

THE CANARD PUSHER

No. 53

Oct. 1987

Published quarterly (Jan, Apr, Jly, Oct) by

RUTAN AIRCRAFT FACTORY INC.
Bldg 13, Airport,
Mojave, Ca 93501
(805)824-2645

U.S. & Canadian subscriptions	\$14.00
Overseas (Airmail)	\$16.00
Back Issues	\$ 3.50

If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 53. If you are building from 2nd Edition plans you must have newsletters 18 through 53. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 53. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 53. If you are building a Long-EZ you must have newsletters from 24 through 53. If you are building a Solitaire, you must have newsletters from 37 through 53. If you are building a Defiant, you must have newsletters 41 through 53.

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 ACITIVITY/OSHKOSH '87

Since the last newsletter, we have been involved in the logistics of getting ourselves, and all of the necessary "stuff", to and from Oshkosh, Wisconsin for the 1987 EAA convention.

We would like to thank Larry Lombard and Michael Dilley for their tremendous help both in the RAF booth during the convention as well as in closing down and packing away the booth at the close of the convention.

The job of manning the booth is always tiring, but this year was eased considerably by having a great deal of help from Bernadette Shupe and her merry gang of helpers from the IVHC. They certainly lightened the load and made it much more fun. Bernadette, of course, also organized the Hospitality Club dinner at Butch's Anchor Inn which was better than ever this year. One of the major highlights of the dinner this year was the extremely funny spoof on the Voyager entitled "The Record Breaking Flight of the Scounger". This was presented by Quickie builder/flyer and Long-EZ builder, Norm Howell. Norm has recently broken two world records in his Quickie.

The Voyager was on static display on the flightline at Oshkosh this year giving many of the Voyager supporters a last opportunity to view her close up before she is installed in the National Air and Space Museum. She was transported from Mojave to Oshkosh and then on to Washington, DC on an enormous truck normally used to transport oversize or overweight objects. The long journey took the Voyager and crew chief, Bruce Evans, through many towns on the way, giving yet another opportunity to many people to see her close up and talk with the ground crew, to say nothing of the photo opportunities. The Voyager will be hung in the museum on October 9, 1987, with an "official" opening of the Voyager display on December 14, 1987. (The first anniversary of her take-off to go around the world.)

The new color poster with 18 of Burt's aircraft designs was available for the first time at Oshkosh 1987 and proved to be very popular. This poster was advertised on the back of CP52 and will be on sale as a great Christmas gift next month.

As usual, there were far and away more RAF-type airplanes at the convention than any other type. "Mom" Rutan was hard pressed to get them all counted as they arrived and departed. In fact, this year for the first time, a couple of IVHC volunteers gave her a very much appreciated helping hand. She says that there were 50 VariEzes, 79 Long-EZs, 3 Defiants, 3 VariViggen, 1 Voyager and 7 "spin-off" designs. As usual, not all of these were registered. Irene counted 5 VariEzes and 8 Long-EZs not registered so, once again, the EAA "official" count will not be accurate. Next year Irene requests that you please register your airplane! It costs nothing to register!

DEFIANT NEWS

We were visited recently by Dr. George Best and his son, Michael, in their truly magnificent Defiant. Mike was very lucky to be offered the opportunity to fly this beautiful aircraft and he was very, very impressed! George had previously built an excellent example of a Long-EZ, his first homebuilt, so the Defiant was not an unknown to him. He says he really enjoys the contouring and finishing, if you can believe that! The contour perfection of George's Defiant must be seen to be appreciated. Quite the best Defiant we have seen! George had some help from one of the most innovative homebuilders there is, Tom McNeely, who laid out a really superb instrument panel, and also a very nice, clean and simple rudders-in-winglets installation. Tom also did the cowlings which are real works of art, flowing perfectly into the fuselage. The rear cowl has a flush NACA inlet and the outlets are on top, similar to the front cowl. The aft end is completely sealed. Really wild looking and, so far, works rather well. This Defiant is very smooth and quiet, particularly at a low cruise. As an example, Mike checked a couple of points at 10500 feet, a normal cruise with both engines turning 2500 RPM, a total fuel burn of 11.5 GPH with an indicated 140 KTS (160 MPH) gave a true airspeed of 168 KTS (193 MPH) for almost 17 MPG. A low, economy cruise with both engines turning 2100 RPM, a total fuel burn of 8 GPH, indications 98 knots (113 MPH). George's Defiant holds 120 gallons of fuel, so at this power setting, he could fly over 2000 statute miles!

George originally had installed Hoffmann constant-speed, feathering, 3-blade propellers. He, like everyone else who had tried these props, had many problems trying to get them to hold RPM. These props have very small pistons inside the hubs, and therefore require very high oil pressure to hold maximum RPM and, of course, as soon as the oil comes up, the governor seals and main bearing seals allow enough leakage so that it is not possible to hold the pressure required. George had special high volume governors with a modified ratio installed and felt he just about had the problem whipped when disaster struck! The nose gear collapsed on take-off, the NG-2 weldment failed allowing the gear to retract. Of course, the front propeller was reduced to splinters and some minor front cowling work was required to get it back in the air. George ordered two fixed-pitch, wood props from Great American, and even though these were a first cut and not optimum for this Defiant, they work so well George will be sticking with the fixed-pitch, wood props and getting rid of the Hoffmanns.

He says that he was never really very satisfied with his Defiant with the heavy constant-speed props. It was heavy, did not maneuver well (keep in mind George is a Long-EZ driver). When he installed the lightweight wood props, he reduced his empty weight by 110 lbs. and, suddenly, the airplane flew like he thought it should, light, quick, and fun to fly. Mike flew it with the Great American fixed-pitch props and was impressed with the performance.

The failure of George Best's nose gear retraction link, NG-2, was what prompted the mailing of the mandatory change in NG-2 to a welded tube structure with no rod ends. The rod ends are not very strong if they see a side load. When the nose gear hit a curb-type bump or a chuck hole which causes the aft load to go directly along NG-2, the weak rod end bearings bent inward which allowed the main tube, NG-2B to bend. This let the rod ends bearings bend inward enough for one, or both, to fail, either causing the nose gear to be very difficult to retract and extend, or to collapse.

Charlie Gray had only one rod end fail on the way to Oshkosh. He replaced the NG-2 and made it to Oshkosh in the very slick Defiant he built for his friend, B. J. Jordan. He brought the failed NG-2 to Burt and Mike at the RAF booth where it was examined. Mike Cardinale of Merritt Island, Florida had the misfortune to run off the runway when his rudder/brake pedals pulled up out of the floor. The aft load on the retraction link, NG-2 caused exactly the same failure as Charlie Gray's and George Best's. The original Defiant, N78RA, built by Burt does not have these rod end bearings in it at all, rather, it is exactly like the mandatory change drawing sent out to all Defiant plans owners dated September 15, 1987. Do not neglect to make this fix. If you do not fix it, your NG-2 retract link will fail. When it does, the nose gear will collapse and your Defiant will end up sliding on its nose. Depending on the speed and the type of surface, this could easily result in the lower cowling being ground away to the point of grinding on the carburetor bowl. If that should happen and fuel could escape from the ground away bowl, the result will almost certainly be a fire. This, obviously, could result in the total loss of your aircraft and maybe - you. Ground your Defiant until you have completed this change.

Please note that on page 2 of the four page nose gear modification, sent to all Defiant plans owners, that the caution note pertaining to NG-4 stating that the bolt in NG-4 is the stop is not correct. Please ignore this caution note. When retracting or extending your Defiant nose gear, it is important that you grasp the gear handle and squeeze the NG-4 to unlock the gear and that you continue to squeeze the NG-4 and hold it until the gear is either up or down, then release NG-4. Do not release NG-4 in the middle of the gear retract or extend cycle since this could possibly allow the NG-7 uplock link to flip over and jam the gear. Rodie Rodewald reported this problem to us. It happened to him twice in his Defiant. Fortunately, he was able to force the jammed gear down each time but he said it caused quite a little flutter in his heart for a minute or two!

A number of Defiant builders have reported problems in rigging their ailerons correctly. The plans change DPC #26 in CP 45, page 4, is incorrect and should be ignored completely. There is no differential in the Defiant aileron control system. To rig the ailerons, follow this procedure, in order: Rig the C-7 belcranks at exactly neutral as shown on page D-48. Lock them in this position with two small 'C' clamps. Both control sticks should now be firmly locked. Now, rig the C-27 welded crossover tube by adjusting the length of the cables from the stick assemblies to make the C-27 look exactly as it is shown on page D-26 (top left). Now, adjust the aileron pushrod tubes (rod end bearings) to the proper length to set both ailerons exactly at neutral. That is it! You will now have approximately +19° of aileron travel both up and down. (+2.3" at the aileron inboard trailing edge). Variations of up to +0.3 at the trailing edge (i.e. 2" to 2.6") are okay.

AROUND THE WORLD IN TWO LONG-EZ'S

John Koch and Ed Roman completed their trip around the world arriving in Sacramento in June 1987. As reported in CP50, John and Ed took off from Spokane, WA last year and flew their Long-EZs across the Atlantic ocean to Europe, Egypt, India and on to Australia. The weather was not favorable to continue and they were both low on funds, so they left their Long-EZs with Australian builder, Bill Sheedy in Bankstown, Australia and came home via airlines. Early this year, they returned to Bankstown and flew around Australia visiting Sydney, Adelaide, Port Headland, Broome, Alice Springs, and then to Port Moresby, Papua, New Guinea where they found themselves grounded by officials! Apparently it is illegal for single engine aircraft to cross the 400 miles of water that they did, to get there by the shortest route! After a day or so, this misunderstanding was cleared up and they took off across Papua, New Guinea - very tough country! - on to Biak, then to Manado in the Celebes. From there to Manila and on to Guam. They spent a little time on the island of Truk, southeast of Guam and really liked the place.

From Truk to Majuro, and from Majuro, (2000-plus miles) over Johnson Island (emergency landing only!), on to Honolulu, Hawaii. Visited several islands in the Hawaiian chain, then departed from Maui, over Oakland to Sacramento. This was the longest leg and John arrived in Sacramento with 20 gallons while Ed had 15 gallons remaining. John's engine was a little stronger and consistently burned 1 qt. of oil every 25 hours average. Ed averaged 1 qt. every 8-10 hours. Both Long-EZs were

equipped with Lycoming O-235 engines and they generally cruised at 2500 RPM using 4.5 to 5.0 GPH, or for the long legs, at 2400 RPM using 3.7 to 4.0 GPH. No provision was made for inflight replenishment of oil. Loran-C (Apollo 612B) was the primary means of navigation. Only one serious glitch occurred when both 612B's suddenly decided to switch hemispheres! No warning light told of this problem and they very nearly got into trouble. John said it really shook his confidence in the Lorans. They contacted the manufacturer who, so far, has had no comment on this serious glitch with no warning light. Both aircraft were equipped with 37 gallon aux. tanks in the rear cockpits for a total of 88 gallons on board each EZ. Both aircraft performed flawlessly with only routine maintenance, oil and fuel plus one brake pad change in Cairns, Australia.

