

# THE CANARD PUSHER

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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 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 ACTIVITY

We would like to apologize for the fact that there was no January 1987 newsletter. Unfortunately, we simply did not have time to write it, type it, paste it up and get it printed. This process usually takes about 3 weeks and we would normally have been doing this in late December and early January. As most of you know, during that period the Voyager was on it's historic "round the world" flight and we were heavily involved in that effort.

Composites Prototypes, a small division of Scaled Composites which now occupies the building that RAF used to be in (Building 13 on the Mojave flight line), recently completed its first airplane, a prototype loosely based on the RAF Long-EZ design but with a 30 foot-plus wingspan and using a 210hp, turbo-charged Lycoming engine. Mike Melvill made the first flight on February 27, 1987, and the aircraft is currently involved in developmental flight testing. The design is proprietary to our customer, California Microwave, Inc. A photo of it on its first flight is printed on the cover of this newsletter.

## VOYAGER

Burt, Mike and Sally departed from Mojave in a Beech Duchess very early in the morning of December 14, 1986. They arrived over Edwards Air Force Base so early the tower had not even opened! After a few minutes of conversation with Edwards Approach Control, the runway lights were turned on and the Duchess landed and taxied to the "hammerhead" area of runway 4 where the Voyager had been parked all night while Bruce Evans and his crew had worked virtually all night fueling her up for the world flight! The wings and canard were covered in household bedsheets! This was an effort to prevent the formation of frost on the flying surfaces. These sheets had been loaned by many homeowners from the town of Mojave.

Obviously, there is not nearly enough space in this newsletter to cover an event of this magnitude in any detail, however, we would like to share a few highlights with you.

The take-off roll! Wow! We lined up on Runway 4 off the right wing of the Voyager. Burt was ready with his video camera as Mike eased in the power. The Duchess slowly rolled with the Voyager as she started on what we think may be the longest take-off time ever! At the 7000 foot marker, we still were not going fast enough to lift off in the Duchess! The Voyager wingtips were dragging on the runway, Jeana was calling out indicated airspeeds each thousand feet, and the Voyager was behind schedule on speed.

Finally, we lifted the Duchess off and continued following the Voyager while we were a few feet off the ground. The end of the runway was rapidly approaching, the end of a 15,000 foot runway! Finally, Jeana called 87 knots, the speed Burt had predicted the Voyager would need to fly. Dick began to rotate and slowly, magnificently, the wingtips rose off the runway and the wings bent into a graceful arch - she lifted off with less than 1000 feet of runway remaining! The take-off roll lasted for an unbelievable 2:04 minutes! The excitement in the chase plane was short-lived when we realized that the winglets were failing. The frightening moment when the winglets failed and fluttered off, ripping the top and bottom wing skins inboard to the outboard wing tanks - the beautiful sight as the Voyager crossed the coast at Point Mugu and headed out over the Pacific - these are the unforgettable memories. We followed them in close formation until we were almost 300 miles off the coast. A last careful look at the engines, wings, everything but the wingtips looked optimum. We said our tearful "good-byes", waved to Dick and Jeana and, with difficulty, turned 180° and headed back to the coast.

Working in the Communications trailer at Mojave, some highlights come to mind: threading the needle, when Len Snellman guided Voyager around the cyclone "Marge" out in the Pacific - fighting sleep near Sri Lanka - trying to persuade Dick to quit flying and go to sleep - trying to figure out what was going on in the fuel system. The storms and unfriendly countries in Central Africa - oil starvation in the middle of the Atlantic at 4:00am - the right side fuel transfer pump failing - both engines stopped, gliding for a full five minutes off the coast of the Baja peninsula at 2:00 in the morning on the last night. Jeana replumbing the fuel system and then they can pump fuel from the right side - both engines running. Burt and Mike leaving the trailer at 4:30am to take off in the Duchess to greet the Voyager and escort her in.

At first we communicated via the trailer and HF. Then suddenly, we were able to talk plane-to-plane on VHF. We tracked out of Seal Beach VOR on the 155° radial while Dick and Jeana tracked inbound on the same radial with a 1000 foot altitude difference. It was a black night over the Pacific, almost 100 miles off the coast and we were about to attempt a night join-up. The Voyager had only a very small strobe on the bottom of the left boom tank just aft of the wing. Our DME to Seal Beach was the same - we did not see them, we turned 180° and descended 1200 feet - now we were 200 feet below them and suddenly, there was a small strobe. Mike requested Dick turn off the strobe for identification and, yes, it was the Voyager, and tears flowed. Slowly we stepped closer, like an apparition, the dark shadow of the Voyager with almost perfectly straight wings, appeared against the background of clouds over the Los Angeles Basin.

The emotional join-up was something Burt and Mike will never forget. There, after completely encircling the globe, was Voyager containing Dick and Jeana, so close we felt we could touch them. It was incredible.

As the day dawned, we sailed over Los Angeles, over an almost solid cloud deck at 10,500 feet. An airliner curved around and descended across our bow as the TV/camera plane flown by Fitz Fulton, the Grumman Tiger flown by Doug Shane, and the Beech Sierra flown by Crew Chief Bruce Evans, all joined up on the Voyager. And we all headed for Edwards.

The excitement of flying off the edge of the clouds and seeing Edwards and Rogers Dry Lake far below, clear and calm; the talk over the radio with Edwards and between all the chase planes and Voyager; the sight of all the thousands of people who had got up at 2 and 3 o'clock in the morning to line the edge of the dry lake as Dick and Jeana flew several passes over the crowd - these are the memories.

Finally, the gear is down and we float in to land on the compass rose, right behind the Voyager. What an effort, what an incredible achievement, what a super couple of real live heroes, Dick and Jeana. What an unbelievable airplane, the Voyager. Success at last! The last major unlimited world record in atmospheric flight, captured forever by Voyager and the Voyager team. Congratulations Burt, Dick and Jeana - and the whole team of Voyager volunteers.

Burt has put together a technical talk that includes 110 slides and some exciting original film of Voyager testing and the world flight. He is doing a limited number of these presentations to large engineering audiences.

#### SUN AND FUN FLYIN 1987

So, if you didn't go, you missed a good one. Superb weather, lots of airplanes and lots of fellow builders to swap tales with. The EZ Race that has been held every year since Dick Rutan started it in 1981 was run again this year, thanks to Charlie and Marshall Gray. Those guys plus all of the local help they have in Florida really put on a great race and more important, a safe race. Twenty-five racers signed up and 22 started. This race is a flat-out, all-you-can-gospeed race started from a standing start and flown around a triangular course, finishing over the start point in flight (not including the landing).

This race used to be strictly for EZs, but has been expanded to include this year, Glasairs, a Lancair, a White Lightning, Cassuts, RV's, T-18, TC-2, etc., etc. Not surprizingly, the fastest airplane around the course was the 300hp Glasair III, turning in an average speed of almost 267mph! He beat the White Lightning by more than 10mph. The fastest EZ, Klaus Savier's VariEze, turned an almost unbelievable 219mph! We understand that Klaus has "breathed" rather hard on his Continental O-200 and it now puts out 145hp! Klaus was only 1mph slower than a turbocharged 180hp, retractable gear Glasair with constant speed prop!! And Klaus' VariEze has fixed main gear and a fixed pitch prop! The fastest "stock" Long-EZ was 171mph, the fastest "stock" VariEze was 196mph. A Long-EZ with a 160hp Lycoming engine turned in a speed of 206mph.

Congratulations to all for an excellent, safe race this year. For those who missed it and would like to try, start planning now for next year.

#### DEFIANT NEWS

Congratulations to Dennis Riehm of Bowling Green, Kentucky, who recently completed and test flew his Defiant. It took Dennis only 28 months from start to first flight. He has two Lycoming O-360, 180hp engines and has fitted them with two Great American fixed-pitch, wood props. Says it gets off and climbs like a rocket but, so far, he is disappointed in top speed.

How about you Defiant builders/flyers out there sending in a short note giving a brief summary of performance such as top speed and RPM at 8000ft at full throttle (approx. 75% power), approximate take-off distance, and approximate rate of climb? Also, state which engines and props you have and we will compile a summary and print it in the next CP. It would be helpful to everyone who is building a Defiant.

As we reported in the last CP, Don Foreman in England was having trouble getting his Defiant signed off by the English equivalent of the FAA. They finally told him the only way they would sign it off was if it was static loaded to 4.5 G's. We at RAF supplied the static load schedule. The English "FAA" disagreed with our data - and, anyway - to make a long story shorter, after several iterations of data exchanging, Don flipped his Defiant over and got it all ready for the static load. Solid lead bars were used to load the aircraft and these were stacked on top of each other as high as 5 or 6 layers as required. Then, they were tied together in bundles, as well as tied to the wings, to keep them from slipping as the wing or canard bent under the load.

This caused the "top" of these stacks of lead bars to swing outboard of the "bottom" of each stack of lead as the wingtip bent down. This, of course, increases the static load since gravity always works straight down.

Anyway, the outcome was that the main wing came through the load test with flying colors, but the canard, unfortunately, suffered a compression failure in the top skin at BL 110, right at the outboard tip of the elevator. This only occurred on the left side, the right side was not damaged.

We were not present at the time so are not really able to say exactly what may have caused this failure. It could have been simply an overload. It could easily have been a tiny wrinkle in the top skin or a small bump in the skin. It could have been damaged during the sanding/contouring/finishing stage. There are only three plies of UND in this area and the loss of some of the top skin, locally, would result in just such a failure. Post-test analysis of the area indicates that, in our opinion, a structural beef-up is required. We are making the following repair a mandatory change. Limit any flying Defiant to 2.5 G maneuvering load factor and reduce maneuvering speed (gust penetration) by 10 knots until this is done.

In a new-construction Defiant, this simply means that you must layup your canard top skin per plans then add two more plies of UND spanwise as shown, on the top skin only.

In an already finished Defiant, you will have to very carefully sand all paint, primer and micro off until you have bare glass in the area shown. Be careful not to sand into the glass - it is your structure. Now, layup two plies of UND spanwise as shown, and fair them in with micro and refinish. There is no requirement for any additional structure on the canard bottom skin. This repair must be done symmetrically, left and right sides of the canard.

