

# THE CANARD PUSHER

No 25.

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If you are building a VariViggen from 1st edition plans you must have newsletter 1 through 25. If you are building a VariViggen from 2nd Edition plans you must have newsletter 18 through 25. If you are building a VariEze from the 1st Edition plans you must have newsletters 10 through 25. If you are building a VariEze from 2nd Edition plans you must have newsletter 16 through 25. If you are building a Long-EZ from 1st Edition plans you must have newsletter 24 and 25.

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 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.

Saturday Demos - Every Saturday (except as shown below) RAF conducts a demo at our shop at the Mojave Airport.

We start the presentation/discussion at 10 am each Saturday with flight demos of our experimental aircraft at approximately noon (weather permitting). This will be done each Saturday except when we will be gone to the following airshows:

2 Aug 80	Oshkosh Wisc.	EAA Convention
9 Aug 80	Oshkosh Wisc.	EAA Convention
4 Oct 80	Tulahoma Tn	EAA Convention

Bring any of your parts for inspection. We are located near the west end of the flight line at the Mojave Airport about 2 hours drive north of Los Angeles on Highway 14. When arriving at Mojave by car turn east at the Carl's Jr. restaurant to find the airport.

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

**RAF ACTIVITY** - since CP 24 has included development of grassfield/rough field capability for the Long-EZ, development of a fuel pump system for the O-200, new pilot checkouts in the Long-EZ, finishing up the Long-EZ owner's manual, and several consulting jobs.

## LONG-EZ/VARIEZE PREFAB GLASS PARTS

We are very pleased to report that our new manufacturer is in production on nose wheel wells, strut covers, sump blisters (Long-EZ) and cowlings. He is also working on tooling for wheel pants and looking into making tooling for wing tanks (strakes) on both VariEze and Long-EZ

The quality of all the parts is outstanding. The first new parts will be shipped to our suppliers starting July 7th. The tooling has been completely redone and is first class. The cowls, direct from the mold are shiny white gell coat finish and may not even require paint.

## LONG-EZ OWNER'S MANUAL

The Owner's Manual is now available from RAF, and is an excellent place to go for Long-EZ performance, range, etc. Note: unless otherwise specified all speeds shown in the manual are in **KNOTS**.

NOTE: RAF WILL BE CLOSED 1 AUGUST 1980 THROUGH 12 AUGUST 1980 FOR OSHKOSH.

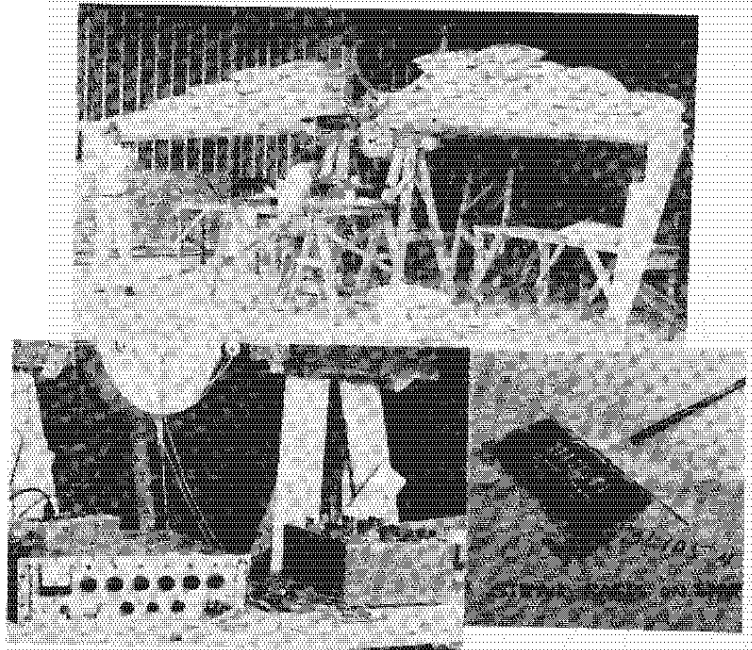
## FIRST HOMEBUILDER'S LONG-EZ FLIES !!

Johnny Murphy, that prolific builder pilot from Cape Canaveral, Florida is now flying his Long. He and son Steve plan a non-stop flight to Oshkosh 80, weather permitting. Johnny has built one of the first VariEzes and Quickies also!

The adjacent photos show the six-g static load test Johnny conducted on his Long to assist RAF in confirming the structure. Strain gages confirmed only about 50% of allowable stresses were reached at six-g, with a wing tip deflect of 8.5 inches (21.6 cm).

He also reports it holds 55 gallons of fuel and gets of in 700 feet on a hot day with full fuel. Johnny says his Long is faster than his VariEze.

As of July 2nd, Johnny has eight hours on the airplane and has had three other pilots fly his Long, because he says it is "so easy to fly".



## DICK AND MIKE'S LONG-EZ'S BY Mike Melvill

We like the Long-EZ so much that Dick and I decided to get together and build two of them. We rented a building, fabricated a couple of tables, the wing jigs and centersection spar jig and ordered complete raw material kits from Aircraft Spruce and complete prefab parts from Ken Brock. We picked up the parts and materials on June 14th. Since this is our own project and we are doing it as a recreation and hobby type thing, we only work on them during our spare time, after work and weekends. Today, 12 days after receipt of kits, we have two fuselages assembled and glassed on the outside with speedbrakes and are laying out centersection spar parts. We are building them as quickly as possible, as we both want them for economical transportation machines, and we would like to have them flying as soon as possible. Neither of them will be "grand champion quality" by any stretch of the imagination, rather they will be "plain vanilla" Long-EZ's built as light as possible to be flying as soon as possible. I have obtained an engine already, a Lycoming O-235 L2C, 118 hp at 2800 rpm out of a wrecked Cessna 152. Unfortunately this engine is not ideal for a Long-EZ in that it does not have a fuel pump, and does have a full-flow spin-on oil filter. The filter projects into the centersection spar, and a fuel pump is mandatory on a Long-EZ. I am currently looking for an O-235-C accessory case! The O-235 L2C come as above only from Cessna 152's. The same engine from a Piper Tomahawk or Grumman trainer is fine and does have the fuel pump. Dick is still looking for an engine for his Long-EZ. We will continue to report progress on our two Long's in future CPs.

### HOSPITALITY CLUB FLYINS

Kern Valley Airport, Kernville, Ca  
May 31st - June 1st.

Twenty five member airplanes flew in from all over the west. The weather was great, the campsite good, the hospitality provided by the airport was outstanding, extending to a really excellent bacon and eggs breakfast grilled out doors on Sunday morning.

The "dawn patrol" certainly woke everyone up with fly bys over the campsite, much too early for me at least!

Burt and Dick's grandfather, Mr Goforth, 91 years old, went for his first ride in a small plane when Dick took him up in Long-EZ. Several people sampled the thrills and "chills" of the whitewater in the Kern River, and good times were enjoyed by all.

Saturday evening was the highlight. We all went to dinner at the 'Ewings' resturant in Kernville and after a little dancing, returned to the airport where Bill Brackett gave a most enjoyable impromptu show. Bill is a talented musician and a very funny comedian.

Once again, the Hospitality Club flyin proved to be really outstanding.

### Burt's Surprise Birthday

June 21st.

Mojave Airport was the sight of the most recent Hospitality Club flyin. Burt was kept in the dark about it and was not aware of anything until he drove in at around 11:30am on Saturday morning. There were 25 VariEzes parked in front of the RAF hanger, surprise!!!

Several people flew in from considerable distances, Norm Ross from Victoria, Canada, Charlie Richie, Los Cruces, NM, and Gary Johnson from El Paso, Tx to name a few. The San Diego contingent arrived in style with a 5 ship flyby. They have 14 VariEzes flying and 28 under construction in the San Diego area!

An excellent chicken dinner was catered in the RAF hangar; where much "hangar flying" was conducted. Over 120 people flew or drove in, and again a great time was had by all.

Dues - Just a reminder, the dues for the Club are \$4.00 State side and \$6.00 overseas.

### VARIEZE HOSPITALITY CLUB FLYIN TO THE BAHAMAS

Bruce and Bonnie Tift have been really working hard in getting all the information together for this Christmas trip. The plans are pretty well firmed up and for further info, please send a self-addressed-stamped-envelope to Bruce and Bonnie. The dates planned are December 27, 1980 through January 2, 1981. Blanket oks have been approved for VariEzes flights to the Bahamas. Bruce and Bonnie Tifts  
8746 Ventura Ave,  
Ventura, Ca 93001

### LBF RACE OSHKOSH 1980

We are looking forward to a great VariEze race this year and some interesting competition. It's not an all out full bore but a strategy race getting the most speed out of the least amount of fuel. Even if your EZ is not as fast as some of the others you still have a good chance of winning by good fuel management. So don't let that stop you from entering. If you have't done so call the race director Mr Aaron King immediately (404)355-6185 to get registered, the dead line is short. Or write to: Aaron King

1893 Graystone Rd,  
Atlanta, Ga 30318

We have established a VariEze/Long-EZ class within the race with a \$1500 cash purse to be split between the three best VariEze/Long-EZs. This is in addition to the \$9000 purse given by the race organizer. For rules see page 14 in the May 1980 issue of Sport Aviation and CP 24.

The following VariEze class sponsors each contributing \$250 are Applied Plastics (epoxy formulations), Aircraft Spruce, Wicks Aircraft, Ken Brock Mfg, Herb Sanders (exhaust), and Rutan Aircraft. Plus any more I can line up before race time. Applied Plastics will also donate a safety laminating kit to each entry.

Don't delay do it now time is short. See you at race time.

### PROPELLERS

We are happy to announce a new propeller company to add to our list of recommended propeller manufactures.

The Great American Propeller Co.  
555 West Mont Drive #212  
San Luis Obispo,  
Ca 93401 (805) 481-4450

We evaluated their 56 x 68 on the VariEze prototype N4EZ Continental O-200 and found it's performance to be as good or slightly better than anything we have tested so far. The quality of workmanship of the prop is excellent and should give good reliable performance.

We have been working with Bruce Tift "B & T Propellers" trying to optimize a prop for the O-235 ordered Long-EZ. We just completed an evaluation on his 60 x 66 prop and found a significant improvement in cruise speed (5 mph) without a loss in climb performance. Note, our airplane now is flying faster than the Owner's Manual data. Bruce's quality of workmanship is excellent and his unique leading edge protector make it impervious to rain erosion. Bruce's extra effort in this area is appreciated very much.

B & T Propellers  
8746 Ventura Ave,  
Ventura,  
Ca 93001 (805) 649-2721

### MECHANICAL FUEL PUMP FOR LONG-EZ

The Long-EZ fuel system must have a mechanical fuel pump. The gravity fuel system used on the standard VariEze will not work on the Long-EZ. Most O-235 Lycomings and the Rolls Royce O-200 / O-240's have pumps. The Continental O-200 and some Lycoming O-235's that came out of the high wing Cessnas don't have mechanical fuel pumps nor are the cases machined to accept them even if you had a pump in hand. So if you are looking for an engine be sure it has a mechanical pump. However, if you have a "blue" high wing Cessna engine you can adapt a pump by one of the following methods.

1. The most preferred method is to have the cases machined and install the cams and push rods as necessary to convert it to a standard mechanical fuel pump configuration. Check with a certified engine overhaul shop for the conversion. This method requires total engine tear-down. The machining and parts are expensive. If the engine is in for overhaul have the modification done before reassembly.

