THE CANARD PUSHER

number 12 **april 1977**

NEWS OF THE VARIVIGGEN AND VARIEZE PROGRAMS
(very vig-in) (very easy)

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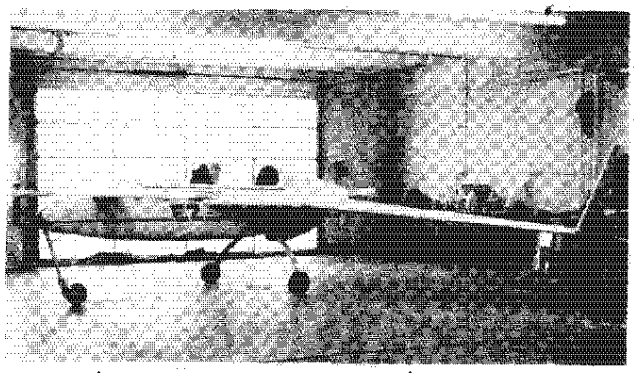
JAN, APL, JLY, OCT Bldg. 13, Mojave Airport
P.O.Box 656, Mojave, CA 93501
(805)-824-2645



WICK'S ORGAN COMPANY'S 101MW

RAF ACTIVITY since the January Newsletter has included homebuilders support, construction workshops, more design work for NASA, and a move. The landing brake plans were completed in February--They are VariEze Section VI ($10, $11 overseas). They consist of five 18" x 24" sheets, all full-size drawings.

N4EZ, our VariEze homebuilt prototype, has been flying extensively over the last few months, including several long trips: 2000 miles for the Seattle workshop and nearly 3000 miles for the trip which included the Denver workshop. With the exception of some exhaust system cracks the airplane has been maintenance-free. Rides or checkouts have been given to several writers for "Flying" and "Aviation Consumer" magazines. Both plan articles soon. The VariEze has appeared in the following magazines lately: Plane and Pilot, Sport Planes, Sport Flying.

We have completed the last of our out-of-town composite construction workshops. These have proven to be very beneficial in disseminating the techniques of foam/glass construction. Cities in which the workshops were given are listed.

Oshkosh, Wis.	Sacramento, Ca.
Highland, Ill.	Atlanta, Ga.
Boston, Mass.	Daytona Beach, Fla.
Van Nuys, Ca.	Snohomish, Wash.
London, England	Denver, Colo.
Paris, France	Anderson, Ind.
Austin, Tex.	St. Paul, Minn.

We will also continue to have an occasional workshop and flight demo here at Mojave to assist builders with construction questions. The next scheduled demos at Mojave are noon to 2 p.m. on May 14 and on June 11. We also plan to fly N4EZ to the Watsonville Flyin May 28 and to the Chino Flyin April 30.

RAF has finally made the move to our new building on the flightline at Mojave and the airplanes are on display for visitors to stop by and see. Our regular office hours are 9 a.m. to 5 p.m. Wednesday through Saturday. We are closed to visitors Sunday, Monday, and Tuesday. Builders who have pressing problems may be able to catch us by phone on our closed days, but we may be out in the shop with epoxy up to our armpits, so try and call Wednesday through Saturday if you can.

The VariViggen homebuilt program has suffered a tragic beginning. Jim Cavis was seriously injured when an accident occurred during his initial tests. A report on this accident is included in this Newsletter.

The VariEze homebuilt program has started on a more positive note with four homebuilt airplanes now flying, and many more soon to fly. However, the VariEze record so far has not been good. One ended up being run through a snowbank removing all three gear and damaging the propellor when it veered off the runway on its first lift-off. Factors contributing to this included a gusty crosswind, one brake being stronger than the other due to a modification, and incorrect rigging of stops in the elevon control system. That airplane has been repaired and is now flying successfully. We are concerned about the safety of many of you who will be conducting your flight tests, since we have observed an almost appalling lack of good judgment of many who have and are doing test work. Some have had a complete disregard of the limitations and procedures in the Owners Manual and have overlooked important things like weight and balance, rigging of controls, etc. It seems unbelievable that anyone can spend so much work building an airplane, then be so sloppy when it comes to flying it. We have also noted that many builders are not familiar with many of the changes and additions in previous Newsletters. Be sure you copy all info from Newsletter #10, #11, and #12 completely into your plans and Owners Manual. A lot of this information is very important to you! A large portion of this newsletter is devoted to preaching and emphasizing the importance of quality control, careful conduct of your test program, and of following known limitations.

WEIGHT AND BALANCE AND INITIAL TESTING

The "lead" builders of both the VariViggen and the VariEze have begun to roll airplanes out of their garages and into hangars. RAF has been trying to keep tabs on these early birds and one alarming deficiency has been common to many: inadequate and inaccurate weight and balance. Now hear this all of you homebuilders: A slipshod weight and balance can kill you. The final weight and balance that you do on your airplane before flight testing begins is just as important as installing the wing attachment bolts. Use the weight and balance methods shown in your Owners Manuals!

A variation of "Murphy's Law" says that anything which can be misunderstood or ignored will be. Our weight and balance instructions are no exception. The first principle of a good weight and balance is to assume nothing. For example, you can't just assume that the nose and main gear stations are exactly as shown in the Owners Manual. It wouldn't be unusual to find that your main gear axle centerlines are as much as 0.5 inch or more off of the target of F.S. 108.0. A small variation in gear location won't adversely affect the way your airplane flies, but it could lead you to believe that your center of gravity is forward (or aft) of its true location by quite a bit! The same principle applies to temporary ballast weights used to keep the aiplane's nose firmly on the scales. You may find it more convenient to put your ballast weight in a different place than we show in the Owners Manual which is ok. But, when you make your calculations use the weight and fuselage station where you put the weight, and not our sample! Also do a weight and balance with the pilot in the airplane to check your calculations. Do not ignore the pilot weight placard in the Owners Manual. Be sure to check the dimensions shown on Page 10 of Newsletter #11 while you are checking gear reaction points.

Those builders who have convinced themselves that the world will stop turning if they don't have alternators, vacuum pumps, or starters on their airplanes will probably discover that the airplane is 1) overweight and 2) aft CG. If you discover this condition in your airplane you only have two options, you can remove the garbage that is causing the aft CG condition and help your weight at the same time, or you can add permanent ballast in the nose to get your CG where it belongs and make your overweight airplane even heavier. Not really much of a choice. If you can't part with your heavy accessories, you will be tempted to ballast just enough to get to the aft CG limit and you will be asking for trouble. We have established a limited "first flight" area on the allowable weight versus fuselage station graph in the Owners Manual. Your initial flight testing must begin within this area. The first flight box is expanded slowly and carefully as you and your airplane gain experience. You can't start your flying at the most aft (or most forward) CG that we reccomended for fully proficient pilots and proven airplanes and expect to be safe! Don't compromise safety for the sake of a few unnecessary gadgets! Read and follow all information available to you. You are building a high performance airplane, not a toy. As you begin your testing be sure to give someone else besides the test pilot the responsibility to check that the airplane is ready, the Owners Manual procedures are being followed, and all limitations are met. He should also have the authority to make the "go","no-go" decision and do the test planning. Test pilots have too much else to think about to be able to make correct decisions on these things.

Already we have seen people doing some really foolish things like flying without side consoles (the right one provides pitch stops!), doing initial testing in crosswinds of almost the full capability of the airplane (Owners Manual specifies zero for initial tests), testing on shorter runways than specified, etc. Unless you stay within recommended limits your chances of success are quite low.

When you get to the hangar with your new airplane take it easy, and do a thorough job of your initial systems checks, weight and balance, etc. This is not the time to hurry. "Homebuilderitis" effects us all and you will lust to see your airplane fly, fast! Don't talk yourself into doing something stupid just to please your ego; finish building the airplane before you try to fly it!

WEIGHT CONTROL

In view of the non-stop preaching done by RAF in our newsletters, plans, over the telephone, and in person, it is a little difficult for us to understand why some homebuilders are still happily ruining their airplanes by making them overweight. The VariEze is also VariSmall and it doesn't have a great deal of wing area. Adding a little weight to <u>your</u> airplane is like carrying another passenger in a Cessna 172!

The worst weight offenders are still the gadgeteers... starters, generators, alternators, vacuum pumps, radios, gyro instruments, dual controls, etc., etc. One group of builders added dual 720-channel NAV/Coms, Dual VOR/ILS indicators, dual glide slopes, an annunciator panel, D.M.E., marker beacon, transponder, encoding altimeter, artificial horizon, directional gyro, rate of climb, turn and bank, starter wiring, night lights, CHT and EGT, a 25-pound battery, and an alternator to power it all. Aside from the $14,000 expense, the airplane is 140 pounds overweight! Unfortunately, this equipment was also on an aircraft finished with over 11 gallons of Featherfil and 6 gallons of white paint (N4EZ has 5 quarts and 1.3 gallons respectively). This airplane is so heavy that a normal pilot can't even operate within the "first flight" limits shown in the Owners Manual. All of the gadgetry in this VariHeavy belongs in a 747, not in a little homebuilt! This airplane is now a single-place. It can happen to you, too, if you lose appreciation for weight control.

N4EZ started life with an 11-pound alternator on the engine and had to have 10 pounds of lead in the nose to balance properly. We really thought that the alternator was necessary to power our little NAV/COM on long trips. Well, we were wrong. The voltage regulator burned out on a trip to Seattle and since we were too busy to fix it right away, we charged up the little 12 Amp-hour motorcycle battery and flew another 3000 miles. Controlled airspace, radio navigation, and weather reports, we used the radio as much as ever and the battery was still strong when the trip was over. Obviously, once home, we ripped the alternator off, took the lead out of the nose, and put the voltage regulator on a polished mahogany plaque. That little voltage regulator helped us take 21 lbs. off of N4EZ's empty weight! You hard core gadgeteers should spend your efforts finding things that can be taken out to save weight, not hunting for space to add expensive and heavy grozmos!

The second major weight offender is the finishing nut. We have heard stories of builders who use Bondo on airplanes for finishing. Bondo weighs 12 pounds per gallon. Dry micro only weighs 3 pounds per gallon. We hear reports of <u>gallons</u> of Featherfil being used where quarts should do. ARRGH! If you wonder why we are getting gray hair, it's because you can wipe out weeks of design refinement and weight saving efforts with a stroke of your Bondo paddle!

Read and use Section V carefully and conscientiously. Don't ruin your airplane trying to make it into a sculpture! A Cessna 150 leaves the paint and finish shop only 13 pounds heavier than it went in, and it has more than twice the surface area of a VariEze. N4EZ's finish weighs 18 pounds and we think that's too heavy. If you add over 20 pounds to your Eze in finishing, you have done yourself a disservice.

There has been some confusion about what to expect for the empty weight of your VariEze. The values shown in the Owners Manual are for a basic airplane without <u>any</u> extra equipment, no electrical system, and minimum weight finish. The average homebuilt VariEze with an O-200 engine, with the basic electrical system (Section III) and with an average finish job will weigh approximately 600 pounds, empty. This goes the same for a VariViggen, too. While the empty weight is given as 950 pounds, the average equipped airplane will weigh about 1050 pounds.

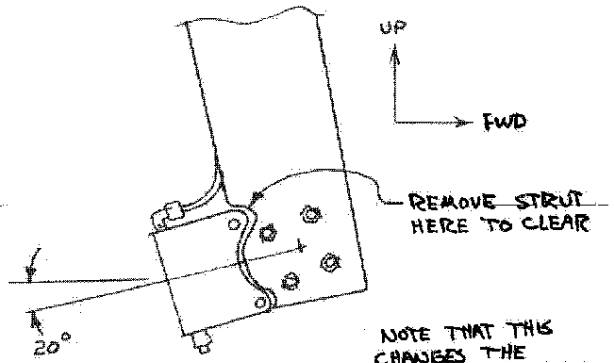
5:00 X 5 TIRES (THE SAGA OF BIG FOOT)

In Newsletter #11 it was mentioned that the larger and heavier 500X5 tires might be creating a problem with the VariEze landing gear. Since January our suspicions have been confirmed and these "Big Feet" have been trouble with a capital TEE. The bottom line is that the <u>500X5 tires must not be used</u> on the VariEze. Stick with the recommended 340X300X5; the following explains why.

The Eze landing gear is a lot like a big tuning fork. It has a distinct "natural frequency" that it will vibrate at, when excited. In the fore-aft direction, the once-per-revolution excitation of an unbalanced tire and wheel or a lopsided brake disc can cause the gear leg to vibrate at its natural frequency when the rotational speed of the wheels (Revs per second) is at the natural frequency (cycles per second) of the gear. If the natural vibration of the gear is excited at high speeds where there is a lot of kinetic energy ($\frac{1}{2}$ MV^2), the vibration is violent and damaging. At low speed the vibration is mild and no cause for concern.

On N4EZ the 10-inch diameter (340X3X5) tires have to turn at about 20 mph (11.2 Rev/Sec) to excite a mild gear leg vibration. The larger (15 inch diameter) tires (500X5) have to zip along at a little over 30 mph to excite the gear. The kinetic energy is more than twice as great, and the vibration is strong enough to damage the gear attachment pads.

One builder has also found that his gear vibration was a problem with his brake mounted below the axle and was solved when he moved it 90 degrees to the correct position aft of the strut. The exact position of the Cleveland brake is not clearly shown in the plans. Refer to the drawing below.

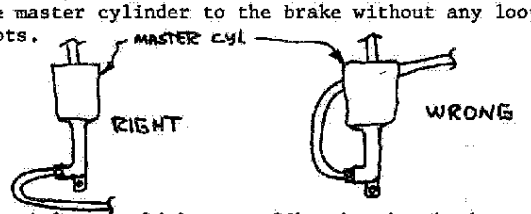


BRAKE SERVICING AND BRAKELINE ROUTINE

We've talked to a few builders who really didn't understand how to service their brakes with fluid and purge the air bubbles. First of all, aircraft brakes and automobile brakes are different, so don't expect the method you use on your car to work on the airplane. The brakes on VariViggens and VariEzes are your only low speed (0 to 30 mph) directional controls. A spongy brake requires <u>immediate</u> attention.

Aircraft brakes must be serviced by pumping fluid from the wheel brake up through the line into the master cylinder. This may seem basackwards, trying to make the river flow uphill and all that, <u>but</u> it is the correct way to do it. The magic in pumping the fluid from bottom to top is that it forces any air in the system up and out. A pump-type oil can or a squeeze bulb can be used to pump the fluid up through the system.

The routing of your brake lines through the airplane is also very important. The brake lines should run downhill from the master cylinder to the brake without any loops or high spots.



A loop or high spot, like the sketch shows, can trap a big air bubble and give you a permanently spongy brake that even proper servicing won't help.

