

THE CANARD PUSHER

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If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 28. If you are building from 2nd Edition plans you must have newsletters 18 through 28. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 28. If you are building a VariEze from 2nd Edition plans you must have newsletter from 16 through 28. If you are building a Long-EZ you must have newsletters from 24 through 28.

A current subscription for future issues is mandatory for builders, as this 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 Activities.

We are pleased to announce that we have entered the Soaring Society of America's contest to design and build a home-buildable single-place, self-launching sailplane. Because of the competitive nature of this event, we regret that we can not release any details concerning configuration, power, performance, or method of construction. There are currently 55 official entries in the SSA's contest, which was announced in September 1980. The fly-off and evaluation of all entries is planned for the summer of 1982. Please do not call or write to us for information on our entry. All information that we feel we can discuss will be released right here in the Canard Pusher. This is also in line with our policy not to put out information on any project we may be working on until we have flown it successfully.

Saturdays from 11:00 am to about 2:00 pm have been very busy with from 30 to 100 visitors showing up at the shop. Generally we have the VariViggen, the VariEze and two Long-EZs on display. We have been showing the construction video tape plus a very entertaining tape of RAF planes flying formation. We then generally have a "bull session" answering any builder or pilot questions and wind up with flying one or all of the airplanes, at around 1:00 pm.

RAF will be closed and the Saturday demo not given on the following dates:

23 May	Watsonville Fly-in
20 June	Cafe Race 250
1 Aug & 8 Aug	Oshkosh EAA Convention

Video Tape

We recently completed our video tape on construction techniques used in building moldless foam/fiberglass aircraft structures. This video tape should be a valuable tool for the first time builder as well as the experienced builder. It runs for 96 minutes and thoroughly covers every phase of construction including health precautions, foam preparations, hot wiring, foam damage repair, epoxy mixing, the use of micro balloons, flox, fiberglass, both UNI-directional and BI-directional, wing shear webs, wing spars, wing skins, leading and trailing edge treatments, corner tapes, peel ply and much more. This tape is available from RAF for \$49.95 in either Beta II or VHS (half inch format).

Newsletter list goes on the Apple We now need your number!

You've all heard good-news bad-news stories. Well, the good news is that RAF is in the process of putting the growing Canard Pusher subscription list on our Apple computer, which will hopefully make the system, by which you receive your copy every three months, more efficient. In the past the mailing labels have been typed by hand - a tedious task at best. Computer-generated labels will speed up the processing of address changes and renewals. This improved system will benefit you as a subscriber.

Progress is not made without sacrifice, however. We realize that the change over to the computer may not be flawless and ask that you be patient with us during the transitional period. Names go on the computer as we receive new subscriptions or renewals, so it will take a full year to use up all the hand-typed labels and get all subscribers on the system.

The bad news is that in these number-oriented times, we are asking that you keep track of yet another number! Each subscriber will have a unique subscription number which will be the first number in the first line, right after the # sign. (#100 in the example). As in the old system the issue number of the last CP you will receive before your subscription runs out will also be in the first line, only now it will be much more obvious.

#100 Last issue - CP 34.
John Doe,
1234 Main Street.
Anywhere, USA 9999

When you renew, or if you have a question about your subscription, please mention your subscription number, or send in an old label. This will greatly speed the processing of your order.

None of us are thrilled with the prospect of losing our identity and being reduced to a number, so we'll let you in on a secret. We will be able to find you by your name, (as long as the computer hasn't misspelled it!) if your Great Dane eats all of your back issues and you can't remember your number due to the temporary amnesia you incurred while chasing the dog around the house, slipping in the wet epoxy on the floor and hitting your head on the corner of your work bench! This is the only excuse we will accept, however! Our system is small and limited - please help us with this so that we can all benefit from the system and so that RAF can be of better service to our Canard Pusher subscribers.

RAF BUILDER SUPPORT.

It has become necessary to further clarify Rutan Aircraft's position in relation to the homebuilder and the support we give. Rutan Aircraft can only offer the assistance that helps them interpret the plans when they desire to build their aircraft like the prototype we have tested. We cannot assist in the design and construction of modifications. We cannot comment on the advisability of modifications. Many of the developments we design and test do not work as predicted. Thus, without testing your idea we cannot reliably predict its success. A similar situation exists for substitutions of materials. We will not be able to advise you on any material we have not tested ourselves.

AD-1 Reaches 60 degree Wing Skew
in NASA Flight Tests.

The RAF-designed AD-1 jet research aircraft has successfully completed initial wing-skew-angle envelope expansion flight tests with the wing being skewed to its 60 degree limit. Although the sensitivity, yaw trim change and coupling were noted, flying qualities at full skew were better than anticipated.

The AD-1 airframe and its two TRS-18-046 jet engines have required no repair or unscheduled maintenance during the test program. The 100% availability is unusual for a research aircraft. For further information on the development of the AD-1, see Canard Pushers No 10, 11, 17, 18, 19, 20, and 23.



Video Tape (See Page 1) Add \$4.00 for postage and packaging for mail orders. The \$49.95 price is for walk-in customers at RAF.

26MS - Mike and Sally's Long.

Currently we have 85 hours on our Long and it is literally running like a Swiss watch. We are truly delighted with it in every possible way. We have been using it to commute to work every day for the past couple of months. From Techachapi to Mojave by road is 26 miles, about a 30 minute drive. It takes between 8 and 12 minutes in the Long, depending on the winds. We use two to two and half gallons for a round trip. This is almost exactly what we use in our Honda Civic car. Beside the time saved the biggest thing is the 'fun' factor. There is a lot of enjoyment in flying across the desert in the early morning with glass smooth air, no traffic and the stereo tape deck playing in the head phones. Coming down-hill in the morning, we usually fly at very low power settings. The quiet, smooth exhilaration really makes it enjoyable to come to work.

All flight tests, engine break in etc., have now been completed. All systems work perfectly. The Radair comm, nav, and transponder work very satisfactorily. The Sigtronics intercom and audio switcher work excellently in conjunction with our stereo tape deck. This also gives us the capability to transmit from either cockpit. The newest piece of equipment recently installed is a Silver Fuelgard. This small instrument accurately reads out fuel flow in gallons per hour and you can look at fuel used with a momentary switch. This fuel flow meter is a TSO'd instrument and uses a flow-scan transducer. We installed it in the fuel line so that all fuel on board runs through it. It is accurate within + 2%. So far it has verified the Owners Manual fuel flow information very closely. N26MS will burn 1.9 gallons per hour at minimum power required for level flight at 8000 ft (max endurance) and at 75% at 7/8000 ft it reads 6.7 gph. Take off, full rich at sea level is a shock, 11.7 gph!! On a recent cross-country, we went to Northern California, a straight line distance of 404 nm (471 sm). On the trip up north we had a ferocious head wind of 29 kt. (33 mph) so we ran at approximately 70% power at 8500ft. for a fuel flow of 6.4 gph. This gave us a ground speed of 130 kts. (150 mph) with a true airspeed of 159 kts (183 mph). Our time enroute was 3.1 hours and we used right at 20 gallons of gas. By contrast on the return trip we had a tail wind!! We climbed to 11,500 ft, where the tail wind component was 35 kts, (40 mph). It took some will power, but we pulled the power back to approximately 48% which gave us a fuel flow of 4.4 gph, and a true airspeed of 133 kts (153 mph) which, with the tail wind, had us crossing the ground at 168 kts (193 mph). The time enroute was 2.4 hours and we burned a total of 10.6 gallons of gas!

I honestly believe that a Long-EZ built to the plans will consistently give these kind of results. The airplane is incredibly comfortable, reasonably quiet, particularly with David Clark headsets, and is an honest to goodness, economical, high speed touring machine, with good baggage capacity, excellent high altitude capability and unbelievable range. All in all, looking back at the intensive effort required to build it, it was well worth it!! The Long continues to delight us, Sally takes it to her 99's meetings, I have been into terminal control areas, we have flown it quite extensively at night. We have flown over mountains, over ocean (to Santa Catalina) and it is just super. The Lycoming O-235-L2C has continued to run like a dream and to be honest, I have no regrets. If I had to do it again, I would build it exactly as we did, using the same engine. The only thing I would not recommend is the electrical system we have. The engine came with a 28 volt starter and alternator, and all the electrics on the airplane are 12 volt. We have got it working, but it was simply too much hassle for the average builder to have to put up with, when you don't have to. N26MS will be here at RAF on a daily basis, and we plan on attending most of the flyins, including Watsonville and Oshkosh.

Long-EZ #4 by Dick Rutan.

Last summer Mike Melvill and myself decided to build ourselves one each Long-EZ. We agreed to work together on the basic structure then split off and finish individually. On 15 June 1980 we started and with a lot of help from Mike's wife Sally and my friend Jeana Yeager both aircraft are now flying. Mike's (N26MS) late December 1980 and mine (N169SH) in early April 1981.

Mine took longer to build for two reasons. First, Mike worked harder, but the biggest reason is all the changes I made to mine. I thought I wanted more power, more roll rate, more negative g and IFR equipment. I installed a bigger engine, longer ailerons, different canard airfoil and several other changes. All these mods took more time to build, cost more and after first flight, I found they didn't work. When I should have been very happy after it flew I was not. Instead of having an aircraft I could use I found I had a "prototype" that needed work. The big engine overheated, the revised canard airfoil resulted in loss of speed-stability at high speed, and very poor stall characteristics (a nose drop). The standard Long-EZ rolls about as fast as mine and because of a poor prop match, Burt's Long even out-ran me on the first flight! I was then faced with finding fixes for all the problems.

I'll fix the problems but it will take some time and effort. But in retrospect, I wish I had stayed more standard. My airplane now is a compromise, a whole bunch more effort that I feel is not worth it.

If you see my light-blue modified Long-EZ (N169SH) at flyins and airshows, remember the mods were not approved by Burt or RAF. In fact Burt was not aware of most of them. Please don't bother RAF about my mods. They have enough to do just to support those building from the basic plans. I do not intend to do as complete a test program on my airplane as RAF did on N79RA. Thus, they are in no position to verify or recommend my modifications.

I am now deeply involved in the Voyager round-the-world program and will not be able to get involved in any way assisting builders.

