

# THE CANARD PUSHER

No. 29

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If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 29. If you are building from 2nd Edition plans you must have newsletters 18 through 29. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 29. If you are building a VariEze from 2nd Edition plans you must have newsletter from 16 through 29. If you are building a Long-EZ you must have newsletters from 24 through 29.

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.

The RAF hangar is located on the west end of the flight line at the Mojave Airport, Mojave, Ca. approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any parts for our comments. We are normally open from 8:00 to 12:00 and 1:00 to 5:00 on Monday through Friday and 9:00 to 4:00 on Saturday. Closed Sunday.

If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to flyins. When arriving at Mojave by car turn east at the Carl's Jr. restaurant to find the airport.

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 is very pleased to announce the addition of Larry Lombard. Larry joined us in May 1981. Larry built and currently flies his own VariEze N15LL (see photo) and has been involved in the building of several VariEzes in the Sacramento area. Larry will be heavily involved with the self launching sailplane development and building, as announced in CP 28.

RAF Activity lately has involved aerodynamic development of our self-launch sailplane design, research on composite component assembly methods and structural arrangements, design support for a new twin-jet research aircraft being built for a major aerospace company, builder support, and the Cafe 250 participation.

CAFE 250 - The first Competition in Aircraft Fuel Efficiency race was held last month in Santa Rosa, Ca. It was well attended, with 27 commercial and 20 experimental aircraft. This is the most extensive fuel efficiency competition ever run for general aviation aircraft. It is not an all-out miles-per-gallon race.

but one whose best result is obtained at about 65% power. The fuel efficiency factor is calculated as follows:

$$FEF = \text{speed} \times \text{mpg} \times \sqrt{\text{payload}}$$

where speed is in mph, mpg is statute miles per US gallon and payload can be up to 200 lb per seat, but not to go over gross weight.

While a VariEze can attain an FEF of 140,000 + in level flight at altitude, it's scores were under 100,000 on the race course when faced with winds, required climbs and descents, time in the pattern and fuel to taxi.

The competition is very interesting technically and a lot of fun to fly. The official placings are listed below. It should be noted that the placings for the small efficient aircraft may be in error due to the inability to accurately determine the small amount of fuel used by weighing the entire aircraft.

For example, aircraft weighing inaccuracies of only 2.4 lb per weighing (0.8 lb per scale) would have swapped the first place and third place aircraft's positions. Variations within the weighing scale resolution (0.5 lb) would drastically change the FEF of a Quickie. The Long-EZ that placed 17th appeared to place 5th if fuel used was based on sight gage and totalizer readings. Race officials are planning to minimize these variations next year with methods to more accurately measure fuel burned.

Place Aircraft	Place Aircraft
1 Q2	25 Cessna T210
2 Quickie	26 Cherokee 180
3 VariEze	27 Grum Tiger
4 Quickie	28 Formula 1 Racer
5 VariEze	29 Rockwell 112
6 Glassair	30 Twin Comanche
7 VariEze	31 Cessna 182
8 VariEze	32 Cessna 172
9 VariEze	33 Piper Pacer
10 Modif Bonanza	34 Aztec
11 Modif Mustang	35 Cherokee
12 Quickie	36 Cessna 175
13 Long-EZ	37 Cessna T206
14 Mooney(disQual)	38 Cessna 172
15 Mooney 201	39 Wing Derringer
16 Powell Special	40 Cessna Airmast.
17 Long-EZ	41 Cessna 175
18 RV-4	42 Cessna 172
19 Mooney 201	43 Piper PA-11
20 LinnMing Must	44 Cessna 310
21 Defiant	45 Bellanca 14-13
22 Comanche	46 Cherokee
23 Bushby Must II	47 Bellanca 14-13
24 KR-1(dis-qual)	

Note that the top 9 winners were fiberglass aircraft, and the top 5 did not have a horizontal tail! The Q2 won the experimental trophy. The modified Bonanza that won the commercial trophy had won the Paris - New York - Paris race two weeks before. The Defiant won the best twin trophy, beating also all the commercial singles except the Bonanza and Mooney 201.

Pilots in the race flying RAF aircraft were:  
 Jeana Yeager N26MS (Mike & Sally's Long)  
 Mike Melvill N4EZ (Prototype VariEze)  
 Larry Lombard N15LL (The winning VariEze 3rd overall)  
 Dick Rutan N79RA (Prototype Long-EZ)  
 Burt Rutan N78RA (Defiant - Pat Storch navigator)

Sally Melvill had planned to fly N26MS but was unable to attend.

## WORLD DISTANCE RECORD - Dick Rutan

Another World Class distance record now belongs to the Long-EZ. 4563.35 miles straight line distance in C1B (1000 kg) is the new record subject to ratification by the FAI. That is the great circle distance between Anchorage, Alaska and Grand Turk Island in the British West Indies near Puerto Rico. The flight time was 30:08. The total fuel burn was 142 gallon, that works out to 151.4 average ground speed and 4.71 gph. We used only 1.8 qts. of oil.

We found the logistics of getting the aircraft (N169SH) to Alaska and recovering it back home was quite an undertaking. We departed for Alaska on May 22 and got

back to Mojave on June 13. Most of the time was spent waiting for favorable winds at Anchorage. For a while it looked like we should have started in Puerto Rico and flown to Alaska. But after waiting 14 days the weather god pushed a high pressure ridge out of the Gulf of Alaska that gave us some tail wind over Southern Canada and the Northern mid west U.S.A. But the rest of the route was a no-help cross wind to a light head wind in Alaska and over the Atlantic. The over all wind factor was only +6 knots.

I flew at between 12 - 13 thousand feet and averaged 153 mph true airspeed. The reason that does not compute is because the actual airway distance was 4690 sm and the route time was 29.5 hours. When I got to Grand Turk I was feeling good and had plenty of fuel so just flew around long enough to log over 30 hours! I landed with 6 gallons fuel, enough for another 200 miles but the next over-water leg was 363 miles so Grand Turk was where it had to be.

Luckily for me I had none of the fatigue problems I had on the 33.6 hour closed-course record flight. I was in better physical shape and was well rested before take-off. Also one big factor was all the adrenalin pumped into my system during the night-long weather system I flew through on only a turn and bank gyro after my vacuum pump failed. It did get a little uncomfortable during the last part of the flight because I had on a lot of arctic clothing. It was quite a difference from my 4 a.m. Alaska take-off to the mid-afternoon Caribbean tropical hot-humid weather! Latitude change for the flight was 40 degrees, longitude changed 79 degrees.

We are a little disappointed that we did not make 5000 miles. We were short because we just could not find any more room for fuel inside the aircraft, the lack of good tail winds and the time spent at low altitude punching through the weather. Also, the bigger O-320 engine used more fuel than Burt's O-235 Long-EZ. The weight limit in the class was 2204 lbs. and my gross weight at take-off was only 2033 lbs. I could have handled the 2200 lbs easily. The take off roll was only 2800 ft and at a stabilized climb speed of 140 mph indicated I had an initial climb of 600 fpm.

When I did the closed-course record in the prototype Long, I had used a cable between the main gear axles to prevent excessive gear spread because the prototype had an early, more flexible gear. My Long has the standard main gear like all the homebuilt Longs, and it did not need any additional support. The wheel camber was only slightly outward at my take off weight of 2033 lbs.

All in all we are happy with what we got. Next is the world altitude record and some of the Long-distance speed records. Most are within EZ reach of the Long. I would like to see more homebuilders involved in breaking some of the records. It is not that complicated and the challenge is a lot of fun.

#### LBF RACE - Oshkosh 81.

RAF plans to offer prizes to the first two VariEze/Long-EZ finishers in the Baker competition. (fuel corrected speed).

#### HOSPITALITY CLUB FLYIN

Taos, New Mexico. Chuck and Joan Richey have organized this flyin and at press time they have 22 VariEzes and Long-Ezs and 39 people signed up! Looks like this should be another super flyin. Rafting trips on the Rio Grande are also available. Builders and flyers are coming from as far away as Minnesota, Ca. Utah and Texas

#### COLOR OF COMPOSITE AIRCRAFT

In spite of a number of composite airplanes showing up around the country with various color schemes, RAF does not approve any color but white. Trim colors must be limited to the vertical surfaces. Do not paint a dark stripe on the top of the wing. Since the introduction of the European glass sailplanes in 1961/62, there have been no cases of the composite sailplanes having any damage from heat, and all of them are white. They cannot be certificated if painted any other color.

There can be no doubt that a dark color will reduce the useful life of your airplane in the long-term, and could lead to even more serious consequences should the structure get too hot. White guarantees that your airplane will never go above about 10 degrees ambient air temperature.

The colors, even the lighter and metallic ones can get hot enough in desert ambient conditions to seriously weaken the epoxy matrix and degrade the foam core. Measurements taken at Mojave of several airplanes and trim stripes have shown the following results using a surface pyrometer.