This is the repair Don Foreman is doing on his and, of course, he will be required to demonstrate the static load again.

It's almost that time of year again - in our opinion the most fun fly-in of the year the:

#### 1987 JACKPOT FLY-IN PROFICIENCY RUN

Coordinated by  
Rutan And Composite Enthusiast, Shirl and Diane Dickey

LOCATION: Jackpot, Nevada (extreme NE corner of state)

DATE: July 3, 4, & 5, 1987

AIRPORT: Jackpot, NV. Elevation: 5217'. Runway: 15-33, 6000x60, new asphalt. Location: adjacent to town. Fuel: 100 & mogas.

CAMPING: Camping is available including restrooms and showers.

LODGING: Cactus Pete's Resort Casino, \$38.75 + tax per night. Advance reservations required, call 1-800-821-1103. Please reserve early.

RECREATION: Tennis courts, swimming pool, golf course, gambling, live entertainment and restaurants.

#### SPECIAL EVENTS:

1. THE JACKPOT 120 PROFICIENCY RUN. This event is designed to eliminate all the bull about who's the most proficient. This year the run will be over a new triangular course to improve safety. The distance will be approximately 120 statute miles. Scoring is based on elapsed time only.

Cactus Pete's Casino is donating \$1800.00 to our event again this year. Classes will be the same as in the past:

Stock VariEze-----Up to 205 CID, no airframe mods.  
Stock Long-EZ-----Up to 240 CID, no airframe mods.  
Unlimited EZ-----All other EZs.  
Exhibition class-----Open to all single engine homebuilts

Prizes will be paid through 5th place as follows: 1st 40%, 2nd 30%, 3rd 15%, 4th 10%, 5th 5%. Entry: \$10.00 per class.

2. RIBBON CUTTING CONTEST. Two ribbon drops each, total cuts wins. Prizes: 1st 50%, 2nd 35%, 3rd 15%. Entry: \$10.00 each.

3. SPOT LANDING CONTEST. Two attempts at a chalk line. Winner takes all. Entry: \$10.00.

4. DINNER SHOW. Friday, July 3 from 7:00 to 10:00 pm in the Gaila Room at Cactus Pete's. Live entertainment and dinner.

5. AWARDS BANQUET. R.A.C.E. has reserved a private banquet room at Cactus Pete's on Saturday night, July 4. Time: 6:30 pm. Trophies and prizes will be awarded after dinner.

COME ONE, COME ALL - YOU'LL NOT BE DISAPPOINTED - ALSO, SHIRL AND DIANE ARE PLANNING TO ORGANIZE ANOTHER "WENDOVER", NEVADA FLY-IN. PROBABLY IN SEPTEMBER, LIKE LAST YEAR.

#### BRUNO AND NATHALIE GUIMBAL

Many of you who attended Oshkosh 1986 will recognize these two names! Nathalie and Bruno are a young French couple who loaded their VariEze on a Boeing 747 in France and off loaded it in Miami. They then proceeded to fly around the United States, taking in the Centennial celebration of Lady Liberty in New York, the Grand Canyon, Mojave (yah!), Oshkosh '86, etc. They put 75 hours on their beautiful little EZ, landed on 32 different airports in 22 states burning 325 gallons of gas, for an average fuel burn of 4.3 gallons per hour!

Since returning home to France, Nathalie has given birth to a baby boy and she tells us he already has over 100 hours of flight time in the EZ! Their VariEze weighs 606 lbs, pilot plus passenger(s?) weighed 260 lbs and they packed in and carried 126 lbs of baggage!!

Bruno had some very neat ideas in his VariEze, not the least of which is a very clever electric roll trim and pitch trim system that is light and simple and has operated perfectly for over 800 hours! Bruno is a very sharp engineer who has currently designed and is building a one of a kind helicopter (to carry 3, we wonder?). He sent us a sketch of his trim system and we would be happy to send a copy to anyone who wants it. Send a self addressed return envelope.

Thank you, Nathalie and Bruno for spending a little time with us last year, we enjoyed you and hope to visit with you some time in the future.

#### FIRST FLIGHTS

Congratulation to all of you who have reached the major milestone of first flight. Although we no longer hear from everyone who gets this far, we hear from enough of you to know that there are a lot of new VariEzes, Long-EZs and even a few VariViggin's, a couple of new Defiants and even a Solitaire.

It sure is great to hear that so many of you have achieved what must be one of the notable achievements of one's life, the building and flying of a machine that one has crafted with one's own hands. The first flight is the culmination of this experience and, for all of us, is a tremendously exciting and sometimes nervous time. When this time arrives for you, how can you be sure you really are ready? How can you be sure your flying machine is ready? We have always believed that the pilot must be current, must be proficient in at least two different airplanes, preferably three, and must be rested, relaxed and feeling good before he or she ever attempts a first flight on a brand new airplane.

Current means just that. You are presently flying something, be it a Cessna 150 or a Beech Bonanza, it does not matter just as long as you are, or have been recently, flying something. If at all possible, fly another example of the type to be tested. It is dangerous to combine a first flight in a new airplane with a pilot who has zero time in type. If something is unusual, he doesn't know if it's an airplane problem or his proficiency. If you have not flown for a year or more, do not even consider doing your first flight until you have taken a check ride in several types with a good instructor.

Tell him what you are about to try to do and have him really put you through a thorough proficiency check. Have him particularly concentrate on landings, balked landings, approach too slow, approach too fast - how do you handle it? Be as conscientious as you can, ask a lot of questions, be very sure you are feeling good, feeling confident in your abilities.

Now go out and check out in a Grumman TR-2, two place trainer or a Cheetah or a Tiger. When you feel good in this, then try to get a check out in some kind of a taildragger. A Champ or Citabria, or even a J-3 Cub would be good. It's not that you need taildragger skills to fly an EZ, but being proficient in a taildragger simply makes you that much more proficient overall.

Now you are ready, but is your newly completed airplane? The more pairs of eyes that look at it, the more likely you are to get everything the way it should be. Remove the cowlings, canard and nose cover. Invite the local EAA

chapter to have their meeting at your home and have them all look at it. At least, try to recruit a couple of EZ builders to look at it. Concentrate on the control system. It is simple, functional and trouble free, but all the bolts must be tight, safetied, and have two threads beyond the lock nuts. Does the stick move freely to all limits without any friction? Friction in the pitch control will make the airplane very twitchy and difficult to fly. Friction in the ailerons (lateral control) will make the airplane unpleasant to fly because you will not know if you are pushing or pulling against control system friction or against aerodynamic loads. This makes it awkward and not much fun to fly. It really is a truly delightful airplane to fly if it has a nice friction free, precise control system. Of course, the rudder should snap back into the faired position after rudder pedals are depressed then released (they should also do this in flight! If they don't, this condition must be corrected). Also, be sure the elevator shape and canard slot shape is exactly the same as the check templates in the plans. If in doubt, take a "splash" of the surfaces, send a drawing of the splashed shape to us for comment before attempting to fly. Small differences in slot and elevator shape can have large effects on the safety of your airplane at low and high speeds.

The next point to concentrate on is the fuel system. Fuel lines should be fireproof and there should be no leaks of any kind, even with the boost pump running. Flush the whole system several times with gasoline. Clean all screens/filters. Check that all nuts and bolts on the engine, baffling, and exhaust system are tight and safetied. Be sure the prop bolts have been torqued correctly, and re-torqued at the specified intervals.

The engine controls are a critical area. You will need help to check these out, and they must be right! Check the throttle, mixture and carb heat for full and complete travel. The throttle and mixture must travel stop-to-stop smoothly with no tendency to hang up.

If anyone looking at your project spots a discrepancy, write it down. Make a list of these discrepancies no matter how small they might be. Do not fly unless all items that could compromise flight safety have been taken care of. This applies throughout the flight test period and indeed, the life of the airplane, but is particularly important for first flight. You will be nervous, you will be excited. This is normal. If you have taken care of your proficiency and your airplane's readiness, your first flight will be uneventful, safe and a memory that will last forever.

#### VARIVIGGIN NEWS

Surprisingly, there have been three new Viggins take to the air in the past 6 months or so. Emerald and Reggy Ullman have their Viggins flying in Hillsboro, IL. Orv Winfield of Bristol, WI has finally got his beautiful Viggins flying and reports that it flies as expected with no problems. Wendell Hanks of the Los Angeles area in California has completed his, and since he was not current and proficient, he had a friend, Les Glenn (also building a Viggins), do the first few flights. Congratulations to all. That makes a total of 22 Viggins that have been completed and flown, at least, that we at RAF have been notified of. We know of at least one that is essentially ready to fly, George Craig in San Jose, CA. So how many will fly in to Oshkosh? Always the big question. To our knowledge, there has never been more than 3 Viggins on any airport or in the air in formation at any one time. Maybe at Oshkosh '87 we will see this record broken.

#### BUILDER HINTS

We recently worked with Bob Callender of Barry Controls regarding the vibration isolators (engine mounts) for three different engine installations including Mike and Sally's Long-EZ. Mike is very, very pleased with the Barry mounts and reports a noticeable decrease in vibration/noise and a marked improvement in smoothness throughout the RPM range.

Barry wrote us a letter in which he has shared some pearls of wisdom. Since he is an expert in the field, we have printed his letter below. For special or problem installations, contact: Barry at 818-843-1000.

"Dear Mike:

I hope by now you've had a chance to flight test your EZ along with the other installations Barry sent you parts for. I'd like to review your findings someday.

As we discussed, there are some facts and "general" rule of thumb guidelines to be aware of and follow regarding the use of engine vibration isolators.

Normally, each engine, propeller and truss combination will have a unique vibration signature and natural frequency. A change in any one of the three will change the vibration characteristics of that installation.

Under perfect conditions, the elastomeric "mounts" or vibration isolators are designed to suit these individual combinations on an installation-by-installation basis. Choice of elastomeric compounds and spring rates (stiffnesses) are also determined by the overall flexibility matrix of the individual installation.