Would they do it again? You bet! Both had a great time. The only bad experience they had was Thailand, a place they vow never to visit again, and they don't recommend anyone else go there. They were charged \$1560.00 for fuel and overnight parking!

Anyone wishing to try a trip similar to this would do well to contact John and/or Ed. RAF can supply their addresses and phone numbers to anyone who is seriously interested. They established several provisional world records during this incredible journey which, hopefully, will be ratified soon. When we asked John if he wasn't nervous crossing the Atlantic or Pacific oceans, single engine, he said, "No, not really, the Atlantic was actually a very easy, 'no sweat' flight, but the Pacific, now that is different, the Pacific is vast, and there is no sensation of gaining ground. You fly for hours with no change other than on the Loran. It took 17 hours to fly from Maui to Sacramento!"

What an unbelievable trip! The real mind boggling thing is that a trip like this can be undertaken successfully and, apparently rather easily, by two ordinary pilots in their own homebuilt airplanes - Long-EZs, impressive little airplanes.

STOLEN LONG-EZ

During the last week of June 1987, N83RT, a really beautiful Long-EZ IFR equipped with King avionics, was stolen from its tiedown on the ramp at Montgomery Field in San Diego, California.

The owner knew there was only 200 miles of fuel in the tanks, so he flew to every airport in a 200 mile radius and left a reward poster with two color photos of the plane and instrument panel giving all details such as equipment, serial numbers and identifying features. In addition, these posters were mailed to every tower-controlled airport and all flight service stations in California.

By great luck, and due entirely to the keen memory of a fellow San Diego VariEze driver, the above aircraft has been returned to its owner. The thief had previously tried to steal a different Long-EZ from a hangar on the field. He failed for some reason, but did take the owner's manual which was later recovered from his home. When he flew away in 83RT, the tower operator, who knew the owner/pilot, exchanged pleasantries with the thief but did not realize it was not the owner. He flew only 30 miles to Ramona where it was hangared for two weeks while it was dismantled. Then it was removed to the thief's home where he seriously damaged the airplane, cutting out the wiring, instrument panel and sanding all identifying colors and numbers off the airframe.

By pure good luck, a VariEze owner/flyer landed at Ramona right behind the thief. He did not recognize the stolen Long-EZ as a local airplane and maybe that is why when, several weeks later, he returned to the airport and saw the reward notice, he called the owner. The San Diego police followed up and got the name and address of the thief and literally caught him about to repaint the aircraft.

What can we all learn from this incident? First of all, notify the local police and work closely with them. Give them all possible information (do you have all serial numbers, engine, avionics, etc. recorded?). Second, fly to all landing strips within a reasonable radius and talk to as many pilots as possible. Near the Mexican border, you might notify the Drug Enforcement Agency (DEA), also the FBI since stealing an airplane is a federal offense.

Most importantly, we should all give serious thought to coming up with some method to prevent the plane from being flown. A plastic coated, heat treated chain wrapped around the prop and secured with a quality lock is good. Perhaps a fuel shut-off valve located, where only you know, in addition to the normal fuel valve. This could be shut off after you park it. Be very careful that this, or anything else you do to disable your aircraft, does not bite you in some way!! If you park it outside on an airport ramp for any length of time, notify the local FBO, tower, mechanics, etc. that it will be there and ask them to keep an eye on it.

The owners of N83RT were extremely lucky. Imagine if you will, that this thief had managed to get the new panel installed and get the airplane repainted. He could have showed up at Montgomery field with his "new" Long-EZ on a trailer, announced the rollout of his "new" Long-EZ, even had a little celebration to celebrate its "first flight" - may even have been able to join the local San Diego EZ group, and probably no one would have been the wiser! Keep your EZ locked up if at all possible. The heartbreak of having it stolen must be experienced to be appreciated.

ACCIDENTS AND INCIDENTS

A southern California VarEze was taking off when it lost power at approximately 400 feet. The engine was leaving a trail of black smoke. The pilot was unable to make it back to the airport and crashed on rough ground about one-half mile from the airport. The airplane was severely damaged and the pilot sustained moderate back injuries.

The pilot believes that the plastic float in his Marvel-Schebler carburetor became "fuel logged" and sank causing the engine to run so rough it quit. He was aware that there had been some problems with these floats, but he said that the important thing was that he never thought it could happen to him! We appreciate such honesty and frankness and hope this will strike a firm note and prevent more pilots from suffering the same fate. See CP 41, page 6, for details on the float problems and things to watch for.

REFUELING FIRE IN A LONG-EZ

"To Ground Or Not To Ground?" by Alfred K. Tiefenthal

"I had intended to carry out an exact calibration of the fuel sight gauges of my Long-EZ. While in my hangar, and using a metal funnel and "Jerry" cans, I began pouring Avgas 100LL into the right tank. The metal funnel had three legs, but due to the cross wire in the Brock fuel tank openings, they were too short. I supported the funnel with pieces of wood and foam. With that arranged, the funnel did not touch the metal tank opening or cross wire but was a few millimeters away from it. I suppose it was at this gap that a spark jumped over and ignited the fuel.

This happened when I was pouring in the third can. The tank was about half full. Fortunately, there was no explosion, the fuel just started to burn. I must have bumped the funnel when the ignition happened because there was splashed, burning fuel all around the tank opening and dripping down the leading edge. The can I was pouring from was on fire and I, myself, got burned on my right hand, fortunately, not seriously.

I will never forget the nasty sight of my beautiful and beloved Long-EZ, after four years of hard work, burning all over the wing strake with the flames reaching almost to the roof! A few seconds later, I managed to extinguish the fire with a single blow from a powder-type fire extinguisher I found in the hangar, and it was all over.

There is very little damage, some discolored spots on the strakes and a few paint blisters along the leading edge. These were quickly repaired and, surprisingly, I actually flew the plane the next day!

There is no doubt in my mind that the source of the fire was a spark caused by static electricity. It was my fault, of course, that I did not ground the aircraft. Nor had I any grounding connection between can, funnel, and aircraft. I will never pour any amount of fuel into any aircraft without ground, and if I have to fill from "Jerry" cans, I will also make a ground connection between the can, funnel, and grounded aircraft.

It is illegal to refuel an aircraft in a hangar and without grounding and I was fined 500\$ (Norway money!), but what is that?! I could have lost my airplane, or even my life, if the ignition had occurred earlier while there was a combustible mixture in the fuel tank - or it could have exploded.

My hope is that this story will prevent other builder/flyers from having a refueling fire."

The above letter was received from Alfred Tiefenthal who lives in Norway and it is the same incident as was described in CP52. We made a couple of suggestions then and have received several comments concerning this incident.

A fueling fire is a very, very serious situation and anything that can be done to prevent it should be done. Also, be sure to have a suitable fire extinguisher at hand whenever you are doing anything with fuel.

Haley Haynes wrote to us concerning our suggestion of a brass chain and he is concerned that the chain should not be grounded to the fuel nozzle until after it has been dropped into the fuel. The connection to the fuel nozzle should be made as far away as possible and upwind from the fuel tank opening.

He says that at the present level of understanding, a static charge can and does build up on the surface of the fuel, probably due to molecular friction between two dissimilar materials, like cat hair and plastic.

The obvious solution would seem to be to install some form of uninsulated metal ground into the tanks during construction, and securely connect these to the aircraft ground and engine. Thus, the gas truck operator grounding your exhaust system would be grounding the fuel. Unfortunately, the problem is not that simple. This solution, in event of an airborne lightning strike, could result in the inside-the-tank ground strap becoming red hot and causing an explosion! Also, the fuel acts as a dielectric between the metal fuel lines and the static charge on the surface of the fuel. Therefore, a very large area ground is needed in the fuel tank. The aluminum mesh called "Explosafe" and advertised in Sport Aviation, if properly grounded to the engine during construction, may be a good way to go.

We would welcome suggestions and comments on this problem. The other side of the coin is, of course, the fact that many hundreds of EZ's have been fueled many thousands of times all over the world without any reported problem until we heard from Alfred Tiefenthal. Is the problem really as big as it seems? We wish we knew, but unfortunately, we are not experts in this field and we would truly welcome the view of any experts.

Our biggest concern, now, is that someone may actually cause a fire trying to avoid the problem by grounding his fuel incorrectly or in the wrong sequence. We are certainly going to have a nice big Halon fire extinguisher at hand for all fueling operations here at Mojave, but what to do on a cross-country?

CLUBS

(The one and only, first annual membership drive)

(PLEASE PASS THIS ALONG TO ANY EZ BUILDER/PILOT WHOM YOU FEEL WOULD HAVE AN INTEREST IN AND BENEFIT FROM CENTRAL STATES. THANKS FOR YOUR ASSISTANCE.)

Starting its 3rd year, Central States is an association of builders/pilots of Rutan designed and marketed aircraft.

Central States members have the opportunity to attend Spring and Fall Fly-ins and also receive quarterly newsletters containing valuable information supplied by the membership pertaining to the construction, maintenance and operation of RAF-type aircraft.

Central States has in place a membership "hotline" if it ever becomes necessary to get critical information to all members in a hurry. Although it has never been utilized, the system is in place should ever a critical development require its usage.

The cost to join Central States is \$12 annually and covers newsletters for the period of December, March, June and September. (Upcoming issues #9-#10-#11-#12.)

If you are interested in joining Central States, send a check for \$12 payable to:

Central States
c/o Arnie Ash
Rural Route #5
Davenport, Iowa 52806

WANTED

One set of Paul Prout type fuel sight gauges with low level electronics. Please contact: Timothy Scott
72 Lochpark Rd
Traralgon, 3844
Victoria
Australia

SPECIAL XMAS SPECIAL XMAS SPECIAL XMAS

Color Poster Featuring All The Rutan-designed Aircraft
Introduced this year at Oshkosh shows 18 of the Rutan aircraft in a beautiful formation flyby. The poster is a laser print of an original oil painting by aviation artist Jack Leynwood. On the back is a complete chronological chart of all the Rutan designed airplanes. Poster is approximately 20"x30" and will sell for \$15.00 plus \$3.00 postage and handling.

XMAS SPECIAL PRICE - \$12.00 (tax and shipping enclosed)

Burt will autograph all Christmas orders! So please specify "Autographed" or "Unautographed". Sorry, no dedications. Time simply does not allow it.

Aircraft Spruce
PO Box 424
Fullerton, CA 92632
714-870-7551

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

FeatherLite
PO Box 781
Boonville, CA 95415
707-895-2718

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.

SHOPPING

A truly excellent book has just been printed by the light plane maintenance library called Firewall Forward: The Top End. Price is \$17.95.
Send check to: Light Plane Maintenance Library
1111 East Putnam Ave.
Riverside, CT 06878

Some of the subjects covered are: Top overhaul, when is it necessary? Post top overhaul breakin. Compression testing, dealing with low compression. Step-by-step removal of cylinders. Remedies for stuck piston rings. Cures for sticking valves. Checking mag timing, etc. A "must" for anyone building an airplane and doing his or her own engine maintenance.