2. We have been told that a Thompson Vane Type pump series # TF1900 will mount on the vacuum pump pod and provide the necessary fuel pressure. But we have not tested it. The pump is a standard aircraft pump with A.N. fittings but must be adjusted back to a lower 2-8 psi pressure. The pumps are somewhat expensive, but available. Contact Dick Davy at Precision Aero, 2749 E. Wardlow Road, Long Beach, Ca 90801. (213)595-6377 for the Thompson pump.

3. We are working with Rex Taylor from H.A.P.I. V.W. engines to adapt a Volkswagen fuel pump to run off the vacuum pump pad. We have a prototype of this conversion in service test on N4EZ and it's working satisfactorily at this time. However, the V.W. pump has automotive fuel lines, not aircraft A.N. fittings. This will be the least expensive method. Rex is also working up an adapter to run a standard aircraft AC fuel pump off the vacuum pump pad. You can contact Rex directly by calling (714)357-6342. Note: this method is still in the development stage and may not prove satisfactory. We should have something more definitive next CP.

### VARIEZE BOAT-TAILED EVALUATION

There has been a lot of interest in the "boat tail" since Steve Woods ran his in the VariEze race at the Sun-n-Fun. We obtained a boat tail shell from Ken Forrest and ran a very close evaluation to determine if there was any performance advantage to this modification. Our evaluation with and without the boat tail shows no perceptible difference in performance.

Steve Woods also has a NACA engine air cooling intake scoop which involves extensive additions to the fuselage and cowl. Steve has asked us to make it clear that the flush scoop will not adequately cool the engine. Steve had to develop extensive baffling modifications to get the good cooling he now has. We are following Steve's developments and are particularly interested in his cooling baffle configuration.

CP 25 - Pg 2

#### MODIFIED LONG-EZ NOW APPROVED FOR GRASS FIELDS

Rutan Aircraft has recently tested a spring loaded "shock strut" which was installed in place of the NG-9 / NG 10A rod on Long-EZ. This, combined with 500 x 5 main tires, was tested by progressively taxiing over 1" x 2", 2" x 4" 's and finally over two 2" x 4" 's, one on top of the other. The results showed a very significant increase in the rough-field absorption qualities of the landing gear. Taxiing over stacked 2" x 4" 's resulted in very acceptable loads, with a satisfactory ride.

We then flew N79RA to an average grass strip and conducted takeoffs and landings at a range of weights and cg positions. Also, taxi test in tall grass and undulating surfaces was satisfactory. A Long-EZ with the spring strut and 500 x 5 main tires is now approved to operate from average grass fields. This does not mean it is acceptable for gravel or unprepared/rough surface. The prop damage that can result from operating on gravel is unacceptable.

The spring strut is installed by simply removing the 2 bolts on the NG 10A pushrod and replacing it with the spring assembly. Additional clearance is required by trimming away a portion of the strut cover.

The spring is intended primarily for the Long-EZ, to give it the grass capability, however VariEze owners may want to install it to improve the rough field handling of the nose gear. The spring allows the gear to deflect aft and up when a bump or hole is encountered, and greatly reduces the loads on all parts (strut, NG10A, castings fork and wheel). The Long-EZ fiberglass strut is stiffer than the VariEze, thus the new spring is strongly recommended unless you plan to always operate from smooth surfaces. Without it, nose gear damage may occur from rough surfaces.

Note: This is not intended to provide grass field capability for the VariEze. Its faster takeoff/landing speed and inability to use 500 x 5 tires makes it unacceptable for grass.

The strut, ready to install, is being made available by Ken Brock. Ken will also stock the LST-6 spring for those wanting to build their own. Refer to the drawing in this newsletter. Several different spring configurations were tested until arriving at the 1.5 x 4" heavy duty rectangular coil spring. If building your own, shim as required to obtain the specified 250 lb. preload. The strut should not deflect when static with pilot in cockpit and full fuel.

#### A FUNNY THING HAPPENED ON THE WAY TO EZ COMPLETION

by Jud Bock Serial # 738.  
While doing some finishing work in the back seat, I decided to close the canopy to check the rear head rest. It felt great, so I went to open the canopy and lo and behold the safety catch in the front cockpit was working perfectly! There I was, all 210 lb of me, locked in the back seat with no tools or anything to reach the 4" more, required to release the catch. My wife had just gone shopping and was not expected back for three quarters of an hour. Did I panic? Hell yes, because I was getting warm (hot actually!), and I decided to use my head and tried to use mind power to move the catch. After that failure, I started thinking some more and it finally dawned on my dulled brain that I had shoes on, which I promptly removed one of and was out in less than 5 minutes.

In another instance the builder had no shoes on. He removed his pants, rolled them into a stick and used it to reach the catch!

With consideration of this problem we designed the safety catch to be mounted at F.S.57 on the Long-EZ. VariEze new construction should follow suit.

#### BUILDER ASSISTANCE

More names to contact for builder assistance:

Al Coha,  
5173 Leo Street,  
San Diego, Ca Phone: 582-2137

Nat Puffer,  
2182 N Payne Ave,  
St. Paul, Mn 55117

Nat is also willing to check new EZ pilots out in his VariEze, and to do first flights in new EZ's, limited to runway flights, not including envelope expansion.

#### CHECK OUT EXPERIENCE IN THE LONG-EZ

To date 30 pilots have been checked out in the Long-EZ. Pilot experience ranges from student, private, military, aviation writers, VariEze and even the odd airline captain. No problems were encountered by anyone and all made the transition easily.

Pilots current in a VariEze were given a ground systems briefing and turned loose. The more experienced pilots without VariEze time were given one turn around the pattern (instructor in the back) then turned loose. Since the Long-EZ has a more solid pitch response and a lower deck angle on landing than the VariEze there was much less pitch bobble and no high round out landings as in some VariEze check outs. There was still some tendency to push both rudders out, especially on the first take off, but since you don't couple to roll as much as the VariEze this never created a problem. The most common comment was how long it took to slow down to pattern airspeed and how much it would float on landing especially if you were fast.

We checked out and soloed two of our RAF low time pilots, Sally Melvill (Mike's wife) 150 hr private pilot and Pat Storch (Burt's girlfriend), a 24 hour student pilot. At no time did the instructor need to take control to save/recover the aircraft. Both were soloed after 1.5 hours dual in the front seat (6 to 8 landings). Neither had any formal backseat dual. Since the instructor had no throttle or brakes in the back, enough time was spent on the ground making low/high speed taxi runs to be sure this area was mastered. Neither required more than 10 minutes in this area.

Sally is current in a Champ, Grumman Tiger and VariViggen. Pat had only flown the Tiger. Both girls are exceptional pilots, better capable than average for their flight time. The following is Pat's personal perception of her flight:

"Incredulous - that was my first feeling when they told me they wanted me to solo the Long-EZ. Tiny insecurities worked their way out in the form of protests. "But I'm only a student! I've only soloed one other airplane! I have less than 25 hours!" It seemed that I was the only one lacking in confidence, because they would not be dissuaded.

The day came when it was time to give it a try from the front seat. The cockpit looked foreign, almost hostile. Instruments were not where my eyes wanted them to be. Throttle and stick were in the wrong hands. With my heart in my mouth, we started the pattern work. Soon I was thankfully too busy to be nervous, but I still felt I was reaching for an unattainable goal. Control of the Long felt so different, and the full-stall landings I had practiced so diligently in the Tiger were to be forgotten.

Then, amazingly, little pieces started falling together. Each landing felt better, the cockpit looked more familiar and a tiny seed of confidence started to bloom. Could it be? Would it really happen? Down to refuel and then came the words I wanted to hear - "you're ready to go!". My heart was racing once again but this time it was from anticipation and excitement. Lined up on the runway, I took a deep breath and was rolling. The take-off was smooth and felt good. The plane felt fantastic. I played in the sky. Up, down, around, turns and steep turns to 2 gs. I never expected any experience to equal my first solo, but this surely surpassed it. Flying never felt so good! Then came the final test, the landing. A little long, but a good one.

A Long-EZ pilot! I flew the Long! I wanted the world to celebrate with me. Flying had taken on a new dimension. I may have landed, but I was still in the air, and haven't come down yet. What a satisfying, exhilarating experience!"

#### CAUTION - AMATEUR DESIGN

In 1977 an amateur designer/builder highly modified a VariEze with all-flying canard and other modifications. It crashed on its first tests, injuring its designer test pilot. Recently a new design, with the outward appearance of a VariEze, crashed on its first flight attempt, killing the pilot (a professional Cessna test pilot).

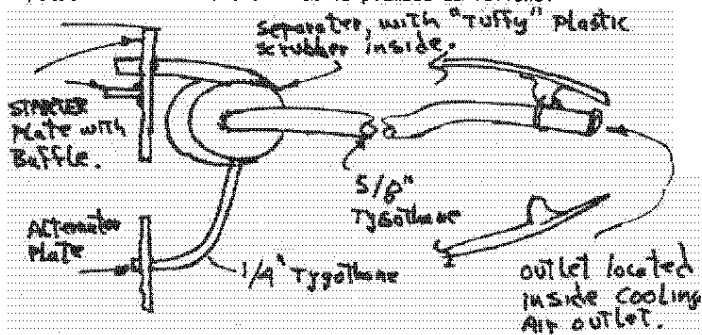
If you are contemplating a new design or modifications to an existing design be sure you understand that aerodynamic design, particularly for tandem wing configurations, is an engineering discipline that requires the appropriate analysis and test before risking one's life.

**RETRACTABLE LANDING TAXI LIGHT INSTALLTION DRAWINGS**

FOR LONG-EZ - are now being shipped with Long-EZ plans. If you did not get this drawing with your plans, send a self-addressed-stamped envelope to RAF. This drawing is too large for the newsletter.

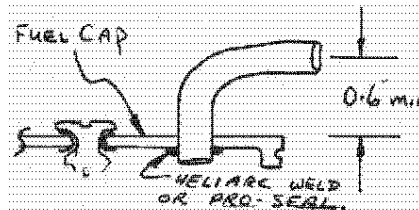
**CONTINENTAL O-200 OIL BREATHER**

Last winter we modified the configuration of the oil separator and location of breather outlet on N4EZ. This configuration is successful in scavenging all oil-none spills out the breather. It is plumbed as follows:



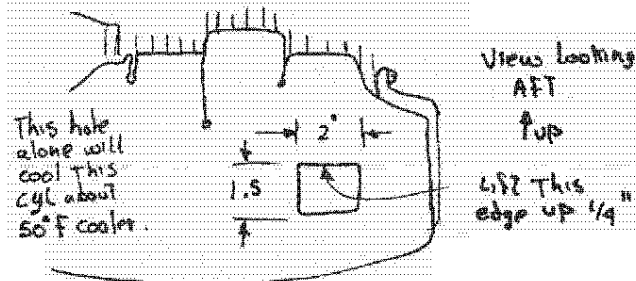
**VARIEZE FUSELAGE TANK VENT CONFIGURATION**

Al Coha reports that unacceptable low pressure on his flush vented fuselage tank has resulted in fuel starvation. This was revised to a ram probe, solving the problem. Vent pressure measurements have confirmed that a ram type probe should be used on the fuselage tank. For new construction install a 1/2 inch aluminum tube inside the top of the fuselage tank and bring it out through the top and bend it 180 degrees to face into the breeze at least .6 inches from the top skin. For existing airplanes, it would work to install an aluminum tube into the fuel cap (see sketch), however there will then always be the danger that the cap may inadvertently be installed backwards, whereupon the fuselage tank may be rendered useless.



**BAFFLE HOLE IMPROVES CONTINENTAL ENGINE COOLING**

Several VariEze owners have opened up a hole in the left-front baffle to improve cooling of the #1 cylinder exhaust port area (Continental only). This is in a position where, due to the locally low height of fins, the baffle does not otherwise allow enough airflow. See sketch. This hole allows direct impingement of cool air on the head just above the exhaust port. Center the hole over the area that is devoid of fins.