Just because an isolator physically fits an installation envelope and related mount hardware doesn't necessarily make it the proper part.

So much for perfect conditions!

The real world (especially homebuilts) requires a combination of best effort and budgetary restrictions when choosing a suitable isolator. The best starting point for most installations is to use the same or cross-referenced equivalent isolator as used in the aircraft the engine came out of (especially if it's a factory airframe). Another choice is to find a factory aircraft using that engine and use isolators normally installed on the chosen aircraft.

New isolators should have current cure dates less than one (1) year old to insure best performance. Ambient air alone will cause elastomers in installed isolators to lose their resiliency and deteriorate. Once the isolators are installed, they need to be inspected for wear and fatigue at the same time as other external engine parts.

Isolators should be kept free of dirt, oil and other petroleum based fluids at all times. Oils will soften the elastomer making them ineffective. Spilled fluids can be cleaned off using isopropyl alcohol or electronic contact cleaner.

Prolonged temperatures over 200° will dry out and harden most elastomers over time. Heat will initially cause the elastomer to soften and "drift", but will eventually harden it, making the isolator ineffective. Extreme ambient temperatures during tie down and storage are just as destructive to the elastomer, and contribute to short service life.

Isolators should be changed every time the engine is removed from the airplane. They will take a permanent "set" within 48 hours of installation and are virtually impossible to replace in an identical fashion.

Wear for installed insulators varies with flight hours, and is not consistent from aircraft to aircraft. Each inspection should include looking for debonds and tears in the elastomer.

Debonds are a physical separation of the metal outer or inner plate from the elastomer. A good rule of thumb is 30% circumferential or 30% depth separation.

Tears or splits will show in the bulged or center portion of the isolator and follow the same rule of thumb. They should not exceed 30% circumferential, 30% elastomer depth or 30% elastomer width separation. Any one of these conditions is cause for replacement, at which time all isolators should be changed. Equal spring rates and loads are essential to proper isolator performance.

Since no two installations are identical, and aircraft hours per year are so different, service life is reflective of those conditions. At very best though, five year old isolators or installations should be changed out. Other items for inspection include excessive deflection, mounting bolt integrity, security and tightness.

Mounting trusses should be made as stiff as possible. This normally allows a "softer" isolator to be used, resulting in a "smoother" ride. Full ringed trusses are best. They also keep engine deflections to a minimum. The "horseshoe" type trusses are very flexible, and usually require stiffer isolators. This in turn allows more engine deflections, that require larger cowlings.

Actual truss members need to be checked during installation for non-concentric bolt attachment and engine mounting flange points. When a truss "leg" or member is pre-loaded during installation to center the bolt or isolator, undue

stresses are put into the isolator that can cause it to prematurely fail. Be sure to look for this especially on rear mounting engines without a completed truss ring at the isolator mounting plane.

We have an 0-200 isolator configuration in place on Bruce Evans' EZ, and have an installation in the works for an 0-290. I'm gathering data and will keep you informed. So far, Bruce seems very happy. Sketches showing the modifications are available if you would like to publish them in the Canard Pusher.

If you have any question, or if any of your builders have questions on engine isolators, don't hesitate to contact me.

Regards,

BARRY CONTROLS  
A Unit of Barry Wright

Bob Callender  
Sales Engineer  
Engine Vibration Isolators"

*Thanks  
Bob,  
Mike*

#### CONTROL SURFACE BALANCING

We have published this before but since it's one of the most common problems we get calls and letters about, here it is again!

First of all, your ailerons, elevators and rudders can be very thoroughly sanded, far more so than the rest of the aircraft. Use a blue foam (Styrofoam) block, sized to fit your hand, and a half sheet of 40-grit sandpaper. Sand vigorously the top and bottom skins of the control surfaces, particularly toward the trailing edges. You can safely sand off up to 50% of the top ply of UND - this leaves one and a half plies of UND - more than adequate for control surfaces. What it does is reduce the weight of these parts considerably, especially aft of the hinge, which makes it much easier to balance and, more important, since it is now very smooth it takes much less fill and paint to finish the part, making it easier to balance. Using this method, and assuming reasonably good workmanship, it should be easy to balance your elevators. Elevators absolutely must be balanced per the plans criteria or they will flutter! This means they must balance after finish.

Ailerons are not as critical due to the much stiffer wing they are hinged to, but even though we have not had a single case of aileron flutter reported, you should still be sure to balance them within the plans criteria. If after sanding them thoroughly as called out here and checking to be certain that the mass balance is correctly positioned relative to the hinge, they still don't balance, the best method of adding mass balance weight is to go to your nearest golf pro shop and purchase a roll or two of the soft lead ribbon used by pros to weight the heads of their clubs. This is a 3M product and consists of a roll about 1/2" wide of lead ribbon with a sticky back. Stick it on top of your existing steel rod mass balance, as far forward as possible without increasing the chord of the ailerons. Stick it on the full span. Use as many layers as it takes to balance within the criteria, then lay up one ply of BID over the lead to permanently attach it to the aileron.

EZ type rudders do not require balancing, however they can benefit from a thorough sanding because it will take less fill and paint to finish and therefore, they will be lighter. As far aft on the aircraft as the rudders are, excess weight here is hard to take care of.

This is the method we have used for many years here at RAF and it works well. In about every case, the sanding alone will balance the ailerons and elevators without any additional lead. At least, this has been our experience.

#### NOSE GEAR/NG-15A CASTING ATTACH

The NG-15A casting is attached to the bottom of the glass strut by potting it in floc and bolting it on with AN525-10R24 screws through a 1/8" thick 2024T3 aluminum plate - (see page 13-9). While these screws can easily handle normal landing loads, a very hard landing may pull the heads off these screws. Several builders have reported to us that this happened to them. The solution is to substitute AN3-14A bolts which can handle a much higher tension load.

## BRAKE LINES

As mentioned in CP49, page 7, Mike and Sally installed Teflon hose assemblies (Stratoflex part #124001-3CR) in place of the Mylaflow nylon brake lines. These Teflon hoses are constructed with a seamless, smooth-bore, Teflon inner tube wrapped with a braided stainless steel cover. These hoses come made to length with the ends swaged (not reusable ends) so must be ordered the correct length to suit your particular airplane. They are not cheap but should last the life of the airframe. Mike and Sally ordered theirs from Aircraft Spruce and the cost was approximately \$42.00 per 40" length. These hoses come with a certification tag on them certifying that they are good to 1500psi. Mike installed them from the brake calipers to the master cylinders in one piece, mainly to avoid any more joints than necessary and to help eliminate any place for a leak to develop. The smallest hose available in Stratoflex is a -3, so you will have to use -3 elbows and nipples. For example, at the caliper, Mike used AN822-3D elbows and AN816-3D nipples on the master cylinders. The stainless wrapped Teflon hoses were inserted into a hardware store plastic tube (split the plastic tube lengthwise) then Hot Stuffed to the main gear strut trailing edge. One ply of BID was layed up over the plastic tube to permanently hold the new brake lines in place.

With over 200 hours on their Long-EZ since installing these brake lines, Mike reports that he is one hundred percent satisfied with their performance, and it was well worth the higher cost. While he was at it, he disassembled his master cylinders and installed all new "O" rings, cleaning the parts in de-natured alcohol. The calipers were cleaned up and new "O" rings installed. Dot 5 brake fluid, a 100% silicone brake fluid (a General Electric product purchased at a local hot rod auto parts store), was used and Mike does recommend it since it is completely inert and therefore non-flammable. It does not affect seals, "O" rings, paint, or hoses so there has been zero maintenance on their brake system and we are in the process of installing the same system on Burt's Defiant, N78RA.

Be sure to measure your own airplane to get the Stratoflex the correct length for your aircraft. If you have brake master cylinders up front, as many builders do, you can either run the Stratoflex lines all the way (probably best, but expensive) or you can run the Stratoflex up each gear leg and then go with Mylaflow or Myloseal from there. It will take an AN910-1D coupling (1/8" pipe thread) together with an AN816-3D nipple and a 268P male connector on each side.

## EXHAUST SYSTEMS

For Long-EZs we have used the Brock prefab, plans-type stainless exhaust headers with "ball swivel" joints. On the prototype, as well as Dick Rutan's and Mike and Sally's Long-EZs (well over 3500 hours total time), we have never had a single problem with this setup. For VariEzes, we have always recommended this same system for Lycoming O-235 powered EZs; for Continental O-200, we recommend the exhaust system originally designed, fabricated, and sold by VariEze builder, Herb Sanders, through his company, Sport Flight.

Generally, we have had very little trouble with either of these systems. In the interest of cooling the engine, we have always recommended a rather small clearance hole around each exhaust pipe where it goes through the cowling. Recently, we were testing another system consisting of four separate exhaust headers that exit the cowling two on each side, one on top of the other. We wanted to see if there was any power advantage using four headers instead of a two-into-one system. In fact, there is a small power gain, between 50 and 75 RPM at full throttle at 8000 feet in level flight, but that was not the interesting discovery. During the testing, we simply cut enough cowling away that the exhaust did not touch the cowl. We inadvertently cut more cowling away than we had intended, and during the flight, we noticed a considerable drop in cylinder head temperature! Yes, lower CHT's, in spite of a relatively large leak in the pressure cowling. We sealed up the leak using engine baffle neoprene/asbestos glued to the cowling and fitting almost perfectly to the exhaust pipes. The CHT's went up higher than ever! We cut away the neoprene a little at a time. The more we cut away, the larger the high pressure air leak, the lower the CHT's became! We ended up with a full 1/2" of clearance between the cowling and the four exhaust pipes. Amazingly, this amounts to about 7 square inches of "leak" area on each side of the cowling! In spite of this leakage, we have excellent cooling.

How could this be? Perhaps the leak so far aft, even aft of the engine, gets the cooling air mass moving aft at a fairly high velocity then, of course, all of the incoming cooling air cannot escape out through the "leak" area, so it has to go through the cylinder cooling fins just as the engine baffling intended it to. For whatever reason, this does work, and not on just one airplane. We know of at least 3 EZ owners who have tried opening up the clearance holes around the exhaust pipes and they saw the same results - cooler cylinder heads!