I don't recommend any of the changes I've made and wish I had not. The best advice I can give is to keep it stock, build it light, and resist the temptation to change, especially anything structurally.

Sun-n-Fun Flyin.

Although none of us from RAF were able to make it over to Sun-n-Fun, RAF was very well represented by Irene Rutan (Burt's Mom) with excellent help from Johnny Murphy. Irene recorded 24 VariEzes and 1 Long-EZ that landed at Sun-n-Fun during the week up til Friday, when Irene had to leave. Here is a list of pilots and their airplane "N" numbers:

Johnny Murphy	Long-EZ	N21VE
Tom Bradford	VariEze	N25TB
S.E. Cochran	"	N115AM
Dick Cutler	"	N46RC
Norm Dovey	"	N16ND
Frank Dudley	"	N20VE
Mule Ferguson	"	N2286A
Tim Gehres/Steve Wood	"	N56EZ
Dave Hesterlee	"	N86DH
Larry Hoepfinger	"	N7Al
Gerry Mason	"	N27GM
David Richter	"	N87ZEZ
Ray Richards	"	N48EZ
Robert Ridihaigh	"	N25RR
Ed Rockwell	"	N7ER
Jack Sargent	"	N75EZ
George Scott	"	N240EZ
Earl Thompson	"	N55EF
Jim Trombino	"	N46JT
L. Uhley/P. Mason	"	N2UN
Joe Walker	"	N419JW
Fred Wimberly	"	N99FW
Bob Woodall	"	N301RW
Don Yoakam	"	N77DY
David Langston	"	N83DL

VariEzes made the front page of the St. Petersburg Times twice during the week. The VariEze race was held over a 49 mile course on Friday morning, and on Friday night the whole group got together to swap tall stories. Irene reports that VariEze pilots/builders are the finest people in the country and she was proud to see so many beautiful ships flown in for the folks to see. She wants to thank all those who were there for being so good to her and showing her such a great time. She loved every minute of the week.

Tim Gehres sent us the results of the race, held on Friday. Ten people entered and 8 raced. The race was a handicap race, based on the Owners Manual performance, baseline being a VariEze with an O-200 with wheel pants and a spinner. Congratulations to Paul Mason who won (his corrected speed for the race was 182.23 mph) George Scott was second at 170.77 mph and Bob Woodall was third at 169.54 mph. Johnny Murphy flew his Long-EZ in the race, although he was not an official entry and surprisingly his speed would have placed him second at 177.10 mph (good show Johnny!) Tim Gehres also was not an official entry and his speed was a blazing 183.9 mph! We would like to thank Tim Gehres and Steve Wood for the work they put in in organizing and running such a successful race. Hopefully this can become a traditional event each year.

Memories of Sun 'N' Fun - 1981 by the "Real" George Scott.

1. Dave Hesterlee's VariEze rising through the North Georgia haze as he departs Bear Creek airport right on schedule to wing into formation with us on the way to Lakeland.
2. The chatter of the ground controller at Gainesville Florida wanting all the performance specs on the EZs.
3. Rapid fire direction from the tower controller at Lakeland. He says "Don't talk to me, I'll talk to you" and then proceeds to ask if we want to make a 360 degree turn behind the STOL or what?
4. As we taxi through the Warbird parking area all thoughts of the spectators leave WW II and Join Star Wars.
5. The envy of all, as Johnny Murphy comes winging in via his Long-EZ "Sweet Music".
6. How Eze the tie down stakes go into the Florida sand, compared to the Oshkosh black soil.
7. Yes, they still ask "Where is the tail wheel?" "What's the solar panel for" and "Where's Rutan".
8. Tim Gehres and Steve Wood trying to coordinate their work schedules, commute from Orlando and still organize the VariEze Race.

9. Paul Mason calling every day with excuses as to why he couldn't run the race but winning anyway.
10. Dave Richter on a nationwide tour from New Jersey to Lakeland, to the Islands, to the West Coast, to Alaska, to Oshkosh and beyond. (Dave, are "C" rations any better than they were 25 years ago).
11. At the IVHC banquet a couple of local patrons ask, "What's a VariEze?" and 12 people all explaining at once.
12. Irene Rutan traveling all the way from the West Coast and spending all week loquing in VariEzes and helping to pass the word on RAF.
13. Jeff Rose smiling when he explains the comparison of flying the VariEze, the Long-EZ and the Defiant. (How many of us have accomplished that?).
14. My sweet little wife working two days parking big ole airplanes and how proud she is of the volunteer patch she's earned.
15. Mule Ferguson scaring the devil out of the spectators with his ugly green mask.
16. VariEze pilots sneaking a peek at the canard Ultralite "Goldwing" (Don't tell Burt!).
17. How the tower Controller's voice changes with a little respect when he recognizes a real VariEze in the pattern.
18. We vow to install cabin heat in the Long-EZ when the OAT indicates 20 degrees F at 5500 ft and my toes chatter against the rudder pedals.
19. John T. Baugh's pet monkey visiting the VariEze crowd.
20. The strong Lakeland winds blowing from the West seemed to carry a faint odor of Safe-T-Poxy. Could those winds have carried a hint of RAF's latest project?

A Note from EZ Ed - owner of one of the highest time VariEzes.

Burt asked me to jot a note for the newsletter since at this writing (4/22/81) I have 680 hours on 777EJ. It first flew in March of '78 and since that time we have really flown it quite regularly. In '78 we went to Oshkosh plus explored all of California twice. In '79 we made a trip through Canada, we were going to Alaska but "someone" got carb ice and Joanne had a tooth go bad in Calgary. In 1980 we went to Montana (home again) and toured some in that area. We also made the Bahamas trip in '80-81 to cap off '80 and start '81. At Easter we went to Loreto Baja Sur, Mexico. Had a really great time.

The reason that the hours build up on 777EJ so fast is that I also use the airplane in my work. I work for Placer Savings and we have 22 branches. I visit each branch at least once a month and often more frequently. I average flying to a branch once or twice a week, (the boss buys the gas) so we really get to keep the cobwebs off Echo Juliet.

As far as maintenance goes I really haven't had any major problems. The engine has run great but I did a top at 400 hours and had one wierdo, a warped intake valve seat. Those two problems though didn't stop the flying for long.

I have used a lot of brake pads as the airplane is an all brake situation after it's on the ground. I can touch down say at 75 mph on a 5200 ft runway, (I did it at Mendocino, with a passenger) and probably would go off the other end. That's with speed brake down and rudders extended. If I ever suspected I didn't have brakes I would land nose gear up. A 2" x 3" x 1/4" steel pad is good for at least 3 nose gear up landings!

When we get 1000 hours we will write another article.

Ed Hamlin.

New Book Details Rutan and RAF Evolution.

A new Tab publication (TAB books, Blue Ridge Summit, Pa, 17214) written by Don and Julia Downie, titled "Complete Guide to Rutan Homebuilt Aircraft" is now available. It is the result of several months of research by the Downies. While much of the book consists of previously published information, the reader who is curious about the early years of Burt Rutan's aircraft work will find extensive information never before written. Also the book is profusely illustrated with over 100 photos.

Care of Composite Structures.

Composite aircraft such as the VariEze and Long-EZ should have a virtually unlimited life, provided they are reasonably well taken care of. In addition to normal maintenance as required for the systems, oil and grease where required, etc., it is very important to immediately repair any dings, chips or scratches in the paint/skin as well as the cockpit interior. Any scratches or chips that expose the epoxy/glass structure are subject to immediate ultra violet degradation and/or water absorption, depending on the degree of damage. Skin damage that exposes the epoxy/glass structure can result in water being absorbed into the laminate, and then when the water freezes (expands) there is a possibility of local delamination damage.

To sum up, all hangar rash, scratches, chips etc., in the finish should be repaired and repainted as soon as possible.

Safe-T-Poxy and Humidity.

Good news! The manufacturer of Safe-T-Poxy has confirmed that this type of epoxy can be used in up to 90% humidity with no problem. This will be a big help to those of you who live in areas with high humidity. Of course temperature is still very important and although it is possible to make a satisfactory layup in temperatures as low as 65 degrees F, and as high as 100 degrees F., the ideal temperature is 75 to 85 degrees F. Safe-T-Poxy is relatively insensitive to moisture and that is why it can be used in an environment with high humidity. This is also a tremendous advantage over the life of your airframe, since the cured laminate is also more immune to water absorption than normal epoxies. This reduces the possibilities of weight gain through water absorption, a common problem with most epoxy laminating systems.

Caution. We have been approached lately by builders wanting to use Ciba Araldite 506/507 epoxy to build their Long-EZ or VariEze. We cannot recommend the use of this material. The heat distortion point of this laminating system is low and can cause long term "creep" problems. The water absorption is high, which will hurt the life expectancy of the airframe. The chemical make up of this material is such that many builders will become sensitized due to high irritation factor.

Remember, Rutan Aircraft Factory, Inc., has spent many thousands of hours, building, testing and flight testing the prototype aircraft that we sell plans for. For us to recommend any material that we have not tested in an aircraft that we are currently flying would be unethical. We have learned that another plans distributor has shifted their recommendation to a cheaper epoxy even though their prototype is not built from the cheaper material. This practice is, in effect, asking the homebuilders to test something new to see if it is adequate. This practice is acceptable because each homebuilder is the manufacturer of his own aircraft. However, we feel that ethics require that if a homebuilder is breaking new ground he should be notified that he is being recommended to use something that has not been tested on a prototype.

VariEze stall Characteristics and CG Position.

We recently received a letter from Shirl Dickey of Utah, notifying us of his initial flight tests of his new EZ, N60SD. His letter is printed below:

Dear Burt,

I just wanted to drop you a note telling you of the first flight of VariEze N60SD. My bird is equipped with an O-200 Continental, wing cuffs, speed brake, full instrumentation and a Cessna alternator. I am planning on installing a lightweight alternator.

Sunday morning 2/22/81 was clear, calm and cold, a perfect day for taxi and flight tests. Bruce Tuttle flew his VariEze N958C down from Ogden and was on hand for help with initial setup and check out of my new bird. Another builder John Wall was also very helpful.