Rocker/Valve Cover Gaskets - stop all leaks with 100% pure silicone "real" gaskets from the Real Gasket Corp.
PO Box 1366
Laurel, MS
39441-1366
601-649-0702 or
1-800-635-REAL

Anyone who saw Doug's display at Oshkosh this year should be convinced for sure. They must be installed dry, no oil, no Permatex, and they will not leak. Mike and Sally have had a set on N26MS now for more than two years with no leaks. They are not cheap though, running about \$30.00 a set for a Lycoming O-235, O-320, O-360, etc., but are worth every penny since they are good for 2000 hours.

NACA Air Inlet Vent Doors - simply the lightest, simplest and most functional way to control the ventilation flow through your canopy vent. Developed by VariEze builder/flyer, Gene Zabler, who also sells a neat, lightweight nose wheel fender which will reduce prop damage from small stones and gravel thrown into the prop by the nose wheel. Contact: Gene Zabler
48 Robin Hill Dr.
Racine, WI 53406
414-886-5315

Teflon Hinge Pin Kit for ailerons and rudders on VariEzes, Long-EZs, Defiants, and Solitaires. Includes Teflon tubing and stainless steel hinge pin. Fits MS 20001 series piano hinges. Contact: Gary Hall
4784 NW 43rd St.
Lauderdale Lakes
Florida 33319
Home: 305-484-4949
Work: 305-974-6610

Please identify yourself as an EZ builder.

These Teflon hinge pin liners really do cut down on hinge wear, especially the ailerons which, due to their proximity to the engine, suffer much wear and tear from vibration. Send \$21.00 and Gary will ship UPS. (\$25.00 outside USA).

Dusty Rhodes of Vista Aviation on the Whiteman airport near Burbank in southern California has recently done a number of avionics packages for EZ's. Since Dusty built his own VariEze, he is quite familiar with our special requirements.

We were down there visiting Dusty and Brenda the other day when we saw a complete Long-EZ instrument panel on the bench. Dusty and Jeff, his avionics expert, were wiring the entire panel, including a full stack of radios and Loran - plus an HSI! Wow!

He showed us a really first-class "EZ" package consisting of the following:
King KX-155 NAV/COMM
King KI-208 VOR head
King KT-76A Transponder
Apollo 612B Loran
Sigtronics SPA-400 Intercom

The "basic" package price, prewired and bench tested, is \$4995.00. The trays are mounted together in a stack and all wiring is complete, including antenna wires and Loran antenna as well as mic. button and headphone jacks. All wires that you, the builder, must hook up (positive and ground) are correctly identified. Obviously, you will have to tell Dusty how long to make the leads to the mic. button and headphone jacks, as well as antenna wire lengths since each plane may be different.

If you want to substitute a KI-209 which includes a glide slope, add \$400. If you want to substitute an Apollo 604 Loran for the 612B, add \$300.00. If you want to substitute a Northstar M1 Loran for the 612B, add \$1300.00. If you would like to include an encoder, Dusty will wire in and bench check a Narco AR 850, blind altitude encoder for an additional \$400.00

When you are all done and have flown off your hours, you can fly in to Whiteman airport, taxi up to Dusty's store, Vista Aviation, and he will do the required ramp check of your transponder for \$35.00. If you have an encoder, he can do the full transponder/encoder and pitot/static system ramp check for \$125.00. (These prices do not include any repairs or adjustments that may be necessary). The above checks are mandatory before you operate your transponder in VFR or IFR conditions. You must have this check done every 24 months and have a log book entry to prove it, to be legal. Be careful. FAA are really hot on checking this kind of thing lately.

Dusty really does know EZ's and is a very knowledgeable avionics man. He suggests not buying your COM/NAV equipment too soon before first flight since your warranty may run out before you fly! Also, do not have your avionics gear in the plane during the finishing process, i.e. sanding and painting, you could ruin your avionics. If you have strobe lights, be sure to shield the power cable and locate it as far as possible from the COM and Loran antennas. Be certain to ground all radio trays together and to a common ground to eliminate noise.

Contact Dusty or Brenda at: Vista Aviation
Whiteman Airport
12653 Osborne St.
Pacoma, CA 91331
818-896-6442

BUILDER HINTS

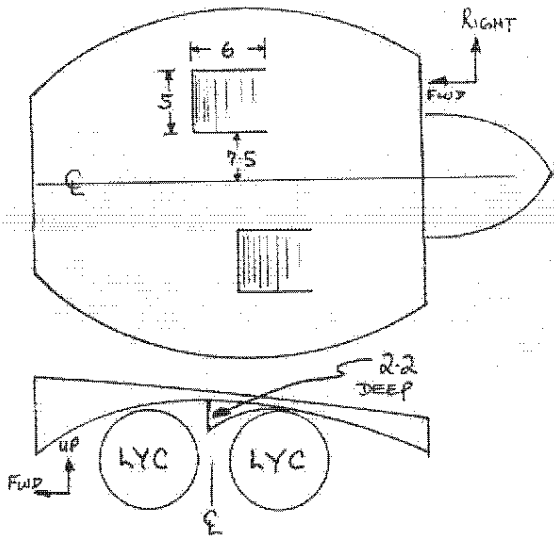
How to remove a stuck Phillips head screw.

Leo Dringoli, Long-EZ builder/flyer, sends in this helpful hint: The next time you are faced with a stubborn Phillips head screw where your screw driver begins to rotate out of the screw head - STOP!! Apply a small amount of OIL BASED valve grinding compound to the screwdriver bit and you will be astounded when the screw is effortlessly removed. "I now keep a small amount of this compound in my airplane tool kit", says Leo.

High cylinder head temperatures

Bob Hansen, O-235 Long-EZ builder/flyer, has had high CHT's since day one. He says he has tried every suggestion in the CPs and many more to not much avail. Finally, in desperation, he cut two "reverse" scoops on top of the cowling with the leading edges pointing between the two cylinders on each side (see sketch). His first test flight after this operation was a pleasant surprise, 70° to 85° of temperature reduction at cruise. Bob's Long-EZ is equipped with a stock TASK cowling, has a NACA flush inlet with 45 square inches of inlet area, a 3" prop extension and an O-235-L2C engine. Since Bob's success, fellow Sedona resident, Gordon Diehl, cut smaller openings in the top of his cowling (1"x3") and he saw a 50° reduction at cruise. Of course, this amount of temperature drop is at cruise and is only about 1/3 as good in a steep climb since it is so velocity dependant.

Test results:	CYL #1	#2	#3	#4
Previous best:	420°	450°	460°	425°
After cowl cutouts:	350°	380°	375°	355°



How to install Long-EZ wings

If you are building a Long-EZ in a basement or a garage too small to mount the wings to the centersection with the centersection mounted into the fuselage, or if by mounting the centersection into your fuselage you can no longer get it out of your basement, or if you would just prefer not to mount the centersection in the fuselage but would like to complete the installation of the wings to the centersection, here is how it worked for Doug Shane (former RAF employee, now an engineer/test pilot for Scaled Composites).

Mike Melvill offered to help Doug after Oshkosh this year to try to get his Long-EZ completed by the end of the year. Doug had completed the fuselage, which was on the gear, and the canard and centersection. With occasional help from Mike's wife, Sally, and Doug's friend, Bob Williams, the two of them worked evenings from 5:30pm to 10:30pm and Saturdays - no Sundays! Sally and Bob helped with wing layouts on a couple of Saturdays. To give you an idea of what a couple of determined fellows can do (should we say "lunatics"?), in exactly 6 weeks, working the above schedule, both wings, both winglets (upper and lower) were completed, then the ailerons were cut out, completed and hinged. The wing roots were completed, the wings were drilled and mounted onto the centersection spar, the winglets were mounted on the wings and the rudders cut out, completed and hinged. The centersection was mounted into the fuselage and the engine mount extrusions were installed. The

canard was mounted and the entire flight control system was installed and hooked up. The brake master cylinders were mounted up front per Debbie Iwatate's instructions and connected to the rudder pedals. Not bad for six weeks of part time work!

During this exercise, the idea of mounting the wings to the centersection prior to installing it in the fuselage came up. Of course, this is the normal way it is done on a VariEze so they were not unfamiliar with the procedure.

Doug's garage is small, but surprisingly, with the centersection firmly bondo-d to his work bench, carefully leveled laterally, as well as vertically (aft face plumb), the work bench plus centersection was placed diagonally and both wings could be mounted to the centersection. Some care was necessary in placing the workbench, but it just barely fit in his garage. The wings were strapped to the centersection using two nylon ratchet-type straps (see photos) on each wing. Using a level on the bondo boards on each wing, and some small wood wedges, the wings were jigged exactly into the correct position relative to the centersection and to each other. Generous blobs of bondo were used to fix the wings to the centersection spar. Doug then spent the next four hours drilling the 6 wing attach holes! That same evening, the bondo was cut and the aluminum flanged bushings were floxed in place and both wings were bolted to the centersection, properly shimmed so that the bondo boards were level, and left to cure the flux to bushings bond with everything lined up.

The next day, the centersection was cut loose from the workbench and this complete unit, wing/centersection/wing, was taken outside for photos. Then it was installed onto the fuselage (out on the driveway) as a complete unit. Of course, the firewall had not been installed yet so the centersection was floxed into the fuselage and held exactly in the proper position, checking each levelling bondo board on the wings and measuring from each wing tip to the nose, by bondo-ing several pieces of lumber, strategically placed, from the fuselage to the centersection. All glass tapes were then installed to tie the centersection to the fuselage and also to support the engine mount extrusions.

This method worked extremely well, better in some ways than the plans call-out. The centersection was very securely mounted to a heavy workbench with bondo and pieces of 2x4 lumber, making it easier to mount the wings since it was not sitting on rubber tires and rocking around. It was at a much handier working height for setting the wing incidence and for drilling the mounting holes. Being able to measure from each wingtip to the nose guaranteed that the wing sweep was perfectly symmetrical, something very difficult to do per the plans installation.

Somehow, this method seemed to go quicker, too. In any event, we would recommend using this method to anyone who has remembered to leave the firewall bulkhead loose! Several photos of this installation will be printed at the end of this newsletter.

DEFIANT BRAKES

We have noticed a couple of Defiants with "standard" 600x6 thin disc, single puck, brakes installed. These are not suitable for an airplane as heavy as a Defiant.

When Burt's prototype, N78RA, was rolled out in June, 1978 for its high speed taxi tests, it was fitted with regular 500x5 (thin disc) wheels and brakes! Needless to say, these brakes were completely ineffective becoming red hot and warping the discs, and fading so badly as to be useless. Next, we installed the thin disc, 600x6 single puck, wheels and brakes with essentially the same results - red hot discs, serious brake fade.

Cleveland recommended the part #199-133x, 600x6 with a 3/8" thick disc and a double puck brake caliper. These were installed and tested and the improvement was really dramatic. Burt's Defiant now has truly excellent brakes.