## PROP BOLT TORQUING

Some builders seem to think that by "overtorquing" their prop bolts they can get around having to check the torque. This is simply not true. There is no way around the fact that you have to periodically check your prop bolts for correct torque. Overtorquing makes no sense and can crush the prop hub over a period of time until the bolts run out of thread and bottom out! Very dangerous since you are not now gripping the prop! Your prop, once badly crushed, may not run true anymore leading to vibration. Also, it is possible to ruin the threads in the drive lugs. The correct prop torque value for 3/8"-24 bolts is 200/250 inch/pounds (18/20 ft/lbs) for any 5 laminate wood prop, and 300 inch/pounds (25 ft/lbs) for the new multi-laminate wood props.

For Defiants and those using the 7" diameter flange with 1/2-20 bolts, we have used 400/500 inch/pounds (33/42 ft/lbs) with no sign of crushing the new multi-laminate props. Even so, you still have to periodically check your prop bolts torque. This is true whether you fly a factory built Champ, Cub, or whatever. If it has a wood prop, it must be checked every 50 hours or so. If you move from a wet climate to a dry climate, check it more often.

## NOSE GEAR CARE

We recently replaced a nose gear shock spring on our Long-EZ (Brock part #LST-6) and were amazed at the difference. We had noticed that while taxiing, the strut would flex off the stop. The spring very slowly loses its capability to support the nose and, over a couple of years, insidiously, this condition gets worse and worse until you are taxiing nose down a few inches. It happens so gradually that you may not notice it. In fact, since we replaced ours, we have been noticing quite a number of Long-EZs that fly into Mojave are taxiing "nose low". If you have noticed that your nose gear rides on the spring as you taxi on a smooth taxiway, chances are you need a new spring.

Shimmy dampers! This has been by far the most frequent maintenance item on the EZs. The problem is that unless you keep your shimmy damper in perfect adjustment, the results can be a broken nose wheel fork. We recently installed an innovative shimmy damper designed by Bob Davenport onto two Long-EZs here in Mojave and so far, the results have been excellent. Bob has gone out and found an excellent machine shop to produce the few parts required to make this shimmy damper a bolt-on kit. Bob's kit is complete and includes stainless steel Bellville washers (which provide the spring pressure), the threaded shaft, and all necessary washers, the nut and cotter pin. We have noticed a marked improvement in several areas. There has been no need to adjust it in over 3 months - about 50 hours of flying time. When the nose wheel touches down, it does not move at all when viewed through the little plexiglass window, whereas the original damper always allowed the nose wheel to shake side to side just a little at touchdown. Also, it seems, subjectively, to be easier and smoother to taxi and make turns using the brakes.

We strongly recommend Bob's shimmy damper for all Long-EZs and it will also work well on a VariEze (Paul Mason has been using one on his VariEze for almost two years with no problems whatever). Bob will sell you a complete kit including the drawings and instructions for \$39.05 plus shipping. Contact: Bob Davenport, PO Box 650581, Vero Beach, FL 32965, 303-567-1844

## COMPOSITE SPINNERS - GOOD, OR NOT SO GOOD?

Mike obtained a Kevlar spinner a couple of years ago and has been running it on his Long-EZ, N26MS, on and off since then. At first it really seemed like the answer to crack-prone aluminum spinners but now, he is not so sure. This spinner was hand layed up inside a mold and looked like perhaps one ply of Kevlar and at least one, probably two or three plies of glass BID using Safety Pox. After several hours of flight, the attach screws were found to be

a little loose. They were tightened and were noted to have crushed the glass/Kevlar/Safe-T-Poxy locally. A month or two later, the same thing happened. This time, when the screws were tightened, they really "bit" into the spinner. To make a long story shorter, after several such iterations, several of these screws pulled through the spinner!

It was removed for repair before it left on its own! Carefully sanding the inside and the outside of the spinner, a uni-directional glass layup was vacuum bagged inside and outside the spinner. Again, Safe-T-Poxy was used and the spinner was post-cured at 250°F for 2 hours. Much sanding and filling was required to make it fit the Brock spinner backplate/bulkhead and it never did fit as well or look as good again.

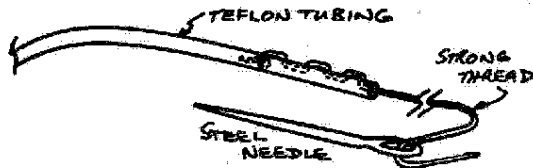
This time it lasted almost a year before the same problem occurred to the point where it almost departed the airplane! It has been removed and retired forever and Mike, at least, is very disillusioned about composite spinners. He is currently fitting an aluminum one.

Mike's theory on this is as follows: The screws are tightened and bite into the epoxy/glass/Kevlar and even crush it some. After all, it is not nearly as hard as aluminum. Then, after a flight, the Long-EZ is parked nose down. All the heat in the engine rises out of the back of the cowl and is conducted into the aluminum prop extension - and then into the spinner bulkhead. Feel it sometime ten minutes after you have shut down and parked! This heat then gets into the Safe-T-Poxy spinner and the Safe-T-Poxy softens, allowing the glass/Kevlar laminate to crush thus giving the appearance of loose screws! So we tighten them and the same thing happens. It takes a while, but after a year or less (250 flight hours) the screws are through the spinner and it can come off.

If you are flying one of these hand layed up spinners (obtained from Sport Flight when they were in Memphis), check it often and remove it if it is doing what Mike's did. Use large diameter Tinnerman washers to spread the load. Maybe what we need is a high technology, pressure cured (in an autoclave), high temperature, epoxy-type spinner. Until then, maybe the old aluminum spinner isn't dead yet!

#### INSTALLING TEFLON "SPAGHETTI" TUBING IN AILERON AND RUDDER HINGES

John Bingham, VariEze builder, suggests the following idea: Split the Teflon tubing as shown in CP39, page 7, then, using a needle and about 12" of strong thread, stitch the thread into the end of a piece of Teflon tubing per sketch.



Now, pull the needle through the aluminum hinge using a small magnet. Then, pull the thread at the same time as you push the Teflon tube through the hinge. While it is difficult to push the Teflon tube through the hinge, it is easy to pull it through! Thanks, John.

**CAUTION!** DO NOT CUT THROUGH ANY SPAR CAPS!! WE HAVE HAD SEVERAL BUILDERS WHO HAVE CALLED US FOR HELP AFTER CUTTING THROUGH A CENTERSECTION SPAR CAP! UNFORTUNATELY, THERE ARE SOME THINGS THAT ARE SO DIFFICULT TO FIX THAT IT IS EASIER AND QUICKER TO BUILD THE PART OVER. THE MAIN PROBLEM IS IN THE AREA OF THE ACCESS HOLES FOR WING ATTACH BOLTS ON THE OUTBOARD END OF THE CENTERSECTION SPAR BOX. BE CAREFUL, GO SLOWLY AND BE CERTAIN YOU ARE CUTTING THROUGH FORWARD OF THE SPAR CAP! IT MAY SEEM BETTER TO HAVE THE ACCESS HOLE CLOSER TO THE WING, BUT IN THIS CASE IT IS NOT! LOOK AT THE PLANS IN CHAPTER 14, PAGE 9, SECTION C-C AND YOU WILL READILY SEE THAT THE ACCESS HOLE IS FORWARD OF THE SPAR CAP. THROUGH A RELATIVELY EASY-TO-CUT GLASS-FOAM-GLASS AREA. IF YOU CUT INTO THE SOLID GLASS SPAR, IT WILL BE VERY TOUGH TO CUT. IF YOU FEEL IT IS TOUGH TO CUT - QUIT! CHECK AND DOUBLE CHECK BEFORE PROCEEDING.

#### MIXTURE CONTROL RETURN SPRING PROBLEM

There have recently been two cases of engine failure resulting in forced landings (luckily without damage) caused by failure of return springs in the engine mixture control linkage. These, we believe, are due to improper installation of the bracket supporting the push/pull cable at the carburetor. The springs as properly designed are intended only to snub the system and improve the fidelity of the mixture control by eliminating free play. The springs should never be required to move the mixture control away from the idle cut-off position. In both instances, the springs had failed or lost their force due to fatigue and vibration. Properly installed, the swage at the cable end should sit very close (within 1/2") to the cable conduit clamp when the mixture is in the idle cut-off position. If your bracket allows excess exposed cable, then the mixture control cable may buckle rather than positively force the arm away from idle cut-off in the event of a spring failure. Do not depend on the spring to bring the mixture control into the mid range, well away from idle cut-off. If you do, the engine can fail due to a spring failure. If your aircraft does not pass the test shown in the plans changes section of this newsletter, ground it immediately and rebuild your conduit clamp so that the exposed cable is short, allowing the mixture lever to force the arm to at least mid range without assistance from a spring. This is required on the throttle as well as the mixture control.

#### VARIIZE FUEL TANK VENT

Recently had a report from a VariEze builder who was having terrible "overrich" problems with his new EZ. Every flight the engine ran so rich it required severe leaning to run smoothly. Fuel stains were all over the cowl and carburetor, pointing to a leaking needle and seat or a stuck float. Several calls later, after much head scratching, several mechanics had looked at it and given various opinions. The carburetor was completely overhauled and still, the fuel leaked all over the inside of the cowl!

Finally, on the phone, we decided that it was the fuel tank vent. It was installed so that it protruded out of the bottom of the fuselage into the airstream but, inside the engine cowl inlet! We were rather astonished by this but we are printing it here just in case anyone else may misinterpret the plans and install the tank vent incorrectly. If it happened once, it could happen again! Apparently, the suction of the cooling air entering the cowl sucked fuel out of the tanks through the vent and into the cowl, spraying fuel all over the carburetor and cowl leading this builder to suspect a sunk float or bad needle and seat. This was not only very frustrating for him, it could have been a disaster with all that fuel blowing around in the cowl near the hot exhausts.