Bruce and I discussed the procedure I would be going through starting with low speed taxi tests, high speed taxi tests and runway flight. All went per plan until I attempted my first runway flight. I had accelerated to 80 mph and pulled the power off and with pitch up command it lifted off and went unexpectedly to 50 feet. I could see that I would not want to attempt a landing on the remaining runway and so after only a slight period of indecision I added power and climbed out.

That first lift off and flight came some what unexpectedly and I was immediately filled with apprehension about landing. This was where all my practice in a Cessna 172 and Mooney 231 would have to pay off. I brought it around the pattern at 100 mph on downwind, 90 mph on base and 80 mph on final. I approached low with slight power and crossed the numbers with the runway visible over the nose. Then I chopped all power and it sank unexpectedly fast and my reaction was to pull up elevator, which wiped out my view of the runway and I found myself feeling for it for a nose high landing. Not too graceful but I got it down on the mains and then dropped it on the nose pretty hard.

The roll out was exhilarating. It was the first opportunity that I had to think about what had just happened. We checked the plane out for landing damage (none) and then it was off again. All in all the first flights were so successful that I logged 6.1 hours that day including about one hour flown by Bruce, & some formation flights alongside his Eze. My wife, Diane rode with him and took some air to air pictures. I also flew some long orbits within my restriction area

getting the feel of the plane.

No slow flight was attempted but I did investigate high cruise. I got 160 mph indicated at 8000 ft. straight and level which trued out at 181 mph (no wheel pants, no spinner and no nose gear covers) at 2800 rpm.

The only flight problem was a slight left banking tendency. It flew ball-centered with no yaw trim. Roll rate was fantastic, with the rudders it was really quick. Stick forces were roughly equivalent for pitch and roll and very comfortable.

I ended up the day doing touch and go's, working on my technique, I found that it was best to carry a slight amount of power and fly it onto the runway, a Cessna-style flare always resulted in a nose-high, high sink rate landing and so I soon learned not to do it that way. As the sun was dropping low I reluctantly had to call it a big day and put my new toy away.

The aircraft is everything I had dreamed of and more. It made the 23 months construction period seem like nothing compared to the pay off in fantastic performance and pride of building and flying my own airplane.

Thank you is just not enough to say to you for providing this fantastic design for me and others who have a little ambition and a big dream.

I hope to fly off the restrictions in about a month and one of my first cross country flights will be to Mojave to show you the plane and thank you in person.

Thanks again and 'll be seeing you soon.

Shirl Dickey.

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Shirl's initial stall tests were done with nose-ballast as required to bring the cg into the center of the first flight box. Stall characteristics were correct - a stable trim at full-aft stick. He then removed his nose ballast which resulted in a cg of approximately 101, about 1 inch forward of the aft limit. The stall characteristics at that cg were not desirable. He reported that an excessive angle-of-attack could be reached using only a few degrees of elevator travel, and the aircraft would roll-off on the right wing before full-aft-stick was reached, particularly when stalled at low power.

When he reported these characteristics to us we asked him to recheck cg because those characteristics normally occur only when the cg is aft of the aft limit. We also asked him to check the contours of his wings for any inconsistency that could cause premature stalling. He did, and was unable to find anything wrong. Shirl and Diane flew into Mojave last week on their first long trip in their new VariEze. Dick and Mike flew it, evaluating the entire flight envelope. N60SD is an excellent flying machine with good roll rate and control harmony. It's stall characteristics, however, are not how a VariEze should be. Instead of the stable trim condition normally obtained at full-aft-stick, N60SD behaved as if it wanted to drop a wing unless the pilot carefully controlled ailerons and rudder. Also, the nose seemed to trim to a higher angle than the prototype, N4EZ.

Remembering that these were the characteristics that existed with N4EZ when it was tested at a cg aft of the aft limit, we were convinced that Shirl had done his weight and balance incorrectly. So, we rolled out the platform scales and lifted N60SD onto them. The mystery, however, still existed when the numbers were all calculated - we obtained the same cg that Shirl had reported. We measured the planform dimensions and confirmed that his airplane seemed to be built accurately. It must be that his airplane does have some difference in incidence or contour of the wing or canard, however, we did not determine this.

When Shirl and Diane left, all we could tell them was to go ahead and install 12 lbs of permanent ballast in front of the battery to keep the cg forward of station 100, thus resulting in the desirable stall characteristics that VariEzes should have.

The purpose of telling you this story is to reiterate to all builders that they cannot assume that each airplane is identical to our prototype. We have learned that variations are to be expected, since these airplanes do not come out of one mold in one factory. Thus each manufacturer should start his test program at the most conservative condition (center of first-flight box cg, for example). Then, as described in the Owners Manual, open the envelope slowly, carefully and safely. Place the limits on your individual aircraft where they properly belong, rather than assume they will be identical to the limits used for N4EZ.

Leaning for Cruise.

Few Pilots realize the extent of fuel economy benefits available when an engine is leaned to proper "best economy" (BE) settings. Due to cooling requirements, BE setting (50 degrees F on lean side of peak EGT) is allowed only below 65% power. Lycoming-supplied data shows that at BE, specific fuel consumption is 14% lower than at "Best Power" leaning (approximately 90 degrees F on rich side of peak EGT). A pilot that cruises at full-rich is not only damaging his engine and fouling plugs, but is burning up to 55% more fuel than at the BE setting! Always lean at least to peak EGT when cruising with less than 65% power.

How much Power ?

One of the basic functions of the aircraft designer is the sizing of the aircraft such that the selected powerplant is correct. An engine too-small for the aircraft results in inadequate climb in high-altitude summer conditions or an unacceptably long takeoff roll. Too large an engine is wasteful of fuel because either the high cruise speed is at an inefficient flight condition for the airframe (low cruise lift-to-drag ratio), or the engine itself is inefficient when throttled back to obtain the speed for a good lift-to-drag ratio.

If a designer attempts to select an engine for optimum cruise efficiency, i.e. at a flight condition for maximum miles-per-gallon he finds the engine inadequate for climb. This situation is not unlike that of the automobile designer who finds his vehicle is cruised at a speed far in excess of that for the best mpg. However, the designer knows that the airplane should not operate at best L/D (or best mpg) anyway, since this is not practical unless you are setting a distance record. Increases in speed above but near the best mpg speed result in only small losses of mpg. But, as the speed increases considerably above the best mpg condition, the mpg drops drastically. The big question, then, is how fast should you really fly? If this question can be answered, then the designer can size the engine for this practical speed.

Aerodynamicist, Dr. B.H. Carson of the U.S. Naval Academy has published an excellent analysis of the fuel efficiency of light planes (AIAA publication 80-1847) and has presented theoretical rationale for practical cruise efficiency. His interesting technical treatise is beyond the scope of this article, but the summary of findings is of interest to pilots. Rather than focusing on the cost per distance (mpg), he finds the speed that gives the minimum cost per speed. This "cruise optimum" speed corresponds to minimum outlay in extra fuel (over best mpg) per increment in additional speed. This speed corresponds to the closest approach of the airplane to a "technology barrier" of efficiency proposed by Gabrielli and Von Karman in an article "What price speed?" published in Mechanical Engineering Vol. 72 October 1950.

This "cruise optimum" speed, at 32% over the speed for best mpg, results in a 16% increase of total fuel used, requiring a 52% increase of power and saving 24% of flight time. This speed is regarded as the most productive use of excess fuel for cruising. The pilot should consider it his best "economy" cruise speed.

Accepting this theory, lets see what the resultant engine size is for the Long-EZ. At 8000 ft. altitude and 1325 lb. weight the "cruise optimum" speed is 139 kt. (160 mph) and requires 47 thrust horsepower (55 brake horsepower). This is a power setting of less than 48% power when using the 118 hp O-235 Lycoming. This suggests that, for 65% power cruise (to allow operation at lean side of peak EGT), the ideal engine for a Long-EZ would have 86 BHP. However, here is where the theory breaks down. The 'Long' is a fast aircraft for a fixed-pitch prop application. Thus, with the low prop efficiency at slow speeds, it requires a 100 BHP engine for satisfactory take off performance.

The larger engines, 160 BHP for example, are wasteful of fuel at any speed. This is because specific fuel consumption (SFC) increases as the engine's power is reduced below 75%. The accompanying graph obtained last month shows this trend. Data are for best economy setting, about 50 degree F on lean side of peak EGT.

If a Long-EZ is cruised at "cruise optimum" speed, its O-235-L2C engine will burn 8% less fuel than would an O-320-B at the same speed. (48% power for the O-235 and 36% for the O-320). If both engines were run at 65% power the O-320 would burn 22% more fuel than the O-235 for a given trip.

The following table shows data from a computer printout using the performance parameters for the Long-EZ, and assuming sfc=0.5.

Long-EZ weight = 1325 lb.

Sea Level, * asterisk denotes 8000 ft.

Data for sfc = 0.50

True Speed Knots	Indic Speed Knots	Req'd THP HP	Induc THP HP	Prop eff %	Req'd BHP HP	Fuel Flow GHP	Naut Miles Gallon	L/D Ratio
90	90	21.8	7.7	65.7	33.2	2.76	32.58	16.8
100	100	26.2	7.0	70.7	37.1	3.09	32.34	15.5
110	110	32.0	6.3	74.9	42.7	3.55	30.96	14.0
120	120	39.1	5.8	78.5	49.8	4.15	28.94	12.5
130	130	47.7	5.4	81.3	58.6	4.88	26.62	11.1
140	140	57.8	5.0	83.4	69.4	5.78	24.23	9.9
150	150	69.6	4.6	84.6	82.3	6.86	21.87	8.8
160	160	83.2	4.4	85.0	97.9	8.16	19.61	7.8
170	170	98.7	4.1	84.6	116.7	9.72	17.49	7.0
180	180	116.2	3.9	83.4	139.3	11.61	15.51	6.3
90	79.8	20.9	9.9	65.7	31.8	2.65	33.97	17.5
100	88.7	24	8.9	70.7	34	2.83	35.33	16.9
110	97.5	28.2	8.1	74.9	37.6	3.14	35.08	15.9
120	106.4	33.5	7.4	78.5	42.7	3.56	33.71	14.6
130	115.3	40.1	6.8	81.3	49.3	4.11	31.67	13.2
140	124.1	47.9	6.3	83.4	57.4	4.78	29.26	11.9
150	133	57	5.9	84.6	67.4	5.61	26.72	10.7
160	141.9	67.5	5.5	85	79.5	6.62	24.17	9.6
170	150.7	79.6	5.2	84.6	94.1	7.84	21.69	8.7
180	159.6	93.2	4.9	83.4	111.8	9.31	19.33	7.9
190	168.4	108.5	4.7	81.4	133.3	11.11	17.11	7.1

Weight Control.