SHORT AND MEDIUM HEIGHT PILOTS

We have had a number of calls from medium and short pilots concerned that they might not be able to reach the controls on the VariEze and wondering what mods to make. The most common question asked is "Can I move the stick?" and the and swer is no. The pilot should move forward, the stick should not move aft. The short pilot is also generally lighter than tall pilots and has a built-in weight and balance problem requiring permanent ballast in the nose. Moving the light pilot forward will help keep the center of gravity forward where it belongs. The rudder pedals as shown in the plans will adjust enough to fit pilots from 6'4" to 5'5" without changing anything. Medium height pilots may find it necessary to use a cushion to raise their eye-line for adequate visibility.

The short pilots, 5'4" down, who are building VariEze's will need to make some minor modifications to their airplanes for adequate visability and better control reach. The obvious things to move first are the rudder pedals. The bottom pivot of the rudder pedal as shown in Chapter 17 is at F.S. 17 (approximately) and they can be shifted aft 2½ inches to F.S. 19.5 without any trouble at all. The rudder pedal pivot bolts are simply located ½ inch forward of F-22 instead of 3 inches forward as shown on Page 17-8.

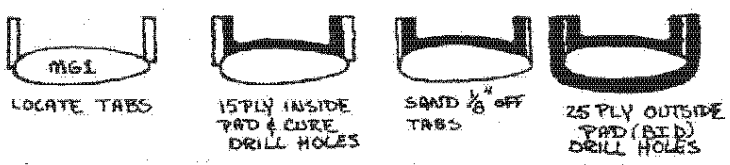
The major difference between short people and tall people is the length of their legs. Strangely enough, torso's and arms are fairly standard (compare the range of pants leg lengths with the length range of shirt sleeves on your next trip to the department store). The short troops may need to cushion themselves forward by the thickness of an extra back cushion but not much more for comfortable stick throw. Even 5'2" pilots can easily reach the stick. If you move forward, the canopy tries to force you lower in the cockpit, so as the pilot moves forward, the canopy has to move forward also. As the Owners Manual specifies, the pilot has to stay high in the canopy for good forward visability. Short troops have two options; they can add one to 3" of foam thickness over the theigh support as a permanent spacer and use the standard seat cushion, or have an extra thick cushion made.

MAIN GEAR TESTING AND MODIFICATIONS

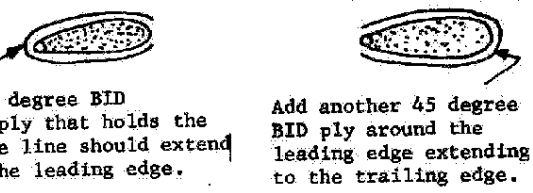
The drop and static load testing of the main landing gear strut has been quite extensive. The accompanying photos show the two types of tests which have been conducted; one test is a static load applied by a hydraulic ram, the other is a more traditional "free drop" test as is specified by F.A.R. part 23. Both types of test showed excellent results, even when using components that were considered rejects. The drop test components were in most cases (We did test a good one too!) of inferior quality to the parts shipped to builders.

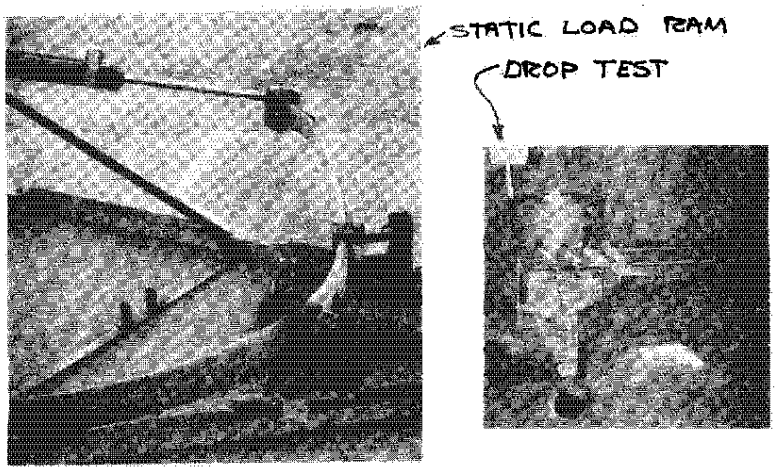
A few builders have asked what the weakest part of the landing gear is, and the answer is the attachment pads. Don't misunderstand, it is strong enough to do the job and then some, but it is the part we expect to break first if the system is overloaded. On N7EZ (VW prototype), it's trip through a ditch at 75 kts last summer tore the gear free of the airplane by failing the attachment layup, but the gear strut itself was not damaged and will be reinstalled on the airplane. We speciffically tailored the attachment layup to fail first in a crunch because it is the easiest and cheapest part to replace.

If you choose to strengthen the attachment area, it can be essentially doubled in strength with very little additional weight using this approach. Follow Chapter 18 exactly up to the end of Step 2, then do Step 3 in two parts: First layup the 15 ply inside pad, clamp, and let cure; second, drill the ¼ inch holes through the inside tab, then sand about 1/8 inch off of the red foam tabs front and rear faces, prep sand the MG 1 and layup a 25 ply outside pad, clamp and cure.



The torsional strength of the MG 1 strut can be increased significantly by applying an external BID wrap. This adds little weight and significantly increases its resistance to splitting if a severe aft load is applied. We do recommend that you make the wrap as shown. This can be done even after the gear is mounted to the fuselage, but is better if done full length before the mounting pads are installed.





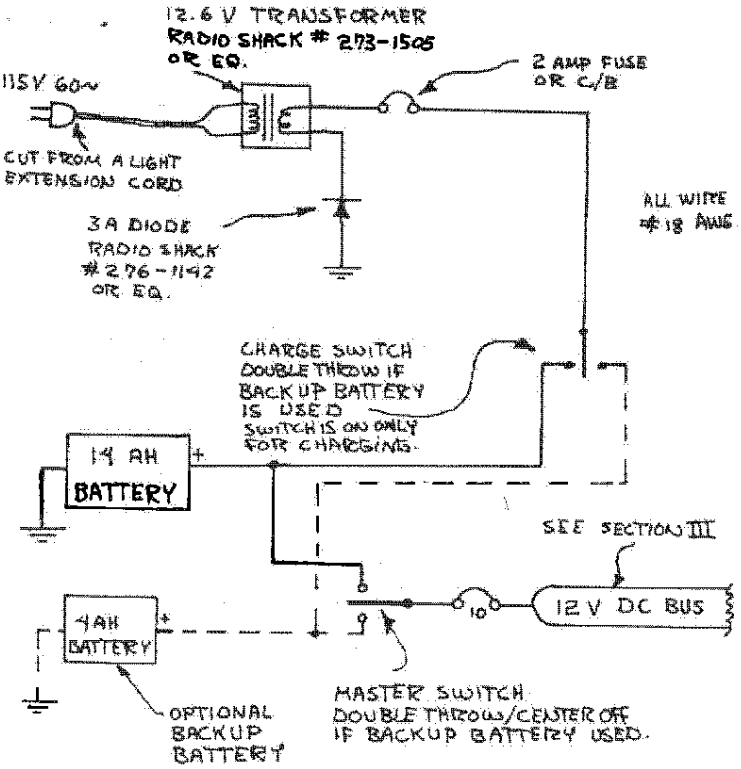
VARIEZE ELECTRICAL SYSTEM

Lately we have been attacking the problem of how to provide reliable electrical power for NAV/COM and instruments without using the heavy engine-driven alternator. Note that leaving out the alternator is highly recommended for the heavy O-200 and is mandatory for the Lycoming O-235. It seems unreasonable to use a 60 amp alternator to provide power for an average current drain requirement of less than one amp. Why only one amp? Well, the NAV/COM generally needs to be used only five to ten minutes out of every hour. The only exception being touch-and-go's at controlled airports. Since the VariEze is not a training-type airplane, this use is not common. NAV/COM for cross-country needs to be used only in terminal areas or for a few seconds at a time to obtain a bearing or to check weather. Engine instruments (oil temperature/oil pressure) are very low current drain. The turn and bank is required only if you need to extract yourself from poor weather planning and is thus off the vast majority of the time. In summary then, we have found actual average electrical current requirements in N4EZ to be less than one amp, even including trips with all stops at controlled airports.

We are then taking two approaches to developing a satisfactory no-alternator electrical system. The first approach has already been tested on N4EZ for the last two months, including two 2000+ mile trips. It has worked very satisfactorily and its use is recommended. The second approach will be tested soon.

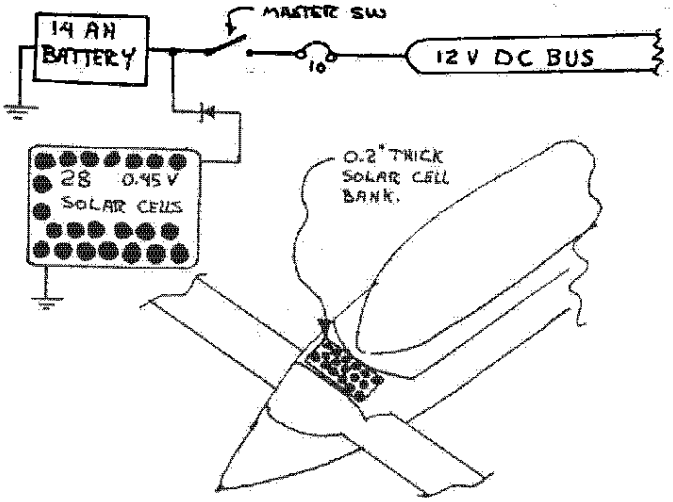
1. No in-flight charging. Convenient self-contained trickle charger to top-off battery when parked or hangared.

   The system shown can be built from less than $10 worth of electrical components available at any Radio Shack or eletronics supply store. The components can be mounted in a small box on the F-22 bulkhead. Total system weight is one pound. To use the system, simply plug in to any 110-Volt AC receptical and turn on the switch. We generally give the battery an over-night or one-day charge every 10 to 15 hours flying, or about once a month. On a long trip, charge it over-night when hangared. Charge rate is 1/2 to 3/4 amp and will take about one day to fully charge a low battery. Do not leave it plugged in for extended periods (more than two days), or battery damage can occur. The battery is the same 14 AH Honda 750 motorcycle battery shown in Section III. Note the optional backup battery. This is a small 12-Volt motorcycle battery that can be selected (to use or to charge) if, due to poor planning, you deplete your standard battery. The smallest 12-Volt motorcycle batteries weigh only 4 to 5 pounds and will run your NAV/COM and instruments about an hour continuous.



2. Solar-powered electrical. Note that we cannot recommend this as we have not yet tested it.

   The solar cell panel shown costs about $170, weighs a few ounces, and should keep the battery charged if ratio of sun-exposure time to radio-use time is in excess of ten.



EXHAUST SYSTEM

One of the four mild carbon steel exhaust stacks on N4EZ developed cracks recently and had to be replaced. The cracks appear to have originated along some deep mandrel marks (left from forming) in the first bend downstream of the exhaust port. The cylinder appears, from exhaust deposits, to have been operated at a normal mixture (one cylinder of an engine doesn't necessarily get the same fuel/air mix as another even though they are hooked to the same carbuerator). There are a lot of possibilities open as to the cause of these cracks. The mandrel marks alone could be the culpret. The combination of heat and vibration may require the use of stainless steel instead of carbon steel. It is also possible that the geometry of the exhaust stack is incompatible with the engine for another reason. We are evaluating these possibilities as fast as we can, however this involves flying a lot and many homebuilders will be flying before we have the final answer. This problem doesn't pose any immediate threat to flight safety but until it is resolved you should plan to inspect your exhaust system visually for cracks at least every 25 hours or engine time. In the meantime we will be testing a stainless system (same geometry) to determine if this will solve the problem.

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EPOXY

Last October we began working with a large epoxy formulator to develop an alternate supplier of the RAE, RAEF, RAES and 5-minute material for VariEze construction. Meeting our specifications for this material has not been easy, particularly for RAES. . The new material supplied by Applied Plastics is now available at the VariEze distributors, and that it meets or exceeds all previous specifications. It is also less toxic to work with. Most important, we are confident that the quality control problems with the previous vendor will not reoccur. Here's what to look for if you suspect that you have problems with your epoxy. Your epoxy resin (RAE) should be clear or have a slight amber, red, or greenish tint. At 75 degrees its viscosity should be low enough so that it is easily poured. (Cold temperature makes all resins thick). The resin should not be contaminated with particles or lumps floating in it. Thick honey-like resin or contaminated resin should be returned to the place where you bought it. Hardeners may be tinted a variety of colors. A new bottle of hardener may occasionally show a milky sediment in the bottom; warming and shaking should allow this sediment to go back into solution. It should be warmed by placing the jar in hot water (130 to 170 degrees F.) Do this before using a new bottle. If the sediment will not return to solution, the pot life of epoxy mixed using the hardener will be shorter than it should be, so return it to the place of purchase for replacement. If your hardener has crud in it that doesn't drop into solution by warming and shaking, get is replaced, also.

5MIN epoxy is a very quick setting system of high viscosity. The 5MIN appears to be about twice as thick as the RAE laminating resinand takes about 5 to 10 minutes to cure out hard after mixing. 5MIN is used to locate and fixture parts and must cure out hard. Any tendency to remain soft of "bubblegum" after 1 hour is unacceptable and the material should be replaced.

EPOXY SENSITIVITY

Since last Newsletter, we have had quite a bit of mail from builders who have become sensitized to epoxy. It looks like about 10 to 20% of the builders have some mild form of sensitivity, like Burt does, and about 1 to 2% have indicated a severe reaction. Some have simply had to abandon their projects because of it; others find simple precautions adequate to avoid the alergy. We don't have a "cure-all" for the sensitivity problem but we have had some additional inputs on the subject. We have also changed to a different epoxy formulator, who is now supplying a less toxic material but we don't know if the reduction will be enough to help the severe sensitivity or not.

Epoxy sensitivities seem to be of two basic types; a systemic reaction like an alergy that can be aggrevated by breathing the fumes, skin contact with the epoxy, or both; and the second is a "contact dermatitis" or rash which is aggrevated by skin contact. Some people have found that an antihistamine like the 'allergy' tablets sold for pollen allergies are effective against epoxy senitization. As well, one builder sensitive to fumes, found that an activated charcoal filter equipped painting respirator did the trick for him. Another builder is using a "space suit" H.G. Wells thought up.

Some commercial epoxy handling shops prefer to use a disposable plastic glove with a light cotton glove under it. The plastic glove keeps the epoxy off while the cotton allows the hand ventilation and snugs the plastic so that your dexterity isn't impaired. The Ply 9 skin protector is a good barrier, but it can be rubbed off accidentally by working with tools or if your hands sweat or get damp otherwise. Be aware of the limitations of Ply 9 and reapply if you think you have rubbed or washed it off. One physician on our Newsletter list advises that your clean-up can be just as important as protection beforehand. In the process of washing up, epoxy can be smeared onto unprotected skin, so be sure you wipe away excess epoxy with a paper towel before you start washing, AND WASH THOROUGHLY.