We thank this builder for allowing us to print this story. Hopefully we can all learn a lesson here. On a VariEze, the main fuel tanks vent (which must be a common vent) protrudes out through the side of the fuselage under the right fuel tank/strake and faces forward at least 0.6" from the fuselage side and fuel tank bottom surface in high pressure air.

After he rerouted his vent into the correct position, this problem was completely eliminated and he is now enjoying flying his VariEze.

#### ACCIDENTS AND INCIDENTS

Long-EZ N218EZ: Incident Report

Scenario: I was the pilot in command of Long-EZ N218EZ at Scottsdale Municipal Airport when it crashed into a Cessna 152 after hand propping the engine. The situation occurred as follows: I had just fueled up for a local flight and was preparing the aircraft for engine start. I placed the wheel chock under the port tire and set the magnetos for ignition. I set the throttle position incorrectly although I did not realize this until it was too late. I then hand propped the engine and she started on the first pull but the RPMs were too high and the Long-EZ jumped the chock. I ran around the port wing but then my last failsafe malfunctioned. The rubber stopper under the nose, which was made out of a hockey puck, sheared off and the Long-EZ raced away toward the active runway. A previous gear up landing prompted the installment of a stainless steel plate under the nose in the event that a gear up landing occur again. The steel plate offered little friction to the asphalt and she accelerated away from me (I am slow of mind not of foot). I was only able to get alongside the



wing at full sprint and the plane was still accelerating toward the active runway. I decided to try to alter the plane's course and at my last chance grabbed the port winglet and pulled myself up off the ground. Off balance, the Long-EZ did veer away from the runway but my troubles were just beginning. Now a less than willing passenger on the wing of a pilotless plane going approximately 25mph, I helplessly watched as the Long settled on a course directly at a parked Cessna 152. I had no choice but to release and watch the planes collide.

Damage: The Cessna suffered a collapsed wing and sustained propeller, nose gear, and engine cowl damage. The Long lost the canard and punctured the port wing strake on the Cessna's propeller.

Recommendations: This situation arose primarily because the throttle was set at too high a power sitting thus initiating the runaway condition. Second, the rubber stopper was made out of the wrong material (hockey pucks are designed to slide) and it was not secured to the fuselage properly. For those who hand prop their planes, I would recommend installing a parking brake and/or some remote cutoff switch for the engine. A simple procedural solution would be to set the fuel valve to off so that if the plane runs away, it won't get too far. Always be certain of your throttle setting.

by Michael Best

I had an unfortunate accident to my Long-EZ in mid-January when as a result of heavy snowfall the hangar it was kept in at Biggin Hill collapsed on top of the machine. Estimated weight was around 100 tons! Much of this was taken on the canard - a girder across each side. One side was snapped off - the other side believe it or not when the weight was removed returned to its normal position. Other damage was a smashed canopy, damaged fuel tanks, undercarriage pulled forward slightly by the immense pressure. In addition, I had to saw off the top of one winglet above the rudder to release it. Plus some easily rectified damage to the other winglet. I was thinking of building the new canard anyway! Hope to be back in the air in a couple of months if everthing goes well.

by Robin Smith

Editor's note: This incident occurred in England at the Famous World War II aerodrome at Biggin Hill. England had one of the worst winters in living memory in 1986/87. Another Long-EZ in the same hangar was also seriously damaged.

#### 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
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.

#### VARIEZE PLAN CHANGES

MAN-GRD Same as Long-EZ below.

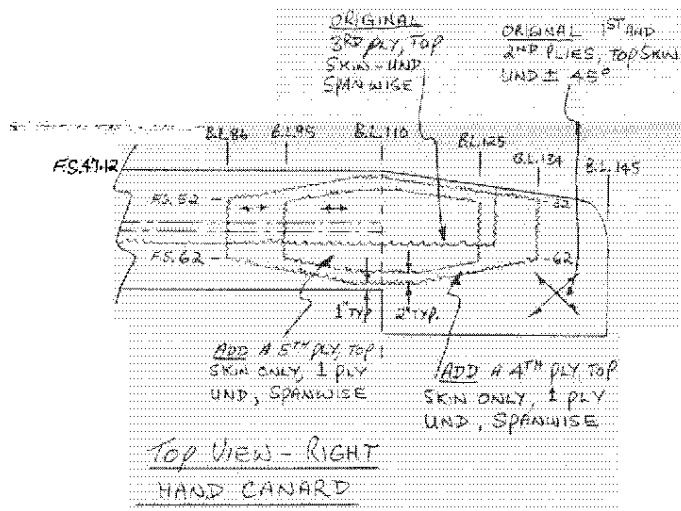
#### LONG-EZ PLAN CHANGES

LPC #132 Inspection of engine mixture control system. Before flight, remove the cowl and remove any spring installed on the mixture control and the throttle control which is used to assist the control arms to go to the full rich or the full throttle positions. With the springs removed, pull the mixture control to idle cut-off and the throttle to idle, then push the levers forward and confirm that the mixture positively moves to at least the mid range (well rich of idle cut-off) and the throttle moves to at least to two-thirds power without the assistance of any spring. Then re-install springs and put the aircraft back in service.

#### DEFIANT PLAN CHANGES

DPC #42 In a new-construction Defiant, this means that you must layup your canard top skin per plans then add two more plies of UND spanwise as shown, on the top skin only.

In an already finished Defiant, you will have to very carefully sand all paint, primer and micro off until you have bare glass in the area shown. Be careful not to sand into the glass - it is your structure. Now, layup two plies of UND spanwise as shown, and fair them in with micro and refinish. There is no requirement for any additional structure on the canard bottom skin. This repair must be done symmetrically, left and right sides of the canard.



LIGHT PLANE MAINTENANCE is published monthly by Belvoir Publications, Inc., 1111 East Putman Ave., Riverside, CT 06878. Subscription is \$72.00 annually, \$6.00 per single issue. This is an excellent publication and, although aimed primarily at A&P mechanics working on factory built airplanes, there are occasionally articles that do apply to the engines and accessories we use. Gary Fisk was kind enough to send us a list of potentially interesting articles for EZ builders.

Dec. 1986 - "Continental's O-200: An up-close look" by Kas Thomas - 6 pages.  
 Aug. 1986 - "Lycoming's O-235: An up-close look" by Kas Thomas, 5 pages.  
 Sept. 1983 - "An owner guide to T80-Busting" by Kas Thomas, 5 pages.

Back issues can be ordered for \$6.00 each plus 75¢ for postage and handling. We recently read the above articles and there are some excellent observations and helpful hints - we strongly recommend them.

SHOPPING

Aircraft Spruce and Wicks Aircraft both have in stock Cleveland wheels and brakes as follows: For VariEze and possibly very light Long-EZ - upgrade kit 199-93, includes a thick brake disc, but uses original 1-1/2" diameter piston in the brake caliper.

OR  
199-156, includes wheels, thick brake discs and 1-1/2" diameter pistons and calipers.

FOR NORMAL OR HEAVY LONG-EZ  
199-152, wheels, thick brake discs and large calipers with 2" diameter pistons. These give excellent braking capacity, even to a fully loaded Long-EZ and this is what Mike and Sally have had on N26MS for over 2 years with excellent results.

Wicks Aircraft has, also, now got in stock the Facet fuel pumps with built-in 37°/3/8" JIC flare (-6 aircraft):  
FP-40108 - 12 volt 6 psi  
FP-480610 - 28 volt 6 psi (this part number was incorrect in CP50)

Wicks also stocks 1/4"x 3/8" O.D. x .035 wall 304 stainless tubing for fuel lines. The plans call-out for Defiant pitot static has become so expensive (in the order of \$280.00!!) that we have approved the following "under wing" "L" shaped pitot statics:  
AN5814-1 - 14 volt \$165.00  
AN5814-2 - 28 volt \$165.00

Aircraft Spruce is now carrying the Braycote 601 fuel valve grease that Mike and Sally had. 2 oz. syringe cost \$209.95 (enough to grease at least 20 EZs). They also have a new, economical flight warning system for gear or canopy warning. Please note that all EZ fiberglass prefab parts offered in the Spruce catalog are made by Larry Lombard and Michael Dilley of FeatherLite, Inc., Boonville, CA.

FEATHERLITE, INC. - The only RAF recommended manufacturer of prefab glass and Kevlar parts for RAF designs, is pleased to announce that they are setting up to make a run of Solitaire kits. The Solitaire's method of construction is much different than that used in VariEze and Long-EZ parts and uses pre-preg glass and nomex honeycomb. Due to the expense of this material, it is really not efficient to try to run one Solitaire kit through. At least 6 kits are needed at a time - so, if you have ever thought that the Solitaire might be the "one for you", give Michael or Larry a call.

<u>Solitaire Kit Complete</u>	\$4360.00
<u>Long-EZ gear strut</u>	324.00
nose gear strut	55.00
glass engine cowling (top/bottom)	283.00
Kevlar engine cowling (top/bottom)	448.00
weight saved, approx. 5 lbs.	
Cowl inlet (not used with MACA inlet)	30.40
wheel pants 3.5x5 set (used with Lamb tires)	131.75
wheel pants 500x5 set (used with cert. 500x5 tires)	155.25
NG30 cover (optional)	19.95
bulkhead kit (optional)	655.00
pre-cut foam cores (canard) (optional)	99.50
fuel strake leading edges w/bulkheads (optional)	499.00
strut cover - SC	17.85
nose wheel cover - NG	17.85
sump blister -SB (2 required)	each 17.85
<u>Defiant main gear strut</u>	756.00
Kevlar engine cowl set -front & rear	1488.00
Glass engine cowl set - front & rear	986.00
glass 600x6 wheel pants set (Kevlar on request)	175.00

Larry and Michael are both ex-RAF employees and were heavily involved in the Rutan Ams/Oil Racer, the RAF Grizzly, and the RAF Solitaire. Larry built (and still owns and flies) his own VariEze, one of the real early ones and one of the highest time VariEzes. Michael is in the process of building his own Long-EZ. Both are very knowledgeable to the extreme on the EZs and glass work in general. Michael and Larry will be at Oshkosh 1987. They will be sharing the RAF booth with us, same as last year. Contact Michael or Larry at FeatherLite, Inc.  
PO Box 781  
Boonville, CA 95415  
707-895-2781

B&C Lightweight Products - Bill Bainbridge  
518 Sunnside Ct.  
Newton, KS 67114  
316-263-8662

We recently installed one of Bill's really fine LR-2 Linear Regulators (28v) and two of his 15 ampour, 12 volt sealed batteries (never add water! - no drain required!) in our latest aircraft and, frankly, we are very impressed. We have, at times, cranked that aircraft engine (T10-360, 210hp, turbo-charged) for long periods with no sign of battery fade. The voltage regulator is the best we have ever seen and has built-in overvoltage protection. It also has a self-test feature and a low voltage warning light. Quality, as with all of Bill's products, is truly superb. Bill's 10.2 lbs., 14 volt starter, of course, was the sensation of the show at Oshkosh last year and is really a fine unit. Fred Keller installed two on his Defiant and is very pleased with the weight savings and excellent cranking power. AVCO Lycoming is currently running an extensive test and evaluation on Bill's starters with a view of offering them on some of their engines. Bill is still working on the 28 volt model and hopes to have it available at Oshkosh 1987. Look for Bill and his electrical products in his booth (not far from the RAF booth) at Oshkosh this year.