We highly recommend that you take full advantage of all the testing that RAF did to arrive at the homebuilt Defiant, and save yourselves the expense and hassle by obtaining a set of the Cleveland 199-133x, double puck, extra thick disc, 600x6 wheels and brakes from the beginning. Dr. George Best related to us how he started

out with the thin disc, 600x6, wheels and brakes, found them to be very marginal, ended up buying the 199-133x wheels and brakes and is now very satisfied.

CAUTION: CORROSION IN VARI-EZE WING ATTACH FITTINGS

A VariEze which had spent most of its life outdoors in the eastern US, but significantly, not on the coast, was found to have severe intergranular corrosion in the top plates of the wing attach fittings as well as in the two aluminum tubes between the top and bottom plates. Very little evidence of this was visible upon casual inspection. However, when the UND wrap on each end of the centersection spar was lifted, the corrosion was rampant and this EZ builder said he would not have flown this airplane knowing how bad the corrosion was.

All VariEze owners should make a very careful inspection of the aluminum wing attach fittings, especially under the glass that laps onto the aluminum plates, particularly if there is evidence that the glass has peeled or delaminated from the wing attach plates, both on the wings and the centersection spar.

For new construction, all aluminum parts, including wing attach fittings, should be cleaned in Alumiprep 33 or metal prep #79 and then soaked in Alodine 1201 which is a visible (golden brown) moisture barrier, greatly increasing resistance to corrosion. This also acts as an excellent surface to bond epoxy or paint.

Do not anodize wing attach fittings since this finish, if not done exactly right, can cause embrittlement in the highly stressed wing attach parts.

Alodine is a common aluminum preparation and can be obtained from RAF-approved suppliers such as Aircraft Spruce or Wicks Aircraft.

CAUTION: BINDING BRAKES

Dave O'Neill, Long-EZ builder from Johannesburg, South Africa, writes of his first flight. Empty weight was 849lbs with starter and alternator and 500x5 wheels. The only problem Dave had was one that could affect all of us and this is binding brakes. Even a fairly light binding of the brakes can increase rotation speed significantly. Dave had to accelerate to more than 15kts above the normal rotation speed in order to get the nose wheel off. This is potentially quite hazardous since you are taxiing at above flying speed and things could get out of hand quite rapidly in the event of some small problem. Check your brakes before you go out to do your high speed taxi runs and be sure that the brake discs turn freely between the brake pads when the brakes are not applied. Thank you for this important point, Dave, and congratulations on your first flight.

CAUTION: AIRSPEED INDICATOR INACCURACIES COULD CAUSE PROBLEMS ON A FIRST FLIGHT.

Fred Mahan, Long-EZ builder/flyer reports that on his first flight he was uncomfortable on final, felt too slow, decided to check his airspeed indicator. Using a water manometer, Fred discovered that his airspeed indicator read 200 kts, when the manometer said 200 MPH. This continued all the way down to 40 kts, so his airspeed had been mis-graduated by somebody. This meant that when he was indicating 75 kts, he was, in reality, only doing 65 kts! This could have been a "gotcha"! Of course, it was great at the high end, Fred thought he was going really fast! Check your airspeed indicator before first flight. See the neat water manometer suggestion in this CP.

USERS OF ROTORWAY RW-100 ENGINES - John S. Derr is forming an association for those EZ flyers who are using the above engine. Please send your name, address, daytime and evening phone numbers, serial number of engine, type of plane and status of project, any photos or written material you would like to share. If John gets enough response, he will underwrite the first issue of a newsletter. John is a professional scientist and is used to gathering data and presenting it in a reasoned way.

If you have a Rotorway engine and are interested in such a newsletter, contact: John S. Derr
706 Partridge Circle
Golden, CO 80403

This neat water manometer article is taken from the Long-EZ Squadron 1 newsletter.

One instrument in my airplane that has been a source of constant irritation is the airspeed indicator. For some reason mine always reads too low and my friends' airplanes, at least during hangar flying sessions, say they are always faster than mine.

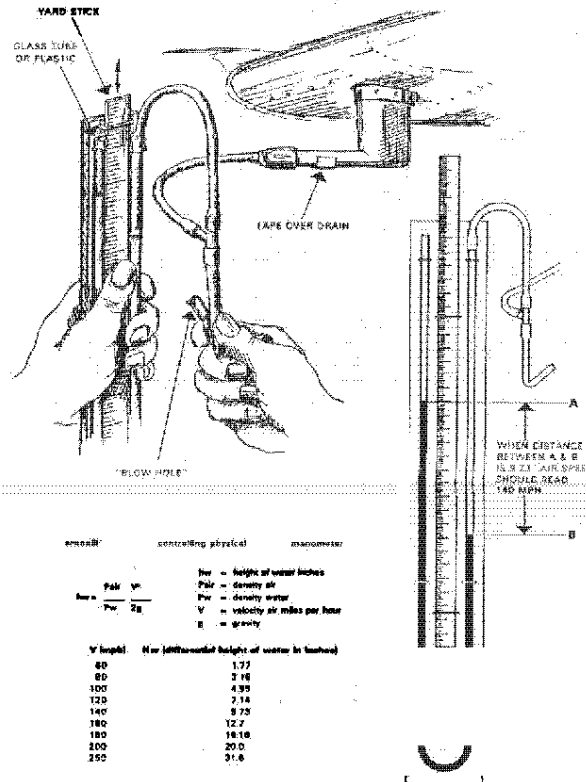
On the verge of an inferiority complex, I decided to do some investigating which revealed that the airspeed indicators are based on a well known physical law and that it is feasible for owners to check and calibrate their own aircraft's speedometer. Before I relate the principles of airspeed theory, based on Bernoulli's Law, let's get right into how simple it is to make an instrument called a manometer, which is easily put together of a little of this and that found at most hardware stores.

EQUIPMENT REQUIREMENTS:

1. Approximately 10 feet of clear plastic tubing, preferably 1/4 inch to 3/8 inch inside diameter (it should cost between \$1 and \$1.25).
2. A board 30 inches in length suitable for mounting the plastic tubing in a "U" shape.
3. Some type of "T" fitting. This can be made by soldering small pieces of copper tubing together.
4. A yardstick.
5. A few ounces of water with a little bit of food coloring to aid visibility and a small quantity of detergent as a wetting agent.

TESTING PROCEDURES:

1. Examine the pilot tube carefully and if there is a small drain hole, cover it with tape.
2. Scratch the end and of the plastic tubing over the nose of the pilot tube (see Fig. 1).
3. Blow the manometer until the water level between the two sides of the tube has approximately 20 inches difference in heights. Pinch off the air supply tube and check for leaks. If the manometer and the static system are free of leaks the water level will remain constant.
4. With one person in the cockpit viewing airspeed indicator, bleed off the air by releasing the pinch referring to the chart (see Fig. 2) for proper water level differences. Start with a water level that is appropriate for the speed of your aircraft. For example, if your plane is capable of 180 mph, there should be 18.16" difference between the levels of the water in the "U" shaped tube. If your airspeed indicator is reading 183 at the 18.16 inch differential level, you know it's 3 mph fast. Repeat the procedure at 180 mph, 140 mph, 120 mph and so on. Most airspeed indicators are usually read to three tenths off somewhat in their range. Naturally if there is a leak in your airspeed system this is indicated by an inability to hold the water level. It is sometimes difficult to bleed the correct amount of air to reach the exact inch difference that you want. Often several attempts are required. The yardstick is moved up and down so as to measure the different levels that the water will reach.



LETTERS

"In the spring of 1980 my Long-EZ arrived. Boxes, boxes and more boxes. It was mind-boggling and overwhelming to contemplate. But the plans were very specific and the section-by-section, step-by-step format was easy to follow. The one thing that took the most time was the financing of the project. And so, 7 years later, start to finish, I towed 29TM, with a police escort, to the airport, one mile down the road from my front door.

Then the fun began. Final checks, taxi testing and runway flights, (it flies level and stable with neutral trim) FAA final inspection, which it passed with flying colors, and I was ready for the big one - FIRST FLIGHT.

July 19, 1987 the sun went down on a clear, calm sky. I went to bed early planning on an early morning start. July 20, at 7:30 in the morning I stepped out of the door and it was so dark the street lights were on (black clouds). I turned on the radio and the first words I heard were "tornado warning". Four tornados were sighted within five miles of the Grand Rapids airport. But as the day progressed the weather cleared. The plane was ready and I was ready.

After a final check I taxied 29TM out to runway #34. Winds were 5 to 10 from 280 degrees. I eased the throttle wide open. My heart rate went up with the

tach. Rotated at 65 kts. and at 79 kts., with a little more back pressure I was off. I settled into a 90 kt. climb and the hand on the altimeter looked like the second hand on a clock. At about 600 feet, a big bumble bee circled my head. Just what I needed! I was already nervous enough with an unfamiliar airplane on its first flight and now this. I climbed out to about a thousand feet, trimmed for hands off flight, took off my head set and then my cap. As the bee landed on my sleeve, with the aid of the aforesaid cap, I grabbed him and crushed him. I opened the cap and he dropped between my legs to the floor. With a sigh of relief, I went back to the business at hand.

My first landing was not all that good. I came across the numbers at about 80 kts, set it down and got on the brakes hard. My second and all subsequent landings have been much better. When I climbed out of the plane the bee was still crawling around on the floor between my legs.

Later that day, after a cup of coffee to settle down a bit, I took her up again and spent an hour playing.

29TM flies like a dream, solid and responsive and is a pure joy to fly. It lives up to all its advance billing.

Tom Montague"

44JD flies 82CD

"While having breakfast solo at the Sedona airport, a man at the next table saw a Long-EZ take off and opened a conversation with me by saying, "That's the kind of plane you should fly." I'll never have a better opening. I said, "I do! And that's half my plane! And my husband's flying it!" I felt like bragging.

I worked very hard to get to this place and I'm basking in the glory. It was always my intention, and dream, to fly that beautifully sleek airplane half the restaurant watched take off that muggy Saturday morning in August: ever since I met Gordon Diehl a little over two years ago in San Diego.

I spent two years trudging toward my private. Getting the ticket was no breeze being no Amelia reincarnate. Four trips to the FAA examiner and an infamous old bird she is! Finally thoroughly checked out, I took a 2-1/2 week, 30 hours, solo cross country over to California, up to Ashland, Oregon and back in my Cessna 150 staying with such wonderful people as Bernadette and Don Shupe and Bonnie and Bruce Tiff.

A week later I taxied our Long for a couple of hours until with great trepidation I took off solo...and I took off...and then I finally took off....realizing I didn't have the canard high enough. "Whoopie!!! I'm really up here! Now can I get back down?" The half hour was exhilarating and the visibility spectacular. "Boy this sure beats the back seat." I was astonished that I could have so recently enjoyed 30 hours at 80 kts in the now obsolete Cessna. Yes, I was spoiled already.