If you find yourself with an extreme sensitivity you should seek your own doctors advice. Try using all of the normal precautions but for some of you this isn't going to work. It may be that some of you simply can't work around epoxies at all and if that's the case you should probably drop your VariEze project. There is no sense in torturing yourself; building airplanes is supposed to be fun.

SENSITIVITY QUESTIONAIRE

(Fill out and send to RAF)

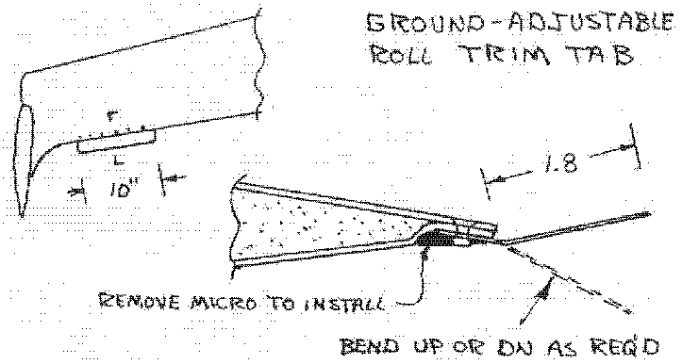
Name_____Building a ___VE___VV___S/N___

Sensitivity _____Mild _____Severe
Describe Reaction_____

Do you use ___Ply 9 ___Gloves ___Nothing ___Other
Did you use any protection when you first started work?_____
Have you found a way to work without getting a reaction?_____

ROLL TRIM

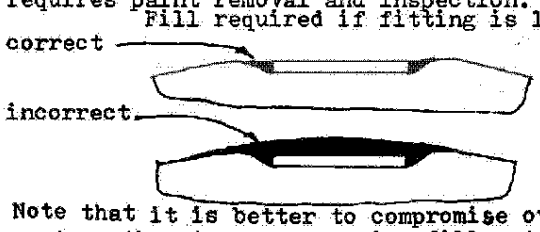
It may be that some builders will find their airplanes far enough out of trim in roll that a fixed ground adjustable roll trim tab may be required in addition to the flight adjustable system shown in the plans. If your airplane requires the additional tab you should install it during your initial runway flying, before first flight. The ground adjustable tab is located on the left wing in the same position spanwise as the plans show for the flight adjustable tab on the right. The tab is .025 aluminum (2024-T3 or 6061-T6), 10 inches long and 2.3 inches wide. The tab is riveted to the wing trailing edge with six 1/8 inch pop rivets. The tab overlaps the trailing edge 1/2 inch as shown and the rivets should be located in the center of the glass to glass overlap.



Note in the plans changes that the chord of the flight adjustable tab has been reduced to 1.7 inches. The airloads on the 2.3 inch tab were high enough to back it off of the selected position at high speeds. If you have already built the tab, trim it to 1.7 inch chord.

VARIEZE FINISHING

We have seen several examples of excess filling used in the finishing process, particularly over the wing fittings. If proper care has been used in locating the wing fittings only a feathered area around them needs contour microfill. Never stack alot of fill over the fittings or unnecessarily high in any area (see Section V). The reason for this is not only cost and weight. Having a high separation between the white paint and the glass structure eliminates the flexing compatibility, in that the paint may crack under normal flexing without glass damage. This flexing compatibility is important since the presence of paint cracks indicates a possible structural problem that requires paint removal and inspection.



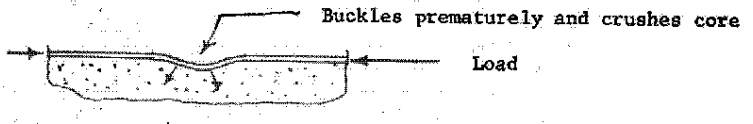
Note that it is better to compromise overall contour than to use excessive fill material.

WORKMANSHIP

In Newsletter #10 we encouraged builders to help "police" each other by being honest with each other and lettin' the guy doing marginal or sub-marginal (junk) work know it. It appears that most builders are doing a good job of building their airplanes but there are a few of you who aren't. We have seen a few examples of workmanship so poor that the parts are structurally unsound and cosmetically wretched. The unfortunate part of it all is that some of these builders either don't know or refuse to admit that they have created junk, not airplanes. It may be a bitter pill to swallow, but some of you will not be capable of building a VariEze. We have found a few builders who try and stretch the limits of our acceptability criteria so they can squeek by with sub-marginal workmanship. The inspection criteria published in Newsletter #10 are minimums for acceptance and they cannot be stretched for your convenience. If you know of someone who is trying to "slide by" with a junk airplane, it is in your own best interest to let him know about it in no uncertain terms. A poor safety record hurts us all. All airplanes are infernally complicated and difficult to build, some are just worse than others. The VariEze is "less worse" than most but some builders will not be capable of mastering it. If you are in this group, be honest with yourself and admit it before your pride gets you killed and puts restrictions on the rest of us. Get some help and get your workmanship up to speed before you continue.

The inspection criteria published in Newsletter #10 were not frivolous standards established to make life hard for the builder. These standards were set up to keep the structure safe and strong. An example of this can be shown in the wrinkle or bump criteria. A bump in the skin tends to trigger a premature buckling failure, and a natural tendency to peel away from the foam core.

The same type of premature skin buckling failure is the result of a dip or impression into the foam.



Keeping the skins straight without humps or dips enables the glass to carry its full load, uniformly supported against buckling by the core. Dips and humps of 1/16 inch or more are structural failures built into the airframe. The key to success is a perfect foam core. Foam core defects not corrected before glassing are the most common cause for scrap parts. Laying up glass over junk just makes it harder and more expensive junk.

VARIEZE QUESTIONS AND ANSWERS

Q. My partner and I plan to do a lot of pattern flying, touch and goes, short passenger flights, etc., in our VariEze, and we don't like the idea of having to switch fuel from mains to the header tank and back for every 15 minute hop. Is it ok if we use the original fuel system shown in Section IIA with the pump?

A. No, the fuel system shown in Newsletter #11 is a mandatory change to the VariEze. The old fuel system was occasionally prone to fuel foaming in the engine mounted header tank and relied on the fuel boost pump to avoid a possible flame-out. Your concern about having to switch fuel tanks constantly are unfounded. The fuselage tank is rarely selected; the only time it is used is when your flight planning requires long descents with low wing strake fuel (2 gallons per side). The fuselage tank does not even need to be selected for nose down starting. Leave the fuel selector on 'wings' and the fuel in the carburetor float bowl will let the engine run for two

minutes at idle. The fuselage tank also provides a very accurate indication of your last 2 to 3 gallons of fuel. The accuracy of the system has allowed N4EZ to complete one flight into strong unforecast headwinds with confidence even though the fuel remaining after landing was only 0.3 gallon! In a standard production type airplane the last 0.3 gallon wouldn't even wiggle the gas gauge and an extra stop would have been made, even though unnecessary! If you're shooting touch and goes with under 1/8 fuel in the wings (3 gallon total) you should switch to the fuselage tank. If you do run your wings dry or flame-out in a steep descent with low fuel, you get a relight in only seconds by selecting the fuselage tank. Putting the below -3 gallon descent starvation in perspective it is helpful to compare it to the average light plane. According to "Aviation Consumer," when a Cessna has an "empty" reading on its fuel gauges it can have from 2 to 9 gallons of fuel! Now, few of us continue to do touch and go's or continue a trip with gauges reading empty. The real beauty of the system is that all the wing fuel can be used in level flight and then have a reliable indication of the remaining 45 minutes of fuel (fuselage). This takes the worry out of using the last few gallons that is present with all other lightplane fuel systems.

Q. I do not speak or read in English. Do you have any plan to offer translations of the plans and instructions into other languages?

A. No, we don't. However, there is a lady in Switzerland who has offered her services. She will translate into German and French for a small fee. Contact Mrs. Dane Rowe, Langgasse 51, CH-3292 Busswil, Switzerland.

Q. If it met reliability and weight requirements, would you accept installation of Rotorways 133 Hp engine (derated to 100 Hp takeoff and 75 Hp cruise)?

A. The engine is like many others, it sounds promising. Only a professionally conducted developmental flight test program can prove the concept good or bad. If the basic engine is proven out successfully then documentation for the operator must be available also so he can operate and maintain the engine properly.

Q: I just finished my wing layup and it took my wife and I all day and half the night. I was so worn out from -- stippling I couldn't even eat my cookies and milk before bed. What am I doing wrong?

A: Chances are that you are doing a whole group of things inefficiently, not really wrong. First, you are probably short-handed for such a big layup. Those half dozen major layups are kind of like a quilting party, by yourself they are just work, but with a group they can be fast, satisfying and fun. Try to at least get two full time laminators with an epoxy mixing third. You are probably spending way too much time trying to make the interior glass plies exactly the right epoxy content, stippling your life away., Try making your interior plies extra wet and fast, then spend your time on the final ply with a squeegee and a roller to get the excess epoxy into the top ply or off on the floor. When you have a monster layup to do, take a break every two hours, wash up and put new Ply 9 on, then rest for ten minutes while the ply 9 dries. Be sure you give all your tools a chance to save you work, don't tackle a major layup if you are out of paint roller covers, or without a couple of clean squeegees. Try the kit-supplied squeegee or a softer type cut from a plastic coffee can lid.

Q. The local FAA is really giving me a hard time and it sure would be helpful if they had a set of plans and newsletters. Can you send them a set?

A. No, there are several hundred offices in the U.S. that inspect homebuilts and we couldn't send them all copies; but, for FAA use only you may Xerox copies of the portion you're fighting over. You can copy the newsletters for any reason you like.

Q. I've never cut plexiglass before and I'm getting ready to trim my canopy. Any advice to offer?

A. Yes, get a copy of Cowley's "Care and Feeding of a Vari-Eze Canopy" from Cowley Industries. Every builder ought to read it.

Q. Section IIA calls out #12 wire for the magneto switches. Isn't #18 adequate? #12 is heavy and expensive.

A. Yes, #18 is ok for the mag switches.

Q. Why do you use those tiny little slick tires? How about something with a little tread?

A. Well, tread is hard on props, it tends to pick up rocks and flip them into the prop arc. $$$

Q. To facilitate any rigging adjustments that might be required after my initial test hops I'm going to leave the side consoles off of the airplane until it's flown. Is this ok?

A. No! The pitch control stops are provided by the console and the side stick controller can be easily over-powered (pilot induced oscillations) unless the pilot has an armrest. Don't try to fly your airplane until you finish building it!

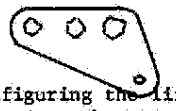
Q. Will anyone be offering a "check out" or at least a back seat ride in a VariEze for other builders to get the "sight picture" before flying their own bird?

A. As far as we know, noone plans to do this commercially. You may find other builders willing to give you a ride but I wouldn't expect to fly their airplane yourself. Keep yourself current, practice the initial test sequence in an airplane you are already proficient in, and then take your initial flight testing slow and easy.

Q. My VariEze will never have a pilot other than myself and I'm a 60,000 hour super jock who can handle anything, even blindfolded. Is it ok for me to keep my Eze simple and delete the spoiler mod in CP #11?

A. No, if we didn't feel that the spoilers were required, we wouldn't have made them a mandatory change.

Q. I mislocated my canard lift tab insert and nut plates too far inboard so I remade my lift tab as shown. Do you approve of my fix?



A. No! Great Zot, reconfiguring the lift tab as you have done, puts about three times the normal load on one bolt.

Q. I like the smoother surface that I get using peel ply. Can I peel ply my whole airplane outside, saving the sanding in prep for micro and featherfil, and use less featherfil to fill the glass weave?

A. I suppose that you could do this, but it also sounds like a lot of extra work and expense. The peel ply costs $1.60 per yard and the extra epoxy to wet it out is expensive too. This approach might save the light sanding done in prep for micro and featherfil, but you would have to wet out an additional 200 sq. ft. or so of the cloth! Don't confuse finishing prep sanding with structural bonding prep sanding; they are greatly different.

HINTS FOR EZE BUILDING

-A paper cutter is excellent for cutting the zillions of little squares of glass cloth used in the wings and center spar. It even measures.

-Clamping a board on each side of the wing attach fitting while making the bearing pad layups allows you to stipple actively and keeps the glass from squeezing out over the edges. Scissors trimming in this area can be a challenge.

-Canopy. If you move the canopy forward as mentioned in Newsletter #11, be sure that you leave the cut between front cover and canopy in the same place as shown on Page 22-4. The front cover is required for the torsional rigidity of the fuselage. If the vent is too cramped to fit between the plexiglass and the edge on centerline, move it off center.

-Leading edge overlap on wings, canard, and winglets, can be done with ease and very neatly using the paint roller. As you layup the upper skin plies, use the roller to wrap the overlap up onto the bottom skin instead of stippling with a brush. The brush tends to fray the cloth as you stipple giving the cured overlap a very rough surface requiring ambitious sanding to fair. The roller leaves the cloth smooth and unfrazzled. Scissor trim each sucessive skin ply a bit shorter than the preceeding ply giving the lap joint a semi-tapered finish requiring far less work to sand smooth, and eliminating any tendency for the plies to pull away before cure.

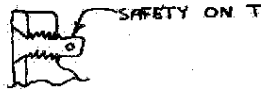
-Trailing edges. When making your final inspection and preparation of the foam core for skinning, look carefully for potential trouble spots. A hot-wiring defect or too abrupt a curvature may tend to leave voids in the trailing edge corners between the glass and foam. If you even suspect the possibility, sand the area to a more gradual transition before laminating. A well preped foam core makes the layup much easier.

-Throttle and mixture return springs. Section IIA calls for Century C-161 springs to be used but some builders have had trouble finding them. If you have to substitute some other spring, it should have an unstretched length of about two inches and a force gradient of about 1/2 pound per inch. Adjust for a light but positive return of the arm.

-Paint rollers. These are two rollers found in hardware stores that are excellent for laminating. ANYON, EZ Paintr, No. 9FB.99 for enamel and gloss paints on smooth surfaces. Also, Cov-A-Roll, r-33M, 5/16 inch pile mohair, by Hansteck Corp., Roanoke, Va. Also for enamel on smooth surfaces.

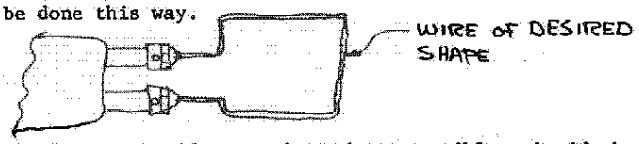
-Hot wire cutting. A good method to use for judging wire temperature is the cut foam surface appearance. A cratered or rutted surface indicates that the wire is too hot. A very light "hair" of plastic strands on the surface is just right.

-Builders have found that the Allen cap screws holding Rosenhan brake discs to the wheel interfere with the glass main gear leg. You can add a 1/8-inch thick aluminum spacer between the gear strut and axle to correct this or make some special flush screws like the one sketched below.