**PV FOAM AND WEIGHT CONTROL**

The original PV core foam, type R45 dark blue, that we tested here at RAF, layed up absolutely perfectly without using slurry. Based on this series of tests, we called out no slurry on type R45 PV foam in Long-EZ plans. The production type R45 PV foam in most cases is representative of our test samples, however in a few cases larger cell foam is being delivered in the kits. This large cell foam is structurally excellent, and can be layed up without slurry with real acceptable physicals, however it is a lot easier to accomplish the layup if you slurry the type R45 PV foam. The glass wets out quicker and you get less air or dry looking areas. There is little or no difference structurally, but our test have shown a slightly lighter part if you use slurry. The best thing to do is conduct your own test as you build and decide for yourself which way works best for you.

In all cases your glassing time should not exceed 2 minutes per square foot per ply, i.e., front side of front seat bulkhead, is two plies, and should take no more than half hour. If you are working slower than this you are doing something wrong, and you will end up with poor work, heavy parts etc., due to epoxy gell. Above all, don't leave excess epoxy in a layup. If a squeegee can remove epoxy, do remove it. Use numerous squeegee passes to wet out as well as to remove excess. Remove the grams of excess epoxy from every layup, and your airplane will be many pounds lighter and stronger.

Do not add extra glass anywhere. One VariEze builder wanted his airplane "extra strong" so he added a ply here and there. His airplane is over 100 lb. overweight and his strength for flight and landing loads is less.

Chase after grams, and the pounds will take care of themselves. Bill Lear once said he would kill his grandmother for a pound. While this measure is not recommended, it is possible if you are not diligent on weight control throughout your project you will be building a sluggish, single-place airplane.

**OPTIONAL LONG-EZ LAYUP CHANGE SAVES WEIGHT**

The following approved layup change on the Long-EZ centersection takes advantage of the better structural efficiency of oriented UND as compared to woven BID. These changes are easier to layup and save 3 1/2 lb weight!

Page	Layup #	Old	New
14-2	5	3 Ply BID @ 45°	1 Ply UND @ 45° 1 Ply UND @ -45°
14-3	6	3 ply BID @ 45°	1 ply UND @ 45° 1 ply UND @ -45° 1 ply UND @ 45° 1 ply UND @ -45°
14-4	8	3 ply BID @ 45°	1 ply UND @ 45° 1 ply UND @ -45°

Note: UND cloth is butted, not overlapped at selvage edges. Be sure alternate plies of UND cross at 90 degree fiber orientation to each other.

**FIREWALL - LONG-EZ AND VARIEZE**

We now approve the use of fiberfrax (a space age ceramic material) as a replacement for asbestos. Since fiberfrax is as good a fire barrier as stainless steel, we approve substituting .016 2024 T-3 aluminum for the stainless. This saves almost 2 lb at the firewall. Both Wicks and Aircraft Spruce are now shipping kits with fiberfrax and aluminum.

Installation of fiberfrax is as follows: Complete airframe construction through cowling installation, then remove everything from the firewall bulkhead, and install fiberfrax with abead of silicone around the edge of the bulkhead. Do not wet out fiberfrax with epoxy. Now install the .016 2024 T-3 aluminum which is required to protect the fragile fiberfrax, from local damage, abrasion etc. See plans changes section of this newsletter.

**REFERENCE LONG-EZ CHAPTER 14, STEP 13**

At least a couple of you Long-EZ builders may have noticed by now that, due to the kink in the centersection spar it interferes with the aft seat bulkhead when you try to slide it into the fuselage. Do not remove the firewall to clear this. Using a coping saw, remove a triangular piece of the back seat bulkhead about 1 inch deep at the center and tapering to zero at the sides. After the spar's in place this piece is installed with wet micro and is structurally tied in by the tapes that lap onto the spar. For new construction do not permanently install the plywood firewall bulkhead in Chapter 6 or 7. Put the spar in from the back in Chapter 14, then install the plywood firewall bulkhead, lapping 1 ply BID around all edges.

### HOT WIRING

Important - do not substitute lighter tube than the 1" dia. steel tubes for the hot wire saw. The wall should be at least .049. The hot wire must be tight to operate without wire lag. Tighten till the stainless wire starts to yield (tone no longer increases when "strummed", as you tighten).

### BUILDER HINTS

You can avoid cutting the bulkhead patterns from the plans if you over-lay the foam with normal typing carbon-paper then trace the patterns through the plans. THIS WORKS GREAT FOR HOTWIRE TEMPLATES TOO.

#### Long-EZ Hints

Wherever BID tape is called out in the plans, this refers to a given width of BID cloth cut off the roll at 45° to the salvage edge. This "tape" then works into a corner "variously" as compared to 90° tape. Pre woven BID tape at 45° is not available to purchase anywhere to our knowledge. It is ok to lap 1/2" where a long piece is required. Do not confuse these "tapes" with the spar cap material (3" wide unidirectional tape).

#### Long-EZ Fuel tanks

**CAUTION!!** Be sure to align bulkhead's RB45 a RB 23 parallel to the B.L. (fuselage C<sub>1</sub>), or your tank will not fit the wing.

When boring the 5/8" dia. holes in the centersection and wings, using the spotface tool, go slow!! Clear the spotface frequently and be sure not to get the layup too hot. Resharp the tool if required.

Carving the inside of the fuselage bottom R45 PV foam can most easily be accomplished by using a very stiff wire brush, cup or cone shaped, in a drill and cut the foam away about 1/4 to 3/8 at a pass. Then smooth it down with a high speed hand held disc sander (Metabo, Bosch etc). Finish it with #40 grit sand paper in your fingers. Be careful not to gouge the foam in the corners with the edges of the sandpaper.

Carving the outside shape of the Long-EZ fuselage will be a lot easier if you rough the corners off with a large carpenter's saw (careful not to cut too deep). Then use a body sander with a coarse sanding disc (or any highspeed power disc sander). Sand right into the bottom longeron till a max. of 0.4 of wood is visible. This gives you a rough shape. Now get a real coarse wood rasp (hardware store). This tool will remove foam with very little effort, and will enable you to arrive at a really pleasing shape. Finish with a 36 or 40 grit hard sanding block. This entire carving job can be done in 2 to 3 hours.

After carving the outside of the fuselage, just before laying up the outside skin, lay out the outline for the speed brake with a magic marker. Now stick strips of grey tape (furnace duct tape) in this area covering the entire speed brake area. Then proceed with the UND skin layup. When you cut out for the speed brake it will be much easier to separate the glass skin from the R45 PV foam. Unlike the urethane foam used for the VariEze fuselage, the R45 PV has tremendous peel strength retaining the glass skin.

### BUILDER HINTS - VARI-EZE ONLY

When laying up UND, spar caps be sure to butt the cap material to the wing fitting and squeegee outboard. Do not trim the glass cap material at the fitting, "yaw" or slide the UND, to butt to the wing fitting (keep fibers straight spanwise).

#### Addition to CP 24 page 11.

We omitted the W.L. and .BL. of the nylaflo tubes routing the pitch trim cable through the instrument panel. These should be at B.L. 9.5 (5/8" inboard of the left side) and top cable at W.L. 9.6", bottom cable at W.L. 8.3" (top of longeron in W.L. 23).

### INSTALLATION OF LONG-EZ GEAR ON VARI-EZE

Builder Report by Craig Gottschang.

Since the original VariEze main landing gear is no longer available, those of us building or retrofitting a VariEze must use the Long-EZ gear. Having just completed this installation on my Eze the following comments may be helpful to those building or retrofitting the Long-EZ gear:

#### LONG-EZ LYCOMING EXHAUST SYSTEM

The adjacent drawings show the system now being tested on N79RA. This system is very similar to the original one which we welded up ourselves, with the addition of a "ball" joint on each stack to take care of vibration. It is working well so far, and looks like the way to go. This system is made

(Drawings on page 7 and 8)

and sold by Ken Brock, and can also be used on Lycoming powered VariEzes.

Note: Lycoming flanges and tube sizes are shown. If you have a Continental engine, refer to Section IIA and build a similar exhaust system to exit the lower cowling just below the trailing edge at B.L. 19.5". A Continental version is not available from Ken Brock at this time.

The Long-EZ gear is both wider and fatter than the VariEze gear and consequently the aluminum extrusion attachments are spaced wider than the Eze. Rather than having two 1/8" extrusions sandwiching each gear attachment tab, two 1/2" extrusions are used on each fuselage side with a single 5/8" steel rod extending between them, upon which the gear tabs are mounted. The gear tabs themselves are beefed up considerably with BID layers locally on both sides while the wrap cloth is actually thinner using 18 layers of UND top and bottom.

The main gear comes from RAF with a 1/4" ridge all around, apparently from the molding process. This ridge must be sanded away flush and a power grinder is a necessity. In addition, 3" of each leg must be cut off for proper gear height on the Eze. The plans call for an 8 layer UND buildup, layered in crisscross fashion, to improve the torsional strength of the main gear. I questioned the requirement for so much beefing up for use on the lighter VariEze but RAF informed me that the basic gear has little torsional strength in itself and must have the UND wrap whether used on the Long-EZ or the VariEze.

Having already installed the 1/8" extrusions on my Eze, my initial plan was to use them on the new gear. Unfortunately, they are too close together and would not allow a smooth "U" shape to the wrap around layers. I was concerned that this would cause an inherent weak spot in the attachment tabs. In addition, the old extrusions are not wide enough to accommodate the larger gear tabs. I found that the old extrusions could be removed easily by simply unbolting and popping them loose. It was not necessary to uncover the heads from the outside as they were held securely by micro. After removing the old extrusions I ground off most of the protruding bolts. The two forward most bolts on each side are common to the new extrusions and should be uncovered from the outside skin and removed. The new aft gear extrusion is aft of the old attachments, requiring the insert of some .7 x 1.0" wood pieces locally and then a BID buildup to support the new 1/2" extrusion.

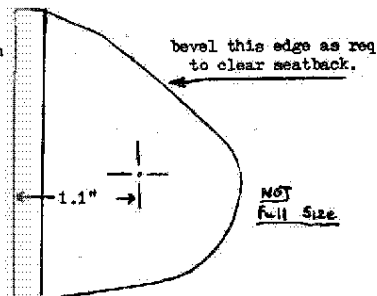
Before installing the new extrusions, (retrofit only), determine which attachment holes may be drilled from the inside and go ahead and pre-drill these 1/2" holes in attach. Some of the holes may not be drilled from the inside due to seat back interference and are more easily located from the outside if not pre-drilled. When installing the attachments, bolt them together with the steel tube in between and position them in the airplane with clamps. Where able, drill the holes from the inside, temporarily bolt these, and then drill the rest from the outside. You may wish to remove the extrusions for final drilling through the aluminum. Once all holes are located and drilled, the extrusions are permanently installed with floc.

The actual mounting of the landing gear is easier than the old method and the plans are clear on this operation. The only change is to lengthen the aft gear tab (plywood jiggling block) by .25". The tab needs to be longer than the Long-EZ due to the greater forward tilt of the main gear on the VariEze. The plans also call for a 5/8" diameter "spot facing tool" for use in construction of the gear tabs. This is a tool used frequently in the Long-EZ and sells for \$29.95 from EZ distributors. Borrow one from a Long-EZ builder if you can.

The new gear installation requires an additional set of drawings from RAF at \$7.50. The steel rods, with inserts are \$9.90 each from Brock and 1/2" extrusions may also be available now. Other hardware is available from Wicks or Aircraft Spruce.