My first attempt to land was too high. I can just hear Gordon saying, "I told you so". I actually hear him on the radio, "Is the nose gear down?" I went around and then got a good glide slope on the VASI at about a 2 mile final, minor adjustments coming down, I flared and held it off until 82CD touched down like a dream. "Hey you guys, piece of cake. Here I've had all you Eze pilots on a pedestal for two years and this is really EZE".

For the next two days, I nagged at myself that it was beginner's luck. I braved it again with a lovely smooth take off and flew for an hour, climbing to 12,500, soaring down to pattern altitude, swooping 40 degree turns around the gorgeous red rocks while listening to classical music. I have never been so relaxed flying. I completed my finest flying hour with another effortless landing.

So, go for it, Gals! Don't let the guys have all the fun!

Jeri Jene Diehl

Congratulations, Jeri, on joining the ranks of EZE pilots. (Editor)

"Dear Burt,

I was disappointed that, upon my return to San Diego, I was unable to stop at Mojave to inform you of our Atlantic adventure. Gene Scott, of Plane Doc at Gillespie Field, is a very good friend of mine and had convinced me to join a partnership with Ed Esteb and Bill Hargis in a Long-EZ which we completed in March of this year after four and a half years of building. We had a great deal of help from Robby Grove and a number of the people at the EZ club in San Diego and it's not possible to list all of the people who participated in the fabrication and modification of this fine machine. It has the new canard, the "almost-constant-speed" prop, a Lycoming O-235 L2C rebuilt with F pistons, and the Avionics package is IFR with Loran and HF. After testing and a few design changes, I flew it to Shannon Airport (Ireland) and back via Greenland and Iceland this month. Except for the collapse of a nose gear at Narsarsuaq, Greenland, during a 29-knot shifting crosswind landing with almost full fuel tanks, a broken field wire, also in Greenland, and the replacement of an alternator at Omaha on the way back, the plane performed flawlessly. Obviously, none of these were design problems. Gene accompanied me in Gerry Hansen's Cessna 182RG from San Diego to Narsarsuaq, Greenland, where he had to leave it and proceed commercially on Iceland Air when his fuel requirements rendered continuation unwise. He picked it up on the way back. He was more than a little upset that he didn't take his own Long-EZ but he and Gerry were not keen for the possible loss of their own fine aircraft.

I did want to let you know that the plane was flown in heavy rain and, unavoidably, some icing. In both conditions, and even with a thin film of ice or ice droplets on both the leading and trailing edges of the canard and main wing, there was no detectable loss of control or tendency towards stall or loss of lift as we had noted with the earlier canard.

I did experience the need for slightly more excursion of the stick to accomplish gentle turns but this was almost negligible. The lowest temperatures I could measure at 12000 feet over the Greenland Ice Cap were in the range of minus 25 degrees Celsius. The engine wasn't overjoyed and I needed full carb heat to keep it running smoothly and CHT above 300 degrees. I haven't yet been able to figure that out unless there was some moisture in the fuel. There was no visible moisture over the cap. I had fabricated a cup ice protector over the elevator counterweights on the underside of the canard and I'm happy I did. The Loran worked fine wherever it was available. I installed a centerline antenna behind the canopy between the fuel vents when our built-in winglet Loran antenna proved unsatisfactory. I installed window screen under the seats from the avionics panel to the firewall with a common ground for groundplane. We had previously imbedded copper strips in the wings for an ADF groundplane and I believe this enhanced the Loran reception as well.

The longest overwater was eight hours in fairly strong headwinds from Reykjavik to Shannon in Ireland. Stornoway was "closed" and I decided to dogleg it directly. I landed with over two hours of fuel still in the tanks.

I'll take the chance of incurring your wrath to tell you that, with all the Emergency Gear, including a raft and minimum Transport Canada requirements, 2 ELT's and a hand-held Terra 720, an HF and full-panel VHF, VOR, Transponder, Loran, DME and a hand-held Marine DDF, exposure suit, minimum clothing baggage, tools and full tanks on every takeoff, with an empty weight of 965 lbs., I was probably a "little over gross"! The only time I felt it, though, was at Grand Canyon, on the way back, at 6600 feet and 87 degrees F on the ground. 97 hours, 16000 miles, an average of 130 knots and 10 plus 30 endurance, occasional IMC, and an unending supply of open mouths and cheering were present at each stop for the unbelievable genius of a guy named Burt Rutan. Everybody I ran into knew your name and your achievements. I never once had any doubts about the design capabilities of this plane and I'm looking forward to your next breakthrough. Thanks for letting me break out of my own closed world into an unforgettable adventure.

With highest personal regard, very sincerely yours,

Sidney Tolchin, M.D.
4421 Mayapan Drive
La Mesa, CA 92041
619-579-0364"

"Dear Mike,

Enclosed is photo of N23TR which flew 1st flight July 11, '87.

I'm using two IO-360B1A engines with Hartzel C/S prop (70") in front and Great American prop (70x78) in rear. Weight was 1887 lbs. with large amount of extras - S-Tec autopilot, radar altimeter, full IFR panel, etc. I put 75 lbs ballast in rear baggage compartment to bring CG into center of box for 1st flight. With no ballast, CG was in flight box at 122.1. Initial taxi tests to 65 MPH revealed no ground handling (nose gear or brake) problems. (I have Don Forman's shimmy dampner installed).

The first flight was basically "out of the box" with no adjustments needed and only revealed a slight left rolling tendency with nose gear extended. This was easily compensated by the roll trim on the elevators. After gear retraction on 4th flight this left roll tendency disappeared. So there were absolutely no surprises during first few hours testing. I had to pull landing (2 of Dusty Rhodes 250 watt bulbs) light out of front intake to get good cooling. Rear oil temperature running around 210° and front, 170°. C/H temperature about 350 range, front and 390, rear.

I should fly restrictions off by early Sept and, it goes to paint shop mid-October. I have about 2900 hours in project so far and am very pleased at this point.

I don't have any meaningful performance figures yet, but will send them out to you as soon as available.

Sincerely,
Ted Rogers

The following three letters are concerning a lightning strike on a Long-EZ flown by Dick Kreidel. We certainly thank Dick for taking the time to write the account which Burt sent to Andy Plummer for his comments. Mr. Plummer is one of this countries leading authorities on lightning strikes and his letter is, also, reproduced here for all of us to read and inwardly digest. Pay attention, guys, our EZs are not indestructable, although many of us fly them as though they were.

"I deliberated for a long time whether to publish this account of poor judgement and foolish mistakes. When I read it now, on the ground, three months later, the faulty reasoning is easy to see. But I assure you, that the decisions and events on May 23rd were made to the best of my ability and skills. My hope is that someone will benefit from my errors. It is a fine line between being around to tell a story and not being around.

This account was originally sent to RAF for their comments. Burt passed it on to Andy Plummer of Lightning Technologies who is reputed to be the foremost lightning expert. Mr. Plummer's comments follows my tale.....

I departed New Orleans Lakefront Airport IFR to El Paso at approximately 9:30 a.m. local on Sunday, May 23rd. I had received a thorough weather briefing from Flight Service only 20 minutes earlier and they indicated that westbound I shouldn't have much problems; rain showers and multiple cloud layers with tops at 14,000' to 16,000' MSL with a thin cirrus layer at 25,000'. Live Radar @ FSS painted a line of thunderstorms about 20 miles south but it probably wouldn't arrive at Lakefront for at least an hour. I was cleared to 16,000' and had gone through multiple layers of cloud and picked up some light clear ice after a climb through 12,000'. I requested from ATC to hold at 14,000' for a while since I was between layers and the next ceiling didn't look as thin as advertised. The OAT at 14,000' was +1° C. I flew through some heavy rain and more ice accumulated on the plane, especially the canard, elevators and vortilons. The wing did not appear to have much ice on it and I could not see any on the winglets or the intersection between the wing and winglets. Indicated airspeed at 2400 RPM was 122 KIAS. The ice on the canard covered about 20-25% of the chord with some "streamers" that went back to perhaps the 50% chord line. Ice formed below the trailing edge of the elevator about 1/8" thick with a uniform spanwise distribution. The ice on the canard was definitely clear ice but what was below the trailing edge of the elevator looked more like mixed or rime ice. The elevator position was about 5/16"-3/8" T.E. down. The airplane was very controllable with good elevator responsiveness. I could have easily climbed if I had wanted to so I was not overly concerned.

ATC was giving me radar vectors to stay clear of any CB's but indicated that contrary to my preflight weather briefing, the "weather west of New Orleans is really wicked with the big boys having trouble going through!" Center advised that the only way they felt would be O.K. would be to deviate approximately 60 nm due North - obviously I followed their recommendation. After a few minutes I was again in cloud and it became increasingly difficult to hear radio transmissions - static was all that came through the headset.

I started receiving small electrical shocks from the roll trim lever through my jeans and shocks from the microphone to my lips. I became aware of the transparent blue glow that was on the nose and canard. I say blue but somehow it seemed blue with a pink tinge. The color was similar to the bright blue from a gas welders flame. This halo was about one chord width above the canard and seemed to "move" - it is very difficult to describe in words. I was now getting shocked through the speed brake handle and from the rudder pedals to my ankles (my feet were in the relaxed position forward of the pedals). The B&D tachometer was bouncing erratically from 500 RPM to full scale and both Nav CDI displays were swinging from stop to stop. The electric engine instruments were also useless - I didn't notice what the wet compass was doing. Here I was; IFR conditions, icing, no communication or navigation, thunderstorms and weird light. So far the ride was smooth with no rain or hail in the cloud - the cloud was not a dark, heavy one. The blue (pink) glow increased in intensity and its movement was more rapid. I am not sure but I believe that the blue glow was now inside the cockpit between my face and the instrument panel, but I could still easily read the gages; it was right out of the Twilight Zone.

I saw a bright flash way ahead of me that seemed to go from left to right that really lit up the cloud I was in; I assumed that it was cloud to cloud lightning and that I was definitely in deep grease! The com was still all static and calls to center were unanswered (or perhaps unheard). I was so scared that I was sure that this would be the way it would all end and Kay (my wife) would be really pissed! I smelled a thick sweet odor, got one good shock from the microphone and then there was a tremendous flash of light and an incredibly loud "crack" - I felt it in my bones and chest as opposed to hearing it.

I had been looking out at the right wing trying to figure out why the blue halo was not on the wings, only the canard, when the flash occurred. I was temporarily blinded so I removed my hand from the stick hoping I wouldn't enter a spiral dive. When I could see again (10-15 seconds), to my amazement 1) I was still alive and 2) the plane was still level at 14,000' on my last assigned heading of 060°. The blue halo was gone and I heard a transmission on the com for a Delta jet. I called center to see if my radio was blown and they immediately answered my call! Apparently they had been trying to reach me to give me a new vector and immediately turned me to 330°. The airplane was again between layers and the visibility was good, I could even see patches of ground below. Everything appeared to be working O.K. but the plane still had a lot of ice on it and I didn't think I was in any mental state to fly an approach. The airspeed now read less than 50 knots so I knew that the pitot tube had iced over. The weather seemed to be improving rapidly with a broken layer above and below with some beautiful blue sky far in the distance. Since the plane would easily climb with full power and the remaining aft stick I saw no reason to descend and kill myself making a lousy IFR approach after all of this! I then saw several dark patches on the wing and winglet leading edges that upon later inspection were areas where only the glass skin remained. In about 20 minutes all of the ice melted and the elevator position returned to 1/16" T.E. up and the airspeed increased to 140 KIAS at the same power setting of 2400 RPM. The flight continued normally in IFR conditions and I landed at El Paso International four hours later.