-Be sure to use Teflon tape to seal the threads of all brake line fittings.

-A soldering gun with a 1/16 inch diameter music wire tip can be handy for carving notches into blue foam. The canard red foam inserts and the rudder cable groove in the wing can be done this way.



-Peel coat should be used anywhere possible. Avoid the hard sanding of cured glass by thinking ahead and laminating a peel ply in before you quit a layup. The peel ply will help avoid the damage possible with sanding. It is ok to sand a peeled surface before glassing and it is much easier than sanding non peel plied glass. See Newsletter No 11.

We have found that many builders are not using peel ply where they should. Do use it for all areas requiring a glass layup over cured glass surface, ie.

All leading and trailing edges
Outer 18 inches of wing and lower 15 inches of winglet
Front and aft faces of center section spar
All edges of all bulkheads
Fuselage sides where they join nose, cowling, bulkheads and fuel tanks
Faces of canard and wing shear web that join spar caps

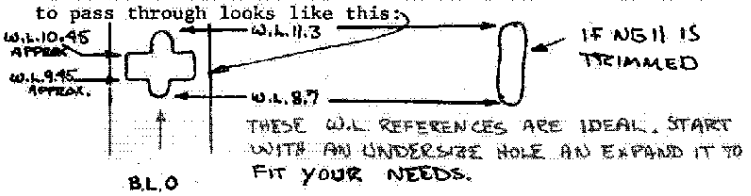
-Some component weights were given in Newsletter #10. Additional ones are

Center section spar (Chapter 8)	21 LBS
Wing/winglet/rudder (Chapter 24)	41 LBS

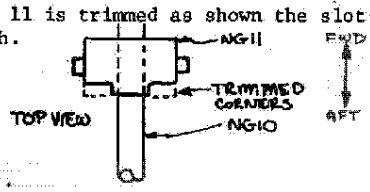
-Carving the nose. One builder found that a black string (weighted with a nut on each end) draped spanwise over the nose helped him to visualize the contour better.

-Nat Puffer has a good solution for raising the height of his Rosenhan master cylinders. It's a simple internal thread/external thread spacer with a cross-section that looks like this sketch.  (See photo - pg 19.)

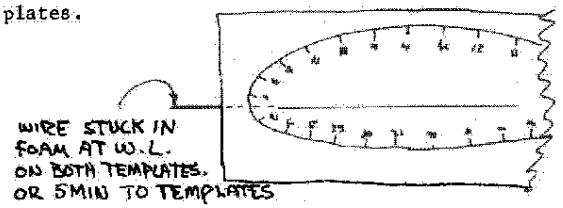
-Nose gear. The cutout in F-22 which allows NG 10 and NG 11 to pass through looks like this:



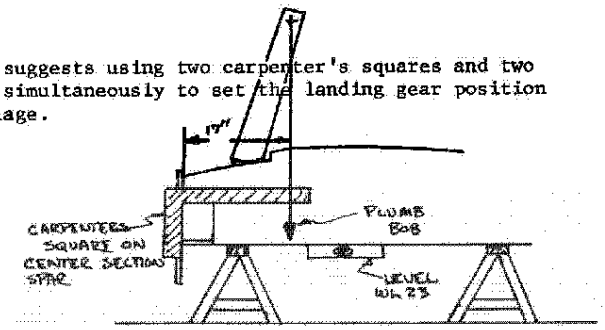
If NG 11 is trimmed as shown the slot looks like the second sketch. (REF PG 17-2)



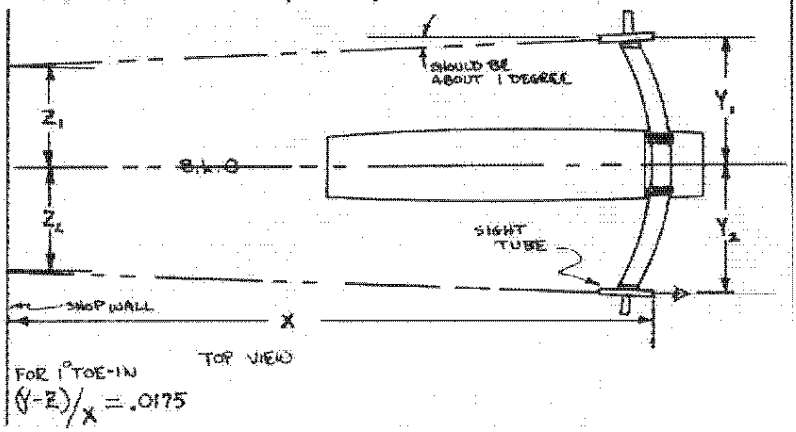
straight leading edges by adding a small wire to each template at the leading edge as shown in this sketch. Instead of cutting all at once you make two cuts from the leading edge aft towards the trailing edge, one top and one bottom. You heat the cutting wire, burn into the foam and rest 1/4 inch from the template on your guide wire, heat the cutting wire for a two count, burn into the template, pause a two count and then go. The first pause gives your partner time to get into the foam because sometimes the distance is uneven. Cutting foam cools the wire therefore the pause at the template. If you were talking the wire around it would go like this: Heating up, burning in, 1/4 inch away on the wire, one-two, go, template 1-2, go, then count the normal numbers. (Renumber if you want but be sure they match on all the templates) It really helps if you say quarter, half, three-quarters when you have a long way between marks on your templates.



-Nat Puffer suggests using two carpenter's squares and two plumb lines simultaneously to set the landing gear position on the fuselage.

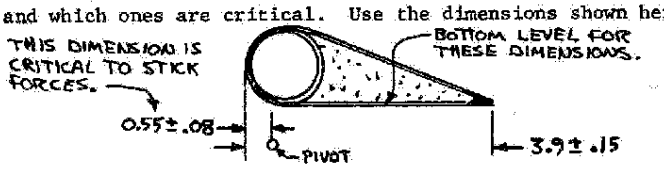


-Main gear toe-in check. An alternate method for checking the toe-in is shown in the sketch. With the axles installed on the gear leg temporarily (clamp), with the airplane level project the centerline onto a wall about 15 feet away. Attach a 4 inch piece of small I.D. tube to the axle mounting faces (5 min or tape) and level them. Use the tubes as a boresight to locate the projection of the axle face on the wall for each axle. Measure X, Y and Z as shown. Z_1 and Z_2 must be equal. Dimensions Z_1 and Z_2 must never be greater than the dimension Y (toe-out).

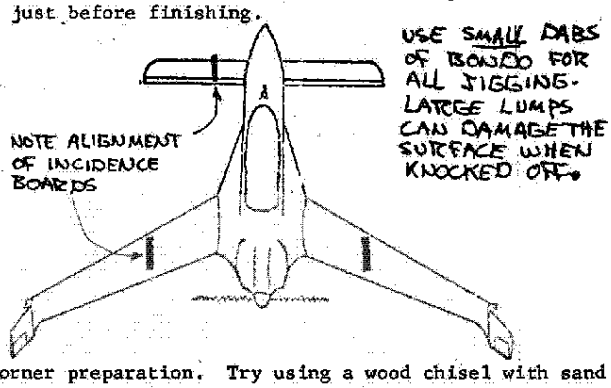


-Layups. Taking a lot longer than the plans call for? Try making your layups purposly wet, then use your squeegee to remove the excess. This method is a bit wasteful but goes much quicker.

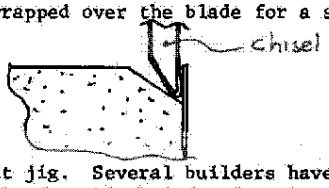
-Elevons. A lot of builders ask about elevon dimensions and which ones are critical. Use the dimensions shown here.



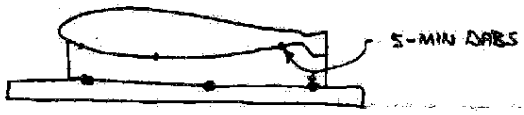
-Wing and canard incidence blocks. After glassing the top side of wing or canard and before removing it from the jig (root and tip W.L. still level), Bondo a board to the top surface at mid-span which is also leveled. This board can then be used as an incidence reference which is firmly attached to the surface and isn't subject to errors in positioning each time it is used. The board remains on the surface throughout the construction of the airplane and is removed just before finishing.



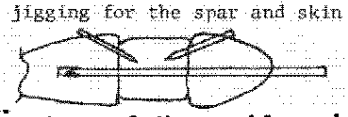
-Flox corner preparation. Try using a wood chisel with sand paper wrapped over the blade for a sanding tool.



-Winglet jig. Several builders have reported good success using the foam block left after hot wire cutting as a glassing jig for the winglet. An inch or two is trimmed off of the leftover block near the leading edge and it is 5 minute epoxied to the work bench to provide a straight custom fitting jig.

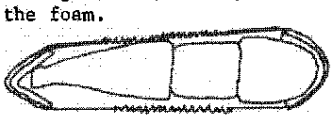


Foam core alignment. To help realign the foam core pieces of the wing and canard for correct spar notch depth, etc., one builder drilled several holes for 3/16-inch dowel rod into the foam block before hot wiring as shown. After cutting, the sections of foam can be assembled on short dowels to aid in jigging for the spar and skin layups.



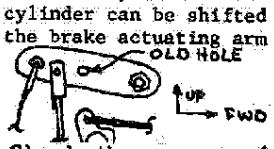
Some of the problems in foam core jigging are the result of sloppy hot wire cutting. Be sure not to rush the wire around the corners of the spar trough. Pause and move simultaneously at the bottom and top of each trough joggle.

-Foam core assembly. To avoid any gaps or heavy micro joints some builders have been spring-loading the foam cores together chordwise until the micro cures. They use a motorcycle bungee cord, twine, and some cardboard to avoid gouging the foam.



If it is apparent during trial fit that you are going to have a gap, fit a foam piece to fill it, not excess epoxy/micro.

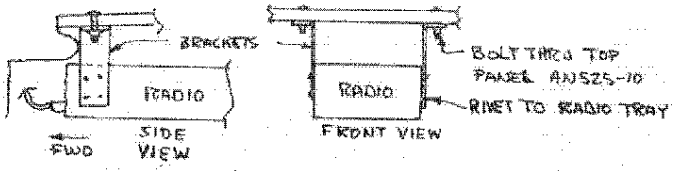
-Spoilers. A couple of builders have reported that their spoiler torque tubes interfere with the brake master cylinders. If you run into this problem, the top of the master cylinder can be shifted aft (away from firewall) by redrilling the brake actuating arm as shown.



DO THIS ON BOTH BRAKE ARMS TO AVOID UNEQUAL BRAKE FORCES.

-Check the zero position of your elevons when using the templates to measure elevon deflection. The drawings on pages 14-3, 5-7, and 5-6 show the elevon in theneutral(zero) position. Use jig block (B) (pg 5-6) on the bottom to verify thezero indication of the page 5-7 template.

-Radio support. If you are installing a little one and one/half NAV/COM radio like the Alpha 200, Escort 110, or RT 553, as shown on the instrument panel drawing (A1), an undefined support bracket is required. The radio comes with a mounting tray designed to attach to the instrument panel. On N4EZ we decided to add a pair of aluminum straps from the front cover (forward of canopy) down to the radio tray for better support on the most forward (away from cockpit) end. The brackets are .025 thick and 2024-T3 sheet metal, installed as shown here. To clear the elevon tubes and pushrods, the radio must be angled down about one inch and inboard 1/2 inch from being perpendicular to the instrument panel. Be sure that the control system does not bind on the radio! The angles between radio and instrument panel are small and not objectionable esthetically.



-The most important inspection time on any part is immediately after you're done laying it up. This is the time in which you should get a good hand held light(trouble light or any 60 to 100 watt lamp) and walk around your wet layup looking very closely at each square inch for areas of voids, dryness, air bubbles, delaminations, excess epoxy, fiber disruption, etc. Hold that light at various angles to the surface- reflecting the light will help you see otherwise invisible flaws.
Take a brush and some epoxy withyou to stipple out flaws. Don't try to inspect a wet layup by yourself, particularly if you don't have sharp vision. If you have made a layup alone, get someone else to look it over closely before you leave it to cure. Your spouse can generally find the flaws on a part that you have overlooked. Most of the unacceptable parts that we have seen were done by a builder working alone and most could have been easily brought up to standards during a thorough post-laminating inspection. Get someone to help you inspect while the layup is still wet, repair it while you can, and avoid making something you must throw away later.

-We have seen one set of wings and canard that the builder knife trimmed 1/2 inch too short. The builder ignored the trailing edge trim line (foam edge), lopping the entire glass-to-glass joint area off. The shape of the canard slot lip and the wing trailing edges were completely ruined. Be sure that you have trimmed at the trim lines shown on the templates and that your trailing edge joints are similar to those shown in the section views in the plans. Check your completed shape and chord length by setting a template on your canard and wing. Do not compromise the length and quality of the trailing edge overlap.

-Your epoxy balance must be absolutely fricition-free. Use small nails in the metal tubes for both pivots.

EQUIPMENT MOUNTING NO-NOS

Every homebuilder likes to personalize his airplane and give it his own distinct cockpit appointments. This is natural and every VariEze shouldn't be a duplicate of N4EZ, however, when you try attaching things to the glass/foam/glass sandwich panel you can run into problems. You can't just put screws or rivets into the inside glass skins to mount extra equipment. Mounting to the inside skin alone will tend to peel the glass skin away from the foam core, destroying the stiffness of that panel leading to further flexing and degradation of the foam core and outside skin.

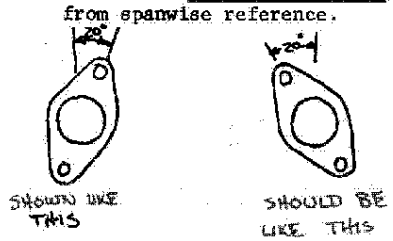
VARIEZE PLANS CHANGES AND ADDITIONS

Section I

Page	Change
6-21	2.3 inch dimension should be 1.7 inch
7-2	Section C-C shows 2-2 with two 1/2 inch diameter holes (not 3 pieces!). It should show only one.
Section I Page 4-8	Change 3 hour to 4 hour on skin layup time.

Section IIA

Page	Change
2 of 37	4 each Century Spring #C-161 are required, not 3 as shown. 12 gauge non-shielded airframe wire (30 feet) should be 18 gauge (optional change).
4 of 37	Magneto wiring diagram #12 or #14 wire should be #16 or #18 (optional change).
14 of 37	Top view of right exhaust system. Flanges are shown with stud hole rotated clockwise 20 degrees. They should be rotated counter clockwise 20 degrees from spanwise reference.