Although switching to the new gear initially seems like a lot of extra work, it is actually not that difficult and in fact easier than the old system. Above all, you end up with a landing gear that will withstand a crunch job landing now and then with complete confidence. From the looks of mine I think it could withstand a landing in a minefield! It is worth the effort.

This is the final shape of my forward extrusion but each builder will have to check his particular fit.



### PLANS CHANGE

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

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

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

### LONG-EZ PLANS CHANGES

LCP #5 MEO	Page 5-1 Spacing between dimensions on fuselage sides is 10", aft dimension is 3"
LCP #6 MEO	Page 20-2 Add A,B,C, dimensions: A = 102.15" B = 108.35" C = 118.35"
LCP #7 MEO	Back cover of plans, wing root leading edge should be 113.9", not 113.4
LCP #8 MEO	Page 19-8 Step 9. Second line should read "form the 0.7" rib by removing foam with a rotary file".
LCP #9 MEO	Page 19-6 Step 6, 3rd line down LWA7 should be LWA2
LCP #10 MEO	Page 19-6 Lower right paragraph, LWA7 should be LWA2.
LCP #11 MEO	Page 19-7 Bottom right, 3 lines up, LWA7 should be LWA 2
LCP #12 MEO	Page 19-8 bottom left, 2 lines up, LWA8 should be LWA7
LCP #13 MEO	Page 20-1 Step 1, 3rd line down, Add page A3 and A14
LCP #14 MEO	Page 2-2 airframe bolts AN3-11 should be AN3-11A
LCP #15 MEO	Page 2-1 Tools. change "2 pcs 16 x 48" to " One piece 1/16" or 1/8" thick x 24 x 48"
LCP #16 MEO	Page 10-2 clarification: remove the word "centerline" two places, W.L. 19.4 is correct, but is <u>not</u> centered on the shear web.
LCP #17 MEO	Page 4-2 bottom right: clarification: "both sides" means <u>"left and right, on the forward face only"</u> ! The foam doubler goes on aft face, with no additional plies at this time See Section A-A, B-B, and C-C on page A3.
LCP #18 MEO	Page 3-3, jig table size omitted - add 3 ft x 11 ft.
LCP #19 MEO	Page A4 engine mount extrusions "Chapter 6" should be "Chapter 14", 2 places.
LCP #20 MEO	Page A5 clarification: The 15 ply BID pad for the aft gear attach angle should stop at W.L. 12.35 (Don't glass above 12.35)(Chap 5)
LCP #21 MEO	Page 2-4 Metal : 3ft of 1.8 x 1" x 1" should be 3 ft of 1/8" x 1" x 1" alum angle

LCP #22 MEO	Page A-3 correction: Hole for gear retract drive tube should be 1" to the right of C <sub>L</sub> .
LCP #23 MEO	Page 13-6 NG 31 is called out of R45 dark blue foam, should be R100 4" red foam, see page 2-3 Also note on page 2-3 that F28 can easily be cut in one piece from the instrument panel foam sheet.
LCP #24 MEO	Back Cover - Nose gear C <sub>L</sub> is at W.L.-22 not -23
LCP #25 DES	Page 4-3 and Page 2-2. Alum can be substituted for the steel firewall, don't install fiberfrax now. Wait until after cowling installation. This allows you to wrap the fuselage skin around onto plywood and allows you to layup the 1 ply inside lip on the cowl lip. You will then have to remove things bolted to the firewall to install the fiberfrax and alum. Install fiberfrax with silicone rubber, <u>not</u> epoxy.
LCP #26 OPT	To save work and weight substitute UND for BID on centersection spar as shown on page 4 of this newsletter.
LCP #27 DES	For rough or grass fields and to relieve stress on nosegear components, install the spring assembly (page 8) in place of the NG 9/10A rod.
LCP #28 MEO	Page 14-2 Step 4 Outboard LWA 1 (sketch on left center of page) 1.0" dimension should be to outside of CS 5 and 8, not inside. Change inside demension to 0.75". Be sure to transition edges of all metal parts with floc.

### VARIEZE PLANS CHANGES

DES Sect IIA Sect IIC	Page 7. Revise fuel vent system per this newsletter page
DES Section I	Page 22-5 Move canopy safety catch to F.S. 57.
DES Sect I	Page 9-3 Alum can be substituted for the steel firewall if fiberfrax is used. Don't install asbestos or fiberfrax now. Wait until after cowling installation. This allows you to wrap the fuselage skin around onto plywood and allows you to layup the 1 ply inside lip on the cowl lip. You will then have to remove things bolted to the firewall to install the fiberfrax and alum. Install fiberfrax with silicone rubber, <u>not</u> epoxy.

### LONG-EZ SPAR-CAP THICKNESS - CENTERSECTION SPAR AND WING

The number of plies of the UND tapes for the spar caps shown in the plans (Chapter 14 and 19) is based on each ply being .035 to .038 thick. We have found that some of the UND tape is of less bulk than expected, and is laying up only about .025 per ply. If this happens, the spar is weak and the depressions are not filled flush. Check your spar cap material by making a 5-ply layup. Cure then measure thickness. It should be 0.18 thick. If it is only 0.125 thick you must add the following plies to all your spar cap layups. All the additions can go on top of the plans shown caps.

Chapter 14, Step 7, Bottom Cap.  
Add 1 ply full span, plus 1 ply to B.L. + 45, plus 1 ply to B.L. + 30, plus 1 ply to B.L. + 15.

Chapter 14, Step 7, Top Cap.  
Add 1 ply full span, plus 1 ply to B.L. + 47, plus 1 ply to B.L. + 37, plus 1 ply to B.L. + 27, plus 1 ply to B.L. + 17, plus 1 ply to B.L. + 12.

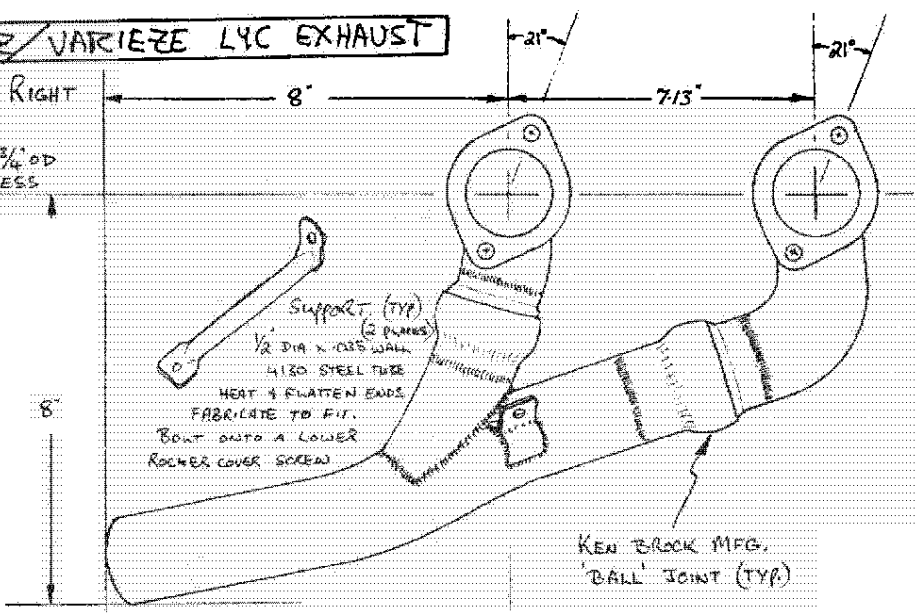
Chapter 19, Step 5, Bottom Cap.  
Add 1 ply B.L. 25 to B.L. 130, plus 1 ply B.L. 40 to B.L. 90.

Chapter 19, Step 7, Top Cap.  
Add 1 ply B.L. 23 to B.L. 140, plus 1 ply B.L. 33 to B.L. 92, plus 1 ply B.L. 40 to B.L. 78.

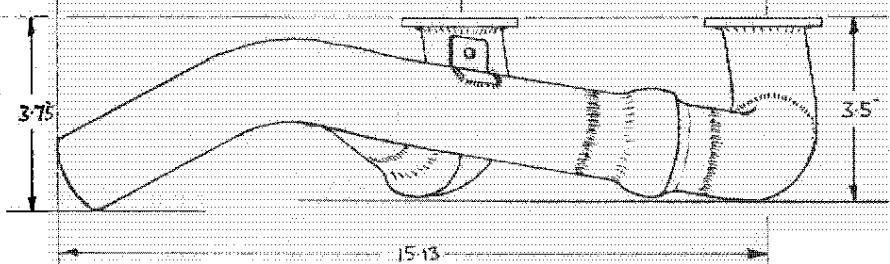
CAUTION! - Use care in carving spar cap troughs, (Chapter 14, Step 5). Do not carve too deep!

**LONGEZ VARIETZE LYC EXHAUST**

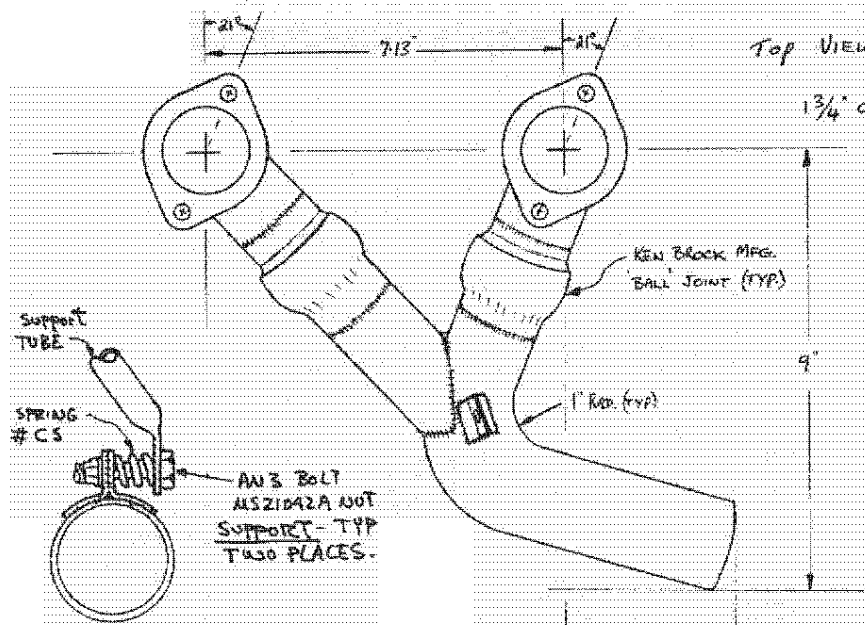
TOP VIEW, RIGHT EXHAUST  
ALL TUBES 1 3/4" OD STAINLESS



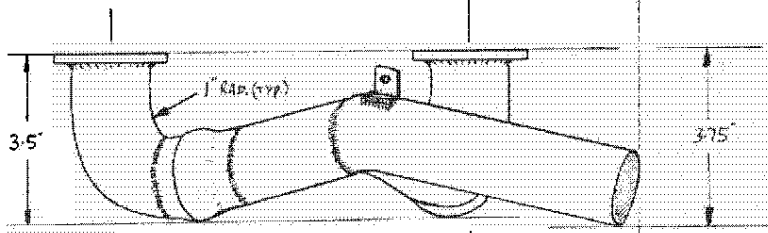
VIEW LOOKING INBOARD FROM RIGHT.



TOP VIEW, LEFT EXHAUST  
ALL TUBES 1 3/4" OD STAINLESS STEEL



NOTE: THE BROCK BALL JOINT IS FORMED AS A UNIT AND DOES NOT REQUIRE HARDWARE OR SPRINGS. IT IS AVAIL FROM BROCK IF YOU WANT TO HOME BUILD THE EXHAUST.