CAUTION - Weight growth generally occurs late in the building project. The following scenario occurs during most homebuilt aircraft projects: Careful weight control is exhibited in the fabrication of the various bulkheads, wings etc., in building the basic structure. The builder is optimistic about the prospect of having a light weight aircraft, because all his components meet or beat the various weight goals. Then, when he begins the final stages of outfitting and finishing he relaxes his concern for weight control. He says "Oh, this is only a few ounces, a small percentage of the total weight". Forgetting that the addition of many seemingly insignificant items results in a large total weight, he proceeds, expecting to attain a light empty weight. Another factor is present that he is not aware of. This is the existence of the Phantom Weight Law (PWL). The Universal PWL states that "additional weight of 3 to 10% of the empty weight will sneak into an aircraft (usually at midnight when the lights are out) between the time the weight engineer is confident he has accounted for everything and the time the aircraft is rolled onto the scales. This Phantom weight will remain in the aircraft and grow, but will never be accounted for nor rationalized".

The biggest trap is the non-concern for each gram of additional weight. Example: a two-inch BID tape installed at two and a half inches wide - seems insignificant? Yes, but that part is 25 percent overweight. Using the next size electrical wire - seems insignificant? Yes, but that part is 25 percent overweight. A small knob that is 25% heavier than another, a 5 lb rather than a 4 lb seat cushion, etc. Note that acceptance of these kind of items throughout the building and outfitting can result in an aircraft more than 100 lb overweight!!

Patch Contest.

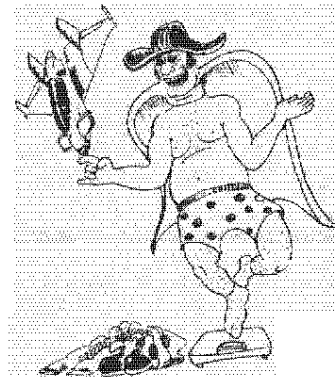
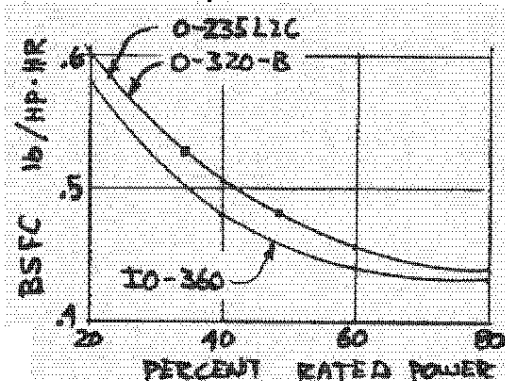
Our patch/emblem contest (see CP #27) has been extended until June 10th. We'd like to get more entries. Try to submit something that is not complex and not with a lot of words. An easily-recognizable symbolic shape or shapes and the letters RAF or RUTAN. We want it to represent not just one of the various airplanes, but a general theme of our aircraft designs. Do submit an entry even if you have already sent one in. The more the better. We will try to get jacket patches made before Oshkosh '81 convention.

FLASH - The fifth Long-EZ to fly !! Max Bradley of North Dakota. Congratulations Max.

FUEL SPECIFIC AT BEST-ECONOMY MIXTURE

LEAN SIDE OF PEAK EET

DATA BASIS: LYCOMING.



Oshkosh - Accomodations.

Nat Puffer provides the following report:

A formidable problem presented to the first time VariEze/Long-EZ pilot flying into Oshkosh, is where to stay. Even with Long-EZ baggage space, it is difficult to pack enough camping gear for a week. If you are fortunate enough to find a place in town, there is still the commuting problem.

There is a solution. Oshkosh Recreational Vehicles has offered to park all of the camping fold out trailers he can muster in Paul's Woods one week ahead of time to get a good spot, for VariEze/Long-EZ pilots for a mere \$125 (\$10 deposit required in advance). You will also have to pay the advance camping fee, even though the trailer is not occupied. These trailers sleep 6, (get together with friends to share the tariff) have heaters, stove, sink and ice box. If you can't carry the rest of your gear in your VariEze, build a lighter one!!

Contact:

Dick Welland,
3691 Fond du Lac Road,
Oshkosh, WI. 54901 (414)233-3298

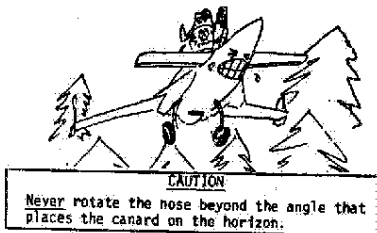
Supply is limited, first come first serve.

International VariEze Hospitality Club.

Fly in at Taos, New Mexico over the 4th July weekend. Charles and Joan Richey (N13EZ) are the organizers and they report that they have 10 confirmed VariEze/Long-EZ and would like bunches more.

Chuck says it is not necessary to be an IVHC member, all interested parties may attend. Taos is in high country, a very beautiful area, should be a great weekend. Contact Chuck and Joan Richey for details.

600 S. Melendres,
Las Cruces, NM 88001 (505)523-1300



Carburetors for Long-EZs.

Most O-235 Lycoming engines come equipped with a Marvel Schebler carburetor without an accelerator pump. This carb is a MA3A and various configurations (10-xxxx numbers) are found. N26MS has a Marvel Schebler MA3A and the configuration number is 10-5199. This carb has no accelerator pump and we therefore have to use a primer to start the engine. A direct replacement for this carb with an accelerator pump would be a Marvel Schebler MA3PA - 10-5220. If you wish to order a brand new Lycoming engine from a Lycoming dealer we feel that probably the optimum engine for a Long-EZ is as follows:

Lycoming O-235-L2C
Must have mechanical fuel pump.
Can not have spin-on oil filter,
instead must have standard oil
screen and housing.
Marvel Schebler MA3PA Carburetor
Part # 10-5220.
No provision for primer required.
Must have Slick magnetos,
Bendix will not fit into the mount.

If you already have an O-235 engine with the standard MA3A carb (no accelerator pump) you can use a primer, which works fine, or you can get an MA3PA. Various other 10-xxxx numbers can possibly be used. According to Avco Lycoming, the following numbers have all been used on O-235 engines:

MA3PA 10-5257 Economy jets, slightly
or 10-5220 E * different at full rich

MA3PA 10-5267
or 10-5220 EN * Approx. 4% leaner
or 10-5257 N *

* E, EN and N designate field modifications to these carburetors.

Accident.

Letter from Alden Andrew, 24531 Vanessa Dr,
Mission Viejo, Ca

Dear Burt,

This note is to alert VariEze owners of problems that made me an ex-owner! I had the Brock fuel caps as specified in the plans. As per original instructions, a vent hole was drilled in the cap for the auxiliary fuselage tank. I did not modify the auxiliary cap with the aluminum tube as per CP 25 page 4.

Recently I removed the left main fuel cap and went to the restroom while the attendant put in the fuel. Upon my return, the left cap was on and the attendant was fueling the right main. I replaced the right cap and went flying. Shortly after take-off I was notified over the Unicom that fuel was being dumped overboard. Sure enough, the attendant had set the left cap on but had not engaged the Ozus fastener and I had neglected to check or notice that it was not secure. I landed immediately and discovered that the cap had hit the prop and left a gash 1/2" wide and 5/8" deep about 4" from the tip. After this experience I considered putting a tether chain on the fuel caps but business matters soon consumed my full attention and the idea went by the wayside.

With a different prop, the plane was again serviceable. On February 6, over the telephone, I gave permission for a 3,000 hour pilot (with 10 hours in my VariEze) to use the plane the next day. Before his flight he attempted to obtain fuel but the fuel pit was temporarily out. Even so, they removed the left main cap as well as the auxiliary cap and attempted to obtain some fuel that might possibly be in the long hose of the fuel pit. After this unsuccessful attempt the caps were replaced (with the un-vented cap being put on the auxiliary tank) and it was decided that with about 1 3/4 gallons in the auxiliary tank that the pilot and his passenger could make Corona Airport from the present Chino location (about 5 minutes). They took off on the auxiliary tank and at about 100' at 105 knots they lost power. In the knowledge that there was fuel in the auxiliary tank the pilot did not try to select the mains which still had adequate fuel. An off airport landing(?) was made in a rough grassy field. The nose wheel was left retracted. [The aircraft was forced to the ground at high speed and high rate of sink because of a fence ahead.] The plane came to rest about 300 ft from the original touchdown point. The pilot escaped with scratches and bruised

legs and toes but no broken bones. The passenger was not scratched or bruised at all. The plane did not fare so well; collapsed main gear, main center-section spar broken and ripped off with the left wing, canard ripped off, the total front end from the trailing edge of the canard was completely severed from the rest of the fuselage, as well as the top and bottom kevlar cowling was ruined. The prop was horizontal at the time of impact so the prop, spinner, hub extension and engine were undamaged as was most of the instruments. The canopy was unscratched.

To sum it up, I would recommend either a mandatory change to include a ram air vent leading to the auxiliary tank or the tethering of the fuel caps.

As my 86 delightful hours in the VariEze has spoiled me, I desire another canard pusher. I guess a Long-EZ is the next project. Does anyone want to buy a good VariEze canopy and a 96 hour SMOH Continental O-200 complete with hub extension, prop and spinner. Sincerely,
Alden Andrew.

