

THE CANARD PUSHER

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If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 55. If you are building from 2nd Edition plans you must have newsletters 18 through 55. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 55. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 55. If you are building a Long-EZ you must have newsletters from 24 through 55. If you are building a Solitaire, you must have newsletters from 37 through 55. If you are building a Defiant, you must have newsletters 41 through 55.

A current subscription for future issues is mandatory for builders, as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY AND FRIDAY FROM 8:00 am to 5:00 pm ONLY. If you have parts that you would like us to see and or would like to drop in, please make it Tuesdays and Fridays if you can. If you need to come up other than those days, please call so that we can be sure to be here. When you call on Tuesdays and Fridays for builder assistance, please have your serial number ready. It is required before you can be put through to Mike. This is a company policy and we must adhere to it.

When writing to RAF send a stamped, self addressed envelope along if you have any questions. If you are placing an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed up your reply.

RAF - BACK IN BUSINESS?

In the February issue of Sport Aviation there was an article quoting me as saying that RAF was being "re-activated". This has caused quite a bit of confusion in that many have inferred that it means we were again planning to market plans for homebuilt aircraft construction. Actually, the comment was referring to statements I made at the Voyager reunion party in Washington in which I mentioned that the Catbird had once again become a RAF project and that RAF may do some projects in the future such as a man-powered helicopter or man-carrying ornithopter.

I am still very busily and happily employed at Scaled Composites in Mojave, California next door to the old RAF building and together with a bunch of engineers and builders (a staff that includes many of our old homebuilt aircraft buddies), working heartily away at some very interesting airplane development projects. I have every intent to continue to persue that job for the foreseeable future as it is one that is being done in a very creative environment and involves some very interesting projects such as the design and fabrication of the wing for the wing-masted catamaran for the America's Cup challenge race this Fall.

You can find out about some of the other Scaled projects in the Aviation Week magazine. RAF projects are primarily in the category of things we like to do as hobbies. However, RAF does have one full time employee, Jim Shultzman, who's been preparing the Catbird for its test program and will be preparing it for the CAFE race this year. Most of you know that Jim is the builder of a Grand Champion quality J-3 Cub restoration as well as a Champion quality Long-EZ.

The RAF projects are not funded by plans sales or by any commercial customer. All the funding for the recent years and next years activities have come from income that I have received recently by making an occasional lecture to engineering groups and aviation industry groups concerning the developmental aspects of the Voyager.

Back in mid 1985, we announced that instead of cashing in the RAF bank account when we decided to no longer market plans, we would use that money to provide builder support as long as we felt it either necessary for the continued safety benefits of assisting current builders, or until the money ran out, which ever came first. I am very happy to report that the cash health of RAF has remained approximately the same throughout this nearly 3 year time period even though no plans sales have been made since July of 1985. The major reasons for this are that RAF moved out of the shop and into a small room, has for the most part only part time employees, has not had any liability expenses, and we have been able to continue the sale of items other than plans. The poster sales alone (the eighteen Rutan-designed airplanes) paid for our Oshkosh trip last year. Joan Richey, our two-day-a-week RAF manager, is currently looking for another product we could sell at Oshkosh '88 to allow us to continue to support the Oshkosh show. This important forum allows us to communicate with so many builders and flyers regarding all the support requirements. The pilots' bull sessions at Oshkosh on the flight line continue to be attended just as well as they were when they were first introduced at Oshkosh in 1978. My specific activity in the homebuilding arena is very limited because I have to do it essentially on hobby time. I plan to continue to attend the Oshkosh convention indefinitely and have given up golf so I can have the most time available to enjoy my favorite hobby.

I would like to say that I will some day re-enter the homebuilt aircraft marketplace with a new design. However, while the demands of Scaled Composites development projects exist, I am unable to predict that for the foreseeable future. We had predicted that RAF would last only two or three years as far as its ability to provide builder support to past customers. Now, however, nearly three years into our post-business time period, we still are not aiming at a particular time in which we must stop builder support. I think that it is important to remind you that your support of RAF and your purchasing the things that we can sell is the reason we're still around. I'm certainly hoping for your continuing support so that we can continue to provide the best homebuilder service available for as long as we can. Thanks again, and we'll see you at CAFE, Jackpot and Oshkosh.

Burt Rutan

BURT'S CATBIRD (MODEL 81) UPDATE

The Catbird is in the midst of a careful flight test program to establish the performance and flying qualities, and an acceptable flight envelope. The airplane is a true delight to fly. So far the three pilots who have flown it have been impressed with its handling qualities "out of the box". A few minor changes have been made, but so far it looks quite promising and we are proceeding with plans to enter the Catbird in the CAFE 400. Burt also plans to fly the Catbird to Jackpot, NV and race it in Shirl Dickey's "The Bull Stops When The Green Flag Drops At Jackpot" race. We have not opened the low altitude speed envelope yet, so at the time of writing this, we have really not got much idea of what she will do in a "Jackpot" or "Wendover" type race. Our preliminary data shows that the Catbird should be quite competitive in the CAFE 400 and we are looking forward to the June 25th efficiency contest.

The Catbird is a 5 place single engine, with the pilot sitting up front on the centerline. The next row of passengers sit on either side of the pilot but aft about 15", the 4th and 5th passengers sit back-to-back with numbers 2 and 3, facing aft. The airplane is a very low drag, low wing with a forward swept "T" tail and a small canard near the firewall. The turbocharged Lycoming 4-cylinder, TIO-360, 210HP engine turns a two bladed Hartzell constant speed prop. At cruise rpm, this is a very quiet cockpit and the view is superb. Rate of

climb is a very respectable 2000 fpm through 16000 feet. Top speed is , well, you'll have to wait for Jackpot or Wendover to find that out!! The good news is that we are still having fun out here in the desert and that is what it is all about.

LONG-EZ SQUADRON II HOLDS AN ENGINE SEMINAR.

This enthusiastic group of Long-EZ builders and flyers organized a really great weekend of seminars on the engine, its installation, instrumentation, etc. We would like to compliment Squadron II for their initiative in setting up such a project.

Several experts were on hand to lecture on the various subjects covered and Burt Rutan was the guest speaker at the end of the very full weekend of lectures and talks. From feedback we have received, this was a very popular program and was extremely informative, educational, and practically helpful to all those who are building, and even those flying. We would heartily recommend this idea as an excellent one for any of the EZ clubs or groups to organize for the benefit of their members.

The aircraft engine, its installation, and its operational requirements are all subjects that are not often talked about in any set of plans in any great detail, and many homebuilders get into this area of their project with great temerity and very little knowledge of what they are about to attempt.

Great idea - Congratulations, all at Squadron II for a great job well done.

MIKE'S TRIP TO SOUTH AFRICA

I was very fortunate to be able to spend a month with my mother and sister and to visit with old friends and relatives not visited in over 16 years. It was a really wonderful vacation and I enjoyed it immensely. One of the shining highlights of my trip was a very special Sunday spent with a group of EZ builders in the Johannesburg area.

Herbert de Graaf picked me up early and took me to his home to look at his Long-EZ project. I had met Herbert at Oshkosh 1987 and it was good to see him again and to meet his wife, Ellie. We then drove out to the Grand Central Airport where a large group of homebuilders were crowded around two excellent examples of Long-EZs. Dave O'Neil was kind enough to invite me to fly his really beautiful O-235 powered Long-EZ. So, with Dave in the back to make sure I did not get lost, we taxied out. Grand Central is at almost 6000 feet elevation, so these EZ builders really do understand density altitude. February in South Africa is essentially mid-summer, so with Dave and I and about 30 gallons of gas, the take off run was quite long. However, the Long-EZ got off and climbed well. Piet van Rensburg, an EZ builder from Pretoria, had taken off before us, so we joined up on him for a formation, low approach. The control tower was most co-operative and OK'd several low approaches.

Flying over the countryside where I was born was quite an experience, a very beautiful place. After we landed, Piet van Rensburg who has a larger engine in his gorgeous Long-EZ suggested that I fly his and another homebuilder who owned a C-210 Centurian offered to carry a few photographers up while I flew close formation in Piet's Long-EZ. Lots of fun.

After taking a bunch of photos, we landed and drove to the home of Chris Carstens, a Long-EZ builder and an employee of South African Airways. Chris is one of the most meticulous craftsmen I have met and his almost completed Long-EZ is, without a doubt, a potential grand champion. A number of EZ builders, their wives and friends were at Chris' house and they laid on a fabulous barbeque for me which I enjoyed tremendously. Later that evening, I showed a bunch of slides and a video of the Voyager world flight. Everyone seemed to enjoy themselves, I certainly had a great day, one I will remember for a long time to come. I only wish I could have met with every builder or flyer in the country while I was there. Unfortunately, time did not allow this but, thanks to Herbert, Piet, Chris and all the others I met, I believe I was able to give some constructive criticism and advice. I must say, I am very impressed with the general quality of workmanship I saw, and even more impressed with the "stick-to-it-ness" that people overseas seem to have - and, indeed, have to

have in view of the difficulties involved with obtaining materials and parts.

To all I met while I was there, many thanks for the great day you made for me - for all I was unable to meet, I am sorry. Maybe next time!!