Varga Enterprises  
2350 South Airport Blvd.  
Chandler, AZ 85249  
602-963-6936

Talk to George Varga. George was the original source for the heavy duty Long-EZ brakes and he reports that he now has complete sets which include heavy duty 500x5 wheels and bearing, heavy duty (3/8" thick) discs, and heavy duty (2" dia. piston) calipers. Kit part # 199-152, complete-for only \$371.35. At this price you get the wheels for nothing! Good deal, George!

CANOPY GAS SPRING FOR THE DEFIANT

We reported in CP49, page 7, that a good gas spring could be ordered from the Gas Spring Co. and that the part number was FB22A(P1-60). Roger Rupp, a Defiant builder from Alaska, recommended this to us but has since determined that this gas spring is too strong and may bend your canopy cross-tube. He has done some careful research and by trying several different gas springs, has come up with part #FB226(P1-40). Order it from: Gas Spring Company  
92 County Line Road  
Colmar, PA 18915-9607  
215-822-1982

See CP49 for more information.

CORRECTION - RETROFITAILERON HINGE KIT

We received the following from Gary Hall after CP50 came out.

"My correct area code is (305) not (303) and the house number is 4784 not 4748. I've notified my neighbor and called Colorado. I explained to those nice people that they are going to get a few calls from a crazy group of people called experimental aircraft builders asking for Gary Hall. The RETROFITAILERON HINGE KIT IS \$21.00 and will be shipped UPS unless you instruct me to do otherwise. (Outside US - \$25.00) The kit consists of Teflon spaghetti tubing and a special high grade stainless spring steel to fit inside the tube. If your hinges are "CLEAN" it will take you about 10 minutes per Long-EZ aileron to retrofit. The importance of this kit is to prevent any wear on the AL2 hinge. Teflon should last several years. This is how long Mike has had his in place and there has not been any wear. This kit will work on any Long-EZ, VariEze, Defiant or other aircraft using the MS20001-P3, P4, P5, or P6 hinge.

Gary Hall  
4784 NW 43rd Street  
Lauderdale Lakes, FL 33319  
305-484-4949 (home)



SOMETHING NEW FOR EZ BUILDERS by Rusty Foster

The Space Saver Panel has been modified to keep up with EZ builders' new ideas. The switches are the same, except for an additional radio master switch. The original Space Saver Panel had 13 circuits and a 30 amp. main breaker to protect the battery. The modified Space Saver Panel has 17 circuits plus a 35 amp. main breaker that protects the alternator to comply with the B and C alternator circuit. 6 of the circuits use auto-type (ATO) fuses. The only drawback I see with these type fuses, is the minimum size fuse they manufacture is 3 amp. so this would mean - in-line fuses below 3 amp. The warning system and fuel system circuits were purposely installed on the radio master buss to prevent electrical spikes if you are using the Ayton Warning system or the Act Easy Fuel level gauges. Another change is the addition of the 12 watt rheostat using up to a 12 watt lamp. You don't need much light if it is in the proper place.

Manhours for wiring is what made the original Space Saver Panel expensive. The new Space Saver is assembled for you and the buss work done. No terminal blocks are provided and none are needed (except for the ground buss). Run your wires direct to the panel and hook them up. Using shielded wire is really not practical (except for the mag. ckts) running your wires through a grounded conduit would be easier to do. The instruction booklet comes with each unit showing you how to wire the Long-EZ using the Space Saver Panel. You have a choice of black anodized or gold (it's more bronze than gold) anodized face plates.

- If you are using Zolotone paint in the cockpit, you may want the unfinished Space Saver Panel - 35 ampere \$525.00
- If you are using enamel in the cockpit, you may want the Gel-coat Space Saver Panel 550.00
- If you want the 60 ampere Space Saver, add 25.00
- If you want the Warning System installed, add 50.00
- If you want the RST Voltmeter installed, add 40.00
- If you want Special circuits - \$20.00 per hour plus parts.

A \$200.00 deposit is required (shipping and sales tax not included in the above prices). Allow 60 days for delivery.

<del>Instruction Booklet</del>	<del>25.00</del>
California Sales Tax	1.50
Shipping and Handling Charges	1.00
	<u>20.50</u>
Warning System Module only	20.00
California Sales Tax	1.20
Shipping charge	1.00
	<u>22.20</u>
Oil Pressure Module "B" only	20.00
California Sales Tax	1.20
Shipping charge	1.00
	<u>22.20</u>

The trend today is some of the builders are buying engines that came out of aircraft with 28 volt systems. Rather than change the system to 14 volt, it is an advantage to use the 28 volt system. For an example, let's say you are using the 35 amp. Space Saver 14 volt system. You have calculated your load to be 30 amps. Now without changing your load you decide on the 28 volt system. Your load then drops to 15 amps. Now you have two ways to go - one; you can reduce the wire size because you are not drawing as much current or, two; you can increase your load by 15 amps more. Most builders choose to increase the load. Another example, supposing you are using the 60 amp Space Saver 14 volt. You have calculated your load at 50 amps. Now you change to the 28 volt system, as before your load drops by one half or as in this case the load would be 25 amps.

The FAA acceptable methods manual, "EZ-AC 43,13-1A & 2A", provides us with a wire chart that shows a 12ft run at 35 amps has to be #8 wire. A 12ft run at 45 amps has to be #8 wire. A 12ft run at 60 amps has to be #6 wire. 12ft is the approx. length from alternator to Space Saver Panel buss. A 14ft run at 10 amps can be #18 wire. A #6 wire 12ft long weighs 1.2 lbs. You can use 6-12ft lengths of #18 in a bundle for a 40 amp rating that weighs .4 lbs. For the 45 amp Space Saver, it would be better to use the #8 wire from the buss to alternator and 4 #18 wires from the buss to the master relay (much shorter run). The load hog on the 35 amp. 14 volt Space Saver and 45 amp. 28 volt Space Saver is the 25 amp. 14 volt and 35 amp. 28 volt electric heaters. Turn them off when preparing for a

landing. The disadvantages of the 28 volt system are you will need a 28 volt to 14 volt converter for some of your electrical needs that are rated at 14 volts only. Also a voltmeter in the range of 0 to 30 volts is a must. Now if you have read this far, I think you can choose wisely the Space Saver Panel that is best for you.

- If you want the 45 amp 28 volt Space Saver, add \$25.00
- If you want the 60 amp 28 volt Space Saver, add 25.00
- If you want the cockpit light installed, add 25.00

The cockpit light installed in the Space Saver will provide enough light to read a chart and also can be directed on the airspeed indicator for monitoring airspeed at night. They were used in the Voyager for a primary source of light on its trip around the world.

Foster's Modular Design Co.  
PO Box 1569  
Portola, CA 96122  
916-832-5993

**RAF SPECIAL OFFER**

Thanks to the super response to the belt buckle offer in the last newsletter, we have exactly two buckles left - the only two Solitaire buckles to be had! Still at the special price of \$10.00. First come, first served!

Summer's here and so this CP special is caps. We have VariEze caps, a limited number of Defiant and Solitaire caps. There are no Long-EZ caps available. Summertime special price, while they last!-\$5.00!

Aircraft Spruce,  
P.O.Box 424,  
Fullerton CA 92632  
714-870-7551

Wicks Aircraft  
410 Pine Street  
Highland, IL 62249  
618-654-7447

FeatherLite  
P.O.Box 781,  
Boonville, CA 95415  
707-895-2781

Brock Mfg.  
11852 Western Ave,  
Stanton, CA 90680  
714-898-4366

The above suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

**FOR SALE**

Lycoming O-235-L2C - Remanufactured for Long-EZ, includes mount, exhaust, Great American prop and prop extension, TASK fuel/baggage strakes - \$8000.00 firm. 805-925-2870 - ask for Don.