Ambient	105 F
White (different shades)	110 F to 116 F
Light Yellow	128 F
Grey	135 F
Light Blue	130 F
Dark Blue	168 F
Dark Red	165 F
Dark Green	175 F

#### FULL-CORE COMPOSITE SANDWICH WINGS

RAF pioneered the structural method of using the hot-wire styro block to form full-depth foam core wings in 1974. We have built over 60 light-hardware flying surfaces using this method in the development of the S.P. VariViggen, VariEze, Quickie, Defiant, Long-EZ, AD-1 and other aircraft.

The method has since been used on other types, including an STC'ed vertical fin for the older Mooneys. It is estimated that approximately 500 full-core aircraft are now flying, logging over 100,000 flying hours.

The major advantages of full-core are the ease of moldless construction, the accurate contour maintenance under airloads, and elimination of moisture traps. Critics have claimed that full-core is heavier than the hollow wing with standard skins. Our analysis has shown the weights to be very close. However, we have built and tested wings designed to the same criteria (hollow vs full core) and have found the hollow wings to be heavier. In addition, the hollow structural configuration is more susceptible to workmanship errors that can result in structural failure. This is due to the presence of peel loads and blind rib closeouts. In addition, the hollow structure flexes, has more points of concentrated stress and is more prone to catastrophic failure should a joint open up (leading or trailing edge).

A builder who had built a VariEze, Quickie, Long-EZ and Adventure is now building a homebuilt with molded wing skins. He reports that despite the large molded parts, the man hours in the wing are at least 50% more than for both full-core Long-EZ wings. This is due to the many ribs, jigs, control system parts etc.

#### RETRACTION!

Regretfully we received incorrect information on Max Bradley's Long-EZ as reported in CP28 Page 6. This aircraft has not flown and is currently only about 80% complete.

The fifth Long-EZ to fly belongs to Richard Sparkman of Naples, Florida. Richard has 8 hours on it at press time and is currently working out an over rich carburetor. Richard is planning on being at Oshkosh. His airplane is full IFR equipped. Congratulations Richard !!

RAF Patch Competition!! At long last we have a winner. Congratulations to Chet Rhamstine of Mt. Clemens, Michigan. We are not printing a copy of the patch that Chet designed as we feel that once it is sewn it will look a lot better than just a copy. We hope to have the patches available for Oshkosh.

#### Warning - Loss of Prop!

Dick recently had an experience with his Long-EZ that would raise the hair of the most experienced pilot. He lost the entire prop and spinner while cruising at 10,000 ft over a solid cloud deck. After watching the prop cascade away he received radar vectors from center to allow a successful approach to an airport, under weather conditions of 1/4 mile visibility in fog. Investigation revealed that the all-important bolt tension (required to transmit torque through faceplate friction) had been lost when the prop dried out in desert conditions after exposure to the humid-wet Caribbean climate at his world-record arrival location. Note the added caution in the plans-change section of the newsletter. Also, do not, do not exceed the recommended interval on prop bolt torque check. (Owners Manual, Appendix III).

## ACCIDENTS.

Power Loss - A south eastern VariEze crashed into trees after power loss on its first flight. The power plant was a conversion of a Chevy Corvair automobile engine. The aircraft was destroyed. The pilot was not injured.

Known Icing conditions/fuel management - A midwest VariEze pilot began an extensive trip in IFR and icing conditions. His flight was a classic condition of many things going wrong - in combination. He reluctantly accepted an altitude assignment in known icing conditions, only 1000 ft above the MEA. The pilot became quite busy as ice was building, switching the single Nav to identify intersections then noting an impending failure of the gyro horizon - nose high at normal airspeed. Also, he reported a Nav problem and center lost radar track of him. They were talking to him but did not know his position. At 40 minutes from takeoff the engine abruptly quit cold. He descended through the clouds breaking out at about 500 ft AGL and put it in a freshly plowed field approximately 30 miles off course, carrying a large amount of airframe ice. The pilot received a fractured vertebra. The aircraft's wing, belly, landing gear and canopy received major damage. Investigators found the fuselage tank empty, speculating that the pilot had departed on the fuselage tank and the engine failed due to fuel exhaustion. Probably the pitot-tube had iced up resulting in his thinking the speed was ok and the gyro horizon was failing. His airspeed was thus too low to allow a restart even when main fuel was selected during the power-off descent through the clouds (windmilling not maintained).

Many builders, including this one, have modified the positioning of the fuel valve on the VariEze, defeating its feature of reminding the pilot (by interference with his right wrist) that the fuselage tank was selected. There have now been two accidents caused by a combination of incorrect fuel management and defeating the interference design feature of the valve handle.

## ACCIDENT ANALYSIS

As you know from reading the Canard Pusher, we report a synopsis of each accident and make recommendations to builders/operators on any item we feel should be changed or emphasized to decrease the probability of reoccurrence. We have reviewed the data available and have found one factor that is significant. A high percentage of the accidents (minor and serious) have occurred within the first few flights after a new owner has bought the airplane from a previous owner. Statistically, you are far more likely to have an accident flying a homebuilt built by someone else. This is true for experimentals, not just for VariEzes. For example, an all-metal type that recently was grounded for a series of structural failures - all the failures occurred after non-builders had bought the airplanes.

The factor may be a combination of inadequate familiarity with the airframe and systems, inadequate checkout and inadequate transmittal of documentation. Putting things in perspective, it is important to note that the builder is an aircraft manufacturer. As such, he may be responsible to a buyer for the quality of the machine and for properly educating the buyer in its safe use and the extent of his flight test program. We at RAF provide builder support to our customers - those who may need assistance or have questions on how to interpret the plans to build or how to interpret the Owners Manual to fly the completed aircraft. But, if you sell your airplane to another person you cannot expect that we can support him. He must go to you, the aircraft manufacturer. For example, if he needs to do a fiberglass repair, but does not have the plans and educational material he will not know how to do the job. He needs to get that information and documentation from the manufacturer.

Homebuilt accident record statistics were reported for a three year time period by The Aviation Consumer last year. They show an overall accident rate for VariEze of 2.59 (1.55 fatal) per 100 aircraft during the 3 years. Average for all homebuilt aircraft was 3.93 (1.07 fatal). We are not happy with this result, as we had expected the VariEze to be significantly better than the average homebuilt due to its strong structure and good stall characteristics. Structurally the fiberglass VariEze has a perfect record - no inflight airframe failures in 100,000 flight hours. Also, there have been no fires either in operation or due to accident impact.

Data published by one source show that flying amateur-built aircraft is statistically a very risky sport, with an accident rate (per individual) higher than that for racing cars.

## LONG-EZ FUEL SYSTEM

Do not change the fuel system. This system was carefully and thoroughly flight tested at all attitudes, and works very well as per plans. Several builders have asked if they could convert the fuel system to a "both on" situation. Absolutely not! Both fuel tanks feeding the carb together will only work on a gravity system. The Long-EZ does not have enough fuel "head" to use a gravity system. Therefore we use a pumped system. That is, the primary pump is a mechanical, engine driven pump, backed up by an electrical boost pump. This is similar to most low wing airplanes, Grumman Tigers, Cherokees etc.

If you try to pump fuel out of two tanks at the same time, it can draw from one tank only, until it is dry then you will get air, and in spite of having one tank almost full of gas, you will flame out and have to land because of fuel starvation.

Be very careful of fuel systems, they must be absolutely fool proof in order to work reliably and consistently.

## NACA FLUSH INLET

We are getting a lot of inquiries about this and frankly we really cannot make your decision as to whether or not you should install it on your VariEze or Long-EZ. Here are the facts. This is all we can tell you. Please do not ask us to help make your decision.

- 1) You have to build the bottom of your fuselage per plans whether you use the NACA inlet or not, since this is required structure to tie the two bottom longerons together. The NACA inlet is an aerodynamic cosmetic add-on, and provides no structural tie between the fuselage sides. The NACA inlet is homebuilder-carved (no prefab parts are available) and spliced in to the standard cowl. You will not need the 'CI' cowl inlet part.
- 2) The NACA inlet works well for cooling and is lower drag than the ram scoop, adding about 3 knots more airspeed. Since the fuselage sides are lower in the area of the main gear you get a better aerodynamic juncture between the main gear and the fuselage.
- 3) The sex change operation (going from the 'male' ram scoop to the 'female' NACA inlet) will add about 4 to 6 lb weight.
- 4) You may elect to install the flush inlet for aesthetic reasons only. We like the side profile view of the female EZ very much, and almost everyone who has seen it agrees.
- 5) RAF did not develop this installation, and therefore we cannot support you in building it. Tim Gehres and Steve Wood did all the work on it, they sell the plans, and they will support you if you have any builder questions. Contact Tim or Steve at:  
Wood and Gehres Inc.  
105 Appleblossom Ct.,  
Orlando, FL 32807

Plans cost \$20 and are very easy to follow.

## SAFE-T-POXY WORKING TEMPERATURE.

Builder feed-back has indicated some difficulty using the Safe-T-Poxy in cold climates. Typical situations are where most EZs are built in garages that are difficult to heat in the winter. Problems are where the builder will heat up the room/garage (air only) and go directly to work but the epoxy, glass, parts, tools etc are still cold-soaked. In use, cold epoxy wets slowly and greatly extends the time to wet the cloth properly.