BURT'S BIRTHDAY FLY-IN AT MOJAVE, JUNE 18, 1988

Come to Mojave and join in the fun. David Orr and Sally Melvill are organizing the event which, in the past, has drawn enormous numbers of EZs to the Mojave Airport. The flyin will start around 10AM on Saturday morning, June 18th and your landing will be your attempt at winning the spot landing contest, so shoot for the white line! Soft drinks and hot dogs will be available but please bring a side dish. This is an opportunity to visit the place where all of our airplanes were designed, built, flight tested and developed into what they are today. Meet with Burt and all of the builder/pilots who fly in. It's a chance to compare notes, shoot the breeze and look at more EZs than you will see anywhere on any one airport. Come join the fun on June 18, 1988 - FLY IN, DRIVE IN, WHATEVER, - JUST COME!

FOURTH OF JULY WEEKEND FLY-IN AT JACKPOT, NEVADA

Organized for the past 5 years by Shirl and Diane Dickey, this fly-in is one of the highlights of the year. The organized events consist of: EZ RACES for stock VariEzes, stock Long-EZs, O-235 VariEzes, and all others (unlimited); spot landing contest, and ribbon cutting contest. Poolside cocktails, a dinner/show on Saturday evening, an Awards banquet on Sunday evening with Cactus Pete's Casino putting up \$1800.00 for prize money (paid to the first 5 places in each class). Call 1-800-821-1103 for reservations, \$38.75 plus tax per night. Last year we had 57 EZ's on hand, and a great time was had by all - come and join us!

WILLIAMS AIRPORT, WILLIAMS, ARIZONA

July 10, 1988. Fly in to this beautiful part of the world and join the fun with the local EAA chapter from Flagstaff/Williams, Arizona area. This is a flyin breakfast, so get there early Sunday morning. The bacon, eggs and sausage were sensational last time we went.

BONNEVILLE 125 AIR-RACE

August 19th, 20th, and 21st at Wendover, Utah. The Stateline Hotel Casino has agreed to contribute \$100.00 per airplane on the ramp (up to a maximum of \$3000.00) for prize money for the EZ Races which will be held like the last two years across the historic Bonneville Salt Flats. Call 1-800-648-9668 and ask for RACE/IVHC block reservations. Shirl and Diane Dickey have organized a Spot Landing contest, a Ribbon Cutting contest, The EZ Races, a Dinner Social on Friday evening with the Awards Banquet on Sunday evening. For more information, call Shirl Dickey at 602-893-8711. Help get the maximum prize money - fly in to Wendover for a truly great weekend of fun.

ROUGH RIVER DAM KENTUCKY FLY-IN '88

SPONSORED BY:
INTERNATIONAL VARI-EZE HOSPITALITY CLUB
-AND-
CENTRAL STATES ASSOCIATION

SEPTEMBER 30 - OCTOBER 2, 1988

The third expedition to the north central hills of Kentucky has a NEW DATE: Friday Sept. 30 through Sunday Oct. 2.

We think the earlier date will increase the probability of warm weather, and most club members didn't have Monday, Columbus Day, as a holiday from work and therefore were leaving on Sunday.

One thing that hasn't changed is the great food and rustic setting of one of Kentucky's best state resort parks. With lodge rooms looking over the tree lined lake, and the park's 2800' paved airstrip a short walk from the lodge, club members overwhelmingly voted to return each year.

This Fall we will again feature Saturday morning forums

on the ramp and rides for builders. The "EZ Formation Flying" forum was so popular that many pilots have asked for more, so we are trying to put together an "EZ Aerobatics" forum.

The Mammoth Cave trip is again on for Saturday afternoon. But this year we have reserved a completely different tour of the 300 mile long cave. The "Frozen Niagara" tour features decorative dripstone formations and towering stalactites and stalagmites that cascade in a wall of color frozen for thousands of years.

Reservations with the lodge should be made EARLY by calling 1-800-633-9744, be sure to tell the operator you are with the fly-in group as they have reserved rooms just for us. A 15% group discount will be applied to your room bill.

In addition, if you will be going on the cave tour, please mail me a \$10.00 per person, (children free), deposit for the bus. Tour tickets are \$3.50 per person, (children \$1.75, under 6 free), purchased the day of the tour at the cave. The final bus cost will be determined the day of the trip based on group size.

For a park flyer, airstrip diagram, and event itinerary mail a self addressed, stamped envelope to:

Buzz Talbot
222 Sunshine Dr.
Bolingbrook, IL 60439
312-759-1124 evenings

or call:

FELLOW IVHC members, VariEze/Long-EZ builder and aviation enthusiast, Ivan Shaw and his lovely wife, Judith, have been in Southern California for more than two months now. Ivan has been working on a project mutual to his company in England and Scaled Composites here at Mojave. His sharp English sense of humor has been much enjoyed by all of us here at RAF and we will miss them when his project comes to an end in a few weeks. For some of the time they have been here, they have been staying with Mike and Sally who have really enjoyed them and enjoyed showing them some of the highlights of the area.

Ivan is a very sharp fellow and built one of the first VariEzes to fly in England. ~~He has since converted it~~ by installing a Long-EZ centersection, wings, and winglets into a - Vari-Long? Since that time, he has gone one step further and designed a neat retractable main gear and installed two 77 hp engines on the wings to make, what he calls, a Twin-Eze but what looks a bit like a tiny Starship.

See below for Ivan's own words on the subject. He only has about 10 hours on his Twin-Eze so far, so he is still faced with a major developmental flight test program when he returns to England. We have printed a photo of his beautiful little creation in this CP. Ivan says he is not sure what he will do with it after he has completed all testing and he does not really want to be inundated with inquiries while he is going through the test program.

Ivan and Judith have been amazed at the freedom we have here in the good old US of A. How easy and economical it is to fly somewhere, the freedom to design and build and fly almost any kind of airplane. These freedoms, that used to exist in England but sadly have been virtually eliminated by the bureaucracy, must be jealously guarded by all of us who live and work in the US. It takes a visit from a fellow EAA-type from a foreign country to point out to us how fortunate we are here in America and to remind us to do all we can to protect our rights and to make sure the "can do" spirit that we have here does not become a "no can do" situation like it has in so many other countries. When EAA asks us members to write our congressmen regarding something important like the latest attempt to restrict private flying as shown in the Sport Aviation Magazine, support the cause, write in, make your voice heard. If we don't, our precious freedom to fly will slowly be eroded away until it no longer exists. As Ivan says, "watch out for the bureaucrat who nibbles away at your freedom". How true!

Excerpt from Ivans letter to Mike Melvill

"Dear Mike,

Please find enclosed a photograph of my latest project, the Shaw "TwinEze", thought you may be interested.

G-Ivan started life as a VariEze that I built in 1980-81. After 350 happy hours flying, I decided to convert it to a Long-EZ then, inspired by Starship, got carried away with twin engines and retractable gear.

The engines are British fully certified units - three cylinder, inline, water cooled, two strokes giving 77 bhp at the prop. They were designed and built by Mike Hewland for the ARV Super Two aircraft. Both engines have completely separate systems, batteries, etc. and left fuel tank feeds left engine, right feeds right.

To date, I have completed approximately 10 hours flying with the only problems being getting the cooling air to go where I wanted it to go and some fuel vapour (sic) locking that has only been completely cured by running on 100LL instead of M0gas. The good news is that it flies superbly, just like the Long-EZ, the noise level and vibration is less. Control on a single engine could not be easier, 350 fpm climb and a VMCA wings level of 56 knots on the critical engine. I have not opened up the envelope speed-wise yet but one thing I am sure of and that is it's going to be fast. The main gear is a retractable unit of my own design that tucks the wheels aft through 115° to where the engine used to be, it is powered by hand hydraulic.

The technical challenge has been everything and more than I expected. The bureaucratic hassle has been something you have to live through to believe. After static load testing the aircraft to 5 g's, gear drop tests to beyond FAR part 23 requirements, engine mount static load test, 25 hours of ground running, taxi, runway hops, my approved inspector clearing it as airworthy, after all this, it took a further six months to get permission to commence a test flight program. I was actually told that I could not do this because, "it has not been done before". What a sorry state of affairs for a country that once led the world in innovation.

My flight testing continues. I will keep you updated on my progress.

Thanks, Burt, for the inspiration,

Ivan Shaw"

REFUELING FIRE

"I knew it was possible, but surely it wouldn't happen to me. How many thousands of times have EZ's been refueled without any incidents of fire? One reported in Norway (see CP 52 and 53) and now me. Why does it happen? Is it carelessness, or is it preventable?

After a 40 minute flight in my LEZ N8HA, I called for the fuel truck and parked on the ramp with the nose headed into an 8 knot breeze. The fuel truck drove up and was parked about 8 feet behind the plane - downwind. Gary, the driver, unreel the ground cable and clipped it to the exhaust stack, just the same as we had done about 30 times before. Gary then brought the fueling hose around the left wing and I removed the left tank fuel cap. Eleven gallons of (100 LL) fuel was pumped into the tank and it was about an inch and one-half from being full. He then shut the nozzle down to slow the flow and with both of us looking directly at the fuel tank opening, the fumes from the tank started burning. No explosion. The flame above the tank was a couple of feet high and was being blown across the wing aftward about 4 to 6 feet. I remember seeing the end of the fuel nozzle positioned even with the fuel tank opening and in the center of the 3 inch flush filler ring when the fire started. We don't know if the nozzle had touched the ring or not. The nozzle was also on fire.