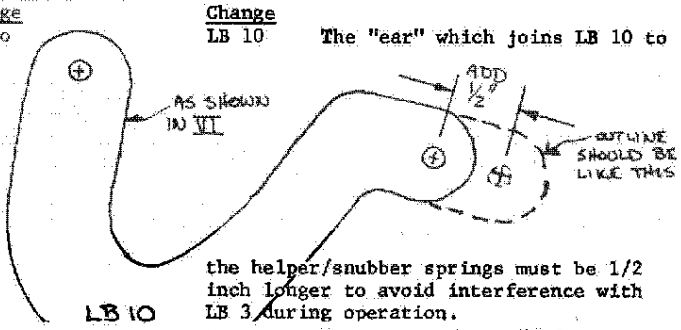


Newsletter #11

Page	Change
A1	Materials list for spoilers. 7 x 4 .063 aluminum should be 17 x 4.

Section VI

Page	Change
Two	LB 10 The "ear" which joins LB 10 to the helper/snubber springs must be 1/2 inch longer to avoid interference with LB 3 during operation.



Owners Manual Page 36 — Add the following statement "Before conducting the tests on this page with your new VariEze, do all of them first with two different airplanes in which you are proficient, ie. a Cub and a Cherokee. These maneuvers (nose wheel liftoffs and runway flying at low power) are a little strange to the average pilot. Doing them in a familiar airplane takes the strangeness out of the maneuver and better prepares you to do them in a new airplane. It also gives you a first hand look at runway length requirements and weather conditions. These maneuvers are important to determine the trim of your aircraft before first flight. Do not ignore them."

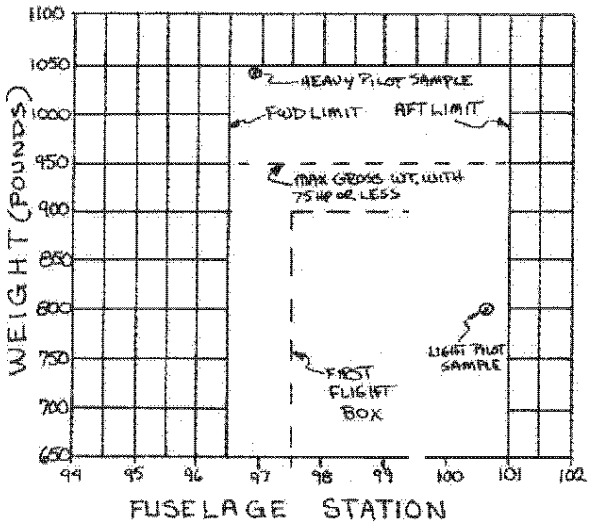
IMPORTANT!

Owners Manual Page 5 — Delete references to 500-5 and 4:10-3.50-5 tires and add the statement "larger tires are prohibited."

Owners Manual page 30 — Under 'Main Gear', add tire inflation pressure 55 PSI. Low tire pressure can lead to tube pinching or tire failure.

C.P. #12 PAGE 9

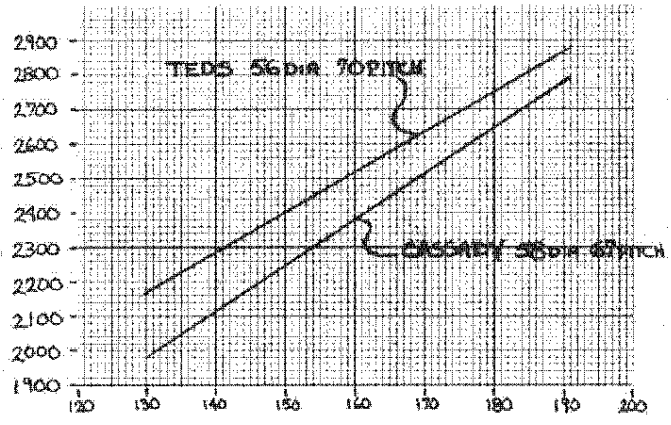
Owners Manual Page 28 — Revise the allowable weight and Cg diagram as shown below. Note that this provides a 1/2 inch restriction in the forward cg and moves the first flight box back 1/2 inch. This change is not done for the normal reasons to restrict forward cg (flare capability in-ground-effect or takeoff rotation speed). The restriction is due instead to the tendency for the down-going elevon to stall at large aileron inputs, (see Newsletter #11 under "Spoilers") a characteristic which increases at forward cg.



Section III, Materials list — Switch type V3JV7 should be V3-1001JV7

LIGHT TEST DATA

This chart is a plot of engine (propeller) speed n level flight at various airspeeds. The data is from 4EZ without wheel pants at a density altitude of 9000ft.



VARIEZE PERFORMANCE

The following data are the average performance obtained on the last several long trips with N4EZ. It is generally cruised at 60 to 65% power near 10,000 feet and still does not have wheel pants.

cruise speed block-to-block=179 mph (156 kt)
cruise fuel flow=5.5 gal/hr (33 lb/hr)
miles per gallon=32.5 sm (28.4 km)

VARIEZE ALTERNATE ENGINES

Development work is still continuing on the Lycoming O-235, Honda Civic, and VW engines for possible acceptance for VariEze use. Insufficient data are available to make any conclusions at this time. It is likely that we will have some concrete information by newsletter 13.

VARIVIGGEN ACCIDENT

On 21 February 1977 Jim Cavis was seriously injured and the forward portion of his VariViggen destroyed when it crashed during taxi tests. The exact cause of the accident is not completely understood, however a description of it and our impression of what might be done to prevent reoccurence is presented in the following:

First, a description of Jim's VariViggen - it has a 180-hp Lycoming engine with a fixed-pitch 69x69 wood prop, composite rudders, and standard-outboard-wing-panel shape, built from composite construction (structurally similar to the SP wing). It used a two-piece canopy (windsheild and canopy "A" being one piece) and did not have the rollover structure (chapter 11).

Burt Rutan was on his way home from the Denver workshop in the VariEze, stopped by to assist Jim in his preparation for tests, and was present at the time of the accident. Inspection of the airplane prior to taxi testing revealed the following: the left vertical fin had a washout of about two degrees at the tip, such that right rudder would be required to trim the airplane directionally. The main wheels were located at F.S.=132.8, rather than at approximately 130. The initial weight and balance indicated a tail heavy condition, which was corrected by bolting 33 pounds of lead to the F20 bulkhead, bringing the cg for a 185-lb pilot into the aft portion of the allowable cg range for first flight (20 gal fuel). A custom electric actuator was used to actuate reflex control. Reflex travel was not accurately measured, however it appeared that the reflex authority was greater than the specified two-inch motion. Control rigging appeared to be satisfactory.

The aircraft was assembled at the Falcon airport at Scottsdale, Arizona for taxi tests the morning of the 21st. Initial low speed taxi tests were conducted without problems except for poor brake effectiveness which was corrected. Several hours were spent doing low and medium speed taxi runs, checking systems, etc. During one of the initial low speed taxi runs it was noted that there was an apparent binding or jamming of the aileron control. This apparent hangup disappeared. A complete inspection of the control system revealed nothing and the binding did not reoccur. Ground cooling on the 180-hp engine was satisfactory.

Since Burt had considerable VariViggen time, it was decided that he do the initial high-speed taxi tests. He conducted the following high-speed runs on the 4300-ft runway 22:

1. The airplane was accelerated to 45 mph, power was then reduced to idle and during rollout the stick was pulled full aft which rotated the nose wheel slightly off the ground. The nose came back down as the airplane decelerated. Right rudder and brake were required during the acceleration to maintain heading. Reflex was full up.

2. The airplane was accelerated to about 50 to 55 mph, power was then reduced to idle and the stick was brought back to rotate the nose. The nose rotated and was maintained about one to two feet off the ground using a stick position of about half-way from neutral to full aft. At about 40 mph the nose came down. Again it was noted that some right rudder was being used and pitch control felt correct. Reflex was full up.

3. The airplane was accelerated to 65 mph and power was reduced to about 1/4-throttle. When it was noted that speed was constant, the stick was brought aft to rotate the nose high enough so the airplane was light on the mains. The airplane felt in good trim so the nose was rotated further and the airplane lifted off in level flight. The airplane was flown about 600-800 feet down the runway at a height of one to three feet. Power was smoothly reduced to idle and an uneventful landing and rollout made. Aileron control seemed in trim during the flight (stick centered). Some right rudder was required, and it was noted that after reducing power to idle the stick was nearly full forward to trim the airplane at 65 mph. Trim change due to power at low speeds is normally high (see "VariViggen Owners Manual") however the up reflex authority of this airplane seemed a bit too much, so the reflex was run down about one to two degrees for the next run.

4. Object of this run was to determine a nosewheel rotation speed for full power and to make another runway flight. Full power was applied and maintained until the aircraft was airborne, then smoothly reduced to idle during the flight. The nose rotated at 65 mph, the airplane flew about 1000 ft at about 5-ft altitude and made a smooth, normal landing and rollout. The airplane seemed well in trim except for the requirement for a bit of right rudder. Reflex position appeared to be satisfactory and adequate for the first real flight. During the short runway flight the wings were rocked to check aileron response. Nosewheel rotation speed was normal for full power.

5. Run four was repeated with identical results.

Burt taxied the airplane back to midfield and commented that the airplane flew well and that he felt it would be ready for its first real flight the next day, after installing a small trim tab on the vertical fin to correct the left yaw trim. Jim got in the airplane to taxi it back to the hangar, but then decided instead to do a couple more medium-speed taxi runs and mentioned that he might try a nose wheel lift off. Burt told him that at idle the nose could be raised at 45 to 50 mph and cautioned him to stay below 50. Jim felt that his current flight proficiency was low.

Jim made a taxi run at about 40 mph, then another in which he reduced power at about 50 mph and raised the nose wheel. The nose wheel was about one to two feet off the ground for a ground roll of about 400-500 feet. Taxiing back, he did not stop at the observers to discuss his run. We assumed that his intentions were only to repeat his nose wheel lift off. On the next run he maintained power on acceleration until a higher speed was reached, approximately 60 mph. He reduced power, but only to about 1/3-throttle. He rotated the nose and rolled about 400 feet with the nose wheel off the ground. He then reduced power, the nose came up a bit and the airplane became airborne. The airplane then flew about 600 feet, wings level, and climbed to about 10-feet height. Power was observed to increase, then abruptly go to idle. The nose then pitched up some more and the airplane rolled to the right, striking the right wing tip on the ground immediately off the runway. Next ground contact was the right canard, then the airplane's nose and canopy as it rolled further right to a nearly inverted position. It slid 60 feet to rest, in a heading 45° to the right of runway heading.

Jim received a very serious head injury and a broken wrist. At this writing his condition was improving but not yet to the extent that he could recall any details about the accident. It is not known whether he had intended to make a lift off or to merely raise the nose.

The entire forward fuselage forward of F.S.90 and the right canard was broken up. The fiberglass pieces (nose cone and visor) are intact, but the majority of the wood fuselage structure was destroyed. The fuselage fuel tank was crushed about 10" and leaked in one corner; there was no fire. The engine, engine mount, and all components in the engine area remained in-

Ch 12 Page 21 #45

tact, inplace, and undamaged. Both vertical fins were undamaged with the exception of the top front corner of the right fin. The entire inboard wing, main landing gear, and left outboard wing were undamaged. The composite right wing's foam core was shattered from the tip inboard about 2-½ feet. The glass skins were intact. The right outboard wing, including attachment was undamaged inboard of a location three feet from the wing tip.

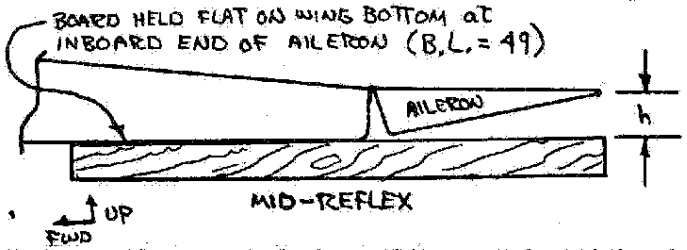
A description of what happened is easy. An alaysis of why it happened is not. The airplane's motions in pitch are explainable and understood. The reason the airplane rolled to the right is not known; we can only speculate. We do not believe Jim was intending to lift off, and thus was surprised and shocked to find himself airborne. After the short flight had progressed in an accelerating and climbing fashion he probably realized that the end of the runway was quickly approaching and thus slammed the throttle to idle. At that point he still had 2400 feet of runway left, but at ten feet altitude and climbing, we're sure the runway looked quite short to him. It did not appear that he countered the airplane's natural nose-up trim change when power was reduced, but that is only speculation.

Why did the airplane roll? Could it be the airplane stalled and thus dropped a wing? Possibly, but this is not likely since the angle of attack did not look excessive and N27VV, the VariViggen prototype, shows no tendency to drop a wing during stalls, even at idle power. Could the controls have failed or jammed? Inspection of the wreckage showed all controls intact. The nicopress sleeves on the roll cables passed within 3/8" of a rib and the cable ends were frayed such that this may have hung up the controls. This, however, seems unlikely; a similar rigging exists on N27VV and no jamming has been noted in over 600 hours of flying. Possibly Jim was disoriented due to the shock of the unexpected flight and nose-up trim change such that he was unable to control the airplane. Possibly he was partially blinded by the sun which was just above the horizon directly in front of him. The airplane's out-of-trim condition would have had a tendency to make it turn left, not right, so that seems to have no bearing on the cause of the right roll.

Now, what can you, as a VariViggen builder do to prevent reoccurence of this tragedy when you conduct initial tests of your airplane? The following procedures should be followed. You will note that they are essentially the same information that is in your owners manual, with added emphasis.

Airplane Preparation

Be sure your weight and balance is conducted accurately. Your calculated cg with the pilot should be checked by weighing the airplane with the pilot on board. Cg should definitely be within the first-flight box, preferably at F.S.122. Check control surface travel: elevator 29° down, 10° up minimum; rudder 29° outboard, 11° inboard ±3°. Set reflex position to obtain the neutral position of the ailerons as shown. This is approximately mid-reflex. Use this reflex position for your initial tests. True, a lower rotation speed can be obtained with up reflex, but using mid-reflex will assure that you have ample elevator control authority even if you have errors in construction, such as incorrect canard incidence, warped wing, etc.



h For BOTH AILERONS	WING TYPE
2.4"	STANDARD
2.1"	SP

Maximum aileron travel about this neutral position is not as important, but should be approximately ±10 to ±12 degrees.

Pilot Preparation

There is no such thing as a minimum number of hours a pilot should have to be qualified for initial test flying. The best pilot qualification is variety. He should be current in more than one type of airplane. The VariViggen is not difficult to fly, but it is different; like a Yankee is different from a Cessna, or a Cub is different from a Cherokee. A pilot who is used to the differences between a Cessna and a Cub, is ready to adapt to the differences in a VariViggen. So, get some current time in a variety of airplanes. Also, shortly before you do your high speed taxi tests and lift offs, do those tests with another airplane. Doing a nosewheel rotation with idle power, doing a short hop down the runway at one to three-feet altitude, etc., is something a little strange to the average pilot. Doing a few of these in a Cherokee or Yankee takes the strangeness out of these maneuvers in a familiar airplane and better prepares you to do them in a new airplane. It also gives you a first-hand look at runway length requirements, weather conditions, etc. Do wear a helmet and shoulder harness for your initial tests. Jim's injuries would have been far less severe had he been wearing a helmet.