So what is there to learn from this unwanted experience? Probably several things. First, that the invincibility I felt in B88EZ contributed to my cavalier attitude in flying in bad weather - this certainly was not the "California IFR" that I was used to. After nearly 1100 hours of flying in a plastic cocoon, I had developed a false sense of immortality - after all, the EZ had gotten me through some tough situation before. Also, I learned to never, ever trust ATC and/or FSS - the pilot must make his own decisions and evaluations on when to commence or terminate a flight.

Another significant revelation is that although the Long-EZ is a great plane and can leap tall buildings with a single bound, it is not suited for hard IFR flights with embedded thunderstorms. I consider myself extremely lucky to have survived this flight - my skill and judgment (or more correctly - lack of both) hopefully will serve me better in the future."

Dick Kreidel.

FIG I - ICE DISTRIBUTION ON CANARD & ELEVATORS

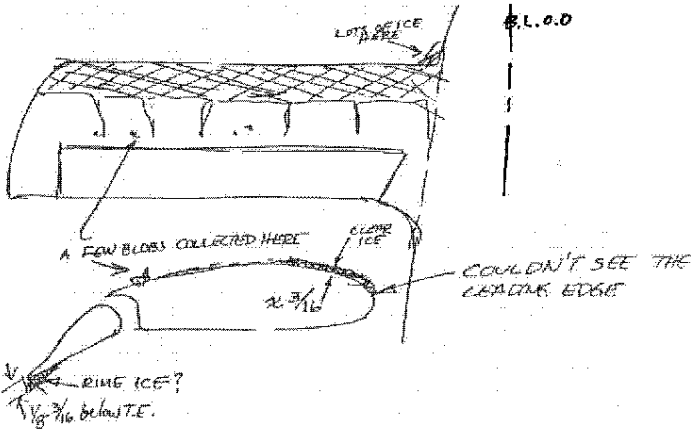
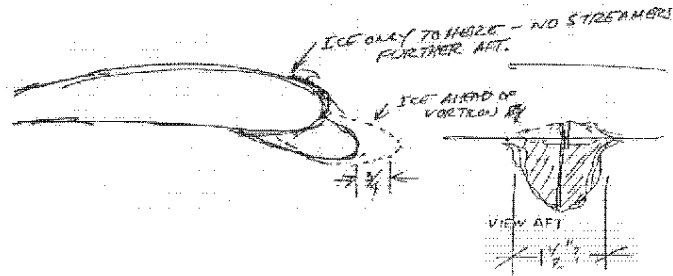


FIG II. ICE ON VORTICONS



LIGHTNING TECHNOLOGIES, INC., 10 Downing Parkway, Pittsfield, Massachusetts 01201 • (413) 438-2135

22 July 1987

Subject: Long-EZ Lightning Strike

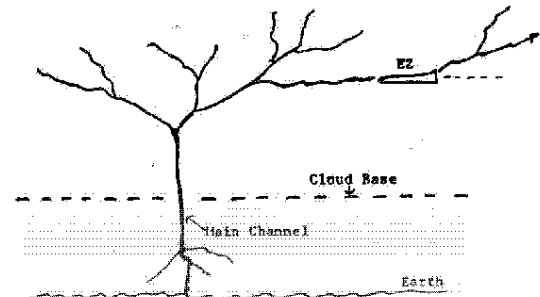
Reference: Your Letter of 3 June 1986, Same Subject, with Dick Kreidel's Letter Attached

Burt Rutan
Scaled Composites, Inc.
Hangar 78,
Mojave Airport
Mojave, CA 93501

Dear Burt:

I have studied the interesting account of a lightning strike to a Long-EZ by Pilot Dick Kreidel, accompanying your letter of 3 June, and have the following comments:

1. After beginning the deviation North, the aircraft entered an electrically charged region, as indicated by the static in the communications system, "small electrical shocks" and "blue glow" (corona) on aircraft extremities. The electric shocks were due to electric field penetration of the non-conductive fiberglass airframe. The erratic behavior of the instruments was also due to electric field interaction with the interconnecting wiring. It is very likely that the corona was indeed occurring inside the cockpit as Mr. Kreidel suspected.
2. The synoptic weather conditions reported by the pilot are very characteristic of those reported by other operators when lightning strikes have occurred (~14,000 ft; icing, precipitation, within a cloud, OAT +/- 50 of freezing). Apparently the aircraft was near embedded thunderstorm cells, through lightning strikes have been known to originate in "layered" clouds as well as CB clouds.
3. The "flash of light" and "loud crack" indicates a lightning strike, although evidently one of mild intensity as indicated by the comparatively minor effects on the aircraft. At 14,000 ft. it is likely that the aircraft encountered a branch of a flash, rather than the main channel of a cloud-to-earth flash; as illustrated in the following sketch.



4. The electric currents in a branch (of which there are a lot in a typical flash structure) are usually much less than that in the main channel. Even so, the flash and noise can be frightening if experienced close at hand.
5. Apparently the lightning current entered one wing tip (take your pick) and exited from the other, being conducted by internal metal conductors between. The amount of damage to the fiberglass and foam structures indicates a very mild strike - perhaps 5 kiloamperes or less (Part 23 rules require on airframe to tolerate 200 kiloamperes).

Comments

1. Pilot Kreidel was lucky! A more severe strike may well have caused major structural damage and lethal voltage differences among metal objects in the cockpit (column, pedals, headphones, etc) as well as severe damage to internal electrical conductors such as control cables, hinges, bearings, rods, electrical wiring, etc. These voltages and currents can be far in excess of fatal levels. Electric fields and lightning strikes themselves will directly penetrate unprotected fiberglass structures, attracted by metal objects within - no matter how small.
2. This is another example of the fact that ATC cannot be relied upon to vector an aircraft safely around - and clear of - hazardous thunderstorms. Controllers are not provided with sufficient (and timely) information for this purpose. Even though avoiding areas of heavy precipitation the aircraft ran into an electrically active region.
3. This incident is not a good example of what would occur to a Long-EZ in a lightning strike. A "full throat" stroke would likely have ripped a hole a foot or more in diameter through the composite and vaporized small diameter control cables and interconnecting wiring. The accompanying shock waves would have caused extensive internal damage, delamination, etc. I doubt very much whether the aircraft or pilot could have survived such a strike.

Notes

1. Continue to warn pilots of this class of aircraft to stay VFR and avoid "weather" clouds, precipitation and icing within 50 of the freezing level, should especially be avoided.
2. This Long-EZ should be thoroughly inspected to be sure that there has not been damage to any internal metal parts. All internal parts should be inspected. It is quite probable, for example, that this strike burned some strands of control cables, electrical wires, etc.

Thank you for sharing this interesting account with me. Please give me a call if you have any further questions.

Yours truly,
J.A. Plummer
J.A. Plummer, President
Lightning Technologies, Inc.



0554/87
3 June 1987
Andy Plummer
Lightning Technologies
10 Downing Parkway
Pittsfield, MA 01201

Dear Andy,

As you may recall when you visited about 10 years ago, we, as well as hundreds of other homebuilders have been flying without lightning protection and with apprehension as to what would occur in a lightning strike. The enclosed account is from Dick Kreidel of Yorba Linda, California who was flying his Long-EZ when it was struck by lightning.

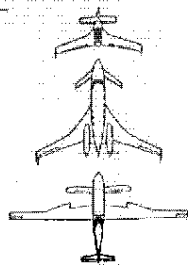
I would appreciate any comments you could pass on to us or any recommendations of analyses which should be done. I am wondering if any data is available on laboratory strikes on fiberglass skins with foam cores. If so, I would like to look at that information to get some idea of the intensity of Mr. Kreidel's strike.

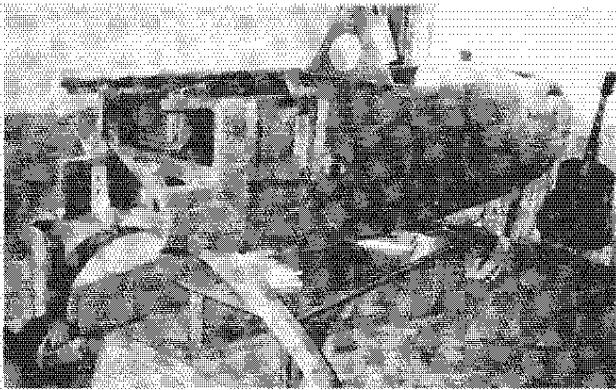
Best regards,

Burt Rutan
Burt Rutan

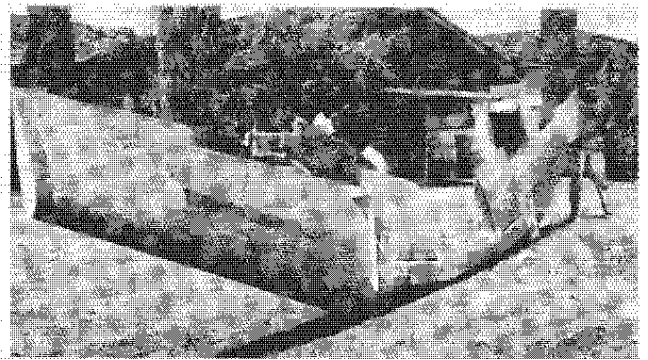
ELR/ri

cc: Mike Melville
Dick Kreidel
Jim Terry

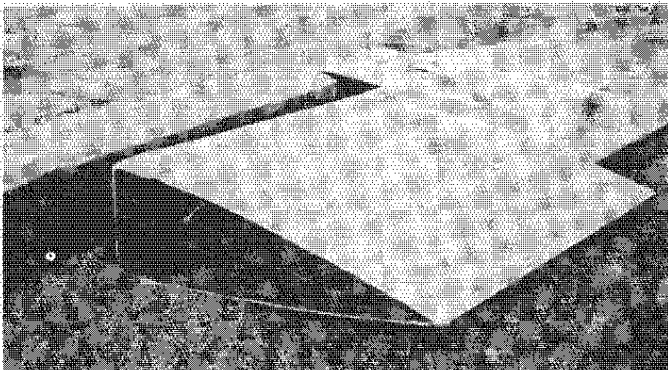




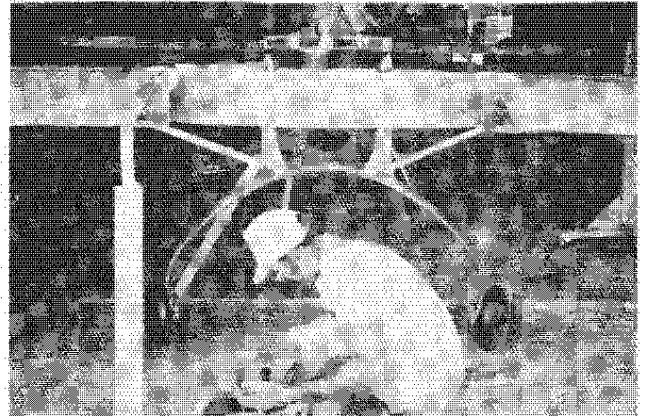
Doug Shane's fuselage on the gear - note that the firewall is not installed yet.