By very fast reaction and a dry powder extinguisher from the rear of the fuel truck, we had the flame out in about 12 seconds from the time it started. Gary had one hand singed and I was spitting dry powder. I had just turned around from getting a small Halon unit in my cockpit when he shot across the wing with the powder. Damage to my LEZ was mostly cosmetic, but with a couple of heat wrinkles in the skin just aft of the filler ring, and some places in the centersection and wing spar area where the finish paint was blistered up from the primer coat. A large area was smoke blackened from the filler ring to the trailing edge. If we had been standing on the downwind side of this operation it may have been a tragedy for both of us.

The main thing I will do for sure is to install a grounding lug onto the metal fuel filler ring and use it instead of the engine exhaust. Also, a jumper groundwire will be clipped to that lug and to the fuel nozzle BEFORE removing the jumper wire or ground cable. The fuel truck should be parked crosswind from the plane and not downwind of it, and should be grounded into earth rods. The fuel handler should not be wearing any nylon clothing. A two pound Halon unit will be mounted in my EZ and it will be "IN HAND" or "WITHIN ARMS' REACH" each time the plane is fueled. If this fire had burned another few seconds the top of the tank may have melted away and then it might have been uncontrollable.

Alfred Tiefenthal of Norway and I have learned from a first-hand experience. I hope it will not happen again, anywhere, but I am sure that it will - Maybe to YOU, so please be prepared.

Herb Anderson
Montrose, Colorado"

EDITOR'S COMMENT

The above letter was sent in by Long-EZ builder/flyer, Herb Anderson of Montrose, Colorado after he had experienced a refueling fire. The only other case ever reported to us was written up in CP52 and CP53. We have refueled EZ's literally hundreds of times ourselves here at Mojave where it is very dry and static electricity is quite prevalent. You can get a nasty jolt just getting out of your car. For some reason we have never had a fire. Now that we know of two instances, it is obvious that we cannot go on without doing the best job we can to prevent such a disaster.

Refueling fires, surprisingly, are not all that uncommon, even in metal airplanes. In the military, for example, the gas truck is grounded, the nozzle has a ground strap that is connected to the fuel tank near the gas cap before opening the gas cap.

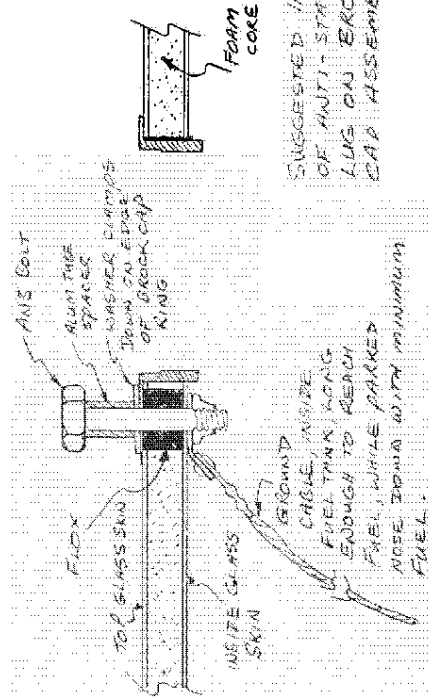
We can learn from this. We are equipping our Long-EZ's with a ground lug which is connected to the gas cap ring. This is where the gas truck will connect his ground strap instead of onto the exhaust as he usually does. We believe that a ground wire should go into the tank from this ground lug or the gas cap ring such that it is immersed in fuel even when the airplane is parked nose down with minimum fuel in the tank. When we get ready to take on fuel, the procedure will be this: a short cable with alligator clips will be kept in the EZ and will be connected to the ground lug and to the gas truck's fuel nozzle BEFORE opening the gas cap. The gas truck's grounding cable will also be connected to this ground lug BEFORE the gas cap is removed. This will drain any static off the airframe, out of the inside of the tank where static can build up. Then we will open the cap and pump in fuel.

The friction of fuel through the nozzle and pouring from the nozzle to the inside of the fuel tank creates static electricity but this charge will drain away from the nozzle, the tank, and the surface of the fuel through our internal cable and ground lug, as well as through the truck's ground lines.

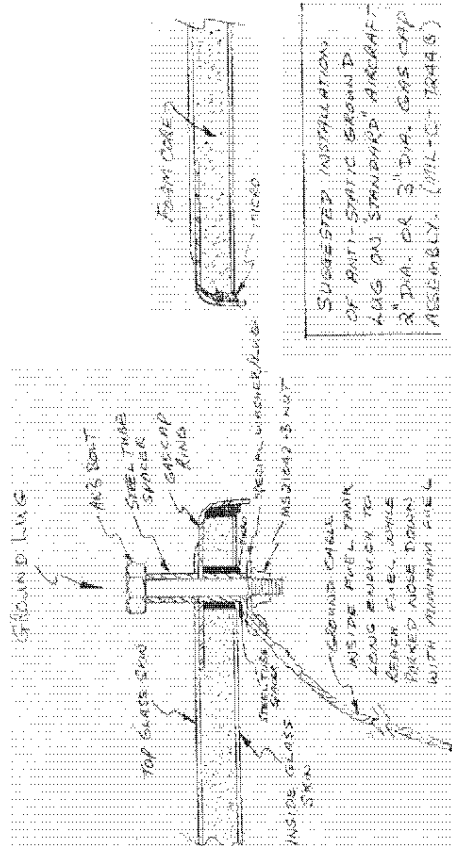
We are not experts in this area, however, we believe what we have outlined is a good common sense approach to eliminating the threat of a fire caused by static electricity arcing from the fuel to the nozzle or from the gas cap ring to the nozzle. We are open to suggestions on this potentially serious problem, but what we have outlined above is what we are doing to our airplanes, and we believe every builder/pilot should do to his or her airplane before the next time you refuel it. In addition, as Herb Anderson has recommended, we will carry a good quality Halon fire extinguisher which will be available to the pilot or person refueling the airplane. Once the refueling operation is complete, the gas cap should be closed and locked before any ground strap is removed.

We would like to thank Herb Anderson for writing his report for the CP. Taking these actions now, before it happens to you, may save you from a potentially very, very serious problem.

Use a Dremel to cut a 3/8" diameter hole through the top skin of each fuel tank adjacent to the Brock fuel cap, as shown. Remove all foam and micro down to the inside skin, but do not penetrate inside skin. Fill this hole with flux - allow to cure. Drill a number 12 hole through the cured flux into the tank close to the edge of the Brock fuel cap ring, as shown. Care must be used to avoid contaminating the interior of the fuel tank.



Top skin is spot faced through the ring. A reverse spot face is required to remove foam and glass from under the ring, as shown, to allow the steel tube spacers to clamp up tightly onto the ring for a good electrical contact. Care must be used to avoid contaminating the inside of the fuel tank.



HIGH ANGLE OF ATTACK DEPARTURE TESTING

Our own flight test experience plus NASA spin tunnel evaluations plus a NASA test pilot's actual attempts to spin a Long-EZ have led us at RAF to believe that it was virtually impossible to get our airplanes (VariEze and Long-Ez) to depart from controlled flight and enter a classic spin. Recent flight testing conducted here at Mojave by three different test pilots on a research airframe similar in configuration to a Long-EZ, have resulted in the classic spin modes.

While opening the high angle of attack envelope, we discovered that this particular airplane would, indeed, depart and would enter steep upright spins from which it would readily recover, at least in spins of less than 2-1/2 turns. As we cautiously pushed into the unknown, we suddenly found that this plane could also go flat! That is to say, it would transition from a steep spin into a very high angle of attack, flat spin, uncommanded.

Recovery was very difficult but a combination of full recovery controls plus power was successful, at least twice. However, in one case, the engine quit due to high centrifugal forces and, although full recovery controls were put in after two turns and held in for eight more turns, this had no perceptible effect. The pilot then initiated full throw pitch control inputs, attempting to get the nose down. Control input was in phase with a slight pitch oscillation he noticed during the previous 10 turns. The oscillating inputs were successful and after 7 more turns, the airplane was recovered and landed dead stick on the Mojave runway.

This experience was quite a shock to the pilot who did not think a canard configured airplane could enter a flat spin. The chances of recovering from such a spin are usually remote. The pilot experienced some disorientation, the spin rate was as high as one turn each two seconds, or 180° of rotation per second. The rate of descent was close to 5000 feet per minute, a total of 4000 feet was lost during the 17 turn flat spin, and subsequent recovery.