Test Procedure

Follow carefully the ground tests and high speed taxi procedure in the VariViggen owners manual. Be sure to reduce power to a low setting or to idle to avoid accelerating to a higher speed when you do the nose wheel lift-offs. Use the mid-reflex position shown above.

Follow the lift-off procedure shown in the owners manual, using mid-reflex. Before lift-off be sure to reduce power sufficiently to avoid accelerating, and above all, make power adjustments slowly and smoothly. The only unusual thing about the way a VariViggen flies is the trim change due to a power change at low speed. This is quite easy to get used to, if power adjustments are made slowly. After you have several hours in the airplane you will find that countering the trim change is not difficult even for rapid power changes.

Follow the first flight procedure in the owners manual using mid-reflex. The prototype, N27VV has satisfactory pitch control authority throughout the entire eight-degree reflex range. However, due to tolerances/inaccuracies in construction you may find that your airplane is different; for example, at aft cg, up reflex, and idle power, your stick-forward (down) control may be limited and thus you should limit up reflex travel, or conversely, at forward cg, down reflex, and full power, your stick-aft (up) control may be limited at low speed. Thus, you should rig your airplane to limit down reflex travel. So, follow the envelope expansion section of your owners manual carefully. Make cg changes and reflex changes a little at a time and evaluate all conditions of speed and power (at altitude) before further changes. Thus, if your airplane is rigged or built differently than N27VV, you can safely determine a comfortable cg range and reflex authority for your airplane. Once this is determined be sure to placard your aircraft, limiting pilot weights to remain within the allowable cg range. Set the reflex stops to limit its authority to the range which you are comfortable with.

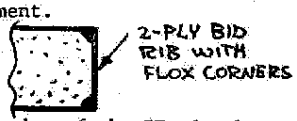
We are making the prototype N27VV available to VariViggen builders who have completed their airplanes so that they can get a frontseat checkout. Those of you who have a VariViggen nearly completed and have good current pilot proficiency are encouraged to get some dual in N27VV before conducting your flight tests.

P.S. AT Press Time we just heard from Jim again. He is feeling well and is rebuilding his VariViggen. He still does not have a good recollection of the events of 21 Feb.

VARIVIGGEN PLANS CHANGES AND ADDITIONS

Owners Manual — Add the information from "VariViggen Accident" to your Owners Manual.

SP Wing Plans Clarification — The drawings do not show the inboard glass rib which is discussed in the text. The sketch below gives the general arrangement.



The trailing edge of the SP wing has a kink in it at the outboard end of the aileron. This is normal and due to the change in taper and sweep which occurs

SHOPPING

WANTED

Steven Sterner, 317 S. Washington Ave., Sabetha, Kansas 66534 is interested in buying a partially complete VariViggen project.

Buyers Beware

The Anderson Engineering Co., Florrissant, Mo. has been dragging out deliveries of hot wire controls excessively. Better look elsewhere.

FOR SALE

1 run out C-85 Continental, $350. Call Dave Bassett 503-378-8227 (work) or 503-476-2021 (evenings).

Epoxy ratio pumps. Gougen Bros. has announced an improved version of their "mini" pumps which is made of a more expensive, but inert, plastic. The new "super mini" pumps sell for $9 a set.

Fuel strakes. Jiran is now offering prefab composite wing strake fuel tanks. These are very nice looking parts and they add about 4 gallons to the total fuel capacity.

DISTRIBUTORS REPORT

JIRAN: F.J.G.R. reports that they are meeting the main gear shipping schedule published in their most recent letter. The engine cowlings are now an off-the-shelf item with no shipping delay. Canopy frames and mounted canopies are also very close to being backlog free. Jiran is now producing wingstrake/fuel tanks and these are very handsome parts. The molded, vacuum laminated parts are a tad lighter and hold about 4 gallons more fuel than the plans Chapter 22 tanks.

BROCK: Ken reports that wing fittings, one of the big delay items, are now caught up to orders placed through February '77. All of the other parts appear to be moving along steadily. Ken and his troops are now producing the bulk of the landing brake parts and spoiler system parts, but they haven't gotten into his catalog yet.

Ken reports that he will have a catalog addition out soon and it will include price and availability of the raw unmachined aluminum castings.

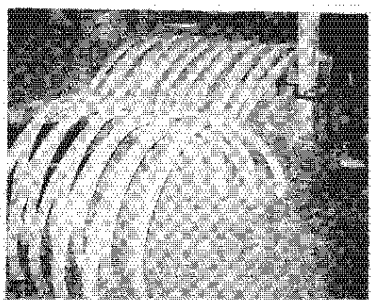
AIRCRAFT SPRUCE & WICKS ORGAN: It looks like the backlog of orders, and the wait for materials, has finally calmed down. New kit orders are now being shipped within 3 to 4 weeks. Some minor items, like wheels and brakes, still seem to be coming in later than the bulk of materials, but the backlog on these items is disappearing fast now that the manufacturers are on line.

COWLEY ENTERPRISES: Canopies are basically off the shelf, immediate shipment items.

Cowley's have opened a facility on the Mojave airport. The address at mojave is Building 170, Mojave Airport, Majave, CA 93501.

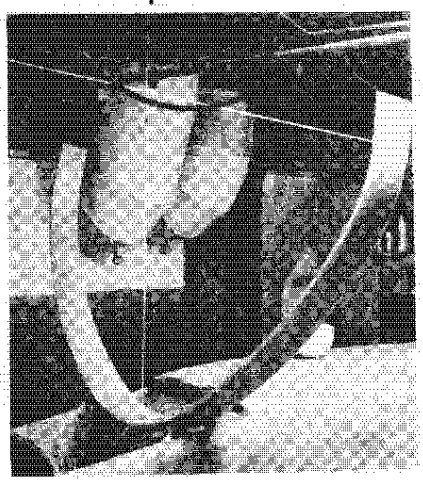
Note that there is now a source for Vari Viggen canopies - check the distributors list included with this newsletter.

NAT POTTERS LANDING GEAR ALIGNMENT

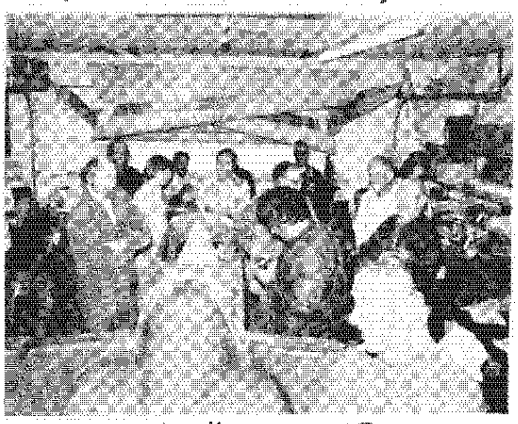


MAIN GEAR STRUTS AWAIT INSPECTION AT JIRANS.

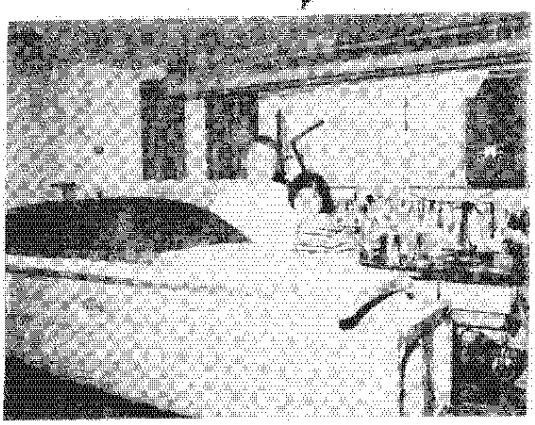
ANOTHER METHOD TO AID IN MAIN GEAR ALIGNMENT. NOTE THE USE OF STRING TO HOLD STRUT IN PLACE



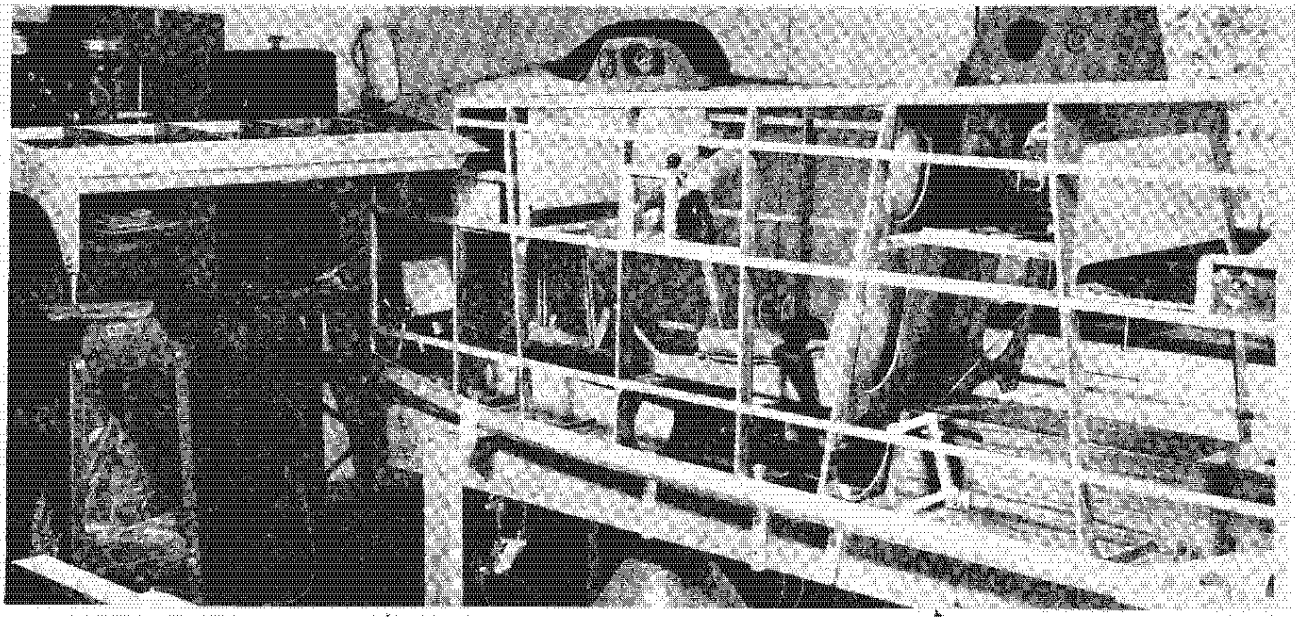
SQUADRON ONE'S MEETING AT ED & JO HAMLIN'S HOUSE ?



JO & ED HAMLIN OF SQUADRON ONE (see Newsletter # 11) with Their EZ

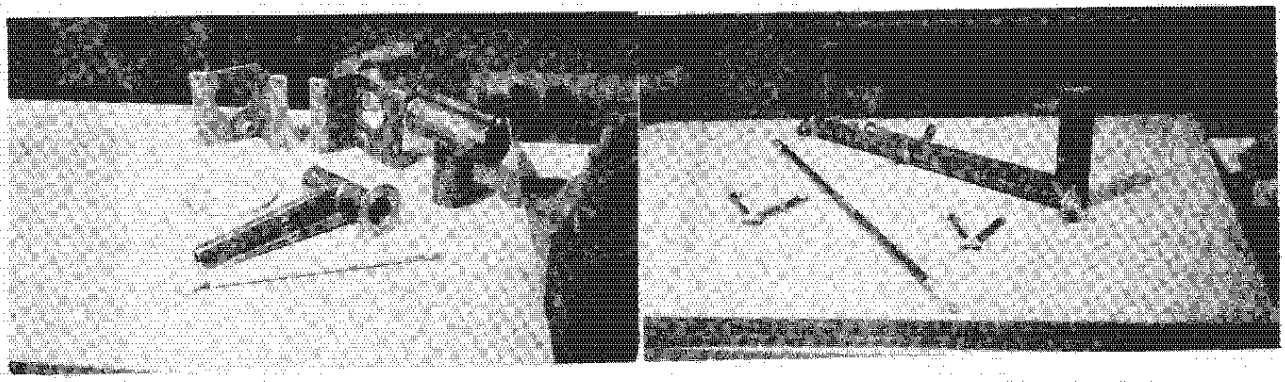


VARIVIGGEN PHOTOS

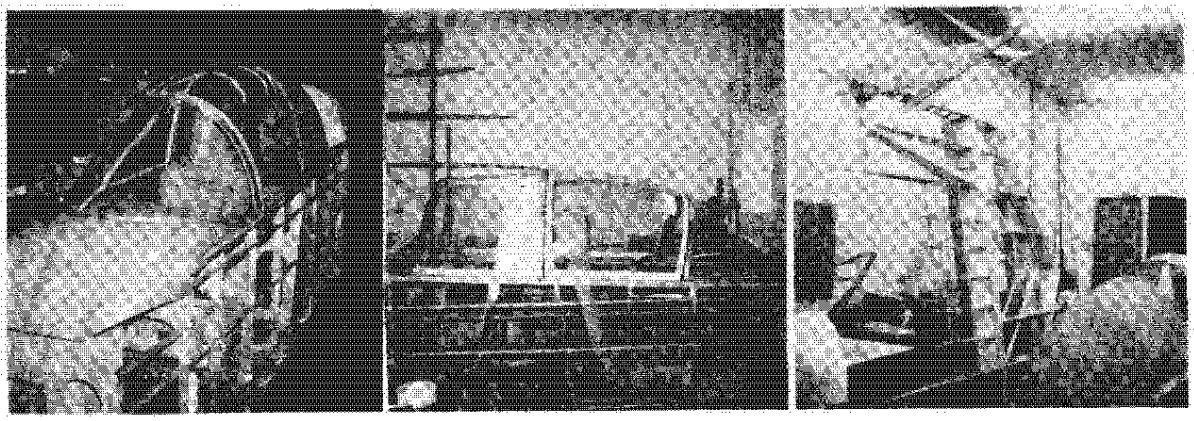


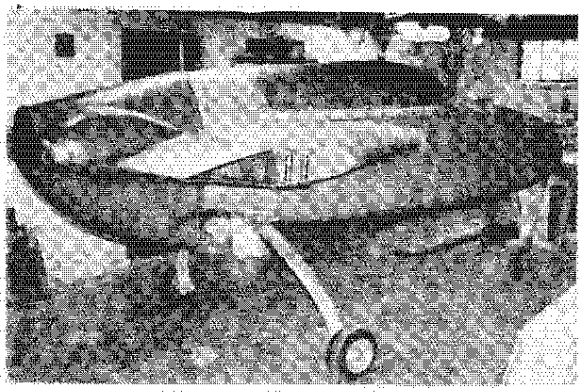
CHARLES ALLEN'S FORWARD FUSELAGE

ULRICH REIFENSTEIN IS BUILDING A VARIVIGGEN IN WEST GERMANY. HIS EXCELLENT METAL PARTS ARE SHOWN BELOW

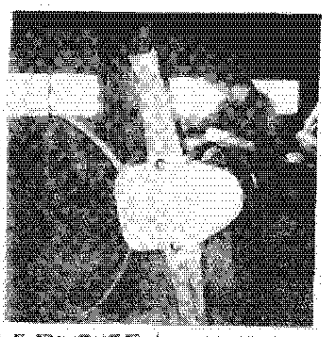


FRED SUMIDA IS INSTALLING A 4-PIECE CANOPY AND HAS ASSEMBLED HIS INBOARD WING OFF THE FUSELAGE.

