McGeehan and Yamaguchi found an unexpected link between blowby and cam wear. It's called nitric acid.

It seems the old belief that organic acids being the nasty stuff in worn out oil is not true. The acids in the oil don't necessarily produce their harm by accelerating corrosion either.

Linking together research dating back as far as 62 years, the McGeehan-Yamaguchi team proved that nitric acid formed in the crankcase does not cause cam damage by corrosion but speculated that the damage is caused by abrasion. *"The nitric acid simply dissolved the martensitic matrix of the metal, liberating iron carbide particles from the case-hardened surface which then caused classic two-body abrasion."*

The researchers found:
"1. Blowby is directly involved in valve train wear.
2. Blowby condensates are highly acidic (PH=2), and high in nitrates.
3. The nitric acid production in blowby is favored by lean mixtures.
4. Wear on cam lobes and followers is caused by abrasion.
5. When blowby is low, cam wear is low.
6. Zinc dithiophosphates can protect against cam wear but only if present in the right amounts and replenished frequently."

Blowby is commonly found in aircraft engines due to: operation at high power settings, long periods of operation at lean mixtures, loose parts tolerances needed for air cooled engines. Many operators who use AV-1 oil are now using extended oil change times. These factors plus the common large inactivity periods sets the stage for high acid levels.

The researchers listed several steps to take to protect your valve train parts, however.

Know the blowby condition of your engine. If compression checks show below 70/80 and the leak is mostly by the rings then you have high blowby conditions. You may test the engine to see by measuring crankcase pressure during engine operation. (See p. 4 CSA Oct 1991). An alternate method is to attach an airspeed indicator to the dip stick tube and ground run the engine at as high an RPM as prudent. Airspeeds above 90 mph indicate a high blowby engine that should be operated with shorter oil drain intervals and use richer mixtures to prolong cam life.

The leaner you set your mixture and the more blowby you have determines the oil change interval. AD oil have enough alkalinity from additives to protect your engine for the first 10-20 hours. When these have been neutralized you will see a sharp rise in nitric acid. *"For most engines,* ***oil drain intervals of more than 50 hours should be unthinkable.*** *An interval of* ***25 hours is infinitely safer."***

If you have a high blowby engine, lean well to the rich side of peak EGT. Lean mixtures increase nitric acid production

Use an anti-scuff agent, like Lycoming LW-16702, at each oil change (it must be replenished regularly) or use Aeroshell Multigrade which has the agent in it. The McGeehan-Yamaguchi team found the additive to be useful in fighting cam wear in acidic conditions.

In addition to the above, it seems devices that take crankcase breather fumes/oil and return it to the crankcase would also increase acidity of the oil. If the vented oil were not "recycled" you would replace it with new oil, having a PH that would help neutralize the older more acidic oil.

Ellison Users Beware!

I recently got a letter from Vance Atkinson describing a sequence of disturbing events. About six months ago he took his Ellison throttle body injector off and installed a new type fuel injection unit. Vance sent the Ellison, with about 600 hours TT on it, back to the factory and had them overhaul it, flow check it and bring it up to new condition. When the unit came back, with a $285 charge, it was sold to his hangar mate, an other Cozy owner.

The new owner, Ken Francis, flew it for about 35 hours at which time the engine began to run rough. Fuel was seen running out of the cowl so the unit was removed and sent back to the factory. During the manufacturing process Ellison drills a hole in the casting and later plugs the hole. During the 35 hours since overhaul the plug had fallen out causing the rough engine and the fuel leak. Ellison fixed it but charged Ken for the repair. *(not much of a warranty, HUH?)*

A week later the unit failed again at OSH in front of several thousand people. This time the problem was a stuck spring or diaphram not allowing fuel to flow into the throttle body once the engine started. Ken sent the unit back to Ellison again. They could not find anything wrong this time but at least didn't charge him again. Presently, the unit seems to be working OK.

*Editor note - We built our own airplanes so we didn't have to put up with shoddy treatment from the **"APPROVED'** manufacturers. Will we willingly go back to that abuse?*

[redacted]

David Orr (CA) - Someone I flew with to Kanab had an aluminium spinner split in flight and become a large source of vibration. We have all gone to lighter weight ones like Klaus' Kevlar Hershey Kiss type or the Santa Monica boy's smaller clone.