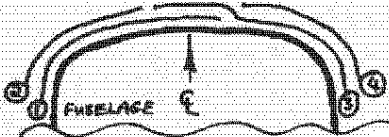
RAF comment: The two VariEze plans changes in this newsletter are intended to prevent reoccurrence of Aldens accident. We have before considered tethering the fuel caps, but were concerned that major tank damage would be done by a cap flailing against the surface. Note that, as was explained in CP #13 page 5, loss of a wing cap on a VariEze will cause all fuel to be slowly drawn into one tank (and overboard if tanks are more than half full) and result in fuel starvation, requiring the selection of the fuselage tank to maintain engine operation. Loss of a cap on a Long-EZ does not effect engine operation due to its left/right isolation and pumped fuel system. Also, the Long-EZ's caps are outboard of the prop to eliminate prop damage should a cap not be secured.

BUILDER HINTS

Exhaust gaskets. It is an excellent idea to use blow-proof exhaust gaskets on your VariEze or Long-EZ or VariViggen. If you plan on installing cabin heat, blow proof exhaust gaskets should be considered mandatory. These are available from Aircraft Spruce or Wicks Aircraft, and for your small Continental engine order part # 627429, for all Lycoming engines order part # 77611.

Long-EZ. Method to lap outside skin plies at bottom CL fuselage to avoid a bump.

- ① 2 PLYS UND @ 45°
- ② 1 PLY UND @ 0°
- ③ 2 PLYS UND @ 45°
- ④ 1 PLY UND @ 0°



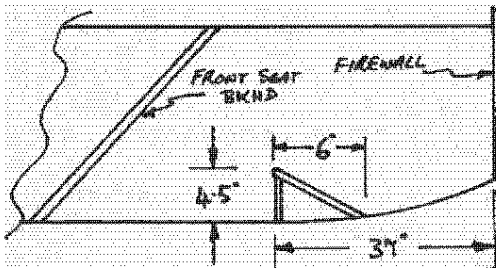
Aileron Hinge Pins.

Long-EZ and VariEze aileron hinge pins. The piano-hinge pins have in some cases been wearing out much more rapidly than they should. This is characterized by evidence of aluminum stain aft of the hinge on the aileron surface and excessive hinge free-play. The wear is caused by vibration of the hinge and can be eliminated if the pin is snubbed to prevent rattle. For new construction, before final installation of the hinge pins, bend them into a gentle "S" shape. This will ensure that they don't rattle in the hinge. A rattling loose hinge pin will cause excess wear to both pins and hinges.



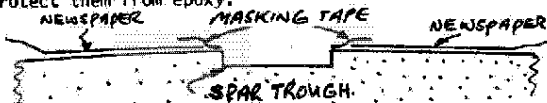
Back Seat Thigh Support.

This little item really makes a difference to back seat comfort. This position works excellently for people from 5'4" to 6'4". Fabricate from R45 foam with 1 ply BID on each side. 1 pc. 4"x19", 1 pc. 7"x19"



Hints from Builder.

1) It will save time in building and finishing if you are neat in everything you do. For example, protect foam and finished parts from slopping or dripping epoxy on them. Example, when laying up spar caps, do like a surgeon and cover and tape off adjacent foam areas to protect them from epoxy.



In a similar fashion, protect finished parts by covering and taping them against drips, runs etc.

2) When gluing foam cores together, use minimum micro

to prevent large excess from oozing out. Tape edges of cores first, so you can clean off excess without smearing it across the foam.



3) Before sanding cores, undercut seams to avoid high spots, or breaking loose micro or 5 minute which will damage foam. Its easy to fill undercut areas again before skinning.

Long-EZ - Prop Position.

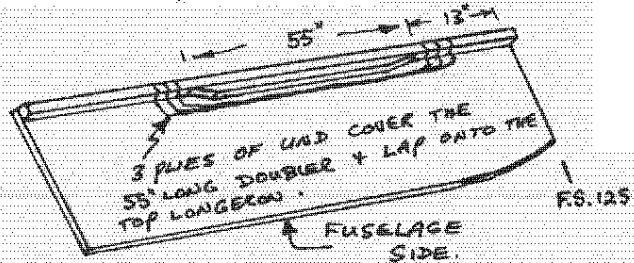
The forward face of the prop hub should be at F.S. 158.8" and at W.L. 21.83. This includes the recommended 3" prop extension.

Long-EZ Main Gear.

When drilling the 5/8" dia. holes through the main gear attach tabs, the 5/8" counter-bore tool drills a slightly undersized hole in the fiberglass laminate. An easy way to get this hole to fit the LMGA tube is to use a dremel sanding drum. Do not use it in a dremel tool, rather chuck it up in your 1/4" power drill (much slower rpm) and it will make the hole a perfect fit on the tube.

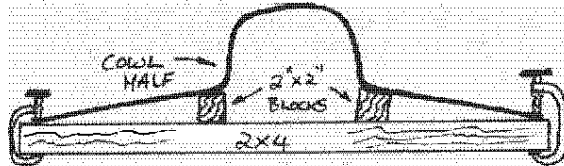
Clarification, Page 5-2 Long-EZ.

A couple of builders have been confused at where to install the 3-ply UND stiffeners on the top insides of the fuselage sides. (page 5-2 step 2). The adjacent sketch will clarify this.

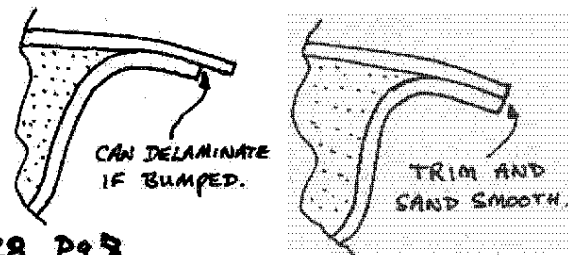


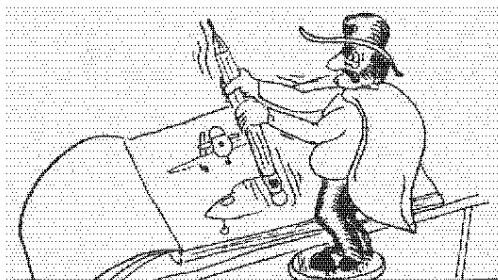
Cowling storage.

When you get your cowling you may not be ready to use it right away, in fact some builders store cowling for months, occasionally years! A cowling left laying around can change shape considerably. For easy fitting when you need it, clamp both cowl halves as shown to a length of 2" x 4" lumber. This holds the cowl in the correct shape to prevent long-term warping.



Wherever you have a glass-to-glass laminate (trailing edge of wings, winglets, canard etc) do not leave the overlapped skins unsymmetrical. Always clean up the edges (see sketch) to a smooth surface without a joggle. It is poor practice to leave areas joggled even during construction, since a blow on the untrimmed edge can result in delamination.





PLANS CHANGES.

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

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

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

Long-EZ Plans changes.

- LPC #54
MEO Page 24-1, Step 1, 3rd paragraph, glass with one ply of BID.
- LPC #55
MEO Bill of Materials Page 2-2, AN970-4 Washers, should be 11 not 5.
- LPC #56
MAN GRD Clarification CP 25 page 6. Lower right corner. Long-EZ spar cap thickness This box must be complied with. Several builders have ignored this. Do not omit this, you must have the prescribed amount of glass in the spar caps, in both the centersection spar and the wings.
- LPC #57
MEO Page 3 -23, Number 6. Wet out Delete this paragraph entirely and add the following:
WET OUT - Squeegee cloth from center outward aligning the fibers straight and removing wrinkles. Pull at the outside edges to straighten any wrinkles. Brush or stipple epoxy into any dry areas or pour on additional epoxy and squeegee out uniformly. Check for excess epoxy "ridge" with the squeegee. (page 3-11).

- LPC #58
MEO Page A5. On the main gear mounting pads bottom of page, two places shows only 1 ply. Should be 15 plies of BID.
- LPC #59
MEO Page 21-6, section F-F. The outside strips of UND glass, the third ply in layup #7 and #9 (shown on Pag 21-4) has been omitted. This should be shown on Section F-F (on the outside of the tanks, directly above layup #4 directly below #3).
- LPC #60
MEO Page 21-3. Fifth paragraph, 1/4 - 27 NTP should be 1/8 - 27 NTP
- LPC #61
MEO Section III Lyc. Engine Installation bill of materials, page 37. Engine mount hardware - under 8 # 71032 rubber bushings, add: OR 8 #6083 Rubber bushings. This choice will depend on the size hole machined into your engine. #71032 for 1" dia. hole and #6083 for 7/8" dia. hole.
- LPC #62
MEO Long-EZ Owners Manual Page 24 - add maximum landing brake extension speed-95kts.
- LPC #63
MEO Section IIC Lyc. Engine Installation. Page 3. Third paragraph on the right. MA3-SPA should be MA3-PA.
- LPC #64
DES Page 19.17 Snub the aileron hinge pins per instructions in this newsletter.

VARIIZE PLANS CHANGES.

- Owners Manual
Page 55 Checklist, after "fuel caps on" add "and locked - screws aligned to locked orientation".
- CP #24 page 6 First Plans change. Delete "DES" Replace with "MAN-GRD".

Shopping.

- B & T Props, 8746 Ventura Av, Ventura, Ca 93001. Reports that they are really getting busy and asks that anyone wanting a prop to please order at least three months ahead of time.
- Aircraft Spruce reports that they now have in stock the following items:
Light weight electric turn coordinators (as used in N79RA).
Spray-Latt (peeI-coat type canopy protection).
Zolatone "Splatter" paint for interior (as used in N26MS).
- Wicks Aircraft Supply and Aircraft Spruce report that they now have the Welen "single" flash wingtip lights, strobes and power supplies as per Long-EZ plans.
- Lycoming O-235 -L2C with fuel pump.
Contact: Howard Libersky, (305)464-6020.
- Continental O-200 A engine zero time.(two of)
Contact: Rudolph Spremich, 520 Turquoise St.
New Orleans, La 70124.
- Original VariEze maingear strut - \$250.
Contact: Herman J. Kuebler,
5109 Falconwood Ct, Norcross, Ga, 30071.
- Decorative leaded glass window hanger. (16" wingspan VariEze planform). \$20 plus shipping (California residents add 6% tax).
Contact: Kathy Ganzer, 343 S. Mollison Ave #14,
El Cajon, Ca 92020
- VariEze dust cover as seen on Herb Sander's VariEze at Oshkosh, (N70VE). Excellent quality, covers the entire airplane \$129.
Contact: Herb Sanders, P.O.Box 18690,
Memphis, Tn. 38118
(901)365-7606
- Jim Witt, 6200 East M-21, Corunna, MI 48817.
(517) 743-5076.
- Jim makes very nice tie tacs, charms, pendants of your N number, for example N79RA. This is made out of gold or silver to your specification. Largest possible size is 4". Jim charges \$50 for his labor plus the price of the precious metal used.