The Safe-T-Poxy has a higher viscosity than the previous resins, thus requiring a higher working temperature to use, especially on the larger layups. The high viscosity was selected for the Safe-T-Poxy to eliminate the tendency of the previous material to bleed-out (inducing air in the layup during cure).

If you are building in a cold garage in the winter you can still use the new Safe-T-Poxy if you take the

following precautions:

- 1) Warm the resin and hardner evenly to 85-90 degrees F prior to mixing. Don't try to hurry this. We use a light bulb under the ratio pump 3-4 hours prior to use, or keep your resin jugs in a cabinet with a light bulb inside.
- 2) Its important to have everything thoroughly warm prior to starting to work. This also cannot be rushed. It takes time to get the parts (wings, foam blocks, etc) up to a stable temperature throughout. If you are starting from a very cold garage the warming process could take 4 hours or more. Don't think just because the air is warm that all the material is warm.
- 3) Use an electric hair dryer to warm the area as you work, being careful not to over-heat the part or epoxy. When, due to cool temperatures, a part is slow to wet out, a few quick passes with a hair dryer will greatly speed the layup time. Do not use a hair dryer to heat a cup of epoxy. This can give local hot spots and ruin pot life.

What shop temperature is satisfactory? That has a lot to do with the size of the job. Small jobs can be worked to as low as 65 degrees F but the working time will be excessive. It will also be more difficult to remove excess epoxy, resulting in a heavier part. On large lay-ups like the fuselage, wings, etc., where there is a lot of epoxy to drag around, 77 degrees F should be considered the minimum. That's epoxy prewarmed to 85-90 F and all parts, glass, foam, tools, table - - everything up to 77 F for 4 hours then go to work. Those temperatures are minimums- add 5 to 10 F and your working time will be greatly reduced and parts built lighter. Optimum working temperature range for the Saf-T-Poxy is 77 - 95 F.

#### PLEXIGLASS HINTS FOR PERFECT CANOPIES.

1. Cutting - An abrasive disc powered by a high speed drill, a Dremel tool, or a hand held circular saw is recommended. We have found that abrasive cut-off wheels of aluminum oxide or silicon carbide provide excellent cutting results. A six inch disc is available at most hardware stores for around \$3.50. A small grinding disc or Dremel saw disc will also give good results. ~~Reciprocating saws like saber saws are not recommended and will probably break your canopy. A tool that progresses slow and hot on the canopy to grind through the canopy is best. Tape a poly plastic cover on the canopy and mark your outline with masking tape. Never cut a cold canopy. Allow the canopy to warm to 70 or more for at least an hour. Don't allow the canopy to vibrate or chatter during the cutting or it may chip and crack. Support your canopy on a flat surface so it will not twist or spread during the trimming. Duct tape is handy to hold things in place. Remember: cut slowly, don't push the cutter. Let the tool do the work. Be sure to use eye protection. Plexiglass chips can be a problem in your eyes since they are clear and difficult to see.~~

2. Drilling: The drill should be ground off to a zero rake angle to prevent digging in, chipping and cracking the Plexiglass. A standard drill bit, ground with no cutting edge pitch, is a safe method of making holes. Be sure to make the holes oversize to allow for motion caused by thermal expansion and contraction. The drill bit should not be allowed to chatter or it will chip and break the Plexiglass. Don't push the drill. Let it cut at its own rate.

3. Cleaning: A damp soft cloth or an air blast will clean the saw dust away. The damp cloth will also dissipate static electricity. To clean dirty plexiglass use plenty of water and a non abrasive soap or detergent. Dry with a clean chamois or soft cotton. Never use acetone, benzene, carbon tetrachloride, Tlghter fluid, lacquer thinners, leaded gasoline, window sprays or scouring compounds. Grease or oil may be removed with kerosene, white gasoline, naphtha or isopropyl alcohol. Small scratches can be buffed out with "Mirror Glaze" HG-17 and a lot of rubbing. Hard automobile paste wax should be applied as a protective coating and buffed with a soft cotton flannel cloth. Do not use cheesecloth, muslin or shop cloths, they scratch. For deep scratch removal, procure a hand polishing kit from a Plexiglass dealer or your canopy supplier.

#### NEW EZ FIRST FLIGHTS.

We have not reported VariEze first flight names since CP #23. The following list is those who, based on our information, have made an EZ first flight since 12-79. If you know of someone who should be on this list please send us the name, address, N-number and date of first flight.

Vic Mondary	N500EZ	In
Richard Clark	N89EZ	Ca
Alex Dimuro	N22803	Hi
Tharon Judd	N77TJ	Tx
John Benjamin	N40EZ	Pa
Bob Erdmann	N245EX	Ca
George Saxon	N11SK	MS
Jimmie Clark	N11SQ	Tx
Jack Mitchell	N55VE	Al
Roman Wasilewski	N24RW	Ca
Al Coha	N2CR	Ca
Buzz Weatherly	N37517	Mi
Alan McPherson	N45790	Ca
Jud Bock	N681JB	Ne
Dennis Beavers	N?	Al
Brad Cantrell	N13NM	Ca
Jack Graehl	N80JG	Ca
Ray Miller	N10ZM	Ca
Marshall Randall	N2CR	Ca
Ron Sukel	N7BAR	Ca
Don Elkins	N106	La
Norm Spitzer	N77NS	Ca
Errol Lima	N?	Az
Elvin Kime	N80EK	Mo
Paul Bergholtz	N80PB	Mi
Gerry Mason	N27GM	Mi
Ivan Harneck	N10ILE	Md
Tom McGovern	N43TM	Ia
Bob Gentry	N248G	Or
Bob Yaple	N1050G	Ca
Hank Ashmore	N34HA	Tn
Martin Pavlovich	N810TC	Wi
Rex Sylvester	N24EZ	Ut
Lewis Porter	N32LP	Tx
Joe Moore	N80681	Ca
Robert Ridihaigh	N25RR	Ia
Vernon Lovelace	N37LL	Il
Chuck Ray	N45CR	Ca
<del>Wes Gardner</del>	<del>N13MM</del>	<del>Ca</del>
Fred Wimberly	N99FW	Va
Jim Giesen	N857EZ	Mn
Lynn Coltharp	N40CL	Ok
Roger Lonsway	N15RL	Fl
David Turansky	N16DT	Ny
Robert Harris	N8021B	In
Gary Hornbeck	N76PG	Mo
Lee Carlstrom	N56LC	La
Patrick Wehling	N80PW	Md
Andre Briquet	FPYHR	France
Norman Dovey	N16ND	Fl
Seig Halhfpap	N8477T	Il
Don Prestin	N39DP	Ca
Bill Nipkau	N78BN	Ca
James Frizzle	C6LJZ	Canada
David Hesterlee	N86DH	Ga
D. Sablayrolles	FPYHU	France
Michael Myal	N797MM	Mi
Chuck Weitzel	N88EZ	Mi
Elvin Kier	N5ZY	Il
Wayne Johnson	N725EZ	Ca
Marc Brewer	N47EZ	In
Earl Wilson	N999EB	Ca
Robert Boyd	N98RB	Id
Roger Pearman	VHEZO	Australia
Harry Benson	N78VE	Id
Ray Lancaster	N44GG	Tx
Merle Musson	N76LM	Mo
R. Crandall	N35PC	Ms
Earle Thompson	N55EF	Al
Les Smith	N1055K	Co
N. Rossignol	N23NR	Ct
Lyle Flogerzi	N18MF	Ca
Richard Freeman	N151VE	Ca
Earl Haquewood	N24EH	Ca
Donald Shaw	N42DS	Ca
Harlan Boyer	N95EZ	Pa
Jack Sargent	N75EZ	Fl
Joe Walker	N419JW	Fl
Larry Smith	N555LS	Co
Raymond Bazin	FPYHS	France
Mike Guthrie	N249MG	Co
Steve Briggs	N15EZ	Ma
Curt Poulton	N79CP	Oh
Gene Horton	N117IE	Tx
Robert Schubiqr	HBV8L	Switzerland
Richard Harkness	N80VE	Sv

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## PREFAB FUSELAGE SHELLS FOR LONG-EZ?

When the second VariEze prototype (NAEZ) was built, we considered prefab fuselage skins. These would be 2-piece shells fabricated by vacuum-bagging a glass-foam-glass sandwich into a female mold. An analysis of cost and construction savings showed that the time saved was minor, particularly considering the extra work involved fitting the bulkheads and systems to the rounded interior.

Fuselage shells bagged into molds should have a potential of a weight savings and a savings in exterior finishing work. However, based on our components and the results of the prototypes which have been built both moldless and molded, the weights of completed moldless structures are generally less than the molded ones. The molded-shell method is a good one for the bulky fuselages of side-by-side airplanes, where extensive compound curves are required. However, they are not cost/time effective for the Long-EZ. Their production cost is high due mainly to tooling amortization, reject rate and packing requirements.