The aluminum spinner was designed to have a front plate, where the spinner leading edge is and a back plate under the prop's crush plate. After thicker props have been installed, the back plate will no longer fit and it is discarded. The remaining spinner support is now at the base of the spinner. That one plate does not provide enough support.

The failed spinner had only one support plate. In fairly close formation the spinner had a 3/4" wobble. The prop was very straight but the pilot reported severe vibration. I headed him off to a desert strip, cleared it for his landing, removed the spinner and continued to Kanab.

At Kanab we discovered the vibration had caused mag screws to back out. After the race, 3 prop bolts were broken and sticking out of the prop. The lug drive holes were egged out of round which made us all nervous. This was all from a spinner that had self destructed.

Electric Trim

Jim Voss (TX) - I have installed electric trim in my Long-EZ by using Mac servos attached to my current manual trim levers. These servos are available from aircraft suppliers or directly from the company which advertises in all the homebuilder magazines. This mod is relatively easy to do, it doesn't change the flying qualities of the airplane (which I like a lot), and even in the unlikely worst case of a trim system hardover failure you just fly to land with stick pressure against the trim springs.

I did my pitch trim first and that is what I will describe now. I have an electric

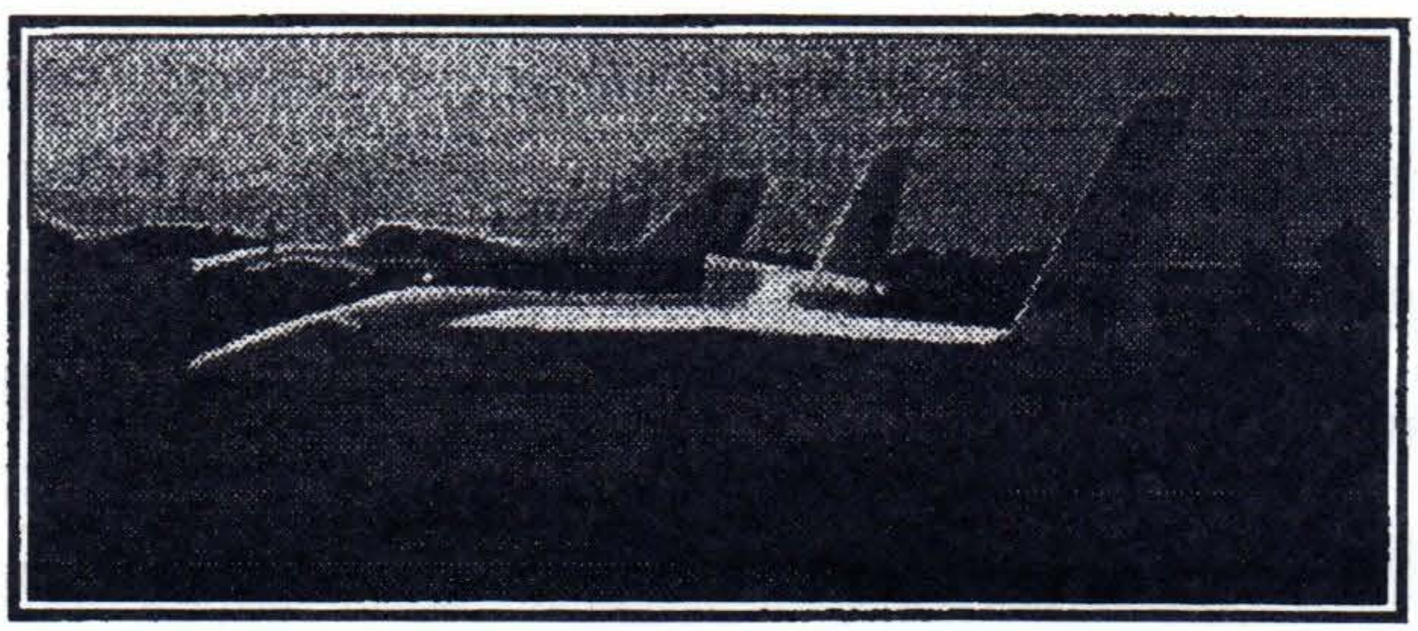
Long-EZ Project For Sale

Long-EZ 60% complete, fuselage complete on the gear, brakes and wheels installed: GU canard and elevators complete with first fill layer & sanded; wings, ailerons, and center section spar complete. I am a military pilot, have been transfered to England and can not take the project with me. Extras incl.; $6500 firm. Excellent workmanship. Contact:

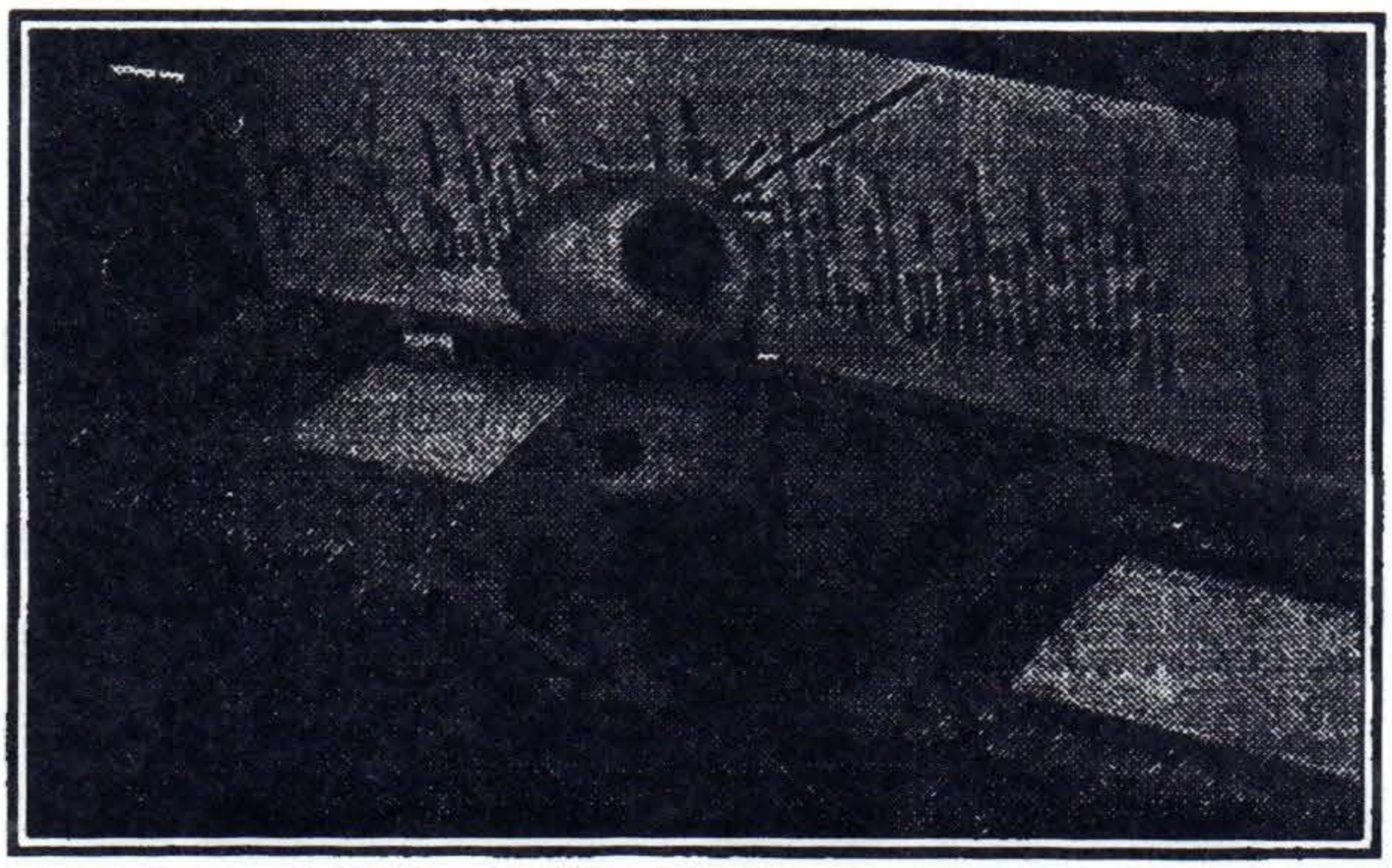
Mark Beres
1206 W. Broadway
Enid Oklahoma
(405) 242-8451

Arizona Sized Oil Cooler

Bruce Vinnola (WY) - One of the best kept secrets in homebuilt aviation is an oil cooler available from Shirl Dickey. When Shirl ruptured a certified avation oil cooler with his V-8 powered E-Racer, he set out to create a suitable alternative. He succeeded with his conversion of a heat exchanger that is rated at 175 psi working pressure (burst pressure unknown). The cooler is Arizona sized at 6.3" x 3.8" x 13.5" and comes with AN fittings. $180. Shirl's number is: 602-427-6384



The primary mission of Tom Kohm's Long-EZ is to provide transportation between Westhampton Beach, NY and Morehead City, NC.