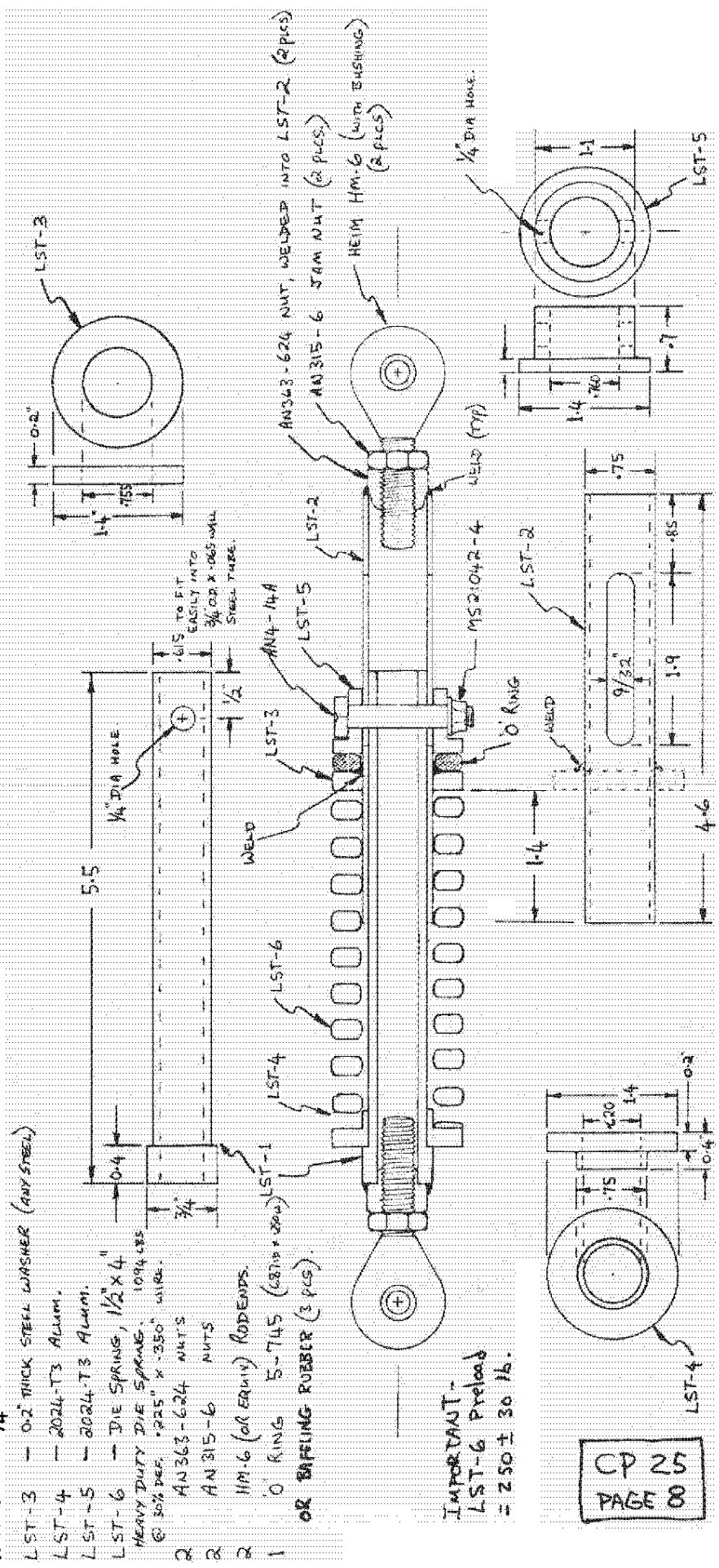


VIEW LOOKING INBOARD FROM LEFT.

LONG-EZ SHOCK STRUT ASSEMBLY - LST.

- LST-1 - 3/4" O.D. x .156" WALL 4130N STL. TUBE.
- LST-2 - 3/4" O.D. x .065" WALL 4130N STL. TUBE.
- LST-3 - .02" THICK STEEL WASHER (ANY STEEL)
- LST-4 - 2024-T3 ALUM.
- LST-5 - 2024-T3 ALUM.
- LST-6 - DIE SPRING, 1/2" X 4" HEAVY DUTY DIE SPRING. 1094 LBS @ 30% DEF. "225" X "350" WIRE.
- 2 AN 363-624 NUTS
- 2 AN 315-6 NUTS
- 2 HM-6 (OR ERVNY) ROD ENDS.
- 1 O RING 5-745 (6800 X 200)
- OR BRAFFING RUBBER (3 PCS).

Replaces NG9/MS10A ROD  
CAN ALSO BE USED ON  
VARIERE TO RELIEVE NOSEBAR  
LOADS IN ROUGH SURFACES.



IMPORTANT -  
LST-6 Preload  
= 250 ± 30 lb.



ITEMS FOR SALE AT RAF - Pick up or Ship.

Long-EZ (VariEze) Main Gear \$277.95  
 Long-EZ (VariEze) Nose Gear 49.75  
 VariViggen Fiberglass Parts:  
 VV Cowl - left or right half \$ 129.50  
 VV Nose Bowl 92.00  
 VV Tank Cover 63.00  
 VV Visor 68.00  
 VV Landing Light Dome F25 9.50  
 Canopies, Shipped FOB Dayton or Picked up at RAF  
 Long-EZ or VariEze Canopies.  
 Clear \$199.00  
 Green 229.00  
 Smoke 249.00  
 Bronze 249.00

Add 6% for California orders. Add \$20.00 for overseas main gear orders. Main gear are shipped by Greyhound - please include telephone number with order. Main and nose gears and canopies are generally in stock for pickup at Mojave. Call ahead for availability of VariViggen parts.

BITS AND PIECES

Cutaway Prints of VariEze, printed on 80 lb paper, rolled in stout mailing tube \$9.95 each or 3 \$25.00. Suitable for framing. Also available folded in a 8 1/2" x 12" c/w envelope for \$7.50

Contact: Robert V. Coon  
 26 Cloverdale Str.,  
 Pittsfield, Mass 01210

Second Annual EAA Rocky Mountain Regional Fly-In  
 September 6 and 7, 1980

Overnight T-hangars - camping permitted.  
 Pancake breakfast both days.  
 Contest, displays, and trophies both days.  
 Ft Collins - Leveland Airport (Cheyenne Sectional)

Contact: Bill Marcy  
 3041 S Golden Way  
 Denver, Co 80227  
 (303)986-4398

This is a Chapter 7 Fly-In and invite all EZE Drivers (along with Long-EZ, if possible) to attend. We hope to have "A GOOD ONE".

FOR SALE

C-85 Tapered Crankshaft, ground .010" under.  
 Contact: Richard Nelson (805) 544-5797

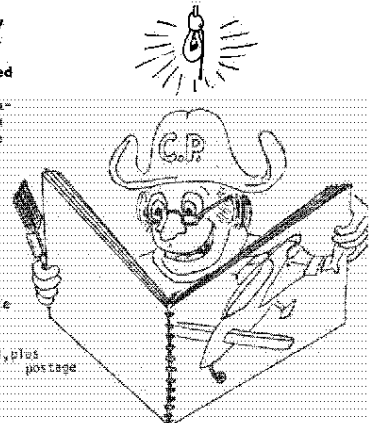
1 N9283R	39 N?	77 N27CP	115 NGVE	153 N64M	191 N245EX
2 N78LM	40 N?	78 N28L	116 N67EZ	154 N68M	192 N115K
3 N83DL	41 N79PJ	79 N81UEZ	117 N780Y	155 N226BR	193 N89VE
4 N65B	42 N?	80 N?	118 N88RM	156 N89E	194 N115B
5 N14K	43 N57EZ	81 N6EZ	119 N837	157 N89J	195 N55VE
6 N899EZ	44 N228OK	82 N81JC	120 N299EZ	158 N46EZ	196 N24RM
7 N61975	45 N88886	83 N34VE	121 N76AJ	159 N877EZ	197 N2CR
8 N78EZ	46 N2TV	84 N?	122 N39EZ	160 N51925	198 N375L?
9 N247U	47 N278G	85 N4584G	123 N34HB	161 N21LB	199 N4579B
10 N89R	48 N575JM	86 N752EZ	124 N422	162 N2UM	200 N68LJB
11 N?	49 N22889	87 N28JF	125 N66EZ	163 N25RM	201 N?
12 N4CM	50 N6459	88 N13CG	126 N?	164 N13EZ	202 N13PM
13 N7MC	51 N37B	89 N?	127 N27CP	165 N66EZ	203 N88JG
14 N81CL	52 N6VEZ	90 N17EZ	128 N234EZ	166 N9688R	204 N182N
15 N168G	53 N78PD	91 N246EZ	129 N?	167 N78JK	205 N?
16 N7EJ	54 N899EZ	92 N21DM	130 N14533	168 N222EZ	206 N?
17 N747TC	55 N78249	93 N575	131 N18ML	169 NHEZK	207 N?
18 N65M	56 N36EZ	94 N3784D	132 N?	170 N9KC	208 N286G
19 N5821Y	57 N7110B	95 N115PM	133 N17DR	171 N588EZ	209 N77NS
20 N2288Z	58 N35EZ	96 N98CG	134 N54Z	172 N113EZ	210 HB-YBG
21 N785P	59 N44H	97 N95F	135 N41QL	173 N5182B	
22 N2MP	60 N15LL	98 N25LP	136 N888CM	174 N139EZ	
23 N?	61 N216EZ	99 N355T	137 N?	175 N2255K	
24 N9833L	62 N124G	100 N5884	138 N26EP	176 N37EZ	
25 N2240C	63 N9783R	101 N?	139 N4DED	177 N?	
26 N68M	64 N288EZ	102 N29CE	140 N37EZ	178 N89EZ	
27 N51NC	65 N379L3	103 N640B	141 N8KJ	179 N?	
28 N27CH	66 N945Y	104 N477CH	142 N98395J	180 N2VE	
29 N3810M	67 N?	105 N28VE	143 N?	181 N665D	
30 N1798B	68 N9113R	106 N9836G	144 N7EZ	182 N899JM	
31 N36RJ	69 N13CF	107 N24RD	145 N4EZ	183 N78VE	
32 NGRX	70 N958C	108 N12CN	146 N23FF	184 N11MS	
33 N950B	71 N255EN	109 N48EZ	147 NLRSS	185 N183B	
34 N3445P	72 N7ER	110 N77EJ	148 N5EP	186 N44EZ	
35 N1B	73 N123EZ	111 N4985Z	149 N56EZ	187 N22883	
36 N46JT	74 N34RD	112 N888CM	150 N8037T	188 F-PV4Z	
37 DEEEZ	75 N9783R	113 N77LF	151 N50EP	189 N771J	
38 N96EZ	76 N9693R	114 N666EZ	152 N?	190 N46EZ	

CAN I BUILD A COMPOSITE AIRPLANE?  
 WILL I ENJOY WORKING WITH GLASS & FOAM?  
 IS MY WORKMANSHIP ADEQUATE TO BUILD AN AIRPLANE?  
 WHAT ARE THE TECHNIQUES USED IN VARI-EZE & QUICKIE CONSTRUCTION?

There is now available an introductory kit to answer these questions for you. The kit consists of a book and sample materials, or the book can be purchased separately. The book, "Moldless Composite Sandwich Homebuilt Aircraft Construction" consists of 26, 11x17 pages (equal to 52 pages) describing how the material is applied, education on the materials, tools required, inspection and repair methods. Sample materials include: foam (2 types), fiberglass (2 types), epoxy, microspheres, flux, peel ply, wire for hotwire saw, etc.