What was learned from these experiences? First of all, it may be possible to depart and spin any canard configured airplane, even a plane such as a VariEze or a Long-EZ, particularly if these airplanes were not carefully and accurately built. Do not deviate from the plans. Use care to not accept any modification or variation from that configuration that has been thoroughly tested here at RAF, subtle modifications of the wing or winglets may make your aircraft dangerous. Use your absolute best effort to set canard, wing and winglet incidence correctly. Level all waterlines as closely as you can read a level. In other words, build your EZ as accurately as you are capable. Conduct a careful, accurate weight and balance, including measuring the airplane. Do not assume your airplane will be the same as the prototype. Also, your test program must include stall/departure tests of your airplane, flown with a parachute and with plenty of altitude.

Fly your airplane sanely and well within your own piloting skills and ability, and remember that flying is not necessarily a dangerous activity, but it can be terribly unforgiving of any carelessness or foolish judgement.

VARI-EZE MAIN WING ATTACH - CORROSION.

Since we first reported the corrosion problem in VariEze main wing attach plates in CP53, page 7, we have heard from only two or three builder/flyers who had found signs of corrosion. Just this week we received a letter from a VariEze owner/pilot who found corrosion in the WA-2-2 plate. He has spent a considerable amount of time and energy removing this plate, in fact, he said he almost resorted to using dynamite! He sent us the WA-2-2 plate, the lower plate of the top two plates mounted to the centersection spar. By far the toughest plate to remove and replace. This plate (see photo) has one of the worst cases of intergranular corrosion we have seen. It is absolutely not safe to fly and must be replaced. Unfortunately, this is probably going to be very difficult, and we honestly do not have any simple fix for this. Just removing the WA-2-2 plate could do serious damage to the centersection spar. The UND wrap around the end of the centersection spar may have to be cut and removed. The foam under the WA-2-2 plate must be dug out, the 8 AMS25 (or AN509) screws must be removed (drilling them out may be the easiest method).

A replacement plate must be fabricated, duplicating exactly all of the holes in the plate. This is a difficult job and will require an expert machinist and a lot of patience. Brock will not be able to help you with this. Each case will have to be dealt with on an individual basis. The new piece should be alodined and then floxed and screwed back into place. If the UND wrap was damaged, it must be replaced, which requires cutting into the fuel tank (we did say it would be tough!).

This is major work, not anything that could not be done by a person who has built a VariEze, but very tedious, difficult work. And it must be done right. There is no short cut, no easy way. If you find more than simple white powder surface corrosion, stuff you can easily polish off with 320 grit sandpaper, you must ground your VariEze and replace the corroded parts.

A mandatory inspection is required before next flight for all VariEzes. Do not take this problem lightly, it could kill you and anyone who may be with you. Remove both wings. Clean all visible aluminum parts at the wing root and centersection spar. Look at the edges of all the WA plates on the centersection spar. Look for a thinner edge or a swollen appearance under the glass. Look in between these plates (where the WA-3 tongue slides in). A white powder appearance that can be completely removed and polished out with 320 grit is OK, but the plates should be very thoroughly cleaned and sprayed with zinc chromate. LPS or a good quality grease as used in marine applications should be generously applied everywhere before re-installing the wings. Check the WA-4 pins and the AN4 bolts and grease both thoroughly. Replace the AN4 bolts if they show any sign of corrosion.

New construction VariEzes, or anyone replacing wing attach fittings with new ones, should clean all aluminum parts with Alumiprep 33 or Metal Prep #79 then alodine them with Alodine 1201 which puts a tough, corrosion-resistant, visible, golden finish on. We are reluctant to try alodining parts in place due to the acid etch (Alumiprep 33) possibly getting under the glass onto the aluminum.

When you inspect your VariEze, be very concienious. Check very carefully, it is difficult to find, you may have to probe under the glass over the WA-2 plates. Look hard and long at it before you decide it is safe to fly.

The only good news about this is that where the epoxy was bonded to this WA-2-2 plate which we have, there is no corrosion. The surface of the metal is as new. Intergranular corrosion is very common in airplanes that live near the ocean.

Sea planes are especially prone and require constant inspection and maintenace aimed at preventing just this problem. The salt in the air plus water from rain or condensation, plus heat and aluminum and, presto!, you have a battery! Galvanic reaction and you have corrosion. Keep the aluminum parts clean, gease them often, and you will have no problems. People who live far from the ocean may not see this problem but they must check for it just the same.

This problem is confined to the VariEze. The Long-EZ wing attachment is completely different and this same problem should not occur. Of course, all metal parts must be protected from corrosion - aluminum with alodine or zinc chromate, steel with zinc chromate (after cleaning in Metal Prep). Wing attach bolts and parts should be generously covered with a good grease in VariEzes and Long-EZs. Replace any rusty bolts and nuts.

CAUTION - AILERONS FREEZING

Jerry Nibler, an Alaskan Long-EZ builder/pilot tells us of an experience he had near an area known as "the trench". He encountered heavy rain and low visibility while trying to fly north so he did a 180° turn to where there were breaks in the cloud cover and climbed up on top. Climbing through the freezing level at 8000 feet, he noticed the ailerons getting stiffer and stiffer until he could hardly bank the plane at all.

This scared him rather, to say the least, so he did another 180° and descended below the freezing level where the ailerons returned to normal, much to his relief. Jerry thinks the rain water got into the hinges, did not have time to dry out completely before he climbed to the freezing level where, of course, the

moisture froze. He advises to stay below the freezing level after flying in rain or taking off covered in dew until the airplane has a chance to completely dry out.

This is a good point, one we have mentioned in the CP before but one that should be repeated because it can really scare you if it happens to you. We have had it happen to us in a Long-EZ as well as Burt's Defiant. We found we could control the bank angle well enough to continue by using the rudders and, eventually, the ice sublimated away and we were able to break the ailerons free. We suspect that water runs across the bottom of the wing, bridges the gap between the bottom wing skin and the leading edge of the ailerons, then freezes there. You can help this a little if you keep the ailerons moving left and right as you climb through the freezing level.

Thanks for this report, Jerry. This is the kind of thing that can really help out a fellow EZ pilot. By the way, Jerry ended his letter by saying that his Long-EZ is the most valued of all his material possessions and has provided him with more sheer pleasure than anything else he can think of (yes, even more than that! he says).

CAUTION

Friction in the pitch control system of an EZ can make it very difficult to fly. In fact, it can flat-out make it so uncomfortable to fly that you won't enjoy it at all!

Friction in an EZ's pitch control system is easy to avoid and must be avoided. There are so few parts involved that it is simple to check. Disconnect the pitch trim springs, push the stick forward and aft, or grab the trailing edge of the elevator and move it full travel up and down. There should be no perceptible friction. It should not hang up anywhere, it should easily flop all the way up and all the way down. If it feels stiff or tight anywhere in the full arc of travel, find out where it is binding and fix it before you attempt to fly. Check the rod ends at the stick and at the inboard ends of the elevators. Check the stick's pivot points. Check every one of the elevator hinges. On the original GU canard, it is easy to get one or more hinge points too tight. The washers at the hinge points should easily spin. The bronze bushing should be lubricated and should be a nice easy slip fit on the AN525 screws which are the hinges. Check that the mass balance weights are not rubbing or chafing inside the slot in the canard on each elevator.

Lastly, put a saw horse or chair under each canard tip (well padded, of course) and have someone push down on the nose or center of the canard. Apply enough weight to bend the canard at least 3 or 4 inches up at the tips, then check all of the above for friction or binding or chafing under load. There should be no perceptible drag in the pitch control system (with no pitch trim springs installed) in any of the RAF designs, VariEzes, Long-EZs, Defiants or Solitaires.

CARB AIR INTAKE HOSE PROBLEMS

Jake Bach, a Long-EZ builder/flyer reports that for almost a year he had had an unexplained loss of about 100 RPM. He checked everthing he could think of - timing, compression, plugs, etc., to no avail. Then he decided to modify his air intake system and when he took the intake hose off (which looked perfect from the outside), to his amazement, it had imploded! All the wire on the inside of the hose had come loose and had balled up in the hose restricting the engine's ability to breathe. A new hose completely cured the problem.

This is another good point, one that has been covered in the CP before and, also, one that, in fact, caused an accident in a VariEze some years ago. Part of the problem is in the installation of the hose. It is critical that the spring wire inside the hose be bent in such a way that it can be securely trapped under the hose clamps at each end. We like to bend the wire 90° so it comes straight out of the end of the hose, then bend it 180° so it comes out of the hose around the edge and back along the outside of the hose. Then the hose is installed over the filter tube or carb intake tube and the hose clamps are slipped on so that the wire and the outside string wrap are held securely in place when the hose clamp is tightened. This should eliminate any chance of the wire "spring" coming loose from inside the hose, however at least an annual inspection of the outside, as well as the inside, of this hose should be conducted

NOSE WHEEL CASTINGS CRACKING AND DISETEGRATING

We have had several reports of this problem from Long-EZ and VariEze builders and, as we stated in a past CP, you should remove your nose wheel periodically and take it apart, clean it and carefully inspect it for cracks in the cast aluminum center bearing holder. This is especially true if you have ever experienced shimmy in your nose wheel. We have disassembled and examined all of the Brock nose wheels we have here at RAF and have found no sign of any cracking. However, we have seen several examples that were cracked and several more examples that broke and, in fact, disintegrated.