Jim's roll and pitch trim servos are controlled by a neat coolie hat switch provided by Mac servo people. This professional looking installation eases pilot work load.

[redacted]

David Orr (CA) - Someone I flew with to Kanab had an aluminium spinner split in flight and become a large source of vibration. We have all gone to lighter weight ones like Klaus' Kevlar Hershey Kiss type or the Santa Monica boy's smaller clone.

The aluminum spinner was designed to have a front plate, where the spinner leading edge is and a back plate under the prop's crush plate. After thicker props have been installed, the back plate will no longer fit and it is discarded. The remaining spinner support is now at the base of the spinner. That one plate does not provide enough support.

The failed spinner had only one support plate. In fairly close formation the spinner had a 3/4" wobble. The prop was very straight but the pilot reported severe vibration. I headed him off to a desert strip, cleared it for his landing, removed the spinner and continued to Kanab.

At Kanab we discovered the vibration had caused mag screws to back out. After the race, 3 prop bolts were broken and sticking out of the prop. The lug drive holes were egged out of round which made us all nervous. This was all from a spinner that had self destructed.

Electric Trim

Jim Voss (TX) - I have installed electric trim in my Long-EZ by using Mac servos attached to my current manual trim levers. These servos are available from aircraft suppliers or directly from the company which advertises in all the homebuilder magazines. This mod is relatively easy to do, it doesn't change the flying qualities of the airplane (which I like a lot), and even in the unlikely worst case of a trim system hardover failure you just fly to land with stick pressure against the trim springs.

I did my pitch trim first and that is what I will describe now. I have an electric