Wing/centersection/wing assembly bolted together and ready to install in fuselage.



Centersection & right wing. Level-board is bondo'd and must remain in place until wings are drilled & cured to centersection.



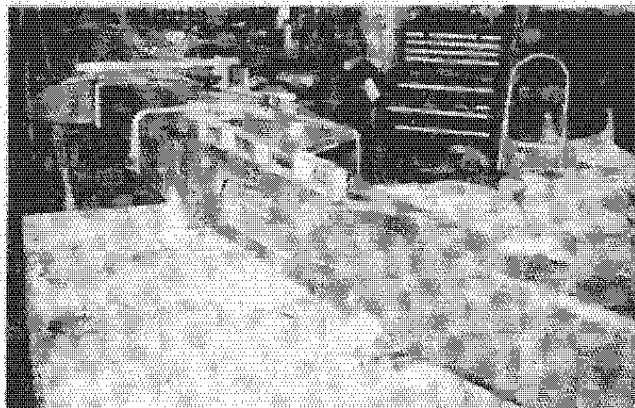
Wing/centersection/wing assembly is flexed into fuselage. Note that this assembly is "sighted" to align perfectly with canard. Firewall being "battered" with floc prior to installation.



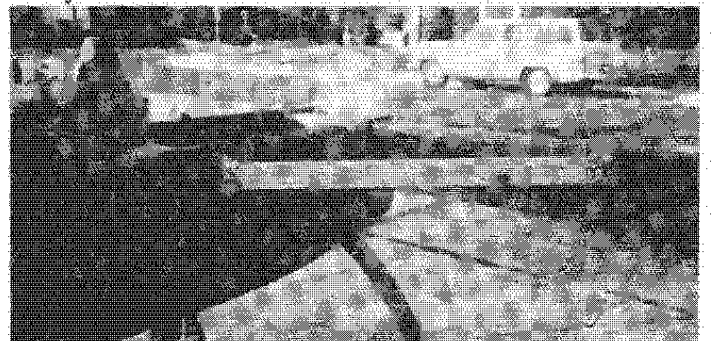
Centersection bondo'd to work bench with both wings strapped in place, ready to drill wing attach holes.



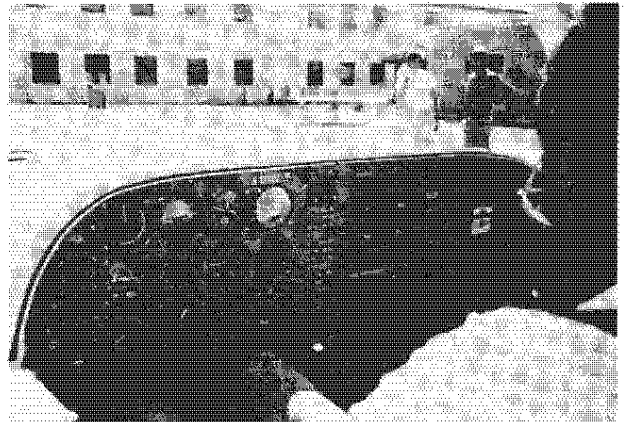
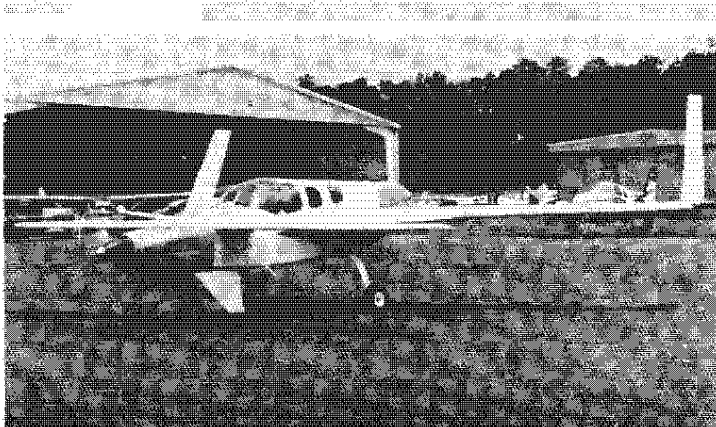
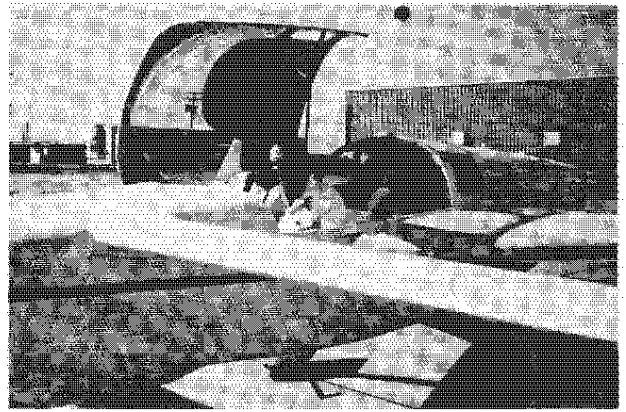
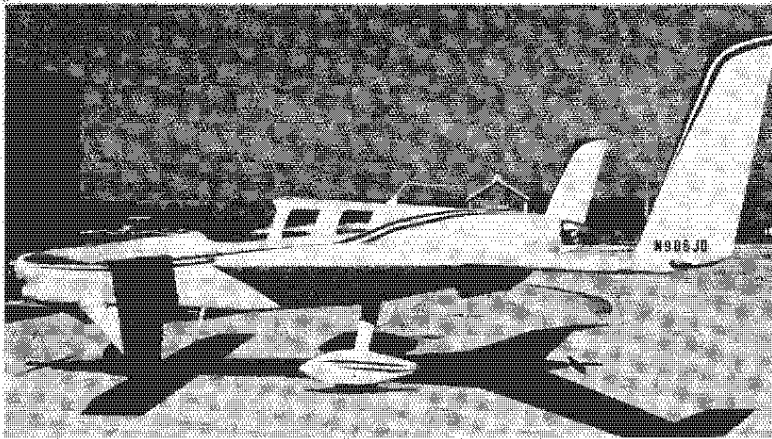
Lumber bondo'd from fuselage to centersection spar to firmly locate it while it is taped in place.



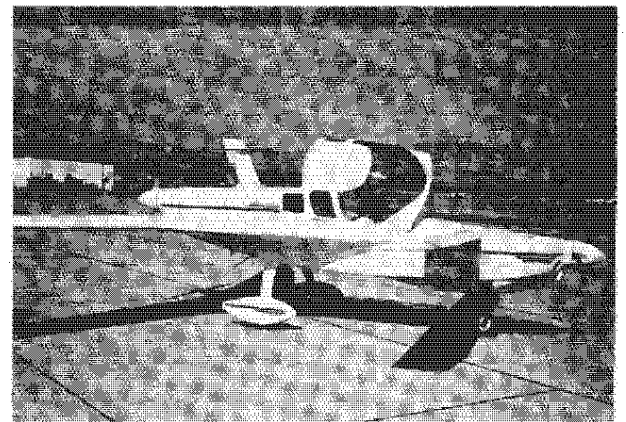
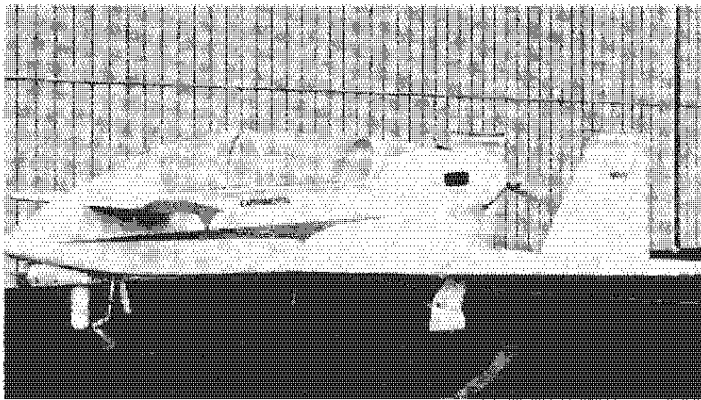
Centersection is level laterally & aft face is plumb. Wings are strapped to centersection with ratchet/nylon straps.



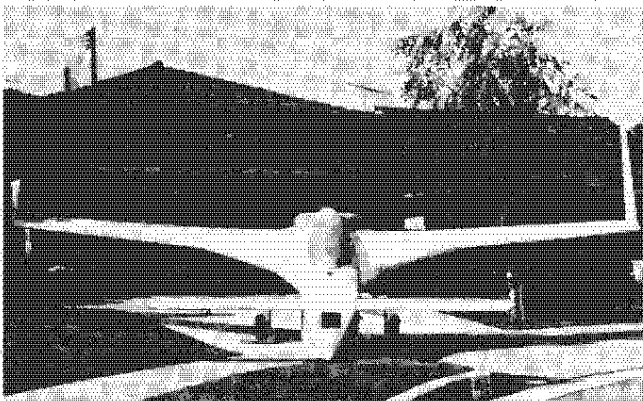
Generous bondo "blobs" will hold centersection firmly, but only if you sand the glass where the bondo goes.



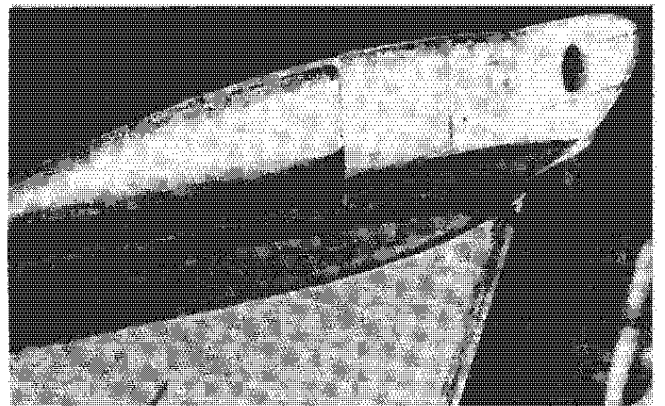
Look at that instrument panel! Mike said there was



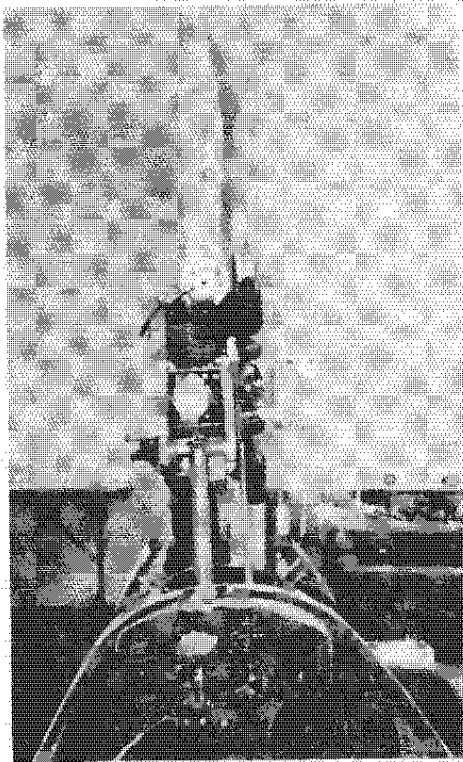
John Martin's beautiful new VariViggen. We are anxiously awaiting John's first flight report.