To say that pre-molded fuselage shells would significantly reduce building time is not true. Effect on total building time is less than 3%.

### Long-EZ Fuselage Shells.

#### Time Savings - Man Hours.

Chapter 4	-5 mh	round bulkheads
Chapter 5	+15 mh	Fab and glass sides
Chapter 6	-8 mh	Exterior jig required
Chapter 6	+10 mh	Carve and glass bottom
Chapter 7	+13 mh	Carve and glass outside.
Total	25 mh saved	- 2.5%

Fuselage shell cost, including packing and shipping \$500 - more than materials for moldless construction. Results = \$20/man hour.

### SHOPPING

Aircraft Spruce has come up with a really nice placard sheet. It is black vinyl with white printing on it, and a sticky back. It has just about everything you will ever need to label your instrument panel. They have printed each item four times so if you ruin any you have some spares. You can cut them out of the sheet with scissors, peel off the back and stick the label in the appropriate position on your panel. There is even a complete checklist and a passenger warning sticker.

Lycoming O-235 1600 SMOH, 800 STOH in storage new crankshaft and cam at major overhaul.  
Call Bill Clark,  
(301)889-5092  
(301)256-5671 (after 6pm EDT)

Lycoming O-235-C1 05MOH, new crank, new cam, new bearings, chrome cylinders, fuel pump. Zero time, slick mags. Modified for 100 Oct. \$4000 + shipping.  
Call Charlie Gray,  
(305)822-5040

Continental C-85-8 Fresh overhaul, 6 hours run in time. New Slick mags and harness.  
Contact Joe Moore,  
11320 Hubbard Rd,  
Grass Valley, Ca 95945  
(916)265-4952

Lycoming O-235-L2C factory remanufactured engines specifically set up for a Long-EZ. They include fuel pump, MA3PA carb with accelerator pump, oil screen and slick mags. Also has new Lycoming engines to your specification.  
Contact Norm Bender,  
2804 Meadow Lane,  
P.O.Box 30343  
Memphis, TN 38130  
(901)365-6611

Six Continental O-200-A engines for sale.  
Contact Rudolph Spremich,  
520 Turquoise Street,  
New Orleans, La 70124

Dick Waters of Florida can supply Lycoming engines to suit your requirements, and is also working on an accessory case to accommodate a mechanical fuel pump. This will be very useful for builders who have engines without fuel pumps.

Contact Dick Waters,  
1325 W. Washington St. Bldg B-8,  
Orlando, FL 32805  
(305)422-0188

An Original VariEze main gear strut for sale. \$195 and also several other VariEze parts.

Contact Wm. C. Morgan,  
6295 White Mill Rd, Rt #3,  
Fairburn, Ga 30213

### Shopping at RAF.

The follows items are available from RAF.  
Tie Tacs and Charms - Silver and Gold - \$6.50  
These come both VariEze and Long-EZ

Belt Buckles, VariEze and Long-EZ, VariViqgen These come large for guys and little for gals. Shiny or brushed finish. \$20 each.

Three ship poster of the Defiant, VariEze & VariViqgen \$2.75 each or \$5 for two + \$1 postage.

We try to keep in stock a selection of the Canopies which are for pick up at RAF only. If you give us approximately 2 weeks we usually can get the color you need.

Clear canopy	\$199
Green canopy	\$229
Smoke or Bronze	\$249

### Main Gear \$309 and Nose Struts \$55.55

We still have a lead time of 7 to 8 weeks. Because of trying to get the gear shipped as soon as possible, please send your payment with your order. We will hold your check until your gear is shipped. If you are going to pick the gear up here at RAF please do so within 2 weeks as we have a storage problem and if you do not need your gear we will juggle your name back down the line. We have so many people needing their gear that we do not feel that we can hold the gear for an indefinite period of time.

### Video tape - Building the Rutan Composite.

This tape runs for 96 minutes and covers every phase of construction. The tape comes in either VHS or BETA \$49.95 plus \$4 for postage.

### Resin/Hardner Storage.

Several builders have reported that their resin or hardner or both have settled out or crystallized. Do not use your resin or hardner while it is in this condition. This problem is caused by temperature cycling. Never keep your resin or hardner in a cold place or on a cold cement floor. It should be stored up on a shelf at room temperature. If you see your resin or hardner start to crystallize and settle out, it is important that it be returned to it's normal clear state as soon as possible, even if you don't plan on using it right away.

To return crystallized or separated resin or hardner to it's normal state, place the jugs (caps on tight!) in hot water (160 F to 190 F) until the crystallized material goes back into solution. Be patient, and occasionally agitate the jugs. The longer you leave the jugs in hot water, the less likely this is to occur again. Depending on how badly the material has crystallized the process could take 30 minutes to 3 hours.

If after 5 hours at 160 F - 190 F your resin or hardner has not become clear, return it to your distributor. Once it is clear and provided you store it at room temperature, it should remain clear, and the structural qualities of the epoxy will not be impaired.

**Questions:** I have built part of my aircraft using Saf-T-Poxy without checking my ratio pump. I now find that the pump is for the older epoxy with 20:100 ratio. What now?

**Answer:** You must discard all parts built with the wrong ratio. Epoxies should be mixed as accurately as possible. Errors as much as 10% can be accented but definitely no higher. Structural integrity, particularly long-term will be unsatisfactory with the enormous error in ratio you have been using. Note that it is a good idea to occasionally check the delivered ratio of your pump. Check that the valves are clean. You can modify the ratio of these pumps by drilling a new pivot hole for the handle. If the pivot is moved to the left the ratio of hardener to resin is increased. The 20:100 pump will deliver 43:100 if the pivot is remote, about 30 inches to the left of the pump. If you use a remote pivot be sure to clamp the pump base securely to the workbench and provide a stop to prevent piston over travel. (see CP # ).

**STICKING FUEL VALVE.**

Some VariEze fliers continue to have problems with their fuel valves sticking. In CP 17 we reported that tight valves must be overhauled before flight. The brass valves can be fixed by dismantling, cleaning and installing a lighter spring (or cutting some off the existing spring). If this is not completely successful the valve must be replaced. In CP 18 we switched to a Weatherhead #6749 valve with a Delrin spool. This appeared to solve the problem. However, a few people still had valves that were hard to turn. Recently a VariEze had a forced landing due to fuel starvation. The airplane was damaged, but fortunately the pilot was not hurt. Examination of the valve revealed that the Delrin spool had broken internally and the valve handle would not turn the spool. This valve had become so tight, on one occasion it required pliers to turn. This VariEze should have been grounded for valve overhaul.

**CAUTION** If your VariEze fuel valve (brass or Delrin) takes more than 5 lbs of force to turn it, (10 lb is ok for Long-EZ) ground your airplane until this is fixed.

The best fix is to shorten the spring by cutting some off and lubricate the valve spool and body with Parker fuel lube. (as reported in CP 25, pg 5). Do not treat this situation lightly, you could destroy your aircraft for lack of fuel and yet have plenty of fuel on board.

**CAUTION**

There is some bad information circulating around about painting styrofoam with Latex house paint before glassing. This is totally false, and should not be done under any circumstances. The foam is there not only to give the correct shape to a part, but to provide buckling support to the stressed skin structure. In order for this support to be adequate, the glass skins must be bonded very strongly to the foam core. If you have a coat of house paint between the glass skin and foam core, this bond cannot be any stronger than the coat of paint. This is a serious structural problem and could very easily lead to a structural failure. If you have built any parts using this method, consider these parts unairworthy, and discard them.

Rebuild them using the correct method, as described in the plans.

**CAUTION!**

We are getting an alarming number of calls from builders asking questions that have been clearly answered in a previous newsletter. The information contained in the CP is more important than the plans, since it is more current.

When you receive your CP, read it very carefully, and read all of it, not just the plans changes. Jot down comments, builder hints, etc. on the appropriate plans pages, and of course all plans changes must be written into your plans.

Remember, the only way that we at RAF can get updated information, plans changes, or mandatory safety changes, to each builder, is through the Canard Pusher newsletter.

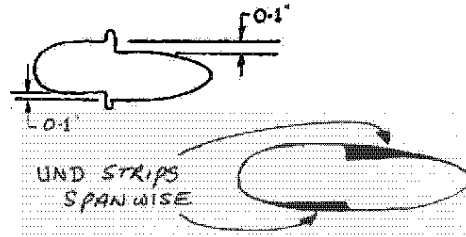
**NEW TIRE TESTED.**

We recently tested a neat 6 ply tire for both VariEze and Long-EZ which is a little larger than the 3.40 x 5 Goodyear tire, but looks just exactly like a miniature 500 x 5 aircraft tire. It has a smooth rib pattern and is rated to 70 lb/in. We have a pair on N79RA, together with a pair of the current small wheel pants, and we like the tire, and recommend it for all VariEzes and for those builders of Long-Ezs who do not want to use the larger 500 x 5 tires.

This new tire should be available through Aircraft Spruce and Wicks Aircraft. It is an 11" x 400 x 5 6 ply ribbed tire. Be certain to use only the 6 ply rated tire.