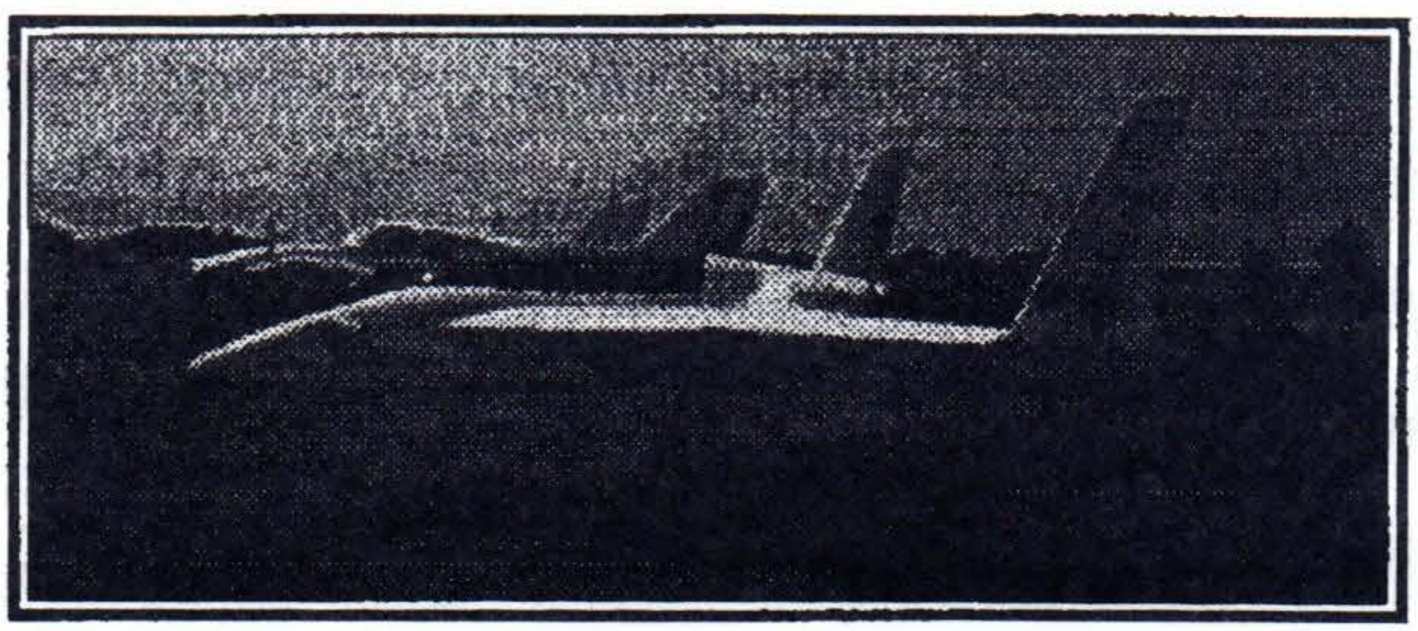
Long-EZ Project For Sale

Long-EZ 60% complete, fuselage complete on the gear, brakes and wheels installed: GU canard and elevators complete with first fill layer & sanded; wings, ailerons, and center section spar complete. I am a military pilot, have been transfered to England and can not take the project with me. Extras incl.; $6500 firm. Excellent workmanship. Contact:

Mark Beres
1206 W. Broadway
Enid Oklahoma
(405) 242-8451

Arizona Sized Oil Cooler

Bruce Vinnola (WY) - One of the best kept secrets in homebuilt aviation is an oil cooler available from Shirl Dickey. When Shirl ruptured a certified avation oil cooler with his V-8 powered E-Racer, he set out to create a suitable alternative. He succeeded with his conversion of a heat exchanger that is rated at 175 psi working pressure (burst pressure unknown). The cooler is Arizona sized at 6.3" x 3.8" x 13.5" and comes with AN fittings. $180. Shirl's number is: 602-427-6384



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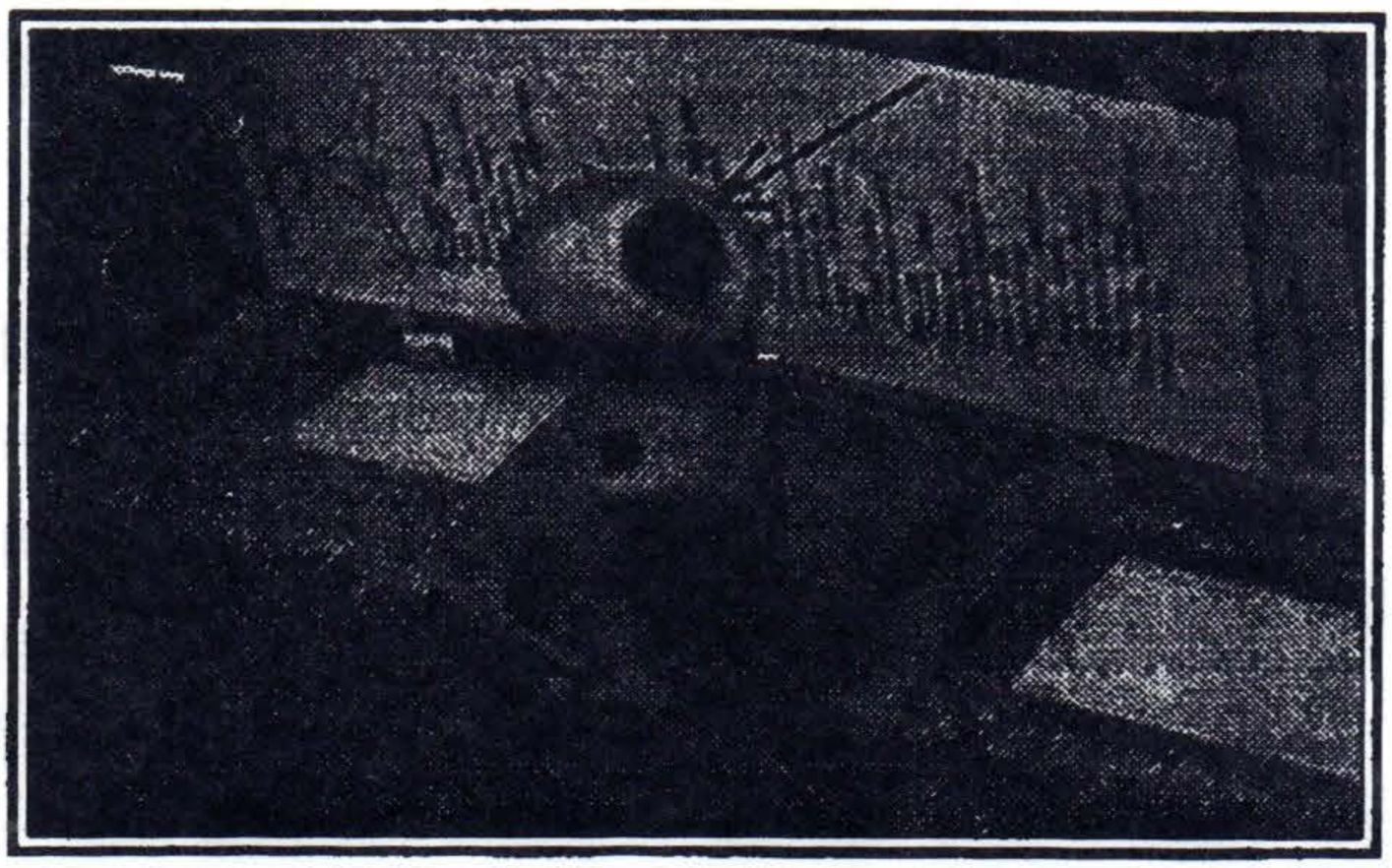