Wicks Aircraft Supply in Highland, Illinois sells a nose wheel that is a direct replacement for the Brock nose wheel that is built just like a miniature of your main wheels. This wheel looks like an excellent alternative although it is a little heavier. If you have had one crack and are looking for something stronger, give Wicks a call. Ask for NW-A1230 nose wheel, they cost around \$50.00, fit the same tire and tube and will mount into the EZ for with a minimum of fuss.

FAA REGULATION CHANGES

Builder identification placards must be installed on your aircraft after March 7, 1988 (if you are flying now without one, you could be violated). According to the FAA, we aircraft owners must have a plate or placard on the exterior of the fuselage adjacent to the rear-most part of the canopy (door!), and it must be legible to a person on the ground. There are no letter or number size requirements and the information must agree with your stainless steel information plate in your cockpit. You are required to display your aircraft make and model designation, (Smith, Long-EZ or a Jones, VariEze, etc.). The serial number must also be shown. You can have a sign writer simply paint this information on the fuselage, or you could stamp it onto a metal plate and bond/rivet it onto the fuselage.

If you plan on visiting a foreign country, even Canada, Mexico or the Bahamas as an example, you will be flying through an Air Defense Identification Zone (ADIZ). After March 7, 1988, you will be required to install 12" high registration marks for this trip. These can be temporary marks provided they do not come off during the flight.

These are new Federal Aviation Regulations and all aircraft owners, including homebuilders, must comply after March 7, 1988.

ACCIDENT AND INCIDENTS

We have had an indirect report of a Texas VariEze that crashed in Arkansas. One witness reported watching the VariEze take off and disappear immediately into the "muck" - apparently the "muck" (bad weather) snared this VariEze a little later on near Little Rock.

This is a particularly tragic accident because it was easily avoidable. Flying into bad weather in a marginally equipped sport plane like an EZ is a hazardous business. Our fun-to-fly EZ's were never intended to be all-weather capable. Too many EZ pilots seem to think that these planes make us into supermen or women. Far too many EZ pilots are trying to do things in their EZ's they would never have considered doing in their Cessna 150 or Piper Tomahawks. We are only fooling ourselves. If we continue to push our luck like this, we will end up paying the ultimate price and it simply is not worth it.

Used properly, an EZ can be a delightful, economical, high-speed transportation machine - a machine you and yours can get years of enjoyment out of. Used carelessly, an EZ can get you into so much trouble you may be incapable of getting out of it in one piece. Use discretion, good judgement and enjoy.

WEIGHT AND BALANCE

We recently heard of a serious deep stall accident in a homebuilt plane (not a RAF design) in which the builder pilot had not conducted a weight and balance! To quote Burt in CP12, April 1977 - "Now hear this, all of you homebuilders, an inadequate or inaccurate weight and balance could kill you! The final weight and balance you do on your plane before flight testing begins is just as important as installing the wing attachment bolt!" DO NOT NEGLECT THIS CRITICAL FLIGHT SAFETY ITEM.

ACCIDENTS AND INCIDENTS

A Pennsylvania Long-EZ builder/flyer was fatally injured when his newly completed airplane crashed short of the runway on his second flight.

Apparently, the first flight was picture perfect, a flight that lasted about forty minutes. The second flight lasted about the same length of time. His engine was heard to be cutting in and out, on his second approach to land. He started a climbing left turn in an apparent effort to return and land. The airplane spiraled down from about 100 feet and crashed.

The right fuel tank was intact and contained approximately 8 gallons. The left tank was crushed, but the 1:20 minutes of flight would probably have used about 8 gallons of fuel. The airplane had 8 gallons on each side when it first took off. The pilot's shoulder harness was tight for take-off yet was found to be loose after the accident, so he may have been trying to reach the fuel valve which was reportedly difficult to turn.

An accident like this is very sad. We have repeatedly given the advice "FLY THE AIRPLANE", and this accident brings it home very forcefully. No matter what happens, if you run out of fuel on one tank or you have to shut it down for one reason or another, "FLY THE AIRPLANE". This must be your first priority. It cannot fly itself, you must maintain control, you must maintain airspeed. Then, and only then, switch tanks or do whatever else you may have to do, all the while maintaining control of the airplane.

Check your fuel valves for ease of operation. If yours is stiff, dismantle it, lap it in with jewellers rouge or a metal polish such as Brasso, using an electric drill. Clean it thoroughly and lubricate it with a suitable grease such as fuel lube, etc. Even if you have to do this once every 6 months or a year, do it, do not let your fuel valve get so tight that it becomes difficult to switch tanks.

While we are on the subject of fuel valves, be certain that you know where your valve handle should point when it is on the left and when it is on the right tank. Check carefully that the valve is in the detent and that this is, indeed, the tank you had selected. Clearly mark the position the handle is in when it is switched to the RIGHT, to the LEFT, as well as to the OFF position. It may be possible to select a mid-position between both tanks. This would not be good since, if one tank was empty, the fuel pump would pump air from the empty tank causing the engine to quit. Know your fuel system. Maintain your fuel valve regularly. Calibrate your fuel sight gauges so that you know exactly how much fuel you have on board. If, in spite of all of your care and diligence, something goes wrong, FLY THE AIRPLANE, try to correct the problem, pick a landing site, and execute a normal landing. Don't try anything fancy. A normal landing, maintaining flying speed and control to touchdown is always your best bet.

ACCIDENT

A Southern California Long-EZ was involved in a forced landing resulting in considerable damage to the plane although the pilot suffered only minor cuts and bruises. The cause of this accident was the use of a molded plastic prop that came apart a few minutes after take-off. This resulted in a forced landing where there was no airport.

This is silly, People. Long-Ezs and VariEzes are not good airplanes to test new-fangled props or engines. With a stall speed close to 60 knots, your chances of making a successful forced landing when (NOT IF), when, the plastic prop breaks or the engine quits (because it will, make no mistake about it) are very, very low. If you are into testing new plastic props or constant or variable speed props or auto engines, please, please, do all homebuilders a favor, and do yourself a favor (you may even save your life), use a Piper Cub or at least a factory built Cessna 150 or something with low wing loading that gives the best chance of making a successful off-field landing when you have your failures. At least, then this will not result in a blot on the record of homebuilt accidents but rather, will go down against factory built airplane accidents or incident statistics.

All of us who build and fly homebuilts must have in mind at all times that it is us, all of us as a group, who have the responsibility of policing our own actions and making sure that we do not end up as ammunition for those who are against us and who use every incident against us to shut us down and prevent us from flying and enjoying our creations.

We are not against experimenting, on the contrary, that is the business we are in and we encourage it. However, an experiment such as the above accident was virtually guaranteed to end in failure from the beginning and it should not have been conducted on an airplane as poorly suited for this type of experiment as a Long-EZ

SHOPPING FOR A PROP?

B & T PROPS
Bruce and Bonnie Tifft
3850 Sherrrod Road
Mariposa, CA 95338
209-742-6743

Bruce builds custom wood props with a urethane leading edge for VariEzes, Long-EZs and Defiants.

GREAT AMERICAN PROP CO.
1180 Pike Lane #5
Oceano, CA 93445
805-481-9054

Fred Griffiths' company cuts wood props for EZs, Defiants, etc. An option is a urethane leading edge or Kevlar wrapped blades.

TED'S CUSTOM PROPS
9917 Airport Way
Snohomish, WA 98290
206-568-6792

Ted Hendrickson is one of the earliest suppliers of EZ props and makes excellent wood props with a urethane leading edge for rain erosion protection.

The above three prop manufacturers are the only prop builders that RAF recommends.

SHOPPING

AIRLINER WINDOW KIT

"At Burt's Homebuilder Forum during Oshkosh '87, the green light was given for Plexiglass windows in the baggage stoke floors. Several builders had made this modification to provide better ground visibility for backseat navigators who don't enjoy 90 degree banks to identify a checkpoint. Any size or shape is O.K., as Burt relates there isn't any structural member there.

One of Arnie's Army from Iowa put me on the trail of the Micro Mesh company as a possible source for inexpensive Plexiglass windows. I spoke to the President of Micro Mesh and learned that the lion's share of their companies profits don't come from selling their famous scratch removal kits, but rather from contract work restoring airliner windows. After about 6 years of high altitude exposure to UV light, the windows develop thousands of fine scratches known as "crazing". The windows are as much as \$600.00 new, but Micro Mesh polishes them to crystal clarity for \$100.00 each. The good news for us is that about 30% of the windows are rejected as too thin or they contain a small chip at the outer edge from a ham handed mechanic during removal. The \$600.00 rejected windows are tossed in the dumpster!

They have recently sent me, (UPS collect), 50 rejected airliner windows for distribution to EZ'ers. The windows are about 11x15x1/4 inches, and of course vary from model to model, (it's fun just going through the boxes as most are labeled L1011, DC8, etc.). The "too thin" rejects are partially refinished and a Micro Mesh kit would be required to polish them out, (I did one in front of the T.V. in about 2 hours). The chipped windows all have some degree of crazing that would likely be unnoticable under the wing, but knowing you guys, you'll want to polish these out also.