**Mismatch on the Main Gear.**

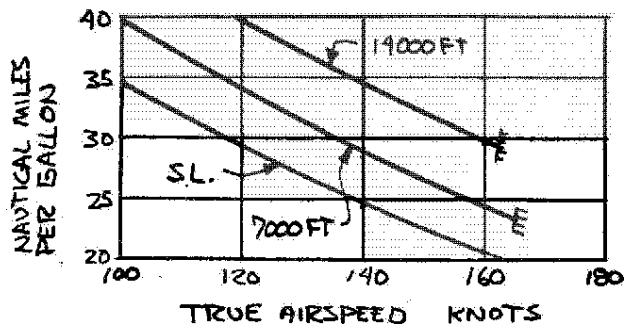
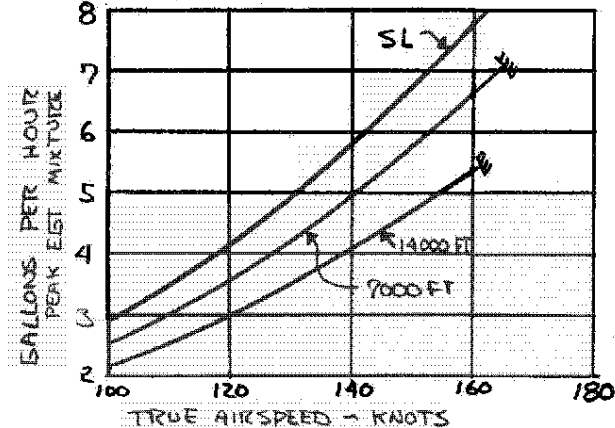
Due to a mold shift, a few Long-EZ main gear struts have been shipped with a slight mismatch. We inspect every strut and have determined that a mismatch of up to 0.1" is of absolutely no concern structurally. You can sand the surrounding glass down to match, or you can build up the low spot with strips of UND and Safe-T-Poxy. Either method is acceptable. A disc grinder with a 16-grit heavy duty disc is best to remove the flash. Be sure to wear a dust respirator and protect your skin with Ply-9 to prevent itching.



**ADDED CRUISE EFFICIENCY CHART**

The Long-EZ Owners Manual cruise fuel flow chart plots fuel flow vs indicated speed (in knots) with lines of altitude. The chart below may be more handy in flight planning and can be added to your Owners Manual.

LONG EZ 0-235  
B&T 60x67 PROP 120016



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.

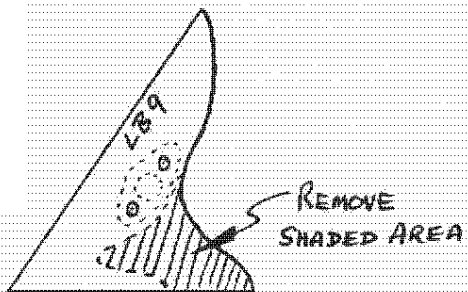
It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight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

<u>Category</u>	<u>Definition</u>
MAN-GRD	Mandatory, ground the aircraft Do not fly until the change has been accomplished.
MAN-XXMR	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.
OBS	Obsoleted by a later change.
MEO	Minor error or omission.

LONG-EZ PLANS CHANGES.

LP # 65  
MAN GRD

There are indications that the back injury noted on accidents (pg 3 ) may have been caused by the center speed brake diagonal bulkhead being forced through the seat back after failure of the landing gear and the airplane's belly impacted the ground. Refer to the sketch and remove the portion of the plywood bulkhead (part #LB9) shown to allow it to collapse without piercing the seat bulkhead. Double check that the speed brake arm (#LB 20 & LB2) does not go over center with speed brake down - recheck the 40-1b closure force.



LPC #66  
MEO

CP 28, Pg 9, LPC #61, the part # 6083 should be #60883

LPC #67  
MEO

Section I Pg 5-3, nuts on the AN6-80A bolt should be AN363-624, not MS21042-6

LPC #68  
MEO

Sect I Pg 4-1. Note at the foot of the page. Remove "NOT" so that it reads, "micro slurry is used on this type R45 foam. We do recommend slurry to be used on all of the various foams in a Long-EZ.

LPC #69  
MEO

Sect IIL, Pag 14. Conical engine mount. The 7/8" O.D. x .049 cross brace tube must be moved down in order to clear the fuel pump. It is shown in the correct position on page 15.

LPC # 70  
MEO

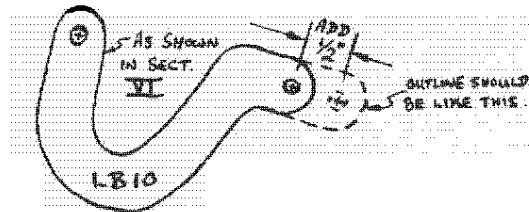
CP 28, Pg 8, under builder hints, UND layups on the fuselage sides should be + 30 not + 45. This is shown correctly in the plans.

LPC #71  
MEO

Sect I Pg 2-1. Add to Ken Brock parts list - 4 spacers A4-84 and 2 nuts J1.25 (Axle spacers and nuts).

LPC #72  
MEO

Sect VI Landing Brake, Pg 2. Part number LB10 should be changed to make the "ear" 1/2" longer to avoid interference with LB3. If you bought this LB10 part from Ken Brock, this change has already been accomplished.



LPC #73  
DES

Owners Manual checklist pag 66. After "canopy-locked" add "visually confirm proper canopy latch engagement and proper safety catch engagement".

LPC #74  
DES

Owners Manual Pg 47, add, CAUTION prop bolts - recheck torque (180 in-lb) before next flight when a transition is made from a wet climate (high humidity) to dry conditions. Wood shrinkage in dry environment can loosen prop bolts and result in flight loss of the entire propeller.

VARIIZE PLANS CHANGES.

See LPC #65 This applies to VariEze as well.

Owners Manual  
Page 38.

Add CAUTION prop bolts - recheck torque (180in-lb) before next flight when a transition is made from wet climate (high humidity) to dry conditions. Wood shrinkage in dry environment can loosen prop bolts and result in inflight loss of the entire propeller.

Owners Manual  
Checklist  
Page 55

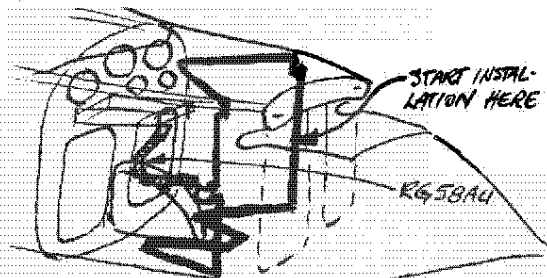
After "canopy locked" add "visually confirm proper canopy latch engagement and proper safety catch engagement".

COMM ANTENNAS - VARIEZE.

The Comm antennas that mount on the landing gear can break after some time in service. This is because most builders apply the copper foil to the underside of the strut. The strut flexes and bends under taxi and landing loads and will eventually fatigue the copper foil. This can be prevented by attaching the copper foil to the leading edge of the strut.

Larry Lombard installed an excellent loop-type comm antenna in his VariEze. It is made from 1/4" wide copper tape. It is a full loop antenna, and has no ground plane. This copper foil should be installed per the sketch below, and ideally you should start

out with it about 102" long, and, using a SWR meter, optimize it by trimming it off in small increments. Larry's is approximately 99" long, but this may vary slightly from airplane to airplane and radio type. It is important to orient the copper foil as vertical as possible on each side, then let it form a "Y" under the top cover and a "W" on the floor such that it clears the nose wheel well. A short piece of RG58-AU should extend from your radio to the fuselage side at approximately the mid point vertically. Solder one end of the copper foil to the center conductor of the RG58AU and the other end of the copper foil will solder to the shield of the RG58AU (after checking the length). Put one ply of light weight fiberglass or BID over the foil to protect it from damage, and you will have an excellent drag-free comm antenna.



#### LONG-EZ BUILDER HINTS.

Several builders have enquired about using the Rolls Royce O-240. We have never tested this but it should be an excellent engine for the Long-EZ. It is certificated for use as a pusher, it comes standard equipped with a mechanical fuel pump and weighs 246 lb. complete with starter and alternator. The only drawback that is immediately obvious is that the induction system comes up over the top of the cylinders which will necessitate a blister on top of the cowl on each side. We should see one or two installed in Long-EZs within the next year or so, and we will publish any data we get in future CPs.

A cheap automotive battery cable terminal cleaner (approximately 85¢) makes an excellent foam carving tool, and works great in small corners.

Small sanding discs made by Merit Abrasive Products, Inc. P.O. Box 5448, Compton, Ca 90224, work very well on a dremel tool. This company sells holders and sanding discs and call them 1 1/2" dia. power lock holder and disc.

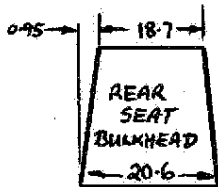
When you Bondo your wing jigs to the floor, be sure to Bondo them so that you can remove the bolts and split the jigs vertically or you will not be able to get the foam cores into the jigs.