Jim's roll and pitch trim servos are controlled by a neat coolie hat switch provided by Mac servo people. This professional looking installation eases pilot work load.

Electronic Ignition Concern

I recently received a phone call from Bill Scott of Precision Engine, (502) 684-1083, concerning the possible danger of running a combination of a magneto and an electronic ignition unit, with spark advance, on your aircraft engine. Bill reported the concern was also voiced by Harry Fenton, (815) 965-4700, technical representative for Slick mags and renowned expert on mags.

Understanding of the problem may be enhanced after review of the related physics.

Air is an insulator. The more dense the air, the greater the insulative property. In WW II, magnetos had to be pressurized to operate at high cruise altitudes where the air is "thin". In a non-pressurized mag internal air pressure is nearly the same as that outside the airplane. The low density air offers little resistance to the flow of current inside the mag. When the air pressure in the mag drops enough, the mag's current will arc to ground within the mag.

Electrical current follows the path of least resistance. In this high altitude case there was less resistance to discharge internally to ground within the mag than to go through the ignition wires and then have to cross the air gap in the spark plug.

Spark discharge within the mag does several bad things which include: engine misfire, formation of conductive carbon trace within the mag, and possible cross fire.

Misfire causes excess vibration as well as mechanical and operator stress. Lower power, poor cooling, higher fuel consumption generally also occur.

An internal spark discharge leaves a small trace of electrically conductive carbon inside the mag. This will usually happens in the high voltage (secondary) portion of the mag as there is more electrical pressure to "jump" the internal air gaps. Bill Scott has reported seeing the low voltage (primary) side of the circuit become involved too. An ignition system became grounded through the primary side of an ignition switch. Once the arcing path has started the carbon trace provides a low resistance path for the current to follow and future internal grounding is easier.

Cross fire can result when the high voltage spark, coming out of the secondary side of the mag, goes to the wrong spark plug. Normally secondary current travels through a rotating arm or rotor (like the hand on a clock) to be distributed to terminals (like the numbers on the clock face). The terminals are connected to spark plug wires which end at the spark plugs. If abnormally high resistance is found in this secondary distribution path, the current will find a less resistive path to ground. Frequently this will be to jump to a different spark plug terminal within the distributor section of the mag. (Imagine the clock hand is over the "3" but resistance is so high that the spark jumps to either the "2" or the "4".) The effect is that the "other" spark plug will fire at the wrong time. If the "other" plug fires as it's piston is starting to move up on compression detonation may occur which can severely damage the engine.

Recommended ignition maintenance on the mag, high tension ignition wires, and correct spark plug gap normally keeps secondary resistance low enough to prevent such internal arcing.

Many people believe these problems do not occur with electronic ignition systems because of the absence of internal air gaps. There may not be an air gap in your electronic ignition but the ignition module itself has an insulative case around it. If ignition wires have high resistance or spark plugs have excessive gap the electronic ignition current can "bore" a hole through its insulative case and ground itself providing no ignition to the engine. Many drivers of modern electronic ignition cars have found themselves stranded along the road because of this.

Secondary resistance can also be increased to permit internal mag arcing by another means. If air density in the combustion chamber increases, the insulative effect of the air in the spark plug gap will increase. Air density can be increased by turbo or supercharging, by using high compression pistons, or by trying to fire a spark plug after the other plug in the cylinder has fired.