I am offering a FAA 51% approved kit containing everything you'll need except engine, prop, avionics, paint and airframe. No moving parts! Price is \$599.95, (such a deal for you because I like you), unless you are a member of an EZ club or support group, (such as I.V.C.H.C., Squadron I (or II), Central States), in which case price is the UPS cost. I don't know where you live so send me \$5.00 and I'll mail the change to you with the windows.

Buzz Talbot
222 Sunshine
Bolingbrook, IL 60439
312-759-1124

FOR SALE

Mooney nose gear for Defiant - \$500.00.
Contact: Byrdell Mathews
26311 Hwy 75
Spring, TX 77580
work - 713-523-1751
home - 713-367-5071

Defiant Builders - two Cleveland 600x6 mag wheels and brakes with new chrome discs. Two B. F. Goodrich 600x6 6 ply, like-new tires and tubes plus two master cylinders, two axles and four rudder pedals with toe brake assembly. All for \$500.00.
Contact: Jim Alexander
2950 Hwy 28 N
Boyce, LA 71409
318-793-4245

Bruce Tiff has a like-new 4" long prop extension available for use on a 180 HP VariViggen. Contact Bruce at:
B & T Props
3850 Sherrod Road
Mariposa, CA 95338
209-742-6743

FOR SALE! All items at 1/2 catalog price!

Two Cleveland brake mater cylinders (10-25). Two gas caps (416-5c assemblies, mil-c-72448). 0-235 cowling with P-51 type scoop. 0-235 Flywheel without starter ring gear. 0-235 flywheel with starter ring gear.
Contact: Chuck Abbey
Box 452
Dripping Springs, TX 78620
512-858-7818

Smoke Canopy for Long-EZ - \$150.00.
Contact: Dave Lund
15114 Paso Del Sol
Del Mar, CA 92014
619-755-6117

Cont. 0-200A - 660 TSMO with accessories - \$3500.00.
without accessories - \$3000.00.
Contact: Jim Alexander
2950 Hwy 28 N
Boyce, LA 71409
318-793-4245

WANTED

VariEze wing attach fittings, complete, for new construction. Contact: Doug Whitt
3613 S. 116th E. Ave.
Tulsa, OK 74146
918-663-1704

SWAP OR TRADE

I have the following 12 volt parts and would like to trade them for equivalent 24 volt parts for a Lycoming.
12 volt starter, Prestolite part #MZ4204.
12 volt alternator, Prestolite part #ALE6406.
12 volt voltage regulator, part #USF7303.

All of the above parts have 1463 hours total time since new. My starter ring gear has 122 teeth.
Contact: Ray Ratzlaff
c/o Rutan Aircraft Factory, Inc.
Building 13 - Airport
Mojave, California 93501
Call 805-824-2645 (Tuesdays and Fridays)

PLANS CHANGES.

We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification requirements. This allows experimentation by the homebuilder, giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
<u>MAN-GRD</u>	Mandatory, ground the aircraft Do not fly until the change has been accomplished.
<u>MAN-XXHR</u>	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
<u>DES</u>	Desired - strongly recommended but not requiring grounding of the aircraft.
<u>OPT</u>	Optional - does not effect flight safety.
<u>OBS</u>	Obsoleted by a later change.
<u>ME0</u>	Minor error or omission.

PLANS CHANGES

VARIEZE

MAN-GRD Check wing attach fittings for corrosion. Remove both wings, clean and inspect the wing attach fittings on the wings and on the centersection spar. See this CP for a more detailed description.

VARIEZE, LONG-EZ AND DEFIANT

DES Static ground for potential fire problems
See this CP for details.

NO SOLITAIRE CHANGES

BUILDER HINTS

Defiant - Several builders have reported difficulty in installing the Defiant main gear between the F.S. 145 and F.S. 153 bulkheads due to the gear attach tabs building up the width of the gear. Before laying up the attach tabs, grind the trailing edge of the gear forward locally at each attach tab area about 1/4". Then layup the attach tabs and it will fit between these two bulkheads perfectly.

Defiant - Optional low level float switches for the fuel tanks, as used in Burt's Defiant are supposed to float in AVgas. They used to! We have used them many times on various airplanes over the years with excellent results. Recently, we installed brand new float switches in the Catbird fuel tanks and, much to our chagrin, they sank and were useless.

We removed them, checked them in water, they floated, but they would not float in fuel!! We called the company that makes them and were told, "yes, that is correct, they are made not to float in gasoline!" Something to do with liability insurance. Anyway, - what to do? We simply carved a foam ball out of H-45 PVC foam (Divinycell), drilled a hole in the ball, and floxed it onto the end of the float. The ball is a little smaller than a golf ball. We painted the ball of

foam with a light coat of epoxy to seal it and protect it. It floats great in fuel, and PVC foam is impervious to fuel so it should last indefinitely. While these are not specifically called out in the Defiant plans, we strongly recommend them to be installed one in each sump tank.

BUILDER HINTS

All RAF designs - While waiting on cure cycles or parts to arrive, or while you are delayed for whatever reason, do little bits of finishing work on the parts you have done. Keep a one gallon kit of West System Epoxy handy. This is obtainable from Gougeon Brothers, PO Box X908, 706 Martin Street, Bay City, Michigan, 48706. Call 517-684-7286 or 6881 (orders only). Ask for 105-B resin, 205-B hardener (fast) and a 301-B mini pump set to pump the correct ratio out of a one gallon resin can and a one quart hardener can. They also sell a slow hardener 206-B but we believe the fast, 205-B, is more useful for mixing dry micro. (You will probably use about 2 gallon on a Long-EZ.)

We mix it as follows: One stroke of each pump into an 8 ounce paper cup, mix thoroughly. Add one heaped 3 ounce paper cup of micro balloons and stir thoroughly. Spread this mix of dry micro and West onto your wings or winglets, canard or whatever you have done, particularly in any low spots like next to a spar cap, etc. Trowel it on a bit thicker than you need and allow it to cure. A full cure normally takes less than 12 hours depending on the ambient temperature. Here in the desert, we can spread it on in the morning and sand it to contour in the afternoon. It is a good idea to dampen a handful of paper towels with West epoxy and moisten the part prior to troweling on the micro. Of course, the bare glass should be scuff-sanded with 36 or 40 grit sandpaper prior to wetting with West epoxy. Don't get it too wet, just moist for a good bond. The West system epoxy and micro will bond very well to Saf-T-Poxy and will be easy to sand (unlike Saf-T-Poxy and micro!).

Doing a little finishing all the while as you are building will make the finishing process at the end of your project a lot easier to stomach! After all the parts are built, the engine and wiring and systems are all in and done, it is usually quite demoralizing to suddenly find yourself faced with the enormous task of sanding, filling, contouring, sanding, filling and sanding and painting all at once. A little filling done once or twice a week will leave you with a much smaller job at the end of the project. Try it, you will be glad you did!

MAGNETOS - TIMING-REMOVAL AND REPLACEMENT

Our experience here at RAF is confined almost exclusively to the Slick magnetos due to Slicks being easier to fit in the confines of an EZ, also due to their being lighter in weight. Since most EZ flyers will have Slicks installed, this discussion will concern only the Slick magneto.

We will start out with the installation of the magneto since this may be the most confusing area, leading to the most starting problems, etc. based on the calls and letters we receive. The older style, 4050 and 4051, "throw away" models probably should be traded in on the newer 4250 and 4251 rebuildable mags. They are more reliable, more readily obtainable, and are easily repaired or rebuilt even by the owner/builder. Basically the differences between the original "throw away" and rebuildable mags is size. The "throw away" being smaller than the rebuildable. Also, when timing the magneto, prior to installing on the engine, you must "spark out" the "throw away" model by spinning the timing gear to set the magneto on cylinder number one. On the newer, rebuildable magneto's, Slick supplies a little "pin", a T-118 timing pin, which is used to set the magneto timing to the number one cylinder. With the distributor cover off, look into the forward end (on a EZ!) of the mag, you will see two holes in the plastic molding, the top one marked for left hand rotation (L), the bottom one for right hand rotation (R). Look on the data plate on the body of the mag for its direction of rotation. Left rotation is normal for a Lycoming O-235, O-320, or O-360. Now, gently push the timing pin into the hole marked (L) until it bottoms. Rotate the timing gear on the shaft of the mag opposite the direction of normal rotation until you feel the pin drop into a hole.

If you have to rotate the magneto very far, you will feel the timing pin trip over a bump inside the mag. Don't force it to rotate. Gently back the timing pin out a 1/4" or so to clear the bump, rotate the shaft and gently push the pin back in. Continue rotating until the pin locates in the hole. The magneto is now internally set on cylinder number one. It is not a bad idea to tape the pin in place with a piece of masking tape. In any case, the pin must remain in this position, without the distributor cover installed, until the magneto is actually in place on the accessory case.

Now, you must set your engine at 25° before top dead center on the number one cylinder (or whatever angle your data plate calls out, 28° for O-235-L2C). Remove the top spark plug from the number one cylinder, hold your thumb over the hole and rotate the engine in the direction of normal rotation until you feel pressure under your thumb. Continue rotating the crankshaft until the advance timing mark (20°, 25°, or 28°, check your data plate) is exactly opposite the small hole located at the 2 o'clock position on the front face of the starter housing. (This is for Lycoming engines with a starter and starter ring gear installed.)