If you elect to use Rochester electric gauges, be sure to run a separate ground wire from all the electric gauges to the firewall. This will assure accurate, non-fluctuating indications. Simply hook all the electric gauges ground terminals together and run one 22 ga. wire from the instruments to the firewall or engine.

On the centersection spar caps and wing spar caps, most people will require the extra plies as called out in CP 25 and CP 28. If you are going to need the extra plies, it is best to apply them in order. That is, the longest ply should go on first, and the shortest ply should go on last.

#### CLARIFICATION

Sect. I Pg 4-2. Several builders have had difficulty understanding the sketch of the aft seat bulkhead. This sketch shows a 0.95 taper in the left side. Since this is a symmetrical part, it follows that there is also a 0.95 taper on the right side. This fact is verified by the dimensions shown.



$$20.6 - (18.7 + .95) = .95$$

CP29, Pg 8

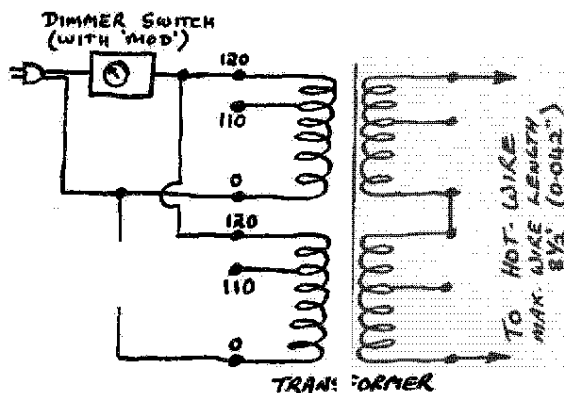
Vince Golden (Long-EZ builder) sent us a really neat homebuilt hot wire alternative to the Variac. Vince built one and sent it to us and we have been using it for a couple of months and find it to be excellent.

#### Parts required:

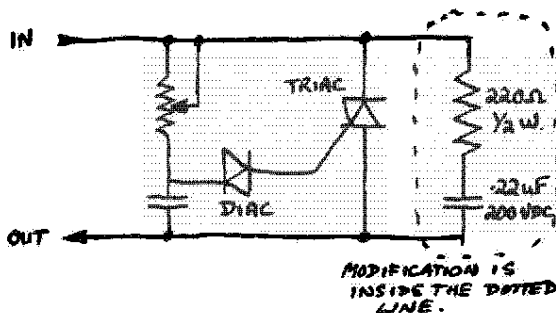
1 Hardware store dimmer switch	\$4.59
(We used an 'ener-g-save' push on/off single pole)	
1 Capacitor .22UF 200 VDC	.35c
1 Resistor 220 OHM 1/2W	.20c
1 Transformer 28 VAC 4 Amp	
Tranex 24-10024	7.50
	<u>\$12.64</u>

You will have to modify the dimmer switch, by installing the capacitor and the resistor inside the dimmer switch box. This will also give you the ability to run a single speed dremel tool as a variable speed.

#### Wiring Diagram



#### Dimmer Modification



Note! By disconnecting the transformer the dimmer can be used to run a dremel or electric drill!

#### BID TAPES

There is still some confusion as to what BID tape is and where and how it is used. BID tape is not a purchased item. You can not buy a roll of BID tape. You cut it from your 38" wide roll of BID glass. BID tape should be cut in 2" or 2 1/2" wide strips at 45° to the selvage edge. In most places where you will use BID tapes (eg. fuselage sides to bulkheads) you need to lap 1" onto the bulkhead and 1" onto the fuselage side. Therefore you need a 2" wide tape. In actual practice it is wiser to cut the tape 2 1/2" wide, because it will stretch and get narrower between the cutting table and the airplane.

If you need a longer BID tape than you can cut off a 38" wide roll, it is ok to join the tape by lapping 1/2".

Since you cannot squeeze the BID tapes very easily you should wet them out with a brush, then peel ply the edges to give a neat smooth finish and also to help dry out the layup. Add a minimum of epoxy to wet out the peel ply, rather use the peel ply to soak excess epoxy out of the BID tape layup. Always peel ply all edges of tapes.



VARIVIGGEN NEWS.

Leonard Dobson of Georgetown, Texas, has his Viggen finished and it is absolutely gorgeous! See photo. "Dobby" reports that he started construction July 1978 and has invested approximately \$16,000 and 5000 man hours! While in the final sanding stages he felt like he was cleaning an elephant with a tooth brush! Anyway Dobby, congratulations on completing your Viggen, sure hope you can get it to Oshkosh.

Ken Winter of Tulsa, Oklahoma, reports that he should be at Oshkosh with his Viggen, which at last report was complete except for final engine control hookup.

Arthur Schwartz has over 65 hours on his Viggen now and reports that he will be at Oshkosh. Arthur is having lots of fun visiting different airports.

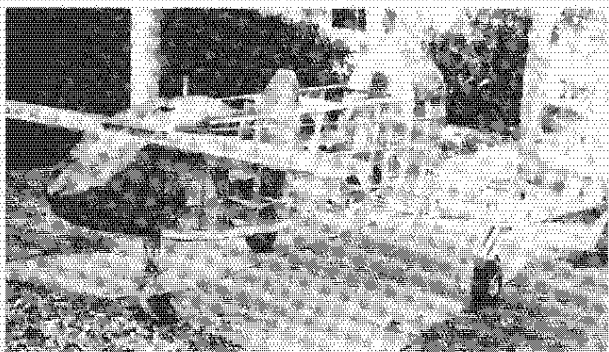
Gene de Ruelle has started working again on his Viggen project after a period of inactivity, and he reports finding a Cessna 150 flap motor and jackscrew, which has worked out real well for his reflex. The unit came complete with wiring and limit switches and a pivot mount that is a perfect fit. Gene got his from San-Val parts in Van Nuys, Ca. and paid \$45 for it. See photo. Gene is building his verticals now, and reports that Jesse Wright's kit is really a big help.

My Viggen N27MS is still running like a dream, the only problem encountered has been a bad magneto coil in one Bendix mag. I am presently overhauling the mag and just generally giving the "old girl" a good inspection in readiness for the annual cross country to Oshkosh. N27MS first flew in September 1977, that makes her almost 4 years old with just over 500 hours.

Hopefully this will be the first year that we have had more than one Viggen at Oshkosh, and we have a possibility of as many as three. Sure would look great to see a flight of 3 Viggens in the pattern!

For Sale: VariViggen project. 1st Edition plans with all updates, Spruce kit, fiberglass parts, wing attach fittings, Cleveland 500 x 5 wheels and brakes, master cylinders and brake pedals. Will trade for Long-EZ plans and parts.

Contact: Ron Lorimer  
1909 Rock Street #6,  
Mt. View, Ca 94040



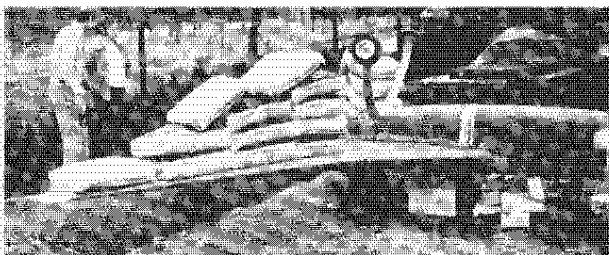
Gene de Ruelle's VariViggen, on the gear. Reflex motor drive mechanism in Gene's Viggen.



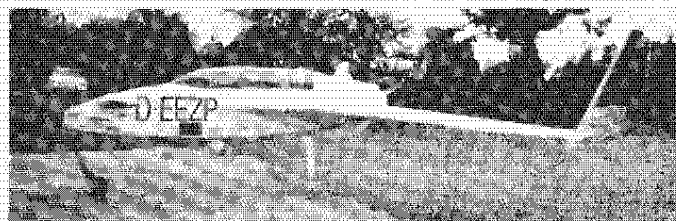
Trisha Palmer joined RAF in December '80. Trisha is the one you guys now talk to on the phone. We are hoping to make a pilot out of her soon!



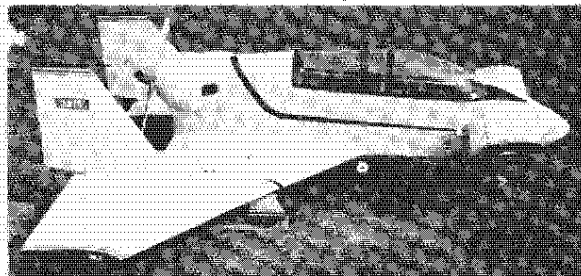
Varieze canard in a specially designed load testing device at the University of Texas, in Arlington. Prof. Jack Fairchild conducted the tests to destruction on two canards.



Hans J. Zuckschwerdt's EZ undergoing a static load test to meet German DOT requirements. Hans' EZ after completion, and now flying.