The book is \$14.50, and is available from Aircraft Spruce, Wicks Aircraft Supply, and Rutan Aircraft. (Add state tax, if resident).

The kit (book and materials) is \$45.50, plus and is available from Aircraft Spruce, Wicks Aircraft Supply, and Rutan Aircraft. (Add state tax, if resident).



Aircraft Spruce & Specialty 201 W. Truslow, Box 424 Fullerton, Ca. 92632	Wicks Aircraft Supply 410 Pine Highland, Ill. 62249	Rutan Aircraft Factory Airport #13 Mojave, Ca. 93501
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LIST OF EZ'S THAT HAVE FLOWN - RAF maintains a list of completed EZ's so we can contact you direct in the event of a flight-safety- related problem requiring an emergency directive. This list is also beneficial to access statistical items relating to structural and systems reliability. The list is, of course, kept in confidence. A printout of registration numbers is shown below. We believe there are about 100 flying VariEzes that are not on our current list. If you have an EZ flying please scan this list to find your number. If you are on the list please write RAF and tell us the date of first flight and the current total flight hours. If you are not on the list please write and supply:

1. Type (Long-EZ, VariEze, VariViggen)
2. Name of Owner
3. Address
4. Date of first flight
5. Registration number (N-number)
6. Total hours.

Ray and Nova Cullen have moved.

New address is now -  
 Rt 1 Box 213 #26  
 Baker, Or. 97814  
 (503) 523-5096

They are now offering plans for their survival kit plus the custom VariEze/Long-EZ seats for \$8. They will also supply some of the more difficult to locate items of the survival kit. They are still interested in supplying any builder support that is requested even though they are now in a very rural area.

The canopy seal they are using on the side rails of the canopy is a 3M Adhesive Weather strip part #021200-01235 Cat #1235 Stock # 93011 It is sold in a few stores there in Oregon but is still hard to find. Nova and Ray have tried almost everything on 22809 to gain rain protection and this stuff is the best! Note: Ray and Nova keep their airplane out a lot in a very wet climate.

## VARI-VIGGEN NEWS - By Mike Melvill

Here it is almost time to pack the Viggen and head for Oshkosh, where has the year gone? Hopefully this year we will have another Viggen to look at on the flight line. James Saunders of Miami, Florida, has got his Viggen N17VY, flying once again, and reports that he is very happy with his ship and has over 35 hours on it now with no problems. James's Viggen has the SP wings and a very pretty rainbow paint scheme. He also has a very complete, full IFR panel. The only change Jim recommends is to lengthen the nose gear strut by 1 1/2". He reports that this has substantially shortened his take-off roll. I have not tried this myself, so can not recommend a good way to do this. I will endeavor to obtain this information from Jim for the next CP.

N27MS has been to several airshows lately and now has 421 hours and 530 landings. The latest alternator is performing flawlessly (touch wood!). My fuel gauge and oil pressure gauge (both Westac) are becoming erratic. I plan on replacing both with a new type that Aircraft Spruce is now stocking. Made by Rochester Gauge Co.; they are bona fide aircraft instruments and look excellent. I will report on their performance in a future CP.

We have not heard from too many Viggen builders since CP24, but Bill Campbell is working on composite main wings, the rest of the aircraft if ready to paint. Gene de Reulle reports good progress on his Viggen, and sends in the following builder hints:

"During the construction of every aircraft, there is a job that the builder dreads. On my Viggen I was particularly dreading the job of grooving the .2 x .3 capstrips for the ribs in the inboard wing. I realize that most builders do this by adjusting the blade height on their table saw but my table saw is old and not that accurate. Besides that, running a strip that small on a table saw is asking for short fingers if one makes a small slip. I think by accident I discovered a better way and I'd like to pass it on to other Viggen builders that may be coming to that stage.

I cut the .3 inch thick spruce (A/C Spruce Viggen kit) into .2 inch strips. Then taking my Dremel tool and Dremel router attachment with the smallest router bit they make, (I forget the number, but in the display case it's the smallest) and clamping the spruce to a flat surface and adjusting the router guide, I made a square notch the length of the strip.

The groove is so exact that it's a beautiful fit on the 1/8" ribs. In fact, even on a curved surface, the capstrip can be held in place for gluing with only masking tape.

Starting at 9:00 am, I was able to cut; groove; fit; and glue all the capstrip for the top of the entire inboard wing by 1:00 pm. Now I will have to find something else to dread".

Arthur Schwartz came to Mojave for a check out in the Viggen in May, his report follows:

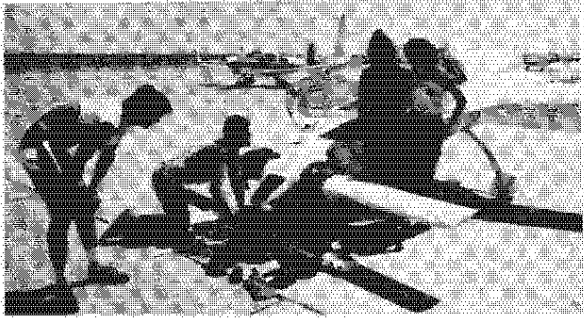
"I was beginning to see the light at the end of the wind tunnel and felt that I could best help myself with check ride in a Viggen before testing my own craft which should be ready in early August. I contacted Mike Melvill and arranged to arrive at Mojave airport in the afternoon of May 2nd. Finding the Rutan hangar made for no difficulty. Introduced myself to Sally and soon met Mike. Both, immediately gave me the feeling that I was an expected guest with most comfortable feelings. Within another few minutes I was looking at 27MS and filled with admiration and envy. I just don't think there's a higher compliment to be expressed. Before I could say or think much more I was seated in the rear seat, buckled-in, wearing a head-set and talking with Mike with a reliable intercom. For this trip I was going to follow Mike through. Mike invited me to taxi and I was quickly impressed about the ease of S turns with gently pressure on the toe brakes. Mike encouraged me to go a bit faster and at about 20-25 mph, I'd judge, the airrudders were quite effective. The large vertical fins do their job well. There was a very solid and substantial sensation to the taxi. At the end of the runway Mike went through the check-list and set the reflex at 8°. The elevation at Mojave is about 2,910 feet plus an OAT of 85° giving us a density altitude of about 5,000ft. So, I was expecting a rather long ride down the runway. Mike advanced the throttle and we were rolling. I was likewise on the throttle and stick but without any input. I was just getting the "feel" of things. Mike suggested that I watch the canard as a reference point and get the sense when it starts to fly. It seemed to me that doesn't begin to fly gradually as we're more accustomed, but sharply. One moment it is not flying and next it is. We were climbing about 750-800 feet per minute and Mike was reducing the degrees of reflex to about 4°. The vibration was smooth, the noise well behind us and with headsets things were really quiet. The rear cockpit has adequate instruments for flying, i.e. airspeed, tachometer compass, and information about gear position. When we got to about 5,000'asl Mike made some stalls but, of course, only the canard. It was ever so gentle.

Then he asked me to try my hand at flying. At this very moment, I knew that I had a very different airplane. Sensitivity with a gentleness. This might be thought of as a contradiction in terms, however I think not. I was immediately impressed with the high rate of roll and this was at speeds of about 140 mph. So, I'd say that a low time pilot might have a tendency to over control. But, this high rate of roll becomes at low speeds the ease of handling and touching-down exactly where the heart desires. The commercially built airplane that came to mind was the Mooney where the ailerons are also quite effective. Since the afternoon was well upon us and the air was some-what bumpy Mike suggested landing and to start early the next morning. I felt that the motion in turbulence was not all that unpleasant and I could have easily spent more time. I was just so impressed with the responsiveness of Viggen that I was not too bothered by anything short of something really major taking place. Came in downwind, throttle back, at some speed below 120 mph let the gear down, set reflex at 4°. When we were at cruise the reflex was all the way aft or 0°. At Mike's instruction I set up an attitude that gave me a speed of about 75 mph. Held the airspeed but having no sensation of a nose high condition. To stay lined up with the runway presented no difficulty. Wind was light. From the rear seat I began to have a problem sensing the height above the runway and took instruction from Mike in the front seat. At the moment, just before a touch-down the slightest bit of flare, just a little. The mains were down and directional control was easily maintained with air-rudders. At this time Mike reminded me of how the canard will stop flying. The very same way it starts - - suddenly, and I should try to hold it off so the nose gear doesn't hit hard. I had a couple of good ones and a couple of not so good.

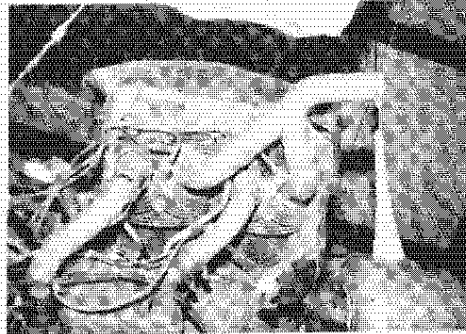
The next morning things were different. It was cool, quite and I was sitting in the front seat. After the day before I was starting to feel like this airplane and I were made for one another. What else gave me that feeling was Mike Melvill as an instructor, he was there but also wasn't. He rally permits you to be in charge and learn from what you do right and from what you do incorrectly. Today we were going to do the things that you must do before you take the airplane high in the air away from the runway and the earth. It's the thing that most pilots never do and it's controlling an airplane in that state between flying and not flying. We were to lift the nose wheel off while going down the runway and test pitch authority and aileron control (rocking the wings while riding on the mains). After going through the check-list I placed my-self on the center line and know that I have about 10,000 feet of runway ahead. Applied power and got moving to about 50-55 mph, came back on the stick until the nose wheel lifted off and at the same time reducing the power ever so slightly. In this condition you can move the stick forward and back and watch the nose rise and fall demonstrating the pitch authority. The lateral movement of the stick (gingerly) will rock the wings. I did that up and down the runway for a considerable time. It builds confidence in feeling about handling, and the responsiveness of the Viggen is tested. Next Mike suggested I try a lift-off of nose and mains but to stay in ground effect. Reflex at 4°, more power than for just nose wheel lift-off, until moving close to 60 mph plus, a lift off, test the pitch control and lateral movements of the wings and then ever so gradually reduce power. Especially not to be concerned that all the runway is gone and make the sad error in a pusher by chopping the power. If there's one place where pilots who don't have pusher experience, is being surprised when the nose-up attitude develops with reduced power, (abrupt reduction of power). But, generally in an airplane all changes should be done slowly and with gentleness. From this point it was into the air with making landings and take-offs. While I came to this experience with 400 hours, in my homebuilt Volmer Amphibian (pusher configuration) I regard and strongly urge anyone thinking about testing flying his newly built Viggen to visit with Mike and reward yourself with this most valuable experience.

A curious state of affairs develops between builder and airplane over the years of construction. The builder comes to regard the plane as a kind of extension of himself and endows the plane with some human features. Especially the one that the plane will take care of you, albeit without you having to do the flying. The reality is quite different you must be prepared to fly, the plane can't. There is a kind of old wives tale that goes through aviation circles to the effect that the builder should not test fly his own airplane. As far as I know the dynamics behind this remark has never been expressed and so I've taken this liberty to give a small insight into the relationship between builder and his creation.

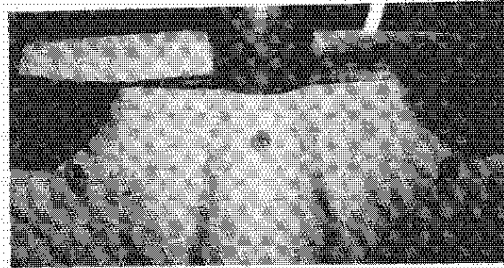
This summer/fall will surely see a couple of new Viggen's flying, Arthur Schwartz, Ken Guskott, Frank Stites all report being very close. See you at Oshkosh.