The retarded firing scenario seems to apply to us that are operating one mag and one electronic ignition. The mag fires at a fixed value when operated above the impulse coupling RPM. A typical value is 25° before top dead center (BTDC). The electronic ignition has spark advance capability which allows greater engine efficiency, especially at high altitude and lower power operation. The spark plug is fired earlier, perhaps 35° BTDC, (advanced 10° more than the mag) in the compression stroke thus allowing more time for the fuel air mixture to be completely burned before the exhaust stroke occurs.

The result is higher CHT and lower EGT because less heat and power are prematurely expelled through the exhaust system. More power is available to turn the prop. That is good as we can then go faster, climb faster or use less fuel at the same airspeed.

The bad implication with all this is that the mag's spark plug is fired, perhaps 10°, after the electronic ignition's spark plug. The mag's spark plug is trying to fire in a combustion chamber where the internal pressure has been increased enormously by the 10° advance firing of the electronic ignition.

The internal pressure of the cylinder raises the mag spark plug air gap resistance so high that the plug may not fire. The mag's high voltage will discharge itself to ground by an alternate path, probably within the mag's highly stressed insulation or will crossfire to another cylinder. **The crossfire - detonation relationship may place you in danger of destroying the engine.**

Questions and implications at this stage of investigation are many. How likely is this to happen? How can one prevent it? How many degrees of uneven spark advance can one run before the mag's plug will fail to fire?

I do not have the expertise to answer the likelihood question. I suspect it varies widely dependent upon the mag and secondary system's condition as well as the advance curve of the electronic ignition unit and type of pressure sensors used.

It appears there are three different ways to prevent the event. 1. Operate your ignition system with two mags set at the same advance. You will lose the many advantages of electronic ignition but may have greater peace of mind. 2. Operate your ignition system with two electronic ignition units set at the same advance. You will have the advantages of electronic ignition but will have lost your independent power source for ignition. That is a huge unacceptable loss! 3. Use both the mag and electronic ignition for take off and landing but turn the mag off in flight. Very close attention should be given to keeping the battery in a good state of charge as the mag may have been under higher than normal stress with previous combined mag and electronic ignition operation and be more prone to failure. If your electronic ignition or power source should fail you will be completely dependent upon the previously weakened mag.

Thoughts on Mag and Electronic Ignition Combination

Klaus Savier (CA) - I have no concerns when the LSE Light Speed Engineering system is used in conjunction with a magneto or I would have never recommended this setup to anyone. I also feel that 4 years of testing in this configuration (1986-1989), with a magneto was adequate. No unusual problems showed. During this time, about 900 hours, I had one magneto coil failure which is about average. AOPA statistics show that magnetos fail every 500 hours. I believe it was a first when I installed a second fully electronic system on an aircraft engine on December 30, 1989.

I have stated in my forums that most magneto coil failures are the result of excessive spark plug gaps. This increased gap requires a higher voltage which overheats an otherwise excellent coil. It also stresses the distributor. This points to a solution for those running a magneto/electronic ignition combination that are concerned about shorter magneto life. Reduce your spark plug gap to .012" on the plugs fired by the magneto. This change will definitely make it easy for the spark to jump the gap. **Under no condition do I recommend turning the remaining mag off with an LSE system.** I have heard of other systems which gave increased power when the mag was turned off. This is a sign of incorrect advance however which should be corrected.

I remember a statement by Mike Melvill, a couple of years ago after he had installed the LSE CDI (capacitor discharge ignition) system. He noticed that his frequent mag failures did not occur anymore after the change.

In the past 10 years of selling the system I can remember only of one or two customers who installed a second electronic ignition system as a result of a magneto failure in a bastard installation. All others switched to the second electronic ignition system because they liked what they got with the first one.

The technical issues related to the perceived problem are huge and anything I would write on the subject would overflow your newsletter before I could transfer enough information to make a valid point.

Those who wish to do some serious reading on the subject should own the two volumes by Charles Fayette Taylor: The Internal Combustion Engine in Theory and Practice Published by MIT Press (1966-1968). ISBN 0-262-70027-1. Harry Ricardo also wrote on the subject in his famous book on combustion engines. I would love to buy a copy if anyone has one! I only have copies of sections since it is no longer available.