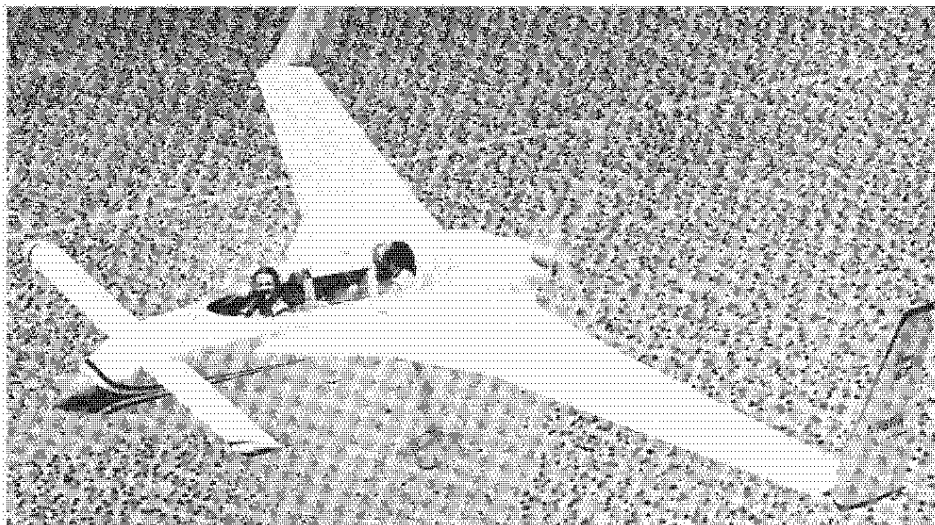


Leonard "Dobby" Dobson's beautiful VariViggen, ready for first flight.



CP 29 A. 9.

# LONG-EZ



FAST - EFFICIENT - HIGH UTILITY - LONG RANGE

## THE AIRPLANE

The Long-EZ is a small, high-performance, high-utility homebuilt sportplane. While recommended mainly for day-VFR operation, competent pilots can also equip it for night and IFR flying. The recommended power plant is any model of the O-235 Lycoming. Note that

a mechanical fuel pump is required. It has an alternator-powered electrical system and can be equipped with electric engine starter. Its cockpit layout is designed to compliment pilot work load, with throttle, mixture, carb heat, pitch trim and landing brake controls on the left console and side-stick controller on the right console. Seating provides correct armrest, lumbar, thigh, and headrest support allowing "recliner-chair" comfort not found in conventional aircraft seats. This allows long, fatigue-free flights. The inboard portion of the large wingstrakes are used as baggage areas, accessible from the front and rear cockpit. These, combined with special suitcases and three other storage areas, provide nearly 10 cubic feet of baggage room.

The airframe structure is a sandwich of high-strength fiberglass facings with a core of rigid closed cell foam. Extensive use is made of the new type R45 PV core foam (poly vinyl). The facings are laid up directly over the shaped core, thus expensive tooling is not required. Flying surfaces are full-core reducing complexity, increasing contour stability, and improving corrosion resistance. As compared to conventional metal and wood, composite sandwich structure offers less construction time, more uniform stresses, improved fatigue life, better environmental resistance, and increased surface durability.

## TRAVELLING MACHINE

At last, an airplane that is specifically developed for efficient, high speed, long range traveling with room for two adults and plenty of baggage. Fuel allowance with two adults is 38 gallons. Single place, you can carry 52 gallons! If you're in a hurry, you can cruise at 75% power at 8000 ft at 185 mph (161 kts) burning 6.51 gallons per hour. This will take two of you from Los Angeles to Seattle or Chicago to Daytona Beach non-stop (965 miles), in 5.2 hours with a 40 minute fuel reserve. If you're not in a hurry, you can cruise "economy" at 12000 feet at 144 mph (124 kts), burning only 3.42 gallons per hour. This will take two of you from New York to Dallas non-stop (1430 miles) in 10 hours with a 40-minute fuel reserve. Single place, using the entire 52 gallons fuel capacity, stretches the maximum range and endurance to over 2000 miles and 16 hours!

The prototype has exceeded these figures on several occasions: longest two place trip, 1840 miles at 175 TAS, with 50 lb. baggage. Maximum level flight speed, 193 mph.

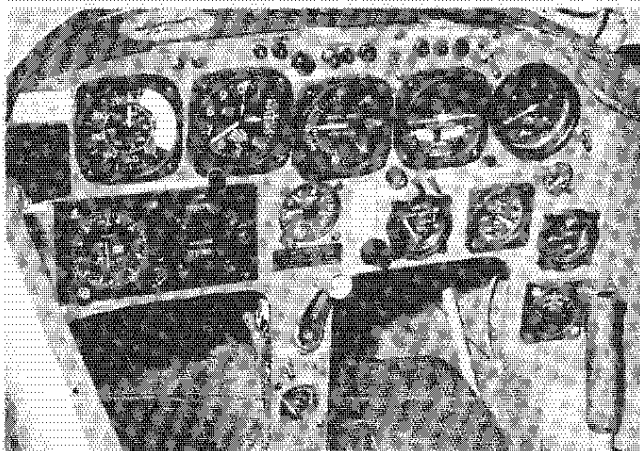
## UNUSUAL EFFICIENCY

The Long-EZ uses the very latest aerodynamic technology, combining winglets, a high aspect-ratio wing with Eppler airfoils optimized for efficient cruise, and a configuration with far less wetted area than conventional airplanes. As a demonstration of its efficiency, our prototype with a large rear-seat fuel tank flew over 4800 miles, setting a world distance record, and landing with enough fuel to surpass 5000 miles. At that, it's capability was not taxed - its initial climb rate was over 600 ft/min! At light weight, it climbed to 27000 ft in still air - an altitude unheard of for a fixed-pitch, non-turbocharged airplane. Out Long-EZ is so efficient, the engine can be shut down while at 5-ft altitude over the numbers at only 120 knots, then it can pull up, fly a 360 degree pattern and land on the same runway - completely without power! It's power-off glide angle is only 3.7 degrees - thus a belly mounted drag devise (landing brake) is used for landings.

## SUPERB FLYING QUALITIES

Development of the Long-EZ included flight testing of many refinements to optimize flying qualities. It is a very solid, stable airplane that has responsive ailerons, good turbulence response, excellent "hands-off" stability and docile stall characteristics. It resists stall or spin even when maneuvered sharply to full aft stick. Flight test show the prototype to be free from stall departures and spins for all type of entries, including tailslides. Climb is excellent, even at the full-aft-stick speed. Trim changes due to power, gear retraction or landing brake are all very small. Its wide cg range allows a large range of pilots or passengers weighing up to 250 lbs.

The Long-EZ's approach and landing speeds are 75 mph (65kts) and 60 mph (52 kts) at normal landing weights. The approach and landing are docile and conventional. Forward visibility is excellent even during a "full stall" touchdown - a considerable improvement over our earlier VariEze.



## THE HOMEBUILDER SUPPORT

The plans are a literal education in using the materials and is a detailed step-by-step guide to construction using an illustrated format not common in aircraft plans. The Rutan newsletter, the "Canard Pusher" published since mid 1974, updates plans, provided building hints etc. Complete owners manual provides all necessary information for initial testing and for normal and emergency operations.

## THE TEST PROGRAM

The test program was probably the most extensive and successful ever conducted on a homebuilt. It included basic flight tests for flying qualities, performance and systems, spin and dive test to FAR part 23 requirements, static load tests and landing gear drop test exceeding part 23 criteria, environmental/thermal tests on structural materials/components, manufacturing methods testing, and many others.

## COST AND BUILDING TIME

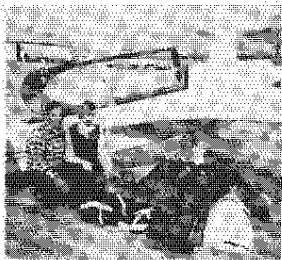
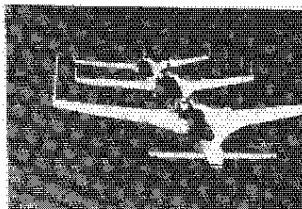
The complete package of raw materials available from the two distributors listed, including all fiberglass, epoxies, foams, fillers, sheet metal, tubing, hardware, control system materials, plumbing, tires, wheels and brakes costs about \$3200. Any of these items can be purchased separately. We strongly recommend that you get the distributor's catalogs to familiarize yourself with the materials. A complete bill-of-materials is in the plans.

The S-glass roving molded structural fiberglass main gear and nose struts are available from RAF, at \$277.95 and \$49.75 respectively. Many other prefab parts ranging from propellers, cowlings, canopies and welded engine mounts to small aluminum brackets and bushings can be purchased from the listed manufacturers. All these prefab parts cost approximately \$2000 - and using them, the competent builder can build a Long-EZ in as little as 800 man-hours. The budget-minded builder may elect to build most of these prefab parts himself, using the drawings in the plans. His building time would exceed 1500 hours and he would save most of the above costs of the prefab items. Contact the manufacturers for their catalogs showing available prefab parts. These are also listed in the plans bill-of-materials.