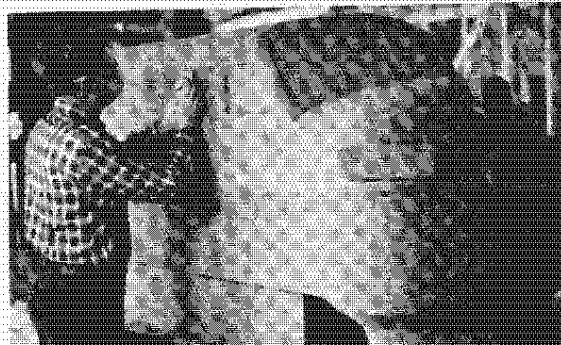
Where does it all go? Burt and Dick inspecting the various baggage and nose baggage areas in the Grand Champion "Pegasus" VariEze. Norm Ross and friend Glenne Campbell stopped by RAF recently on one of their many trips. Norm has flown the Grand Champ more than 300 hours since Oshkosh '79! During their stay Norm flew the Long-EZ and Mike Dick and Burt flew Pegasus. We can now say first hand that this airplane performs and handles excellently. Even though it is well equipped, it is one of the lightest EZ's flying. Norm has the empty weight down to less than 600 lb. now, with alternator removed. Norm is the recognized expert in weight control. He fabricated intercylinder baffles by wetting out 1 ply BID with silicone rubber, then (AFTER cure) mounting them with silicone - presto - a fatigue free baffle that is lighter than aluminum. Norm's CHT runs less than 350° F on the O-200. It can be done, with good baffle workmanship.



New Brock exhaust installed on Long-EZ



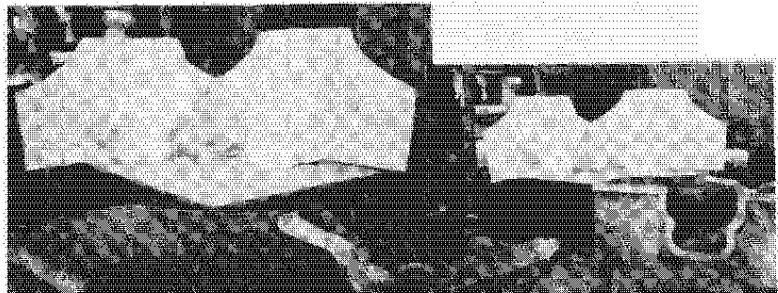
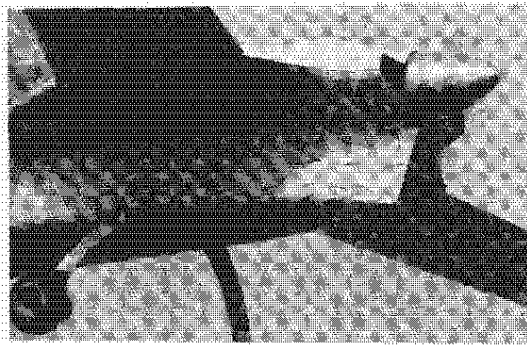
This photo shows the extensive baffling on Steve Woods's O-200. An article on Steve's work will appear soon in Sport Aviation magazine. Also shown is the tufts on Steve's boat tail (photo by Steve from the back seat of the Long-EZ) The amount of turbulence is similar to the standard cowl. Whetted area is greater. The inlet itself is lower drag than standard.



Burt ----  
I epoxied the polyurethane together and carved the fuselage as per your VariEze plans. Either your instructions were too vague or I misconstrued them.

The enclosed photo shows me carving away at FS42 just before I discovered my error. Can you offer a fix or should I fly it this way? You may answer in your newsletter because it might help other who have had this problem.

Jud Hansen  
2674 No 97 St  
Omaha, Ne 68134



Initial cowls out of the new metal tooling for VariEze and Long-EZ.

CP 25, Pg 11

## Tests Prove Old Fiberglass as Good as New

Fiberglass composites were introduced 40 years ago, but only now have their service aging properties been tested. And the results are a revelation.

Real-life tests on fiberglass samples were carried out by two scientists at the Grumman Aerospace Corp., George Lubin and Peter Donohue. With a bit of scientific detection work, they tracked down fiberglass components from 11 to 19 years old that had flown on Grumman aircraft and that had been extensively tested prior to being put into service.

Before this effort, the only published data on aging of fiberglass composites were those based on accelerated testing performed in the laboratory, which is the standard tool in use for testing both fiberglass and other composites for in-service structural degradation.

According to Lubin, "hard work, luck, and the fact that Grumman wasn't quick to change fiberglass formulations" played a part in the

unique opportunity to be the first to document actual before-and-after results on fiberglass components.

In their paper, "Real Life Aging Properties of Composites"—selected as best in its class at the 35th annual conference, Reinforced Plastics/Composites Institute, Society for the Plastics Industry—presented last month, Lubin and Donohue detail the testing results on fiberglass components that flew aboard Grumman aircraft and were subject to extremes of climatic conditions and to combat. Without exception, all components tested showed virtually no degradation as long as they were properly protected by paint coatings.

Their conclusions dispel the myth that fiberglass degrades with age. More significantly, they throw into doubt the validity of accelerated laboratory aging, which invariably causes considerable degradation of samples tested—a result not supported by Lubin and

Donohue's findings.

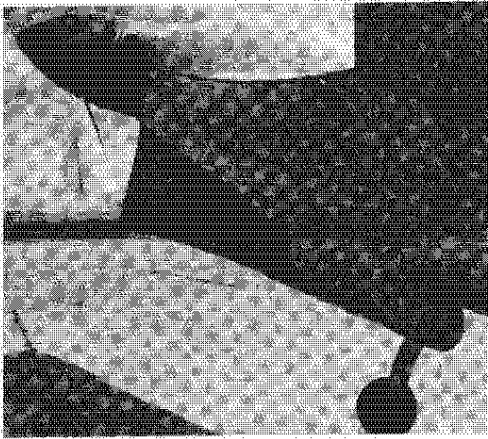
A reassessment of the criteria currently used for testing fiberglass composites is needed, the two scientists believe. They feel it is certain that current specifications based on such testing result in overdesigned and, therefore, overweight fiberglass structures. More realistic accelerated aging specifications would, they say, result in structures of fiberglass composites being lighter in weight. For aircraft, especially, this would permit significant savings.

The two also tested graphite composites, but owing to their relatively recent arrival on the composites scene, the results for these materials were not as conclusive as those for fiberglass. MKB

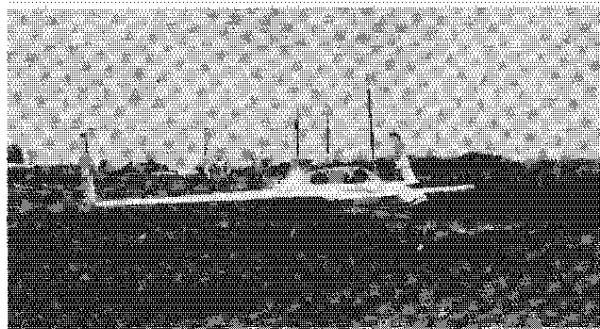
### Ancient aircraft parts prove durability of FRP

Fiberglass composites don't degrade with age, provided they are protected by paint coatings, tests of 11- to 19-year-old aircraft components show. The tests also throw into doubt the validity of accelerated laboratory aging.

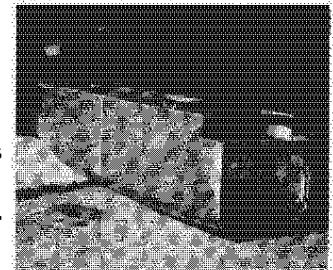
0-200 Continental, zero time, all new, 100 octane valves. Guaranteed for 100 hrs. Contact: Stubs Aviation (317) 271-2762. Price: \$3500. Engine will be Oshkosh, '80.



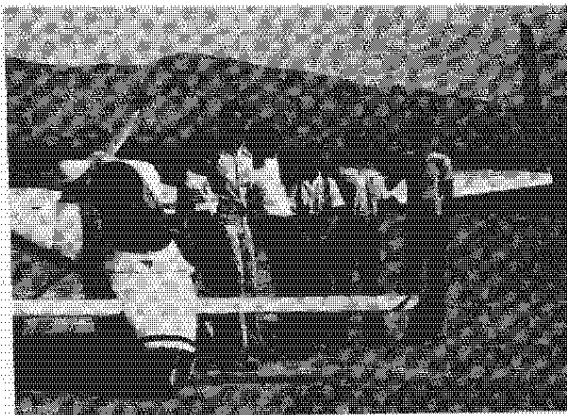
Boat-tailed tested on VariEze N4EZ - Also installed is the new Great American Prop.



The Long-EZ prototype on grass. 500 x 5 tires are mounted, as well as the spring strut. The ride and handling is similar to most light-planes - very pleasant.



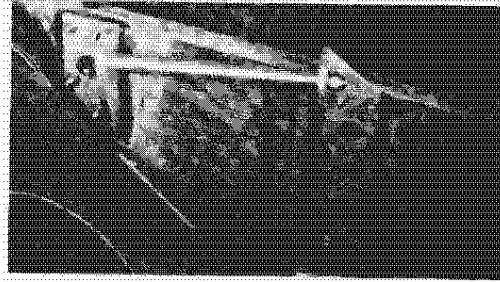
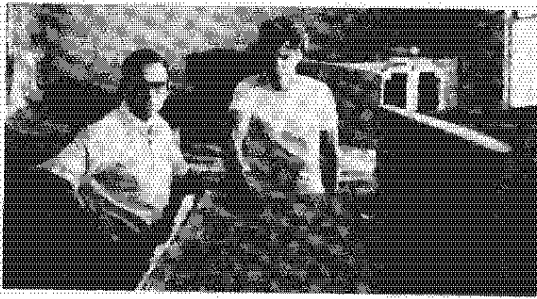
It seems the fastest Long-EZ builders are those that have built VariEzes. The adjacent fuselage is the first 1½ weeks work by Herb Sanders. Other EZ-types of note are Ed Hamlin and Don Shupe. Ed and Don have a total of just under 1000 hours on their EZ's. Ed, Joanne, Don and Bernadette plan a round-the-world trip for a summer vacation when they get their Longs finished.



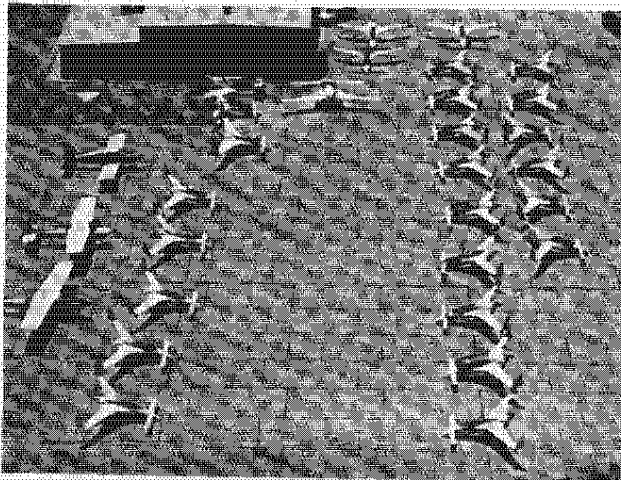
The RAF crew with the Long prototype. Left to right: Pat Storch, Burt Rutan, Dick Rutan, Sally and Mike Melvill, and Roger Houghton.