NOTE: If the prop is accidentally turned in the direction opposite normal rotation, you must repeat the above procedure since accumulated backlash in the timing gears will make the final timing incorrect.

At this point, the engine is ready for assembly of the magneto's. With the timing pin still in place, carefully fit the magneto into its hole. When it sits flush on the machined surface of the accessory case, pull the timing pin out (rotating the prop at this point may shear the timing pin off) and, while holding the mag firmly in place, install the toe clamps, flat washers, lock washers and nuts and tighten until finger tight. Repeat for the other magneto, being certain that the prop has not moved.

Use a battery powered magneto timing light such as a model E50 from Eastern Electronics (available from Spruce). Connect it to a convenient engine case bolt (ground) and to each magneto terminal (the same stud your mag switch is connected to). If the mag switches are wired up, you will have to make both mags "hot" (mag switches ~~to the normal engine running position even though the distributor cover is not yet installed~~). Make sure the fuel valve is off and the mixture is at idle cut off, and always treat the prop as you would a loaded gun!)

Rotate each magneto in its housing until the timing light comes on. Now slowly turn it in the opposite direction until the light goes out. Slowly turn the magnetos forward again until the timing light just goes on. Tighten the nuts a little.

Now, back the prop off enough to turn both timing lights off. Slowly bring the prop back in the direction of normal rotation until both lights come on. They should come on simultaneously, or very close to it. Now check and see if the appropriate timing mark on the starter ring gear is in perfect alignment with the hole in the starter housing. If it is, tighten the magneto hold-down nuts firmly (maximum torque is 150 inch/lbs., minimum is 110 inch/lbs.). Recheck that the timing lights come on together at the proper time and you are ready to install the distributor caps. If you are working on a Long-EZ, this is the hard part! The distributor covers are so close to the firewall that a 90° screwdriver must be used on the standard Slick screws. Believe it or not, this can take an hour or more to do! The Allen head screws Mike called out in CP 54 make this job easy (less than 30 seconds per screw) and he still has a supply of stainless steel Allen head screws suitable for this job. Send \$1.00 plus a SASE for 6 screws.

There you have it! If your airplane has a Lycoming engine and no starter or starter ring gear installed, you will need a timing indicator such as model E25 and a top dead center locator (both available from Aircraft Spruce) or an equivalent protractor-type indicator.

This type indicator fits onto the spinner or prop (does not need to be centered) and has a weighted pendulum-type pointer. Use the top dead center finder in the top spark plug hole on cylinder number one, set the protractor indicator so the pointer points at 0° or top dead center (TDC), then turn the prop backwards to about 35° before TDC, then come slowly forward to 25° (or 28°) to be certain to get rid of all backlash.

If you have a Continental engine with Slick mags (O-200 VariEze), the main difference is that the crankshaft flange on Continental engine is marked every 2° from 24° to 32°. You must look on your data plate to determine which to use (O-200 is 28° BTDC). There is also a mark for TDC. It is a line across the edge of the prop flange between the letters TC.

You will need to make a triangular aluminum pointer on which you must scribble an index line that is perpendicular to the base and passes through the apex. The base of this metal pointer should be placed on the machined front surface of the crankcase with the index line exactly on the split in the crankcase halves. Rotate the prop in the normal direction of rotation until the index line points at the 28° mark (O-200A). This sets the engine with the number one cylinder at 28° before top dead center which is the point at which you install the Slick magneto (which is also timed to the number one cylinder) per the instruction for the Lycoming.

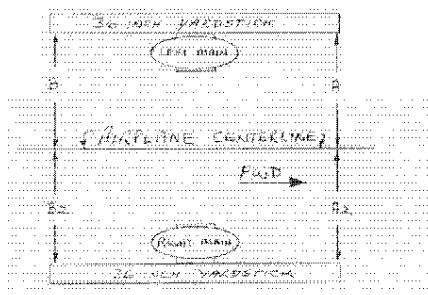
If you have an older 4051 Slick mag that needs to be "sparked out", remove the bottom vent plug. The distributor cover must be installed and you must find the high tension lead marked T1 or B1 on the spark plug nut. Hold the lead wire spring 1/16" to 1/8" away from the magneto body and turn the impulse coupling one "click" at a time until you see a strong spark jump between the spring and the magneto body. Stop turning the shaft right at the point where the impulse trips and the spark occurs. You may have to do this several times to get it correct. It will not shock you if you do it right!

Now, reverse the rotation about 25° until you can see the timing pin hole through the vent plug hole. Insert the timing pin which will hold the rotor and line the pin up with the center of the vent plug hole. Now install the magneto onto the accessory case.

On a 4050 Slick mag with no impulse, you must turn the shaft vigorously counterclockwise (LH rotation) until a strong spark snaps from the spring to the magneto body.

WHEEL ALIGNMENT

When you built your EZ or your Defiant, you should have set the axles on the main gear such that your main wheels were toed in about 1/4° on each side. If you have noticed excessive tire wear, inside edges or outside edges, it is time for you to check and possibly adjust the main gear alignment. With an already completed airplane, probably the easiest method of checking this is as follows: Load the airplane to the same load that you normally fly. Now, pull the airplane at least 100 feet forward on a smooth concrete or blacktop surface. This will allow the gear to spread to its normal position, the wheels will be in their natural position for this weight, and this is the condition you want to check the wheel alignment. Using a plumb bob or level, drop the aircraft centerline to the ground (center of the nose, center of the spinner tip); snap a chalk line between these two points. Use a 36" straight edge (hardware store, aluminum yardstick) and hold it so that the center of the 18" mark is at the axle centerline. Hold the straight edge against the wheel rim (or tire if fat tires are used!) and measure from each end of the 36" straight edge to the chalk line aircraft centerline. Record these dimensions and repeat on the opposite wheel. Ideal or perfect results would have



A=A2, B=B2 and A+A2 = B+B2 or slightly less. When A+A2 * B+B2, then the main gear toe-in is zero which is probably the perfect situation for tire wear, but 1/4° of toe-in, that is A, would be approximately .080 smaller than B and A2 would be approximately .080

smaller than B2, would be best for ground handling and straight tracking. Measuring to the airplane's centerline lets you know if you have the gear on straight but, realistically, it is not critical if your A and B dimensions are not identical to your A2 and B2 dimension. Wow, hopefully you are not all too confused by the above!

Remove your axles and use metal taper shims (available from Aircraft Spruce or wicks) or build up the gear leg with glass and grind to set your axles to meet the above dimensions (you also must use 36" straight edges or the dimensions will be different for the same angle!). Once you have the correct toe-in set, you will notice an improvement in tracking, shorter take-off and less tire wear! Go for it!

HOW TO CHECK FOR THE CORRECT PROP

With any of the RAF designs, matching a perfect prop to your new plane is not real easy but it is not all that difficult, either. The main problem is that the stall speed and the maximum cruise speed in level flight are quite far apart, and getting a fixed pitch prop to cover the whole range perfectly, is not possible. You have to accept a compromise.

With the engine thoroughly warmed up, park on a clean piece of hard surface in the runup area, lock the brakes, and smoothly go to full throttle. If you are at a high density airport, you will have to lean slightly to get maximum static RPM. If you do not see at least 2350 RPM, your prop is already suspect! 2400 RPM is better and 2500 RPM is not unacceptable. Of course, all of this assumes you have an accurate, easily read tach without which this test cannot be conducted. Now, taxi out and make a normal full throttle take-off. Observe the RPM during this take-off roll (make sure you watch where you are going, use only an occasional glance at the tach). The RPM during the roll and early part of the climb should be the same, or actually increase slightly. Maybe 100 or so RPM above static.

Use a normal climb speed, best rate or even a little higher for good engine cooling and better visibility. The RPM should hold at your static or a little better all the way to 8500 feet MSL. As a rule of thumb, your normally aspirated aircraft engine will develop approximately 75% power at 8500 feet at full throttle, mixture leaned to peak RPM.

At full throttle, leaned to best power, concentrate on maintaining exactly level flight at 8500 feet (altimeter set at 29.92). Fly for several minutes in this condition to allow the airplane to accelerate to its maximum speed. When you are certain it won't go any faster in level flight, read the indicated airspeed and OAT (just for your own reference, since this is your maximum 75% cruise speed and you can figure your true airspeed if you know the airspeed calibration error and instrument error). The RPM at this point should be 50 to 100 RPM over the factory recommended maximum RPM. If it is not, you will probably never realize the full take-off and climb potential of your airplane. Now, obviously, most people would not want to fly at over the factory red line, and that is good, you don't have to. This is just a test to see if you have as close to an optimum prop as possible. If your prop meets the above RPM limits, you have the best possible prop for all around performance, good take-off and climb and good high speed performance.