Advanced Composite Lightweight Cowlings.

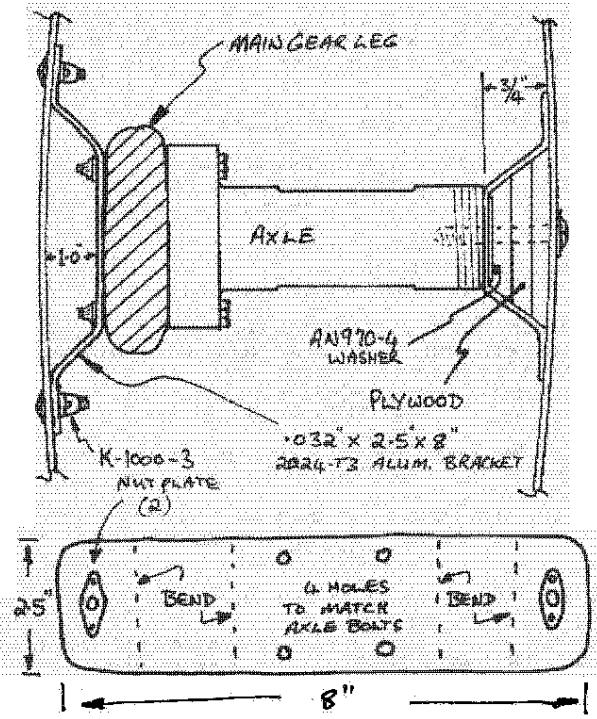
We announced the availability of these cowlings in CP 27 page 5. Unfortunately the supply of graphite woven cloth has since become much more difficult to obtain and almost twice the price. This means that we have had to turn to Kevlar cloth. Any builder ordering a graphite cowl, should be aware that unless he gets an early one, he probably will receive a Kevlar cowl. It is within 1 lb. of the weight of the carbon cowls. The Kevlar cloth is covered, both inside and out with fiberglass, to avoid the sanding/fraying problems experienced with Kevlar. We have approved the use of Kevlar in the cowlings, in fact we have one on display here in Mojave for inspection.

Aircraft Spruce or Wicks Aircraft supplied Wheel Pants.

These wheel pants for VariEze/Long-EZ 3.40 x 5 tires should be available by the time you read this - those for 500 x 5 tires will be available in a month.

The correct method of installing these wheel pants is as follows: Install 11 K100-3 nut plates in the flanges, evenly spaced. Drill and countersink #10 holes for AN 509-10R8 screws. Jig the pant halves loosely in place and carefully mark the top for the gear leg cutout. Cut this out and reposition the pant, making sure it clears the brake caliper and that the incidence is correct. It is best to have the pant about 3 to 4 degrees nose down. Be certain to leave a 1/10" clearance around the brake line to avoid a brake leak due to the pant chaffing on the line.

Now, fabricate an aluminum bracket from .032" 2024T3 approximately 2.5" x 8", see sketch. This bracket mounts on the four axle mounting bolts in a horizontal position. Install two nut plates (K1000-3) in each bracket, and bend the bracket as shown to extend in-board one inch. Drill two #10 holes in the pant to match the bracket. Drill and tap the axle 1/4 x 28 (use a #3 drill). Now cut out 3 pieces of your 1/4" plywood (firewall bulkhead) and glue them together to make one piece 3/4" thick x 2" x 2". This piece should be pyramid shaped and should have an AN 970-4 washer on top of the pyramid. Layup 2 plies of BID over this washer and plywood block lapping at least 1/2" all around onto the inside of the wheel pants. After this cures, drill a 1/4" hole through the center of the washer, and you should be able to mount the pant nice and firmly to the gear leg/axle. Use low profile AN525 screws for low drag.



Pre-Fab Fuel/Baggage Strakes for Long-EZ.

Fuel/baggage strakes will be available by June. These will consist of 4 large pieces (2 tops and 2 bottoms) vacuum bagged into excellent molds. The pieces join at a leading edge joggle joint, eliminating the TLE/BLE pieces, and they extend to match the wing. Installation drawings for these tanks will be provided.

These components will be sold direct by the manufacturer. Task Research, 848 East Santa Maria Street, Santa Paula Airport, Santa Paula, Ca 93060 (805)525-4445 Contact them for price and availability.

Questions and Answers.

Q. Can I make a soft leather "boot" to cover the control sticks, in place of the fiberglass cosmetic covers shown?

A. Yes, we have seen several examples of this, and they looked excellent. The leather can be attached with contact cement or velcro. There must be no restriction to control stick travel.

Q. How noisy is it in a Long-EZ?

A. We ran a comparison with a Cessna 150 and a Long-EZ.

	Long-EZ	C-150
Taxi	82 dba	78 dba
Takeoff & Climb	96 dba	92 dba
High Cruise	98 dba	91 dba
Low Cruise	94 dba	88 dba

Q. Can I use a voice actuated intercom?

A. Yes, we heartily recommend doing this, and also using good noise attenuating headsets. This makes conversation between pilot and passenger varieze, and also enhances your ability to hear and understand ground controllers. Cockpit speakers should not be used in VariEze's and Long-EZ's. With good headsets (we use David Clark H10 type), the pilot-perceived noise level is considerably quieter than in a Cessna without headsets.

Q. Can I move my B.L. 45 rib outboard in my Long-EZ fuel tank in order to carry more fuel?

A. Absolutely not. This will give you an aft c.g. condition, even with a small quantity of fuel on board. Long-EZ's should have enough fuel/range to satisfy anyone.

Q. Why is my L.B. 12345 weldment from Brock, for my landing brake 1" too short?

A. It is not too short. You missed the instruction on page 9-1 and CP 26 page 6, LPC # 35, to go to page 24-1, step 2, where you will find this called out. The reason is that this weldment was made for VariEzes originally, and they are 2" narrower at this point. Rather than make a new part, we accepted mounting the L.B. 18 brackets 1" left of center on the landing brake. We have tested it in this configuration and it works excellently.

Q. Can I substitute a Stewart Warner # 8406J oil cooler for the recommended Harrison #8526250?

A. Yes.

Q. I want to install the NACA inlet. Can I do it before glassing the bottom of the fuselage?

A. No. The normal glass on the bottom of the fuselage is required structure. The NACA inlet per Tim Gehres and Steve Wood's plans is purely an inlet-shape add on, and provides no structural tie between the bottom longerons.

Arthur Schwartz has accumulated some 42 hours and has had the initial restrictions lifted. He flew down the coast under the NY. TCA to Dover, Delaware, where he met George Semac. George's VariViggen is at the airport, and has been signed off for flight, so we will soon have another Viggen in the air. We have heard, second hand, of yet another Viggen at Redding, Pa. Apparently this airplane is doing taxi tests. Unfortunately I do not have this builder's name.

George Craig sent in a few excellent photos of some of the detail work he is doing on his VariViggen. (see page George has built the worm/wormgear main gear retract system, as used in my N27MS, and his workmanship looks great. George has spent a lot of time and effort designing neat little features to make future maintenance easier. A word of caution here: it is really easy to fall into a trap. You figure, heck, this little modification will only weigh a 1/4 lb. more, but the problem is it will sneak up on you. When you finally weigh the airplane, it can really be a shock. When I weighed N27MS I was stunned to find it weighed 1252 lbs. Burt's N27VV, the original prototype only weighed 1070 lbs. This made mine almost 200 lbs. heavier. This means I fly even solo, as though I had a 182 lbs passenger on board, and it really shows up on a hot day at high altitude. Actually I would give an awful lot to have my Viggen weigh 100 or 150 lbs less. Remember, the weight buildup takes place in the finishing area, after basic structure is done. Usually a builder gets the airframe structure done with little difference in the weight, and then he puts instruments in the back, map reading lights front and back, sound proofing, upholstery, wall to wall carpeting, etc., and before you know it, you have ruined the utility of your aircraft.

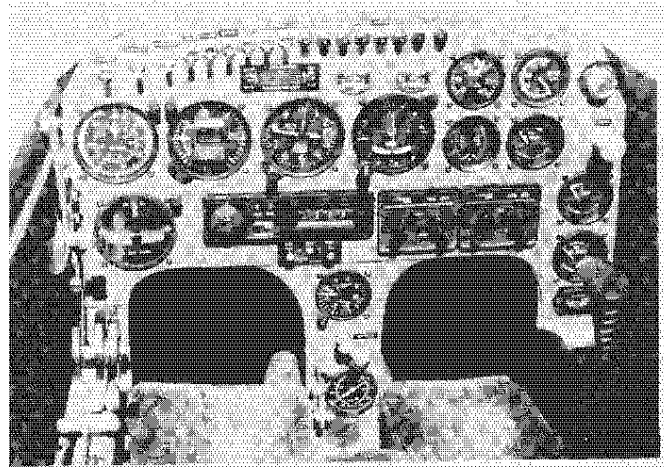
George is building his Viggen as a "stand-off" F14 Tomcat replica. He had built fiberglass seat frames to simulate ejection seats. A military paint job would really look impressive. I once suggested something along this line for my Viggen, but I was immediately and strongly overridden by my wife Sally!!

Frank Tomko has requested clarification on a couple of items and I thought maybe answering them here instead of in a letter would help other builders. He asked where the hole should be cut through the firewall (F152) for the wiring bundle and for the throttle, carb heat and mixture cables. The best place I found for the wiring bundle is at B.L. 7.5 and W.L. 15.5. A 1" diameter hole accomodates all wiring necessary. The wiring bundle could be supported with a rubber grommet or RTV silicone. Either way, precautions must be taken to ensure that the wiring is not chaffed by the stainless steel firewall. The throttle, carb. heat, and mixture control cables can go through the fire wall at B.L. 7.5 and W.L. 14. Again a 1" diameter hole with a rubber grommet works fine.