Lycoming O-235-L2C - 450 hours total time since factory new. Includes 3" prop extension, new Great American prop and spinner. This engine was on my Long-EZ and has been well cared for. The whole package for \$5700.00. Call: Dr. George Best  
602-991-0476

Lycoming O-360-A1D - Disassembled but with new pistons, wristpins, rings, bearings, etc. Yellow tagged cylinders and carb. Magnafused, dye checked, etc. (papers available). Cost a lot more but will accept \$5700.00. Contact: Bill Campbell  
PO Box 253  
Phelan, CA 92371  
619-868-6218

Lycoming O-360-A1A - Low time, No logs, out of a Mooney - Bendix mags, no starter or generator. \$2000.00. Philadelphia area, will ship.  
Contact: Bayard DuPont  
New Garden Aviation,  
215-268-8988

**WANTED**

One set of Paul Prout fuel gauges: Call: Skip Morton  
1199 Hacedinda Ave.  
Campbell, CA 95008  
408-730-6600 (days)  
408-379-1764 (eves)

Finishing my VariEze - need a Continental O-200 or Lycoming O-235. Either must have engine driven fuel pump. Price and condition is important. Contact: James Goebel  
9 Georgia Park  
Conroe, TX 77302  
409-273-2828



2. Cutting tape and cloth with shears.



3. Cutting tape and cloth with pizza cutter.

Bob Waldmiller, while helping Joe Mullendorf and Claes Lundgren build their Defiant, came up with this simple method to eliminate the distortion that takes place when you cut BID glass then pick it up, carry it to your plane, and lay it on the foam. Thank you, Bob, for sharing this idea with us and for the excellent photos which so clearly show what is going on:

"TAPED-FIBERGLASS CUTTING TECHNIQUE

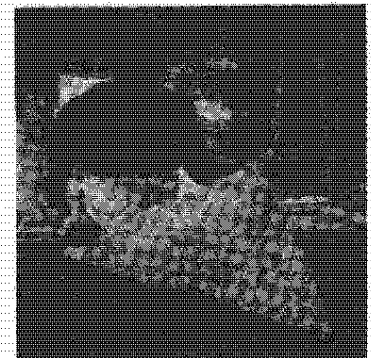
To minimize the distortion of fiberglass cloth when cutting, handling or doing a layup, place 1/2 or 3/4 inch wide masking tape directly onto the cloth wherever a cut is to be made (1). The tape should be placed around the entire perimeter of the piece being cut out. After all the tape is in place, cut through the middle of the tape and the fiberglass cloth simultaneously. The presence of the tape allows the fabric to be cut more easily with either standard shears (2) or a circular "pizza" cutter (3).

After the cut is made, the tape helps the fiberglass hold its shape while it is handled (4a). This is a big improvement over fiberglass without taped edges (4b). Likewise, the free edge of the fabric stock remains straight and will not unravel (5). This greatly reduces the amount of time spent straightening fibers before making a cut or during a layup (especially with BID).

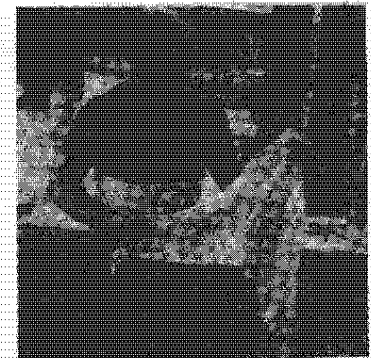
Since the masking tape adheres to the fiberglass extremely well, many fibers will be pulled out of alignment if any attempt is made to remove it. Therefore, trim the taped edge from the layup after it is correctly positioned and still dry, then complete the layup as usual (6). It is not necessary to trim the taped edge anywhere it will be trimmed after the layup has cured, provided it does not interfere with good layup practices (7).

This technique requires very little time to implement and saves much aggravation during the layup."  
Robert J. Waldmiller.

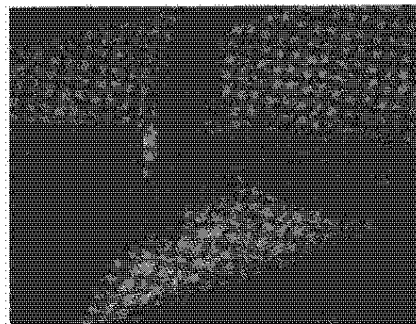
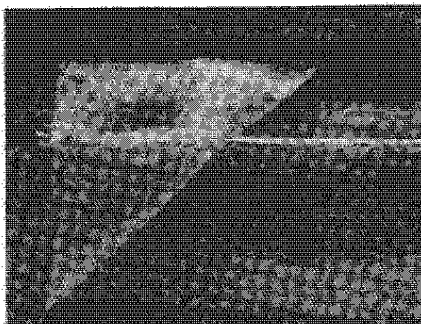
*Robert J. Waldmiller*



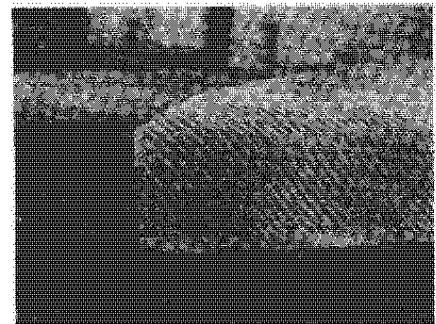
4a. BID held undistorted by taped edges.



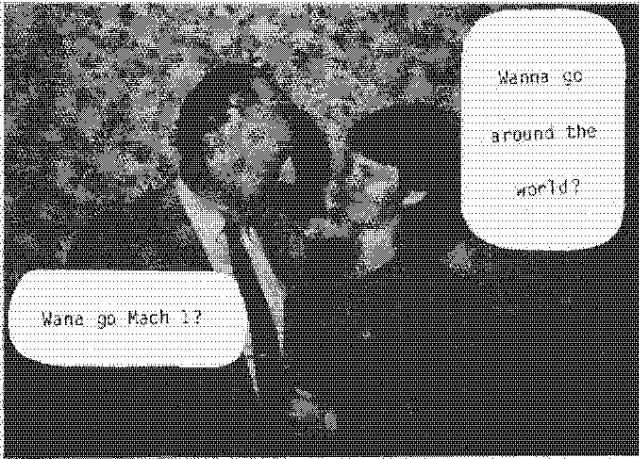
4b. Natural distortion of BID without taped edges.



6. Trimming taped edges after cloth is in position.



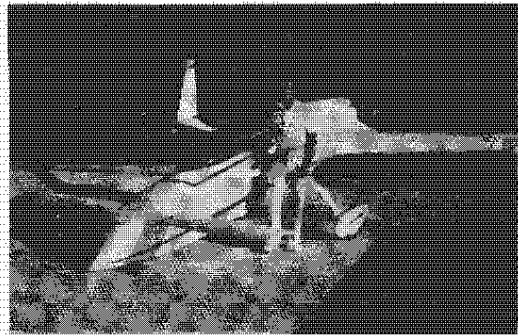
7. Taped edge to be trimmed after layup cures.



Wana go Mach 1?

Wanna go  
around the  
world?

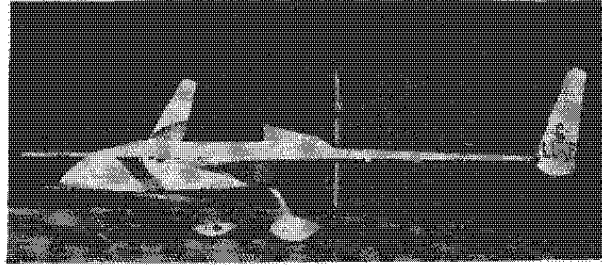
YEAGER AND YEAGER



Norm Radtke poses with his beautiful VariEze at Fond du Lac, Wisconsin



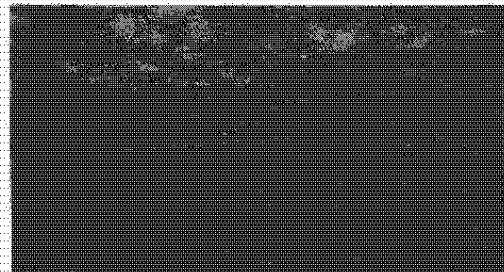
An Australian Long-EZ panel by John Sabadina and Susan McQuillan



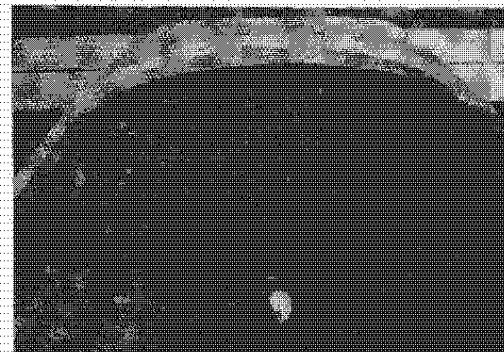
Sid Busby of Marlow, Buckinghamshire, England has 14 hours on his Long-EZ.



John Sabadian and Susan McQuillan with their newly completed Long-EA at the Cairns International Airport in Australia



John L. Hayes taxiing out for first flight. All went well and John is very pleased with the results of his labors.

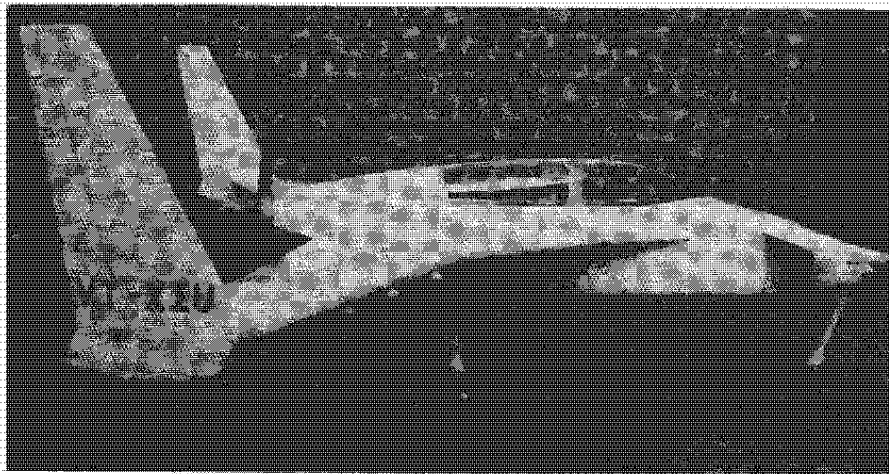


Long-EZ instrument panel by John L. Hayes of Euless, TX



Nathalie and Bruno Guimbal with Burt outside RAF at Mojave - Neat little VariEze!