Pat and Sally after Pat's Long-EZ solo.



Mike and Dick at work on their Longs. Note tools for fuselage bottom carving and main gear attach hardware. The AN 4-16A bolts require two washers for mounting these brackets. A shorter bolt should not be used, as it results in threads in the bracket.



25 EZ's, a VariViggen and a Defiant at Mojave! All the people are inside having lunch.  
Photo by Don Downie

Sally with RAF's Long-EZ. She joined N79RA last year. Sally and Mike are now working about 30 hour per week building their own Long. They plan to fly the new one to the Bahamas this Christmas for the Hospitality Club Fly-in.



# 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. Power plant is either the O-235 Lycoming or the O-200 Continental. 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 wing strakes 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 P.V. 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 or wood, composite sandwich structure offers less construction time, more uniform stresses, improved fatigue life, better environmental resistance, and increased surface durability.

## TRAVELING MACHINE

At last, an airplane that is specifically developed for efficient, high speed, longrange 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 (161kts), 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 (125 kts), burning only 3.52 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-gallon fuel capacity, stretches the maximum range and endurance to over 2000 miles and 16 hours!

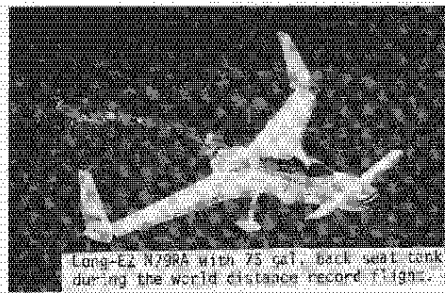
The high efficiency, long-range capability increases a pilots options for fuel availability and weather detours. The fact that the Long-EZ can carry the same load and fly as fast as other 160-180 horsepower aircraft, means large fuel savings - 29 mpg at fast cruise, 41 mpg at economy cruise.

## 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 worlds 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. Our 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 at 360° pattern and land on the same runway - completely without power! Its 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 safe stall characteristics. It can be maneuvered sharply, even to full aft stick, without fear of stall or spin. Flight tests show the prototype to be free from stall departures and spins for all types of entries, including tailslides. Climb is excellent, even at the full-aft-stick speed.



Long-EZ N729RA with 75 gal. back seat tank during the world distance record flight.

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 240 lbs.

The Long-EZ's approach and landing speeds are 75 mph (65 kts) 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 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, provides building hints, etc. Complete owners manual provides all necessary information for safe 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 tests exceeding part 23 criteria, environmental/thermal tests on structural materials/components, manufacturing methods testing, and many others.

## COST AND BUILDING TIME

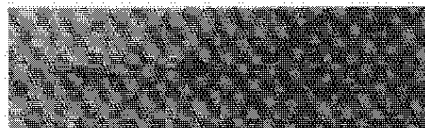
The complete package of raw materials available from the two distributors listed, including all fiberglass, epoxies, foams, fillers, sheet metal, tubing, hardware, control system materials, VFR instruments, plumbing, tools, tires, wheels, brakes and upholstery (cushions and special suitcases) costs about \$2,900. 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 gear 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 those prefab parts cost approximately \$1,600 - 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 cost of the prefab items. Contact the manufacturers for their catalogs showing available prefab parts. These are also listed in the plans bill-of-materials.

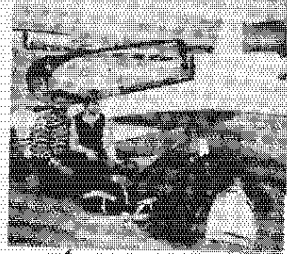
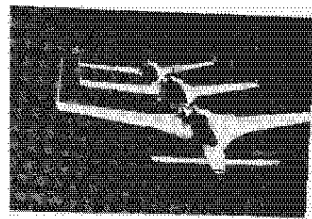
Engine costs vary widely. Our prototype has an O-235 Lycoming that had 1400 hours, when purchased for \$1500. It has 600 hours to overhaul and will be worth then, about what we paid, thus this is a very economical way to go. Newly over hauled or new engines can cost from \$3000 to \$6000. Engine accessories,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

In summary then, total cost can run from \$5300 for a basic airplane with a 3/4 runout engine and owner-built prefab parts, to \$9900 for everything available purchased and a zero-time engine. IFR avionics can add from \$2000 to \$15,000 to those numbers, with many options available.

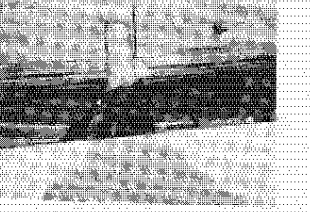


Brief Long-Ez specifications/Performance			
Engine Lycoming O-235 108 hp.			
Span	26.3ft.	Takeoff (solo/gross)	550/830 ft
Area	94.1sq.ft.	Climb (solo/gross)	1750/1350 fpm
Empty Basic	710 lb.	Cruise 75% 8000 ft	183 mph
Empty Equipped	750 lb.	Cruise 40% 12000 ft	144 mph
Solo Weight	960 lb	Max range * 75% (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.

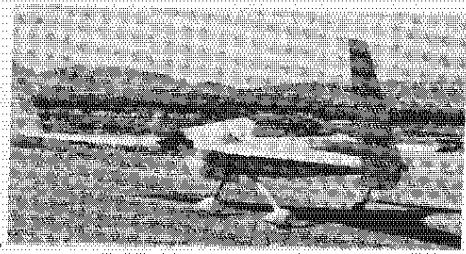
\*40-minute reserve



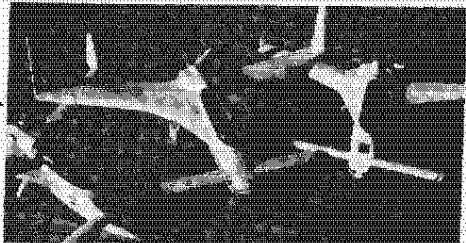
This amount of baggage fits nicely in the Long-EZ baggage areas. Baggage is accessible in-flight.



Sally Melville 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, cowl installation, prop and spinner.

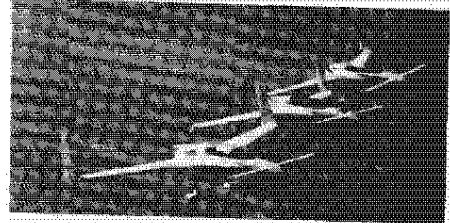
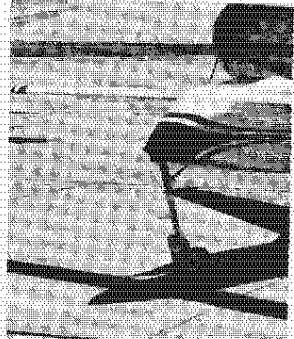
**SECTION IIC - Lycoming O-235**

**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.

The nose gear retracts for parking and in flight.

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



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

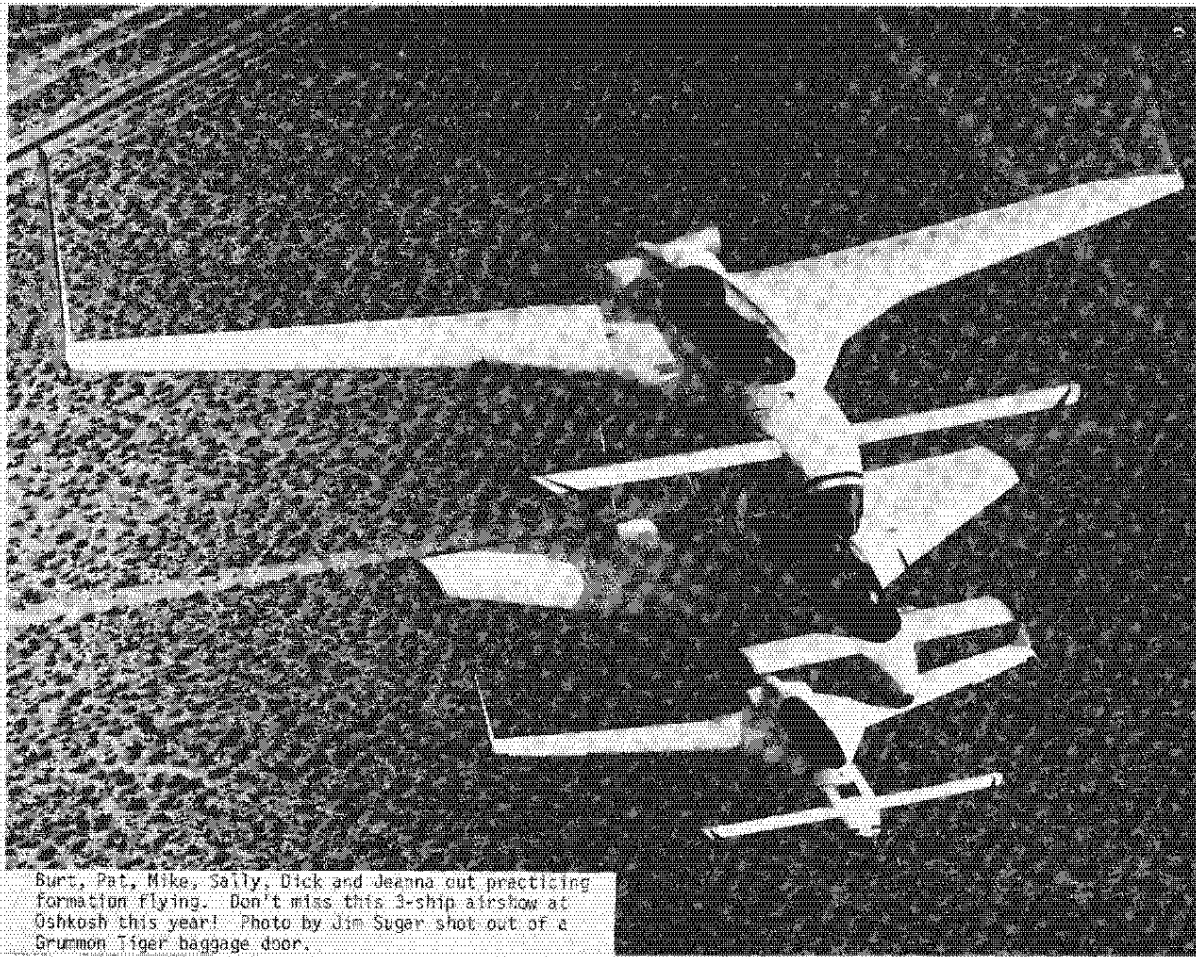
Check items desired.	Price, includes first class mail to U.S. & Canada	Overseas, Airmail - [U.S. Funds on]
<input type="checkbox"/> Rutan Aircraft Information Package-complete data and photos of all Rutan Aircraft designs.	\$ 5.00	\$ 6.00
<input type="checkbox"/> "Canard Pusher" newsletter. Published 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 IIL 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
6% tax, if Calif. order Newsletter not taxable.		
TOTAL		

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.	Near St. Louis
AIRCRAFT SPRUCE 201 W. Trustow Ave, Bx 424, Fullerton, Ca 92632 (714)970-7551 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



Burt, Pat, Mike, Sally, Dick and Jeanna out practicing formation flying. Don't miss this 3-ship airshow at Oshkosh this year! Photo by Jim Suger shot out of a Grumman Tiger baggage door.

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Mojave, CA 93501**

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**TO:**

The number which appears on your label before or after your name, is the last newsletter **issue** which you will receive and requires you to renew to receive the next issue. If your label has a 25 on it, then #25 is your last issue and you need to renew.

**NOTE SUBSCRIPTION PRICE INCREASE.**

**PLEASE STATE THAT YOU ARE A RENEWAL!!**

**25**