Donald Douglas' Long-EZ ready for final contour & paint.

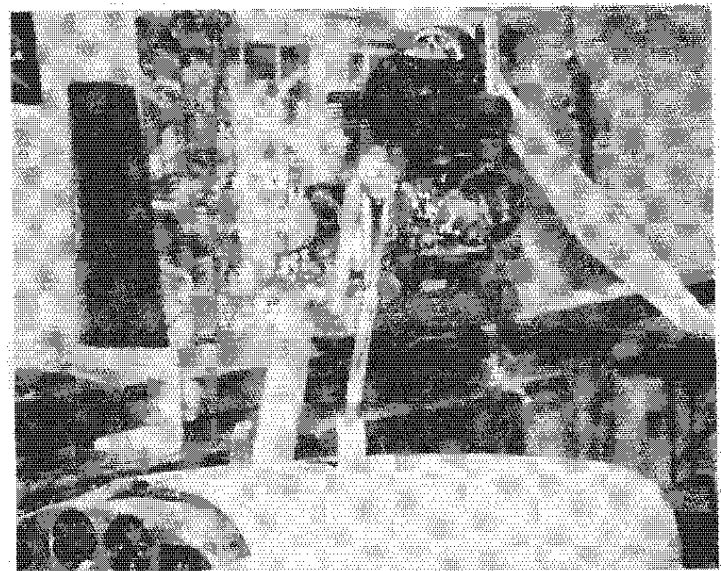
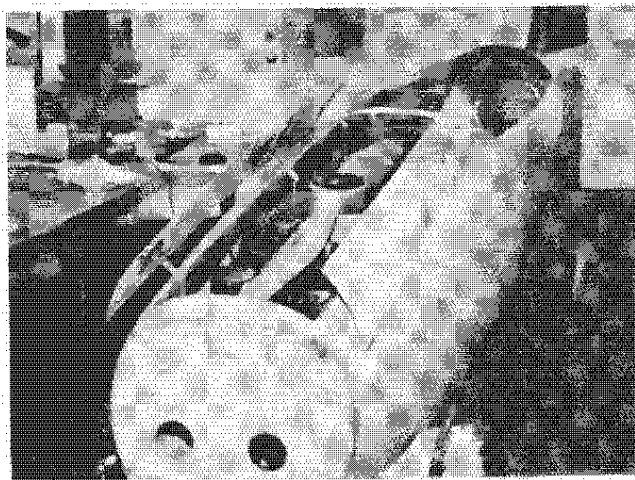
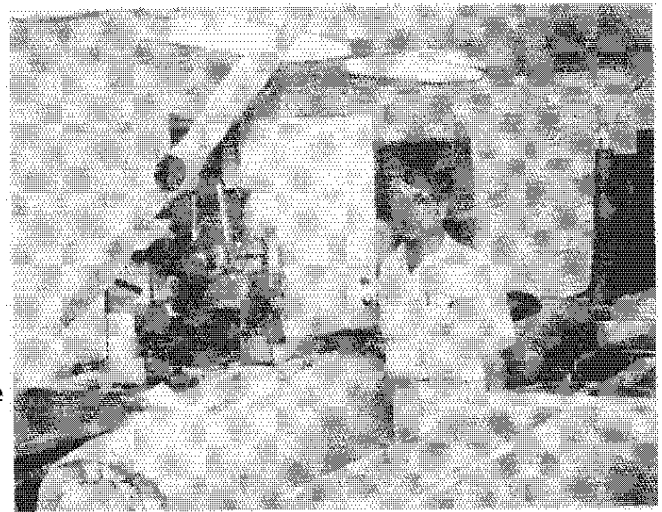


Donald Douglas' wing/winglet junction - this is how it is supposed to look - very sanitary work, Don.

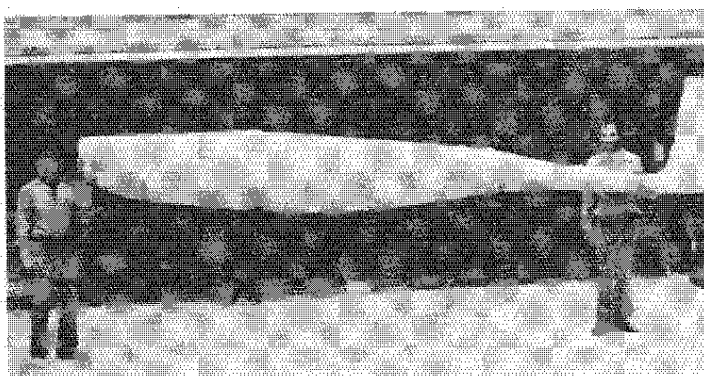


Herb Abrams with his very innovative Solitaire engine installation.

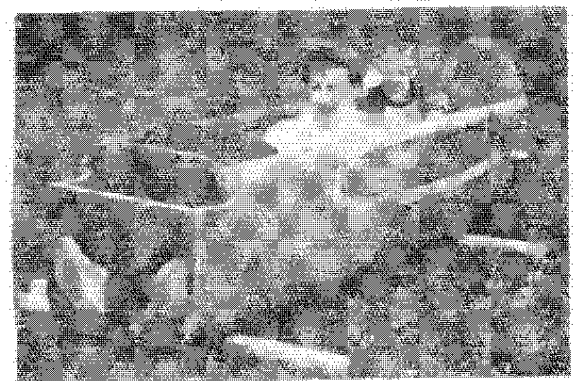
Herb's Solitaire engine/prop seen from the cockpit. This Solitaire should climb like a homesick angel with that reduction drive and huge prop!



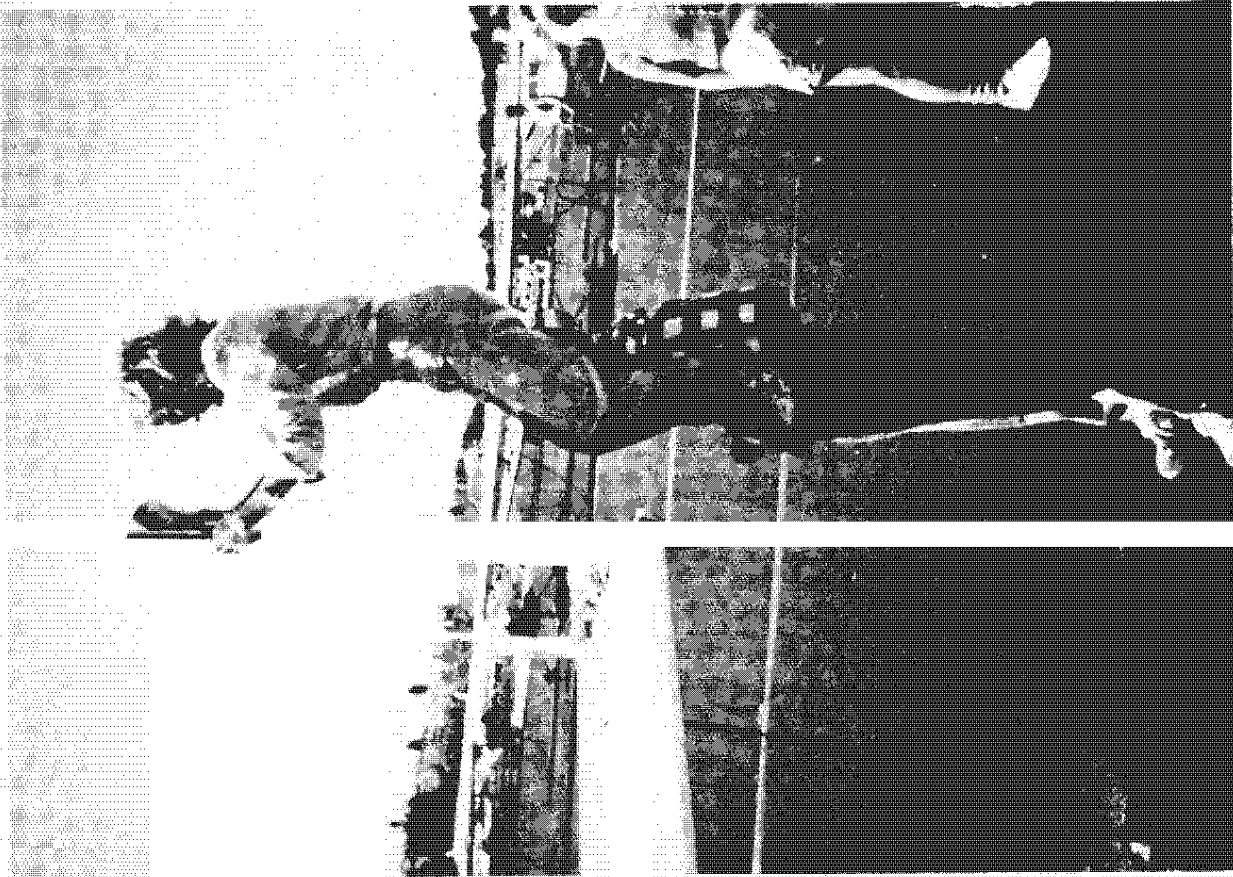
Herb's ultra-sanitary engine installation. Doors close absolutely FLUSH.



Monty Betts' Solitaire fuselage. First one out of RAF-approved supplier, FeatherLite Products owned by Larry Lombard and Michael Dilley. It truly is "feather light".

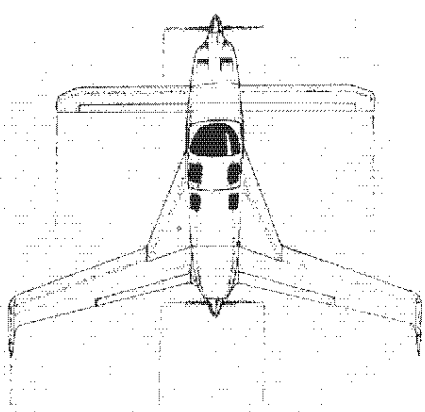


Nelson Millar, Fostoria, MI making the obligatory first flight around his yard.



Seen at the Columbia, CA flyin: Sally cleaning some bird ---- off the top of the winglet of her Long-EZ - So that's how you do it!

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



TO:

first class mail

October '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 53**, then this is your last issue, and you need to renew.

CP 53