You must now decide if you want to sacrifice maximum speed and shortest take-off and climb performance for something more of a cruise prop, say 2300 RPM static and 2700 RPM at full power at 8500 feet. This will let you cruise at reasonable speed, good economy and a fairly quiet cockpit but you will give up take-off and top speed performance. On the other hand, a 2500 RPM static and 2900 or even 3000 RPM flat-out at 8500 feet will give you excellent take-off and climb and a very high top speed - it all depends on what you want! You can not have everything with a fixed pitch wood prop but at least you do get a reliable, safe, economical, easy to maintain prop.

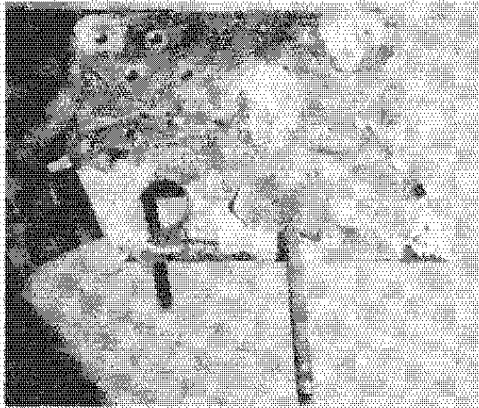
You must do this test at 8500 feet because 75% power is the reference point for maximum cruise speed on all light planes and because this is the easiest way for you to know you are putting out 75% power. Doing all of this at 3000 feet or 5000 feet really does not tell you anything at all unless that is where you always intend to fly.

Keep in mind that this is a quick and easy rule of thumb type method that will work well for most homebuilders. It is not the absolute epitome in accurate testing methods but it does give surprisingly close results.

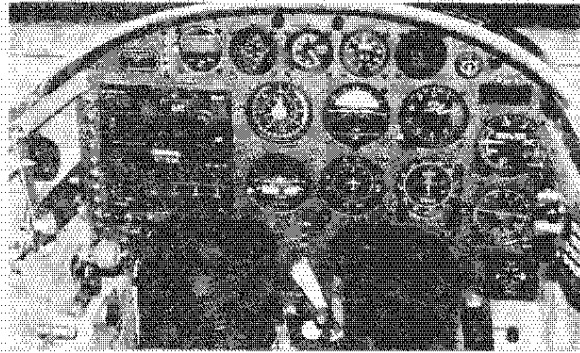
One other comment: We have seen some props that only turn up 2100 RPM static and 3000 or 3100 RPM at V_h (maximum speed in level flight). The performance results with these props, in our opinion, are not acceptable and the designers of these props need to go back to basics and learn how to really design a good wood prop, such as the three prop manufacturers we have listed in this CP, produce.

FULL THROTTLE HP AT ALTITUDE
(Normally Aspirated Engines)

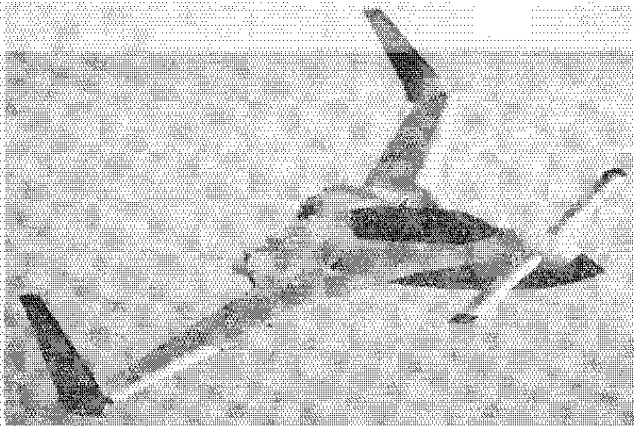
Altitude Ft.	% S. L. H. P.	Altitude Ft.	% S. L. H. P.
0	100	10,000	70.8
500	98.5	11,000	68.3
1,000	96.8	12,000	65.8
2,000	93.6	13,000	63.4
2,500	92.0	14,000	61.0
3,000	90.5	15,000	58.7
4,000	87.5	16,000	56.5
5,000	84.6	17,000	54.3
6,000	81.7	17,500	53.1
7,000	78.9	18,000	52.1
8,000	76.2	18,500	51.4
9,000	73.5	19,000	50.0



VariEze wing attach fitting WA-2-2 removed from a Harlingen, TX based VariEze. Note extensive flaking typical of severe intergranular corrosion



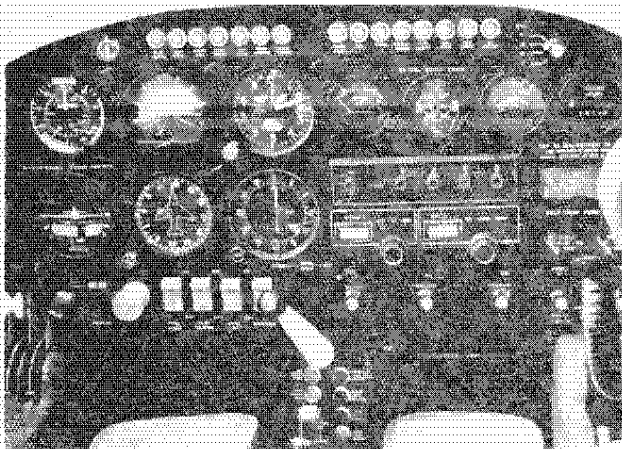
Harry Bawcom's outstanding instrument panel - very clean, well thought out layout.



Ivan Shaw's Twin-Eze, a modified VariEze/Long-EZ retractable twin.



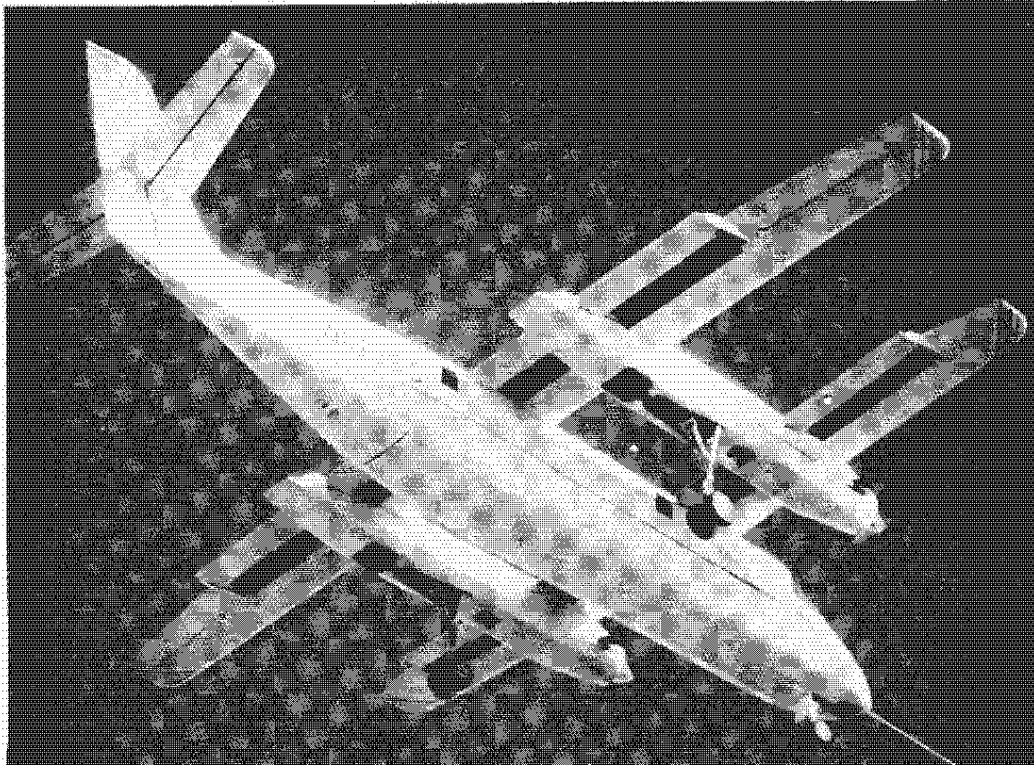
Slick 4250 magneto - note timing pin in top hole for left hand rotation.



Randy Pflanzler's excellent instrument panel layout.

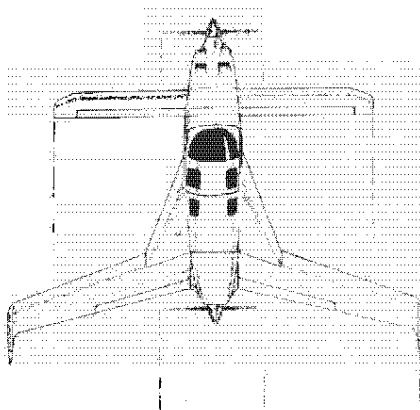


Bruno and Nathalie Guimbal's newest "homebuilt", Olivier. Nathalie carried this little guy (before he was born) all over the States and at Oshkosh when the Guimbal's visited this country from France in their VariEze, F-PYHZ.



Burt's 62% scale model of the Advanced Technology Tactical Transport (ATTT). Built by Scaled Composites and flown by test pilot, Fitz Fulton, retired from NASA where his duties included flying the 747 with the Space Shuttle on its back.

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Mojave, CA 93501**



TO:

first class mail

April '88

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CP 55