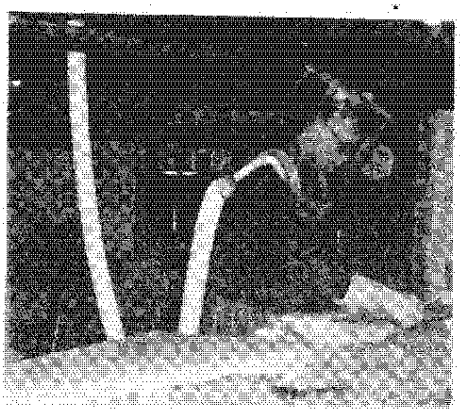




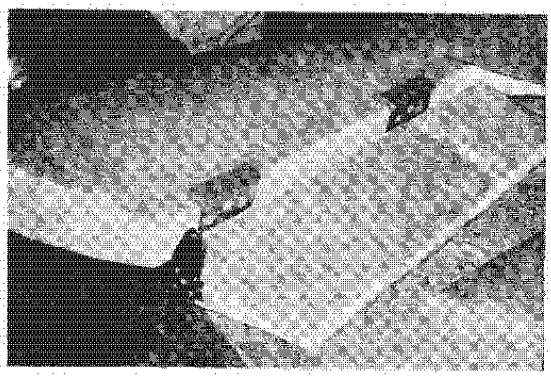
BUDDY COTTLE'S N13CF 3MONTHS AFTER STARTING THE PROJECT



C.E. PROPHET & FRIEND

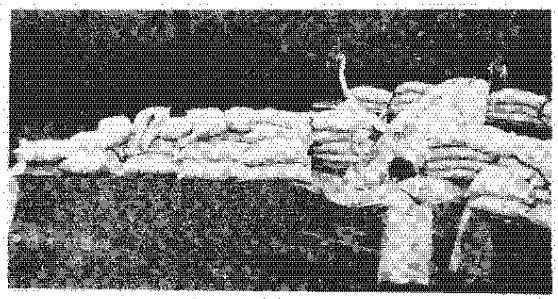


MR CASSITY IS EXTREMELY SENSITIVE TO EPOXY SO HE BUILT THIS RIG. LOOKS LIKE 2001!

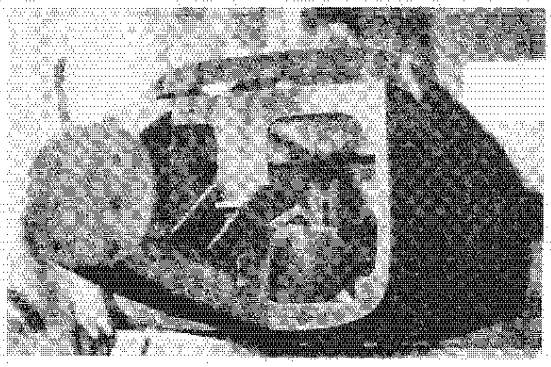


DR JR WRIGHT'S WINGLET SHOWING RUDDER ATTACH DETAILS

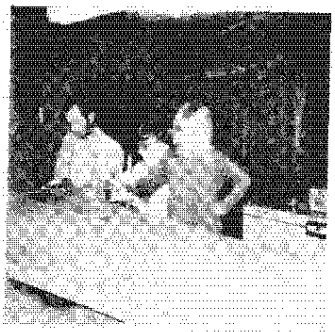
NAT PUFFER'S FIREWALL NOTICE THE MASTER CYLENDER EXTENSION



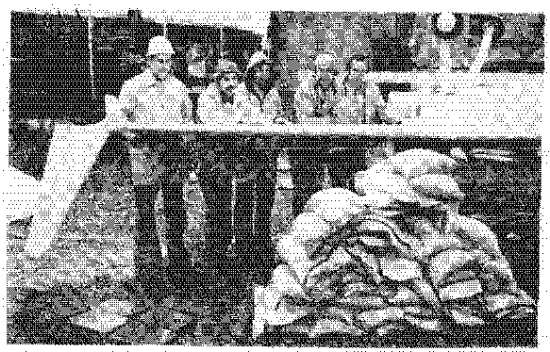
PETER KRAUSS' AIRPLANE WITH A +5G STATIC LOAD. IN WEST GERMANY THIS TEST WAS REQUIRED BY THE L.B.A. (FAA).



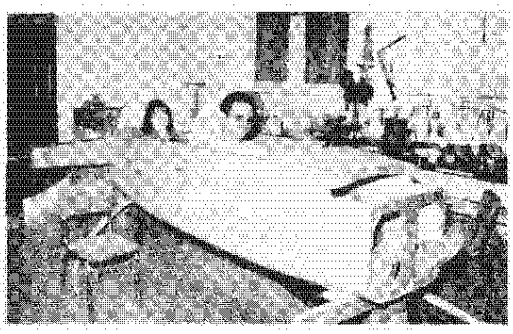
NAT PUFFER'S FUSELAGE WITH THE NOSE GEAR BOX INSTALLED



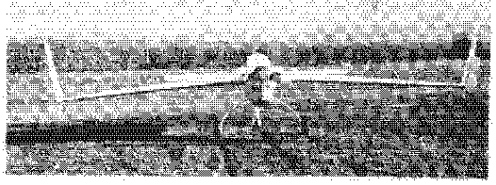
JIM BOYD'S DAUGHTER SAYS SHE'S THE ONLY GIRL IN HER SECOND GRADE CLASS WHO CAN STIPPLE!



PETER KRAUSS AND HIS CREW OF HELPERS. IT TAKE A LOT OF MUSCLE TO LOAD SANDBAGS.



HANGER FLYIN' IN SACREMENTO AT THE 'RAF SQUADRON ONE' MEETING IN MARCH



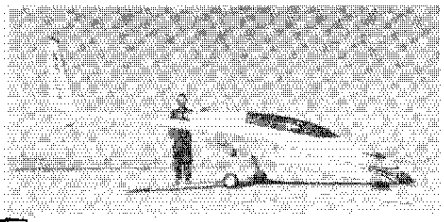
KRAUSS' INITIAL TAXI TESTS WITH A LIMBACH UM CONVERSION. HE HAS SINCE CONVERTED THE AIRPLANE TO CONTINENTAL

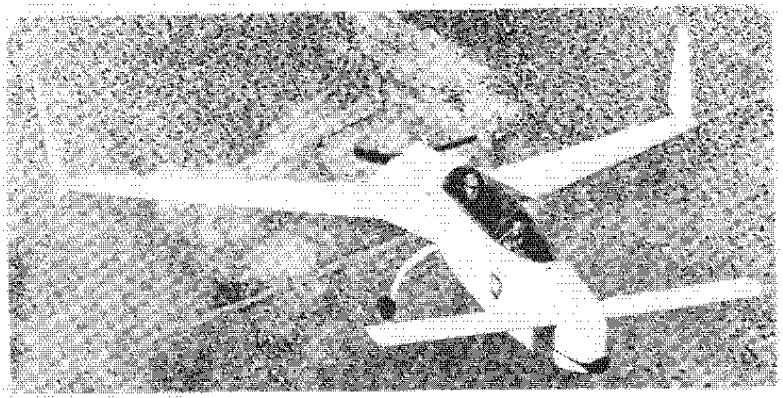
DR WRIGHT LAYING UP HIS CANARD SHEAR WEB

THANK YOU FOR YOUR INTEREST IN THE

VariEze

TWO-PLACE SPORTPLANE





THE STORY

For the last 12 months, we have refrained from promotional activities and marketing on the VariEze to concentrate totally on its development and setting up materials and components distribution. In this short time, we have 1. flown a full 350 flight-hour test program on two prototypes, one Continental and one VW-powered, 2. completed full structural qualification testing, 3. prepared a manual for the amateur builder to educate him in the structural materials and to guide him through construction, 4. set up a materials distribution system through established, competent distributors.

THE TEST PROGRAM

The VariEze 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 tests 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.

THE RESULTS

The VariEze has superb flying qualities for its primary mission - comfortable travel. It has excellent hands-off stability even in turbulence. It is unusually safe at low speeds, can be flown with full aft stick (47 kt) without being susceptible to departure or spin, regardless of attitude or power. Performance is also superb - cruise up to 200 mph and climb up to 1700 fpm at gross weight with the larger engines.

THE MISSION: PRACTICAL UTILITY

Although quite compact outside, the VariEze provides unusual comfort for up to 6-ft, 7-in, 210-lb pilots and 6-ft, 5-in, 220-lb passengers, plus two medium-size suitcases and four small baggage areas. The 24-gallon fuel load allows up to 1000-mile range at economy cruise. High altitude climb is excellent, for flying over turbulence, mountain ranges, and for satisfactory high-density altitude take offs.

THE DESIGN

The VariEze uses the latest aerodynamic features: NASA winglets, both wings cruise at best L/D, basic arrangement provides stall safety, stiff structure provides accurate contour maintenance, basic systems design eliminates or combines complex control systems, which saves weight, cost and building time while increasing reliability and lowering maintenance.

THE STRUCTURE

New composite sandwich structure offers the following advantages over conventional wood or metal: less construction time requiring less skills, improved corrosion resistance, longer life, improved contour stability, better surface durability, dramatic reduction in hardware and number of parts, easier to inspect and repair.

THE HOMEBUILDER SUPPORT

The manufacturing manual is 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. Construction seminars are provided at RAF and elsewhere.

MATERIALS & COMPONENTS

Established, competent distributors are delivering all required raw materials and many manufactured components including canopy, landing gear, wing quick-disconnect fittings, cowling, a variety of small machined parts, rudder pedals, engine mounts, suitcases and upholstery. The VariEze airframe (no engine or prop) materials costs range from $2000 to $3500 depending on the number of prefab components purchased.

VariEze documentation is available in five sections.

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 VariEze except engine installation. The manual consists of a 153-page, bound, 11"x17" book plus nine larger full-size drawings. It includes 168 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. The manual identifies sources for all materials and all prefabricated components.

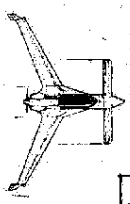
SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction manual for the complete engine installation including mount, baffles, instrumentation, electricals, fuel, exhaust and induction systems carb heat box and muff, cowling installation, prop and spinner.
SECTION IIA - Continental A65, A75, C85, C90, O-200.

SECTION III - ELECTRICAL - This is an optional (not required) set of drawings and installation instructions for electrical system, avionics, landing and position lights, antennaes, starter.

SECTION IV - OWNERS MANUAL - This is an operational handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, pilot checkout, etc.

SECTION V - FINISHING THE COMPOSITE AIRCRAFT- Applies not only to a VariEze, but to other epoxy/composite aircraft. Includes filling/contouring/priming/U.V. barrier/color and

SECTION VI - LANDING BRAKE - See Newsletter No. 11.

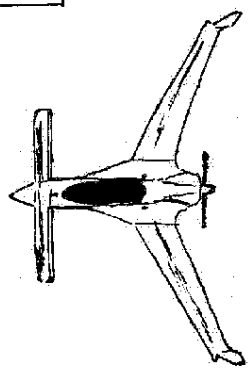


Specs & performance with 100-hp Continental, fixed-pitch prop, @ gross weight							
	Take Off	800 ft	Range @ Max Cruise	720 mi	Canard Span/Area	12.5'/13ft²
	Climb	1700 fpm	Range @ Econ Cruise	980 mi	Wing Span/Area	22.2'/53.6ft²
	Max Cruise	200 mph	Min Speed (full aft stick)	49 kt	Empty Weight	520 lb
	Econ Cruise	165 mph	Landing	900 ft	Gross Weight	1050 lb

Specs & performance with 75-hp Continental					
	Take Off	950 ft	Max Cruise	178 mph	Empty Weight 490 lb
	Climb	950 fpm	Econ Cruise	145 mph	Gross Weight 950 lb

Check items desired:	Price, including First class mail U.S and Canada	Air Mail Overseas*
☐ VariEze info kit, includes current issue of "Canard Pusher" newsletter	$5.00	$6.00
☐ "Canard Pusher" newsletter, published quarterly. One-Year subscription	$4.75	$6.50
☐ Section I	$94.00	$108.00
☐ Section IIA	$19.00	$21.00
☐ Section III	$8.00	$9.50
☐ Section IV	$8.00	$9.50
☐ Section V	$7.00	$8.00
☐ Section VI	$10.00	$11.00
☐ VariEze Jacket Patch	$1.95	$1.95
Calif. residence add 6% tax on all items except newsletter.		