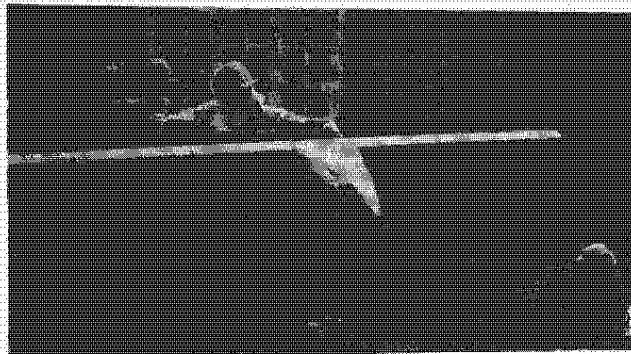




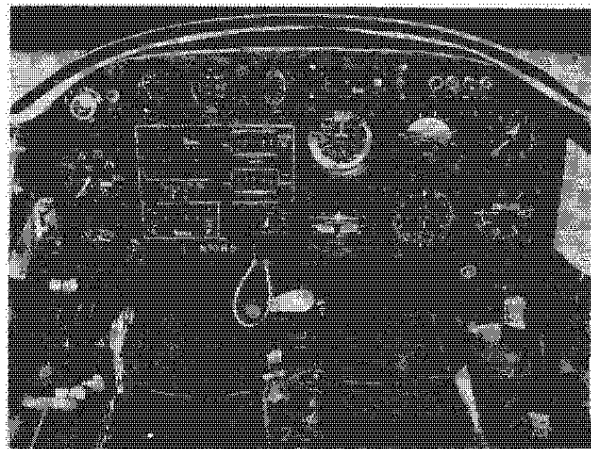
**FIRST LONG-EZ IN INDIA**

The first ever canard type, first composite type and first Long-EZ ever to be built and flown in India was completed and successfully test flown on February 26, 1987 in Bangalore, India, by builder R. B. Damania

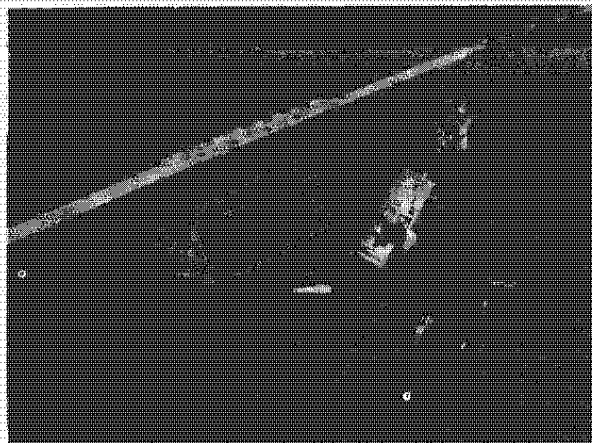
Congratulations, a really fine looking Long-EZ judging from the photos he sent us. When you consider some of the bureaucratic problems some of our builders have to contend with, we have nothing but the strongest admiration for their tenacity and skill. It really makes us realize just how fortunate we who live in these united States are!



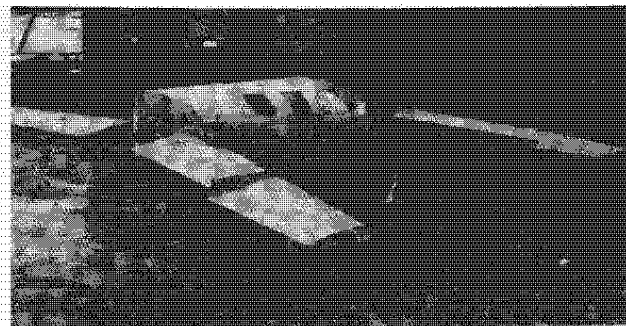
Cecil Cutting and his daughter. Pulling out of the bottom of a loop! Haven't we all done this?



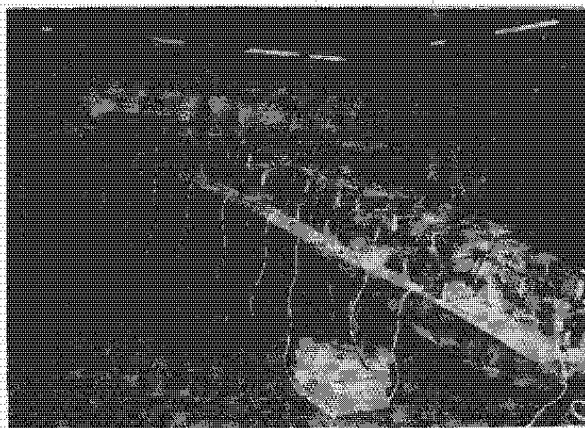
Paul Siegal's Long-EZ instrument panel - neat!



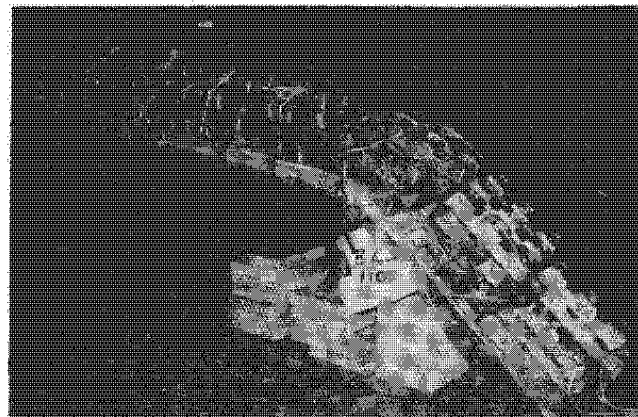
Paul Siegal's Loran-C (King) and his fire extinguisher



Bayard Dupont's Defiant out at the airport in Toughkenomon, PA.



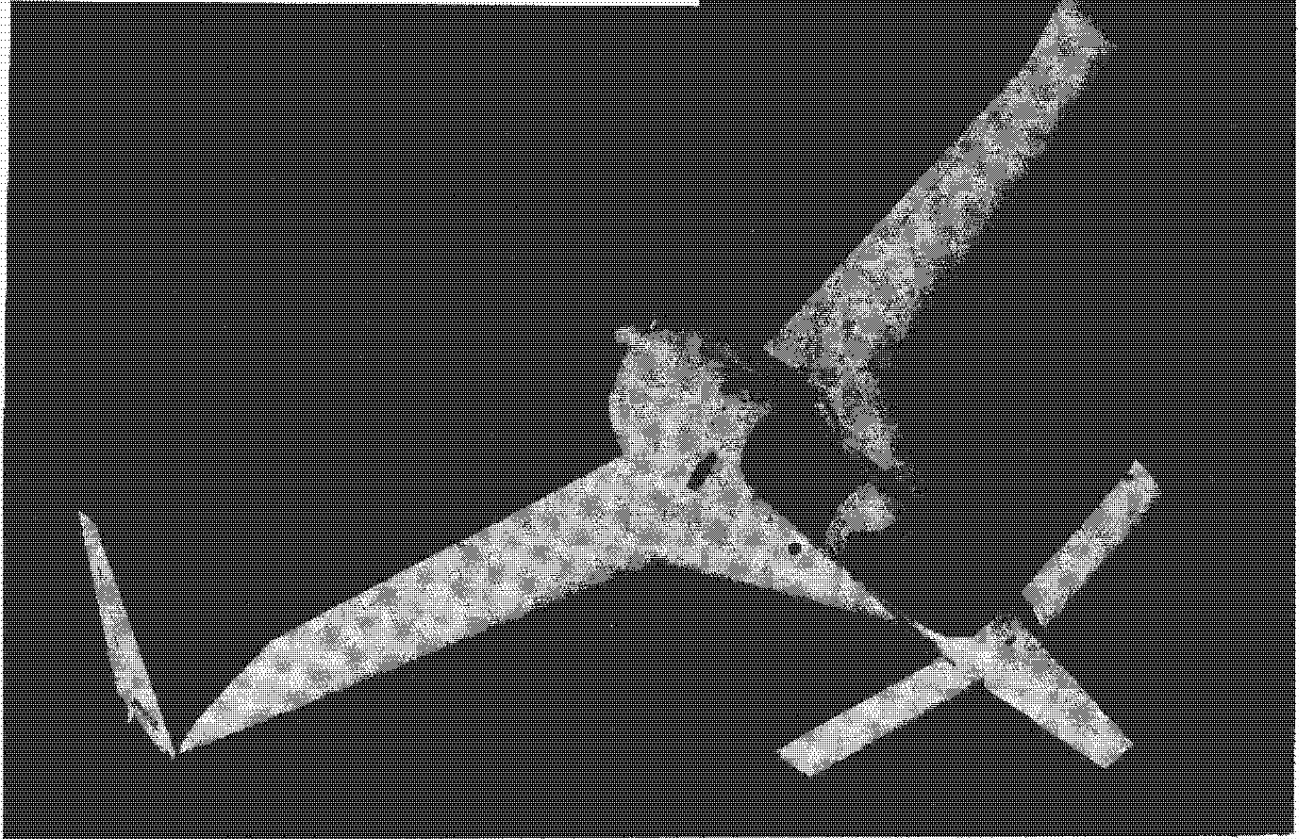
Static load of Don Forman's canard. Just prior to failure.



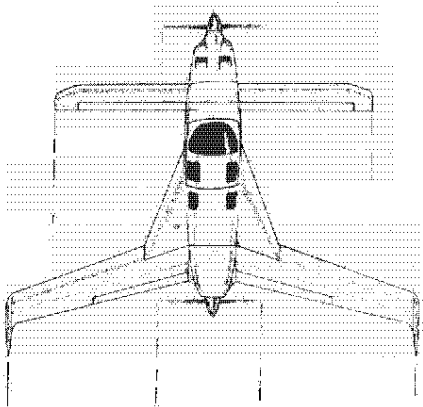
Don Forman's canard - failed at B.L. 110.



Burts latest design, Model 144 (CM44UAV) was built in what used to be RAF, and made its first flight on February 27, 1987 with Mike Melvill at the controls. The aircraft is currently in flight test and will be delivered to the customer, California Microwave, in the next few weeks.



**Rutan Aircraft Factory  
Building 13, Mojave Airport  
Mojave, CA 93501**



**TO:**

**first class mail**

**April '87**

The line which appears above your name lets you know through which Canard Pusher you are paid. If your label says **LAST ISSUE CP 51**, then this is your last issue, and you need to renew.

**CP 51**