Ken Winter of Tulsa, Ok. reports that he will be at Oshkosh this year, Ken has his Viggen through silver at this time, so he is getting close. Ken's Viggen has a Lycoming O-360 (180 hp) and SP wings, and he has really tried for light weight structure. Should be a performing airplane.

N27MS continues to run well, and we do fly it virtually every Saturday here at RAF for demonstration purposes. Of course it will go to Watsonville and Oshkosh at least and possibly other flyins. Maintenance has been minimal, the hour meter quit metering and had to be replaced. Apart from oil changes and putting gas in it, she has been running like a top.

Jim Cavis has written to say that he is giving up on his Viggen. Jim has lost his medical due to an eye problem, and has elected to sell his project as is. We do not normally advertise airplanes in the CP, but we are very familiar with Jim's Viggen. Jim reports that it is about 90% completed and that he has most parts necessary to complete it. Jim's project is a standard wing (foam/fiberglass) 180 hp Viggen. Contact Jim for further information - Jim Cavis, 4921 N 86th Street, Scottsdale, Az 85251 (602)945-0430



Instrument Panel On Mike & Sally's Long-EZ N26MS.

Switches/circuit breakers across top. Left to right.
Master switch. Alternator field, Avionics Master. Landing light*. Strobe lights* Navigation lights*. Fuel boost pump*. Electric turn & bank*. Instrument panel lights*. Master C/B. Comm. C/B. Nav. C/B. X-ponder C/B. Starter C/B. Alternator field C/B. Warning system C/B. Warning system Red Light.

* These are a combination switch & circuit breaker.

2nd row, left to right.
Silver Fuelgard (Fuel Flow). Ammeter, Voltmeter, Manifold Pressure, Tachometer, Magneto switch/starter

3rd Row, left to right.
Airspeed, Rate of climb with digital wrist watch/calculator. Altimeter, VOR - OBS, Combination CHT/EGT, Oil Pressure, Primer.

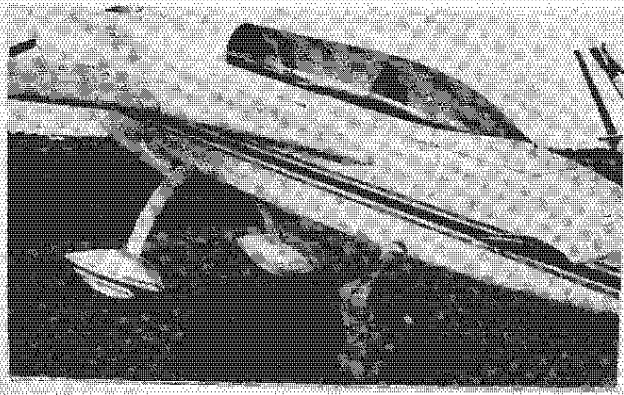
4th Row, left to right.
Electric turn and bank, Radair Transponder, Radair Comm 360, Radair Nav., Oil Temp.

Left Side
Canopy Latch, Push-to-talk button, Carb heat. Throttle and mixture quadrant, Landing brake handle, pitch trim handle.

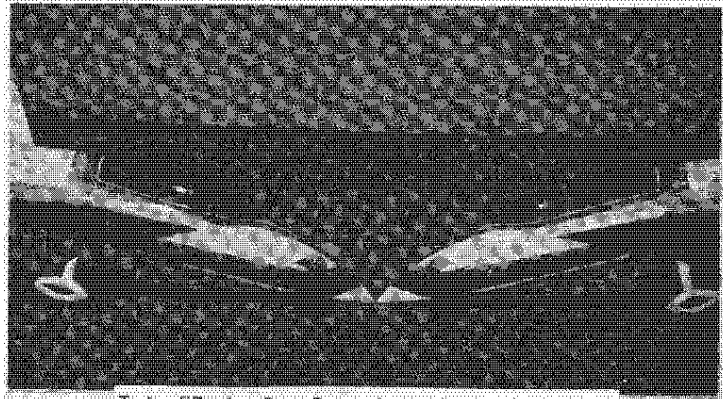
Lower Center.
Sigtronics intercom, "G" meter, Nose gear retract crank, Landing light extend handle, O.A.T., Nose gear window, fuel tank selector valve.

Right Side.
Fuel Pressure, Hobbs hour meter, side stick controller.

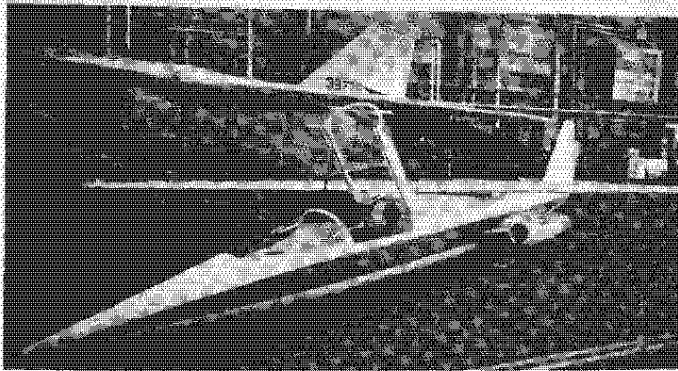
Note: The stereo tape player is under left thigh support. Headset plugs are on seat bulkhead, on the right of pilot's shoulder. A co-pilot push-to-talk button is on the rear left console.



VariEze by Dick Cutler with Long-EZ main gear. Note the soft type luggage.



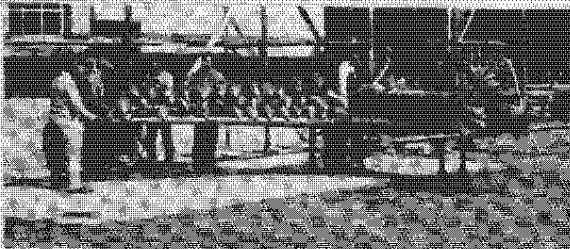
Twin EZs by Don Prestin and Don Young of Santa Rosa, Ca. You have to see this in color to appreciate the 'class' of these two together!



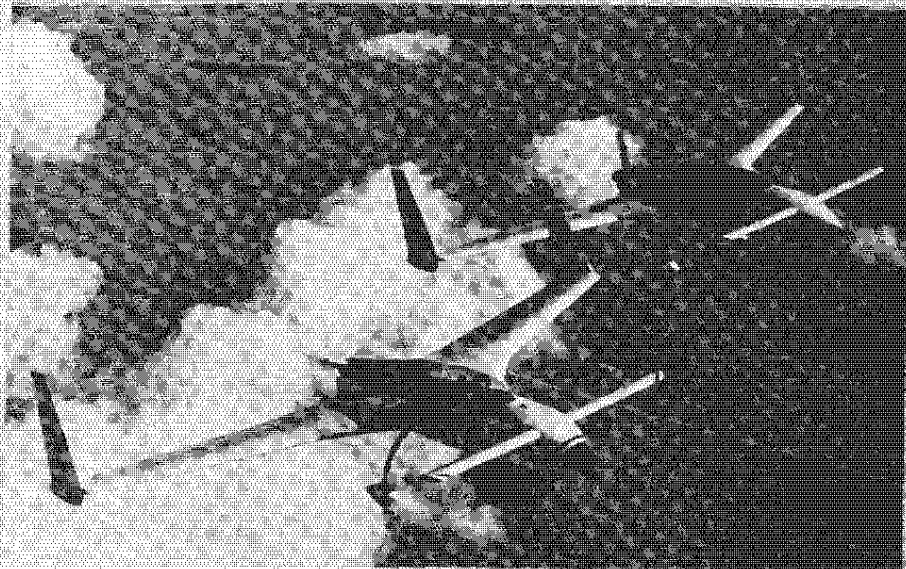
Swiss VariEze undergoes a wing static-load test.

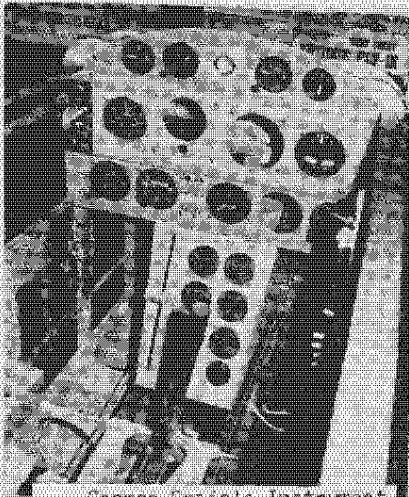


RAF-designed AD-1 at NASA. The variable skew AD-1 is parked beside a variable-sweep F-111. AD-1 project pilot Tom McMurtry - photo was taken just after the shuttle landed at Edwards.

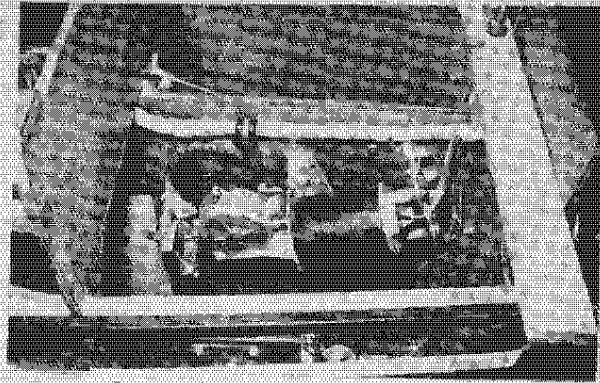


N79RA and N26MS
Two Longs out on a rare day that clouds visit our Desert.

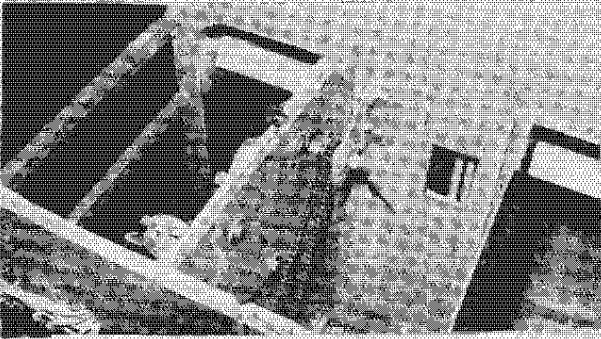




George Craig's Instrument panel layout. George's workmanship is excellent.