The issues deserving close examination include: flame front propagation velocity in combustion chambers without squish, flame front propagation versus pressure build up, normal combustion pressure rise versus crank angle as a function of compression ratio, octane of the fuel and jacket temperature, and flame direction of the two fronts.

We should also look at the political side of the perceived problem. Unison is a uniquely vertical company. They make everything in house, from castings to coils. They exist because of their expertise in producing, marketing and repairing magnetos.

Their "Electronic Ignition" is only two magnetos with variable timing. The essential magneto technology is retained with all of its production efficiency as well as mechanical and electrical problems.

It seems logical they would be concerned when they read in Sport Aviation how a vastly better system will replace their magnetos. A good way to slow the rapid growth in popularity of the electronic ignition would be to circulate unfounded rumors of possible engine failure or at least premature mag failure.

Power Fluctuation With Ram Air Intake Box

Ian Wilde (England) - I have an O-235-L2A (118hp) powered Long-EZ with male air inlet. I had an Amsoil foam filter installed on the plans built version induction air system. I changed to a Hal Hunt ram air box in 1994 as I needed more room for a remote oil filter and was also attracted by the extra top end performance.

The top end performance seemed improved but a new condition appeared at lower speed and full throttle climb. I noticed initial static RPM was down by 25-50 RPM but recovered during take off roll (ram effect?)

If you establish 100-110 kt full throttle climb and then reduce airspeed by raising the nose, a slight vibration develops as airspeed falls below 85 kts. The vibration increases in intensity as speed is reduced to say 80 then 75 kts. It is quite unpleasant and not normal. (Low frequency vibration) Now if you throttle back slightly the vibration stops (starts again if full throttle is re-selected at less than 85 kts **or** if you lower the nose slightly and increase IAS above 85 kts, again back to smooth & normal **or** put in about 1/4 to 1/2 carb heat (alternate non-ram air)

Note: 1. Mixture has no effect 2. this **not** a carb ice problem 3. if the above exercise is done at 10,000' with the engine at full throttle (about 65% power) you still get the vibration problem. 4. a different prop has no effect. 5. problem did not occur with the previous air box which had a larger filter than the Hunt filter 6. Hal Hunt could not offer any explanation and said it had not occurred with any other unit that he knew of.

It seems the engine is "laboring" and thus the vibration due to lack of air for the full throttle setting. Once above 85 kts "ram effect" takes over and all is well.

Why isn't the carb getting the air it requires? Is the flow turbulent at less than 85 kts thus disrupting the airflow into the lower cowling? Selecting 1/2 carb heat would supply "extra" non-ram air from around the exhaust area and stop the vibration.

If the problem is turbulent flow which is reducing dynamic pressure at the air intake, what is the best way to cure this? Vortex generators on the underside of the fuselage ahead of the intake? How do I determine size location and number of them to use?

The Hunt air box front edge is about the same fuselage station as the firewall. It does not protrude forward of the firewall towards the air intake lip.

Why should the same problem show at itself at higher altitudes where it can't produce full power and doesn't need so much air?

Has anyone any comment to make? I would be interested to hear from anyone operating with a Hunt air box, especially with the standard male type air inlet. There must be someone out there who knows what the fix is. Please help me.

Ian Wilde
15 Flaggs Meadow
Olney
Bucks, MK46 5NL
England
phone: 011 44 1234 712235
I will refund postage incurred.

O-235 & Carbs For Sale

O-235-L2C, 2400 TT and 0 SMOH.
2- O-235 carburetors for O-235: one for 105 HP and one for 115 HP.
2- Bendix mags
1- Long-EZ engine mount **Contact:**
Will Kezele
2104 Summit Place
Twin Falls, ID 83301
208-734-1252

Alaskan Long-EZ First Flight

Mark Barker (AK) - We have been flying the Long-EZ all over the place. As you have said so many times - - what machine! After years of Beavers, Cessnas and Super Cubs it is a big change. After 7.5 hrs of ground runs and high speed taxiing, on April 29 N160GB flew for a short 45 minute flight.

We did all ground testing and subsequent tests out of Anchorage International. It was kind of fun working in and around all the 747s and MD11s. Luckily the tower folks have been great to work with and have given us all that we need.

Last weekend we completed our required 25 hours restricted test time and now have been spreading our wings a little more. Yesterday we did a trip to Fairbanks for lunch. It is normally a 6-1/2 hour drive but we did it in 1.5 hours up and 2.0 hrs back.