* U.S. funds only

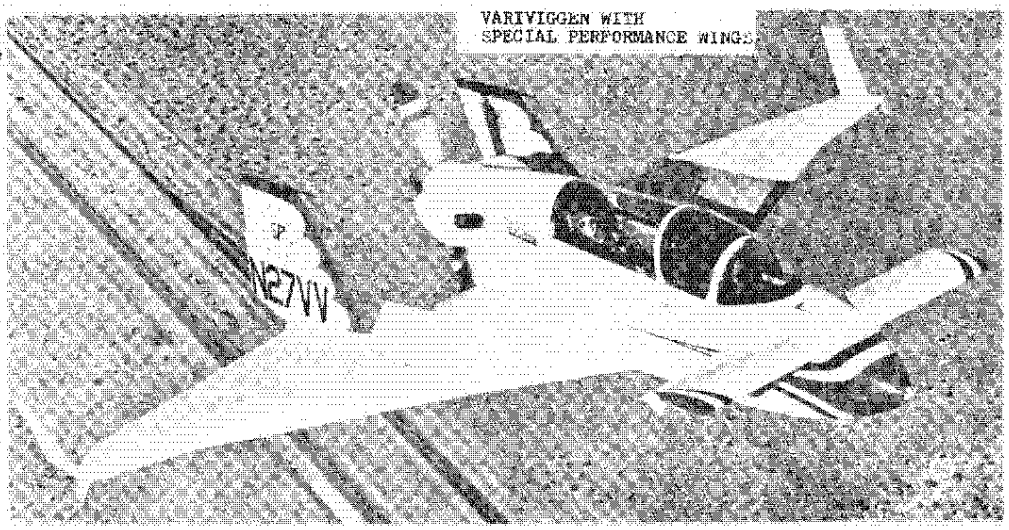


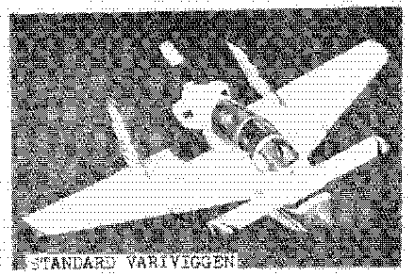
Rutan Aircraft Factory

BUILDING 73, MOJAVE AIRPORT
P. O. BOX 656, MOJAVE, CA 93501
TELEPHONE (805) 824-2645

THANK YOU FOR YOUR INTEREST IN THE VARIVIGGEN

TWO + TWO SPORTPLANE




STANDARD VARIVIGGEN

Performance with 150-hp, fixed-pitch prop, gross weight. Standard VariViggen	Take off	850 ft	Specifications Standard VariViggen	Canard Span/Area	8 ft/18.3 ft²
	Climb	800 fpm		Wing Span/Area	19 ft/119 ft²
	Cruise	150 mph		Empty Weight	950 lb
	Full Aft stick	49 mph		Gross Weight	1700 lb
	Landing	500 ft			

Performance with 150-hp. Special Performance Wings	Climb	1000 fpm	Specifications Special Performance Wing
	Cruise	158 mph	Wing Span/Area 23.7 ft/125 ft²
			Gross Weight 1700 lb

PROVEN DESIGN
Complete flight test program completed: 600 hours on prototype with very little maintenance. Won the Stan Dzik trophy for design contribution, Oshkosh '72.

STALL/SPIN SAFETY
The VariViggen's safe flying qualities have been the subject of technical presentations for EAA, SAE, AOPA, & AIAA. It will not stall or "mush in" like the common delta. At full aft stick (43 kts) it will still climb 500 fpm, roll over 50 degrees per second without rudder co-ordination, and make buffet-free turns. The prototype received the Omni Aviation safety trophy at Oshkosh '73, and the oustanding new design award at Oshkosh '74.

EXCELLENT UTILITY
Comfortable tandem cockpits, three-suitcase baggage area, and an adequate cruise speed provide unusual utility for a homebuilt airplane. Its unusual design turns routine travel into "fun trips." Gas service and other airport services have been better, too! Take it home; it's road-towable with outer panels removed.

UNCOMPLICATED CONSTRUCTION
The basic structure requires few special tools and can be built in a simple jig. The few parts that have double-curvature are available in fiberglass, ready to install. All machined parts are also available, as well as other prefab parts.

EASY TO FLY
Despite its unique appearance, the VariViggen has no unusual or pilot-demanding flight characteristics. It is easier to handle than conventional aircraft, particularly in gusty crosswind conditions.

VARIVIGGEN CONSTRUCTION MANUAL Part 1 of a photo-illustrated construction manual, written by Jim Cavis, S/N 31. Includes fuselage, canard, inboard wing, vertical stabs, control system, and landing gear, along with approximately 100 photos. Part 1 also includes helpful sketches on jigs and numerous building tips. The written information is similar to plans chapter 5, except expanded to about 30 pages.
Price: $18.50 first class mail, $20.50 airmail overseas.

VARIVIGGEN TECHNICAL REPORT - Complete tech report describing the VariViggen two-place sportplane. Includes specifications, pilot report, dimensions, 3-view, stability and performance flight test data, construction cost, description of car-top wind tunnel, 8"x10" glossy photo and current issue of newsletter.
Price: $10.00 first class mail, $11.50 air mail overseas.

VARIVIGGEN OWNERS MANUAL - Complete operational handbook including normal and emergency procedures, loading, operational record keeping. This manual is a must for those close to first flight.
Price: $6.00 first class mail, $7.50 air mail overseas.

"CANARD PUSHER" SUBSCRIPTION - A newsletter designed with the builder in mind. Emphasis on distributing to all builders as many ideas, improvements, building tips, photographs, & flight reports as possible. Details mandatory, desirable, & optional changes to plans & to owners manual. A newsletter subscription and all back issues are mandatory for those with VariViggens under construction. Identifies new material sources as they become known. Published quarterly.
Price: $4.75 per year first class mail, $6.50 air mail overseas.
Back issues: $1.00 each

VARIVIGGEN PLANS - NASAD approved in "AA" catagory. Sixty-one sheets, completely detailed. Also included are builder's handbook information, step-by-step construction guide, complete bill of materials, flight operating limitations, parts lists. Section breakdown: 1. Introduction, 2. Operating Limitations, 3. Bill of Materials, 4. External Geometry (Lofting), 5. Building Tips, 6. Construction Order & Methods, 7. Canard & Elevator, 8. Fuselage, 9. Inboard Wing, 10. Verticals & Rudders, 11. Outboard Wings, 12. Cockpit & Seats, 13. Canopies, 14. Flight Control System, 15. Fuel System, 16. Angle-of-Attack System, 17. Engine Mount, 18. Cooling & Cowling, 19. Landing Gear, 20. Gear Doors, 21. Electrical System, 22. Parts List. Also included are the tech report & photo described.
Price: $53.00 first class mail, $59.00 air mail overseas.

VARIVIGGEN SPECIAL PERFORMANCE (SP) WING/RUDDER PLANS - Construction drawings and assembly manual for glass composite outer wing panels and rudders. These are optional wings, replacing the aluminum surfaces shown in the VariViggen plans. The SP wings are easier to build and provide increased climb and cruise performance. They also have fuel tanks which increase range to over 600 miles.
Price: $39.50 first class mail, $41.50 air mail overseas.

VARIVIGGEN R/C MODEL PLANS - Complete construction plans for the 18%-size radio-controlled model airplane built & flown to evaluate VariViggen spin characteristics. Designed for 4-channel proportional radio equipment & engine in the .35 to .65-cu. inch size. 555-sq inch wing area. All balsa or foam/balsa construction. A maneuverable flying model with outstanding roll rate. Also shown are modifications required for a control-line model (70-ft lines, .19 to .45-cu inch engines).
Price: $4.75 first class mail, $5.50 air mail overseas.

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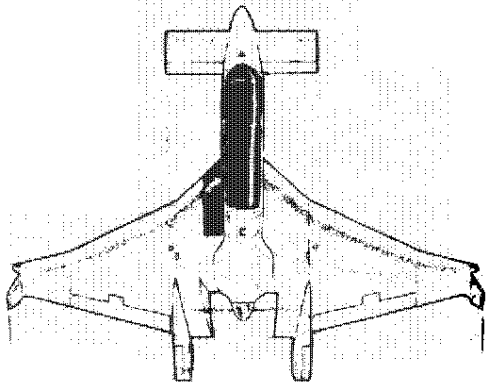
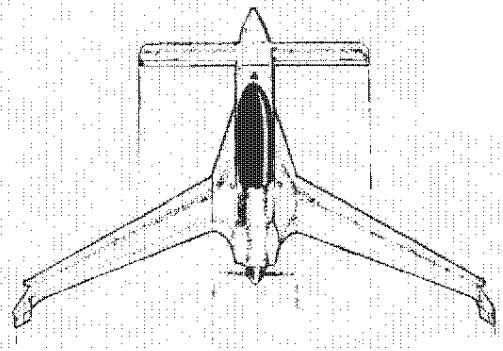
P. O. BOX 656, MOJAVE, CA 93501
TELEPHONE (805) 824-2645



The following are RAF-authorized distributors of materials and components. Items indicated have been developed under RAF approval and are recommended for VariViggen or VariEze aircraft. Contact the distributors at the address shown for his catalog and description of items. Indicate to him that you are a VariViggen or VariEze builder.

Overseas Catalog Orders-
Include Airmail Postage
PLEASE



AIRCRAFT SPRUCE & SPECIALTY CO.
201 W. Truslow Ave.
Box 424
Fullerton, Ca. 92632
(714) 870-7551

OR

WICKS AIRCRAFT SUPPLY
1100 5th Street
Highland, Il. 62249
(618) 654-2191

Catalog cost $2 - Refundable at first order.

VariEze materials: epoxies, foams, fiberglass, filler materials, wood, metals, all hardware, specialized tools, skin barrier cream, seat belt/shoulder harness sets, wheels & brakes & custom upholstery/suitcases.
VariViggen materials: spruce kit, plywood kit, hardware, aluminum & fiberglass.

KEN BROCK MANUFACTURING
11852 Western Ave.
Stanton, Ca. 90680
(714) 898-4366

Catalog cost $1 - Refundable at first purchase.

VariEze prefabricated components: wing attach/quick disconnect assemblies, nose gear machined parts, control system components, fuel cap assemblies, welded engine mounts, welded stick assembly, welded rudder pedals, wheels & brakes.
VariViggen prefabricated components: all machined parts.

FRED JIRAN GLIDER REPAIR
Building 6, Mojave Airport
Mojave, Ca. 93501
(805) 824-4558

Write for brochure.
Send self-addressed stamped envelope.

VariEze prefabricated components: Molded S-glass main gear and nose gear struts, nose gear strut cover, nose gear box.

CONLEY ENTERPRISES
P.O. Box 14
Santa Paula, Ca. 93060
(805) 525-5829

Write for brochure.

VariEze plexiglass canopy - Light bronze tint or clear.

H. C. COMMUNICATIONS
Box 2047
Canoga Park, Ca. 91306

Write for brochure.

VariEze and VariViggen custom COM & NAV VHF antennaes.

THE AIRPLANE FACTORY
7111-A Brandtvista Ave
Dayton, OH 45424

Write for brochure on Viggen canopy

Vari Eze - None
Vari Viggen - Plexiglas canopy

MONNETT EXPERIMENTAL AIRCRAFT, INC.
955 Grace St.
Elgin, Il. 60120
(312) 741-2223

Ask about VariViggen parts.

VariEze - None
VariViggen - All molded fiberglass parts

GOUGEON BROTHERS
706 Martin St.
Bay City, Mi. 48706

Write for brochure.

VariEze - None
VariViggen - 105/206 epoxy and 403 fibers for wood construction.

GEORGE EVANS
4102 Twining
Riverside, Ca. 92509

Contact him for list

VariEze - None
VariViggen - welded nose and main landing gear, 1-1/4" sq. steel tube.

BILL CAMPBELL (VariViggen builder)
Box 253
Phelan, Ca. 92371

Contact him for list.

VariEze - None
VariViggen - Prefab brackets and fittings.

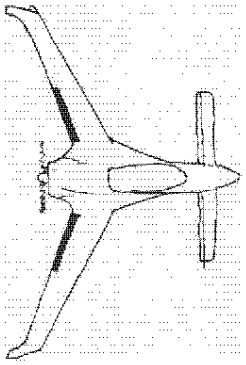
JESSE WRIGHT
7221 S. Colorado Ct.
Littleton, Co. 80122

Contact him for list. (50¢)

VariEze - none
VariViggen - prefab wood parts.

FLASH - AILERONS CORRECT VARIEZE ROLL DEFICIENCY

April 16, 77



BACKGROUND - One of the first homebuilt VariEzes to fly was Tony Ebel's. Tony has flown it only once. Tony took off from a runway too short to allow a trim-determining runway flight instead of following the flight manual-recommended procedure. As he climbed and accelerated he found his airplane had a severe left yaw tendency requiring nearly full right rudder to control. He flew the pattern with cross-controls to keep things upright, made his approach and a safe landing. Tony is an experienced Pitts pilot. A less experienced person might not have been as lucky. His airplane has an incorrect washout in one wing and large unsymmetrical discrepancies in the winglet airfoils. While the reason his airplane flew so crooked could have been predicted by measuring his airframe, we were concerned that even though we have repeatedly emphasized the importance of building a straight airframe, some of you may find your first flight as harrowing as Tony did. Knowing that rear wing ailerons have the potential of much higher roll control capability and that they would definately solve the partial stalling of the down-going elevon, we felt that even a crooked airplane could be safely flown. We decided to develop rear wing ailerons for N4EZ and use the canard controls only for pitch (elevons become elevators).

REAR WING AILERON SYSTEM

Design and construction of the aileron system including manufacturing of all parts and installation in N4EZ required approximately 80 man-hours over a five-day period. Cost of materials was about $45 more than the elevon system. The new system consists of a single pushrod from a modified stick to the canard elevators. The stick mounts on a torque tube extending to the rear seat stick and extends to the firewall (yes, dual controls are not only simple now, but quite practical). Pushrods extend to belcranks near the wing attach fittings and pushrods extend aft to the aileron arms. All controls are within the confines of the cowling; nothing is external. The ailerons extend from the inboard wing rib out to B.L.74. The wing is easily modified, an inside glass layup providing a new aft spar. The spoilers are eliminated.

FLYING QUALITIES IMPROVED & DUAL CONTROLS ADDED

While the roll qualities were improved with the spoilers, the airplane still had a sluggish feel in roll and still had some coupling (pitch imputs when roll was commanded) particularly at forward cg. We have of course been concerned that this deficiency would reflect on the canard configuration itself, a reputation it does not deserve. The aileron-equipped VariEze now has excellent flying qualities and safety in all respects. Its roll rate is comparable to a Yankee. Its roll qualities are superb, with minimal adverse yaw. Its crosswind capability is greatly improved. Its "hands off" stability is retained, and its roll/pitch coupling is gone.

Now for the big question: should you install them on your airplane? We strongly encourage <u>all</u> of you to install the ailerons. Consider them mandatory if you suspect that your aircraft is not built straight, or if your pilot proficiency is not good. since they increase roll control and the airplane flies more "conventional." The new flying qualities not only make the airplane safer for crosswinds, but they allow incorporation of a rear-seat stick and throttle for those wanting fly-home-and-land capability in the event of pilot incapacitation.

Flutter and stall tests are now being conducted. Plans for the modified control system are being drawn and will be available by about 7 May 1977. The plans are free, but you are being asked to provide the postage. Plans can be picked up at RAF after 7 May or will be mailed to you <u>if</u> you send us a <u>self-addressed 9" x 12" envelope with 57¢ postage ($1.50 for air mail over seas).</u> PLEASE include your aircraft serial number.

Those of you who have just installed spoilers are probably upset& asking"what's next"? We can assure you there will be no further redesign of the control system. We are completely satisfied with it now. Changes cause us considerable hardship too!

Rutan Aircraft Factory
P.O. Box 656
Mojave, CA 93501

first class mail

TO:

C.P. NUMBER 12
The number which appears on your label before or after your name, is the last newsletter <u>issue</u> which you will receive and requires you to renew to receive the next issue. If your label has a 12 on it, then #12 is your last issue and you need to renew.

<u>PLEASE STATE THAT YOU ARE A RENEWAL!!</u>