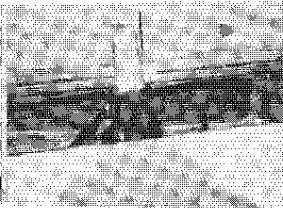
Engine costs vary widely. Our prototype has an O-235 Lycoming, that had 1400 hours when purchased, for \$1500. It has 600 hours to overhaul and will be worth then, about what we paid, thus this is a very economical way to go. Newly overhauled or new engines can cost from \$3000 to \$6000. Engine accessories, such as instruments, prop extensions etc. cost about \$300 to \$500.

In summary the total cost can run from \$5800 for a basic airplane with a 3/4 runout engine and owner-built prefab parts, to \$10,400 for everything available purchased on a zero-time engine. IFR avionics can add from \$2000 to \$15,000 to those numbers, with many options available.

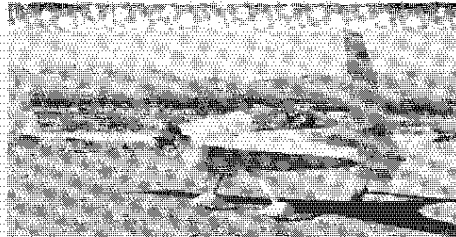
Brief Long-Ez specifications/Performance			
Engine Lycoming O-235 108 hp.			
Span	26.3ft	Takeoff (solo/gross)	550/830 ft
Area	94.1sq.ft.	Climb (solo/gross)	1750/1350 fpm
Empty Basic	710 lb.	Cruise 75% 8000 ft	183 mph
Empty Equipped	750 lb.	Cruise 40% 12000 ft	144 mph
Solo Weight	960 lb.	Max range * 75% (solo/2 place)	1370/965 mi
Gross Weight	1325 lb.	Max range * 40% (solo/2 place)	2010/1430 mi
Max Fuel	52 gal.	Ceiling (solo/gross)	27000/22000 ft
Cabin L/W/H	100/23/37 in.	Landing dist. (solo/gross)	450/680 ft.
*40-minute reserve			



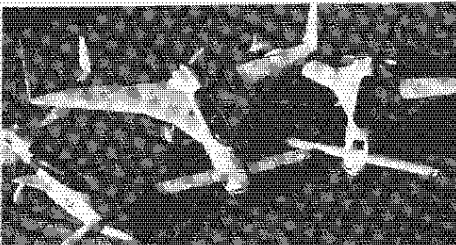
This amount of baggage fits nicely in the Long-EZ baggage areas. Baggage is accessible in-flight



Sally Melvill taxiing out for her first Long-EZ solo flight



Long-EZ parked nose-down with two VariEzes



**LONG-EZ DOCUMENTATION**

**SECTION I - MANUFACTURING MANUAL** - This is the complete education manual for composite materials and methods, also, the complete plans and construction manual for the entire Long-EZ except engine installation and landing-brake. The manual consists of a 180-page, bound 11" x 17" book plus 14 larger full size drawings. It includes many photos, over 800 drawings and illustrations, and over 65,000 words. The builder is led, step-by-step through the entire construction of the airplane, including electrical system, fuel system and finishing procedures. The manual identifies sources for all materials and all prefabricated components.

**SECTION II - ENGINE INSTALLATION** - This is a set of drawings and construction manual for the complete engine installation including mount, baffles, instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.

**SECTION IIC - Lycoming O-235**

**OWNERS MANUAL** - This is the required operations handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, and pilot checkout, etc.

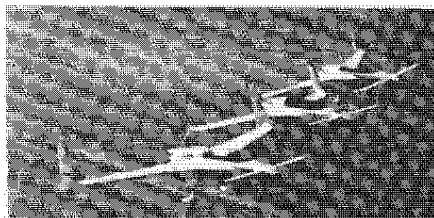
**LANDING BRAKE** - Complete full size drawings for the landing drag device. This is the large drag plate that extends from the bottom of the fuselage for landing approach.

**Rutan Aircraft Factory Inc.**  
 BUILDING 13, MOJAVE AIRPORT  
 MOJAVE, CALIFORNIA 93501  
 TELEPHONE (805) 824-2645

The nose gear retracts for parking and in flight



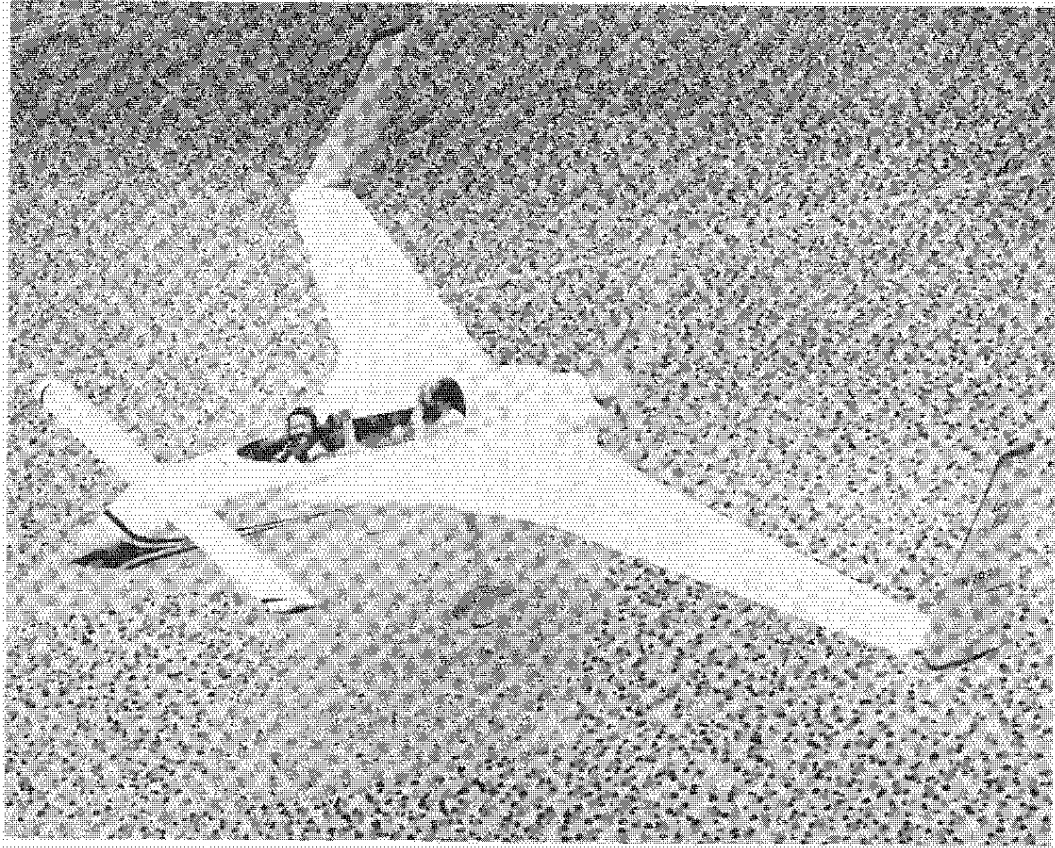
Three generations of EZs in formation. In foreground the newest - Long-EZ



Check items desired.	Price, includes first class mail to U.S. & Canada	Overseas, Airmail - U.S. Funds only
<input type="checkbox"/> Rutan Aircraft Information Package-complete data and photos of all Rutan Aircraft designs.	\$ 5.00	\$ 6.00
<input type="checkbox"/> "Canard Pusher" newsletter. Published quarterly. One year subscription. Approx 10,000 words per issue.	6.75	8.75
<input type="checkbox"/> Long-EZ plans. Section I	198.50	212.50
<input type="checkbox"/> Section IIC Lycoming	21.50	23.50
<input type="checkbox"/> Long-EZ Owners Manual	9.00	10.50
<input type="checkbox"/> Long-EZ Landing Brake	10.00	11.00
5% tax, if Calif. order Newsletter not taxable.		
<b>TOTAL</b>		

THE FOLLOWING ARE RAF-AUTHORIZED DISTRIBUTORS OF LONG-EZ MATERIALS AND COMPONENTS. CONTACT THE DISTRIBUTORS AT THE ADDRESSES SHOWN FOR THEIR CATALOGUES AND DESCRIPTION OF ITEMS.

ALL RAW MATERIALS & COWLINGS	
Near Los Angeles.	Rear St. Louis
AIRCRAFT SPRUCE 201 W. Trustow Ave., Bx 424, Fullerton, Ca. 92632 (714)870-7551 Catalog \$4	WICKS AIRCRAFT SUPPLY 410 Pine Highland, IL 62249 (618)654-7447 Catalog \$3
KEN BROCK MANUFACTURING, 11852 Western Ave., Stanton Ca 90680 (714)898-4366: Control system parts and all machined or welded parts, fuel caps, engine mount, rudder pedals and exhaust system. Catalog \$3	
PLEXIGLASS CANOPY BUBBLE, NOSE & MAIN GEAR STRUT RUTAN AIRCRAFT FACTORY INC. BUILDING 13 airport Mojave Calif 93501	



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

**first class mail**

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**July '81**

**CP 29**