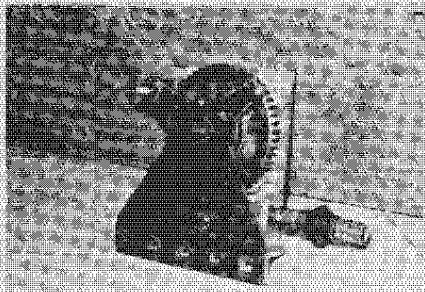
George Craig's nose gear retract/extension motor & reduction gear.



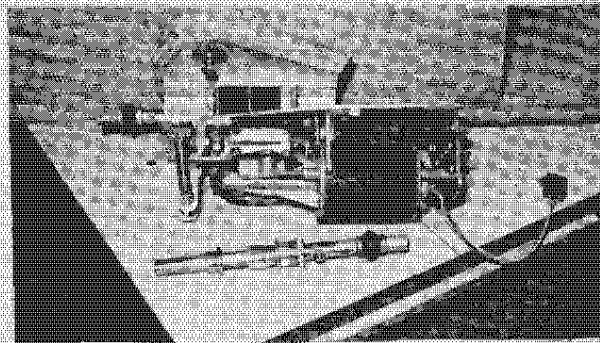
George Craig's nose gear retract system: Note bearing support for drive shaft, an excellent idea.



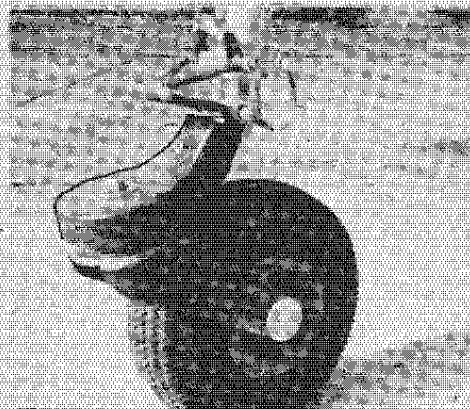
George Craig's nose gear. Gear up micro switch is top center. Easier access.



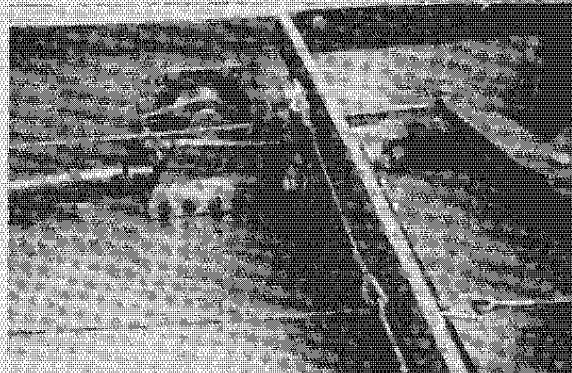
George Craig's main gear worm/wormgear assembly with universal.



George Craig's main gear motor and gear box. Note manual override gear and shaft in the foreground.

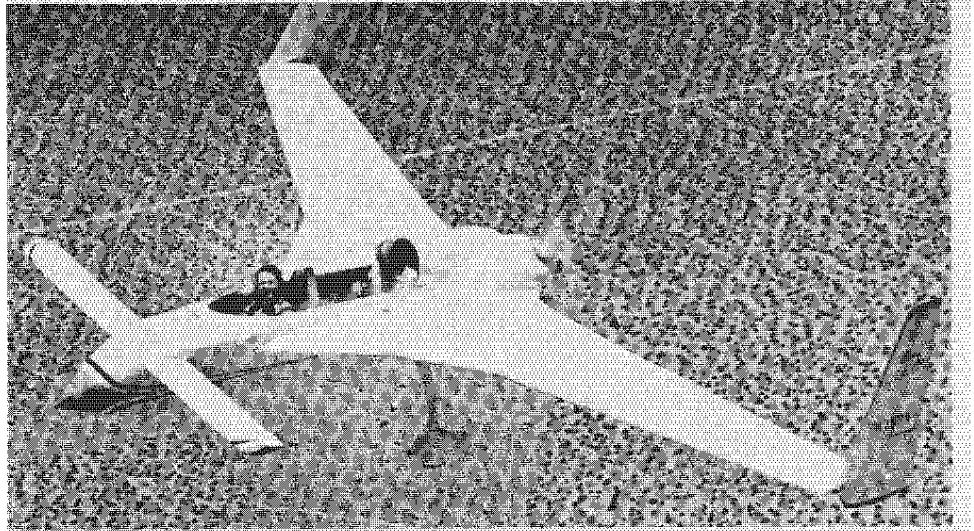


Wayne Wilkin's homebuilt nose gear fork and pivot. Wayne says it weighs the same as the Scott tail wheel assembly.



Wayne Wilkin's interior of right inboard wing, looking aft at spar 'E'.

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.

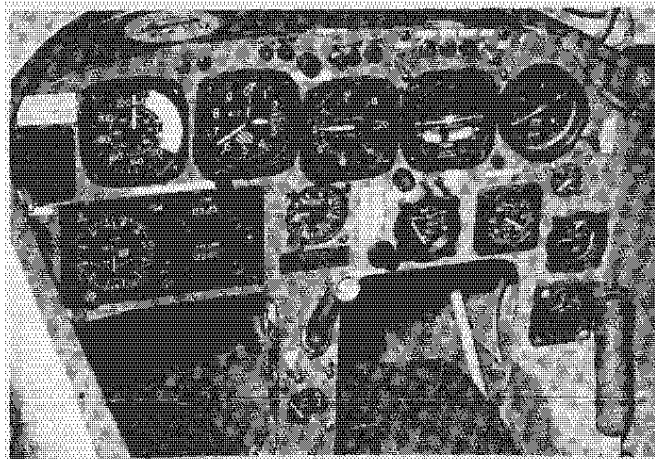
UNUSUAL EFFICIENCY

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's 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 a 360 degree 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 device (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

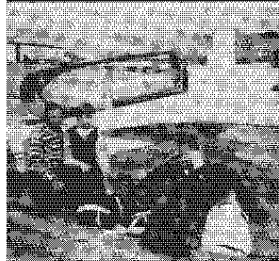
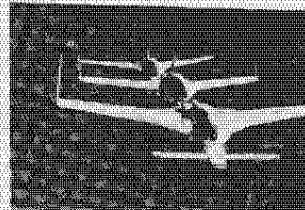
The complete package of raw materials available from the two distributors listed, including all fiberglass, epoxies, foams, fillers, sheet metal, tubing, hardware, control system materials, plumbing, tires, wheels and brakes costs about \$3200. Any of these items can be purchased separately. We strongly 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, cowings, canopies and welded engine mounts to small aluminum brackets and bushings can be purchased from the listed manufacturers. All those 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.

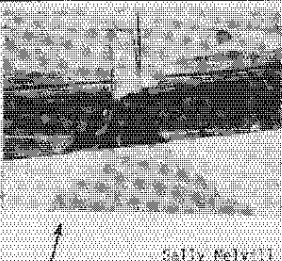
Engine costs vary widely. Our prototype has an O-235 Lycoming, that had 1400 hours when purchased, for \$1500. It has 600 hours to overhaul and will be worth then, about what we paid, thus this is a very economical way to go. Newly overhauled or new engines can cost from \$3000 to \$6000. Engine accessories, 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 as 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	25.3ft	Takeoff (solo/gross)	560/630 ft.
Area	54.1sq. ft.	Climb (solo/gross)	1750/1250 fpm
Empty Basic	710 lb.	Cruise 75% 8000 ft.	153 mph
Empty Equipped	750 lb.	Cruise 40% 12000 ft.	144 mph
S&G Weight	960 lb.	Max range * 75% (solo/2 place)	1370/955 mi
Gross Weight	1225 lb.	Max range * 40% (solo/2 place)	2010/1430 mi
Max Fuel	52 gal.	Ceiling (solo/gross)	27000/22000 ft.
Cabin LxWxH	100/23/37 in.	Landing dist. (solo/gross)	450/680 ft.
*40-minute reserve			

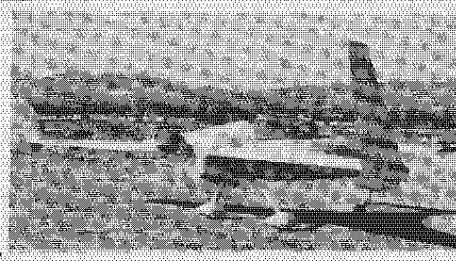


This amount of baggage fits nicely in the Long-EZ baggage areas. Baggage is accessible in-flight.



Sally Melville taxiing out for her first Long-EZ solo flight.

Long-EZ parked nose-down with two Varrizes.



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.

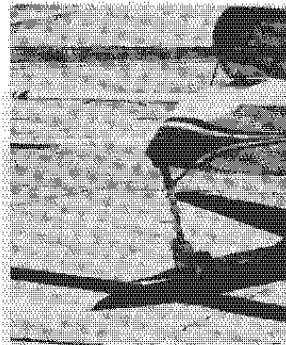
SECTION IIC - Lycoming O-235

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.

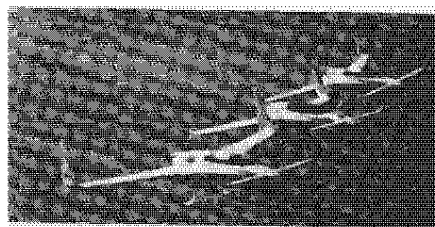
The nose gear retracts for parking and in flight.

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



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 BUILDING 13, MOJAVE AIRPORT
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<input type="radio"/> Rutan Aircraft Information Package-complete data and photos of all Rutan Aircraft designs.	\$ 5.00	\$ 6.00
<input type="radio"/> "Canard Pusher" newsletter. Published quarterly. One year subscription. Approx 10,000 words per issue.	6.75	8.75
<input type="radio"/> Long-EZ plans. Section I	198.50	212.50
<input type="radio"/> Section IIC Lycoming	21.50	23.50
<input type="radio"/> Long-EZ Owners Manual	9.00	10.50
<input type="radio"/> 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. Truslow 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

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CP 28

April '81

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