

THE CANARD PUSHER

Number 11

January 1977

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

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RAF ACTIVITY Since October has been concentrated in several areas. All remaining sections of the VariEze plans were completed and backorders filled. We brought N4EZ (0-200-powered VariEze) into the shop for the first time since it was built and made some modifications. The plan's-configuration, manual nosegear system was installed (it had earlier been tested on N7EZ), the stiffer main gear was installed, a new fuel system incorporated, a landing airbrake fitted, and Cleveland main wheels were installed. All those modifications have been flight tested with very satisfactory results.

The landing brake makes the airplane easier to land and makes short runways more acceptable. We found that we had been using an incorrect combination of Gerdes brake cylinders and Rosenhan brakes. Rosenhan brakes have a smaller cylinder and must be used with Rosenhan master cylinders (1/2-inch cylinder dia.) for good brake effectiveness. The original main landing gear strut on N4EZ was a wider tread and was more flexible, which allowed the airplane to ride quite low with reduced wingtip clearance. The strut was redesigned back in May before drop tests and before Jiran produced the homebuilt gears. The new gear, now installed on N4EZ, raises the airplane about four inches in the back, improving wingtip clearance without compromising taxi handling.

Recent flight tests with N4EZ have included more stall tests to evaluate any effects due to the landing brake, and visits to several small airports to evaluate runway requirements.

There were several things about the VariEze fuel system we were not completely satisfied with: first, the need for a pump to backup the normal operation of the header tank; second, the possibility of foaming the fuel in the vibrating header tank mounted on the engine; and third, the inaccurate indication of the last few usable gallons of fuel. The new system, which is detailed in this newsletter, solves all these problems and increases effective fuel head to the carburetor, since the header tank is removed. The only disadvantage of the new system is that Burt Rutan is now stuck with several hundred header tanks and fuel valves.

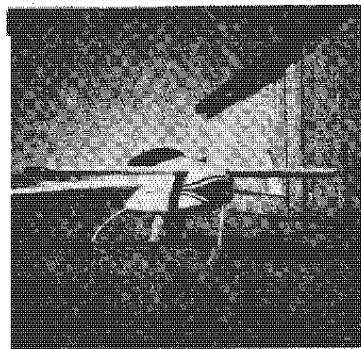
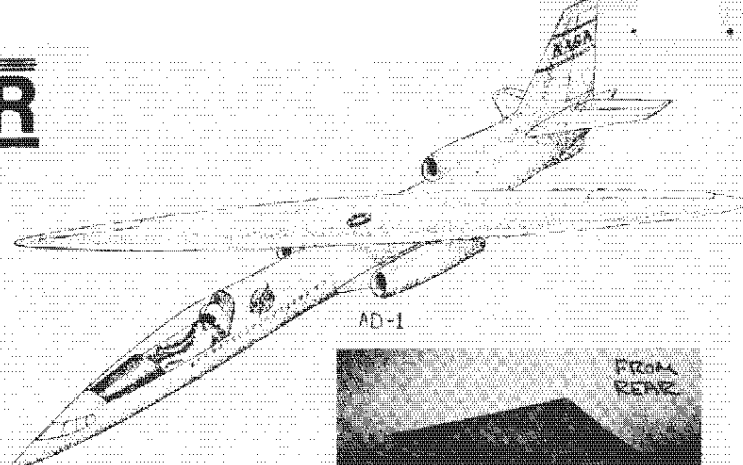
Some of our time has also been spent on further design work of the NASA AD-1, a small, all composite (foam and glass) research aircraft, using the skewed-wing concept. The AD-1 is a 15% size manned, flying model of a Boeing-designed transonic airliner.



The VariEze construction seminars have been very successful. Since October we have conducted ten seminars around the world with over 2000 people attending! Hopefully those 2000 will share their experiences with others and the need for long-distance education will begin to taper off. We plan to conduct only four additional seminars, the dates and contacts follow. If you are building or going to build a VariEze, be sure to attend one.

February 5
Contact:

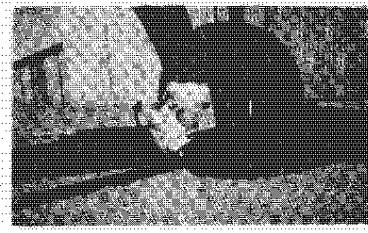
Snohomish, Washington
G. Carter Miller
4912 Senic Terrace
Yakima, Wa. 98908



CLEVELAND BRAKE INSTALLATION ON N4EZ - It probably would be a good idea to rotate the brake up a little higher than this to allow clearance with a flat tire.



NEW LANDING AIRBRAKE ON N4EZ



February 18 and 19
Contact:

Denver, Colorado
Bill Cassidy
4652 Montview Blvd.
Denver, Co. 80207

March 27
Contact:

Anderson, Indiana
Mike Melvill
P.O. Box 561
Frankton, In. 46044

April 2
Contact:

St. Paul, Minnesota
George B. Wilson
2924 108th Lane NW
Coon Rapids, Mn 55433

Please contact the people organizing each seminar a week or two in advance of the seminar date. Be sure to include a self-addressed, stamped envelope. They will send you a flyer describing the seminar. The seminars held this fall had two to three times as many people attend, as had contacted the organizers! The more the better but it helps to know that you're coming!

N27VV, the VariViggen prototype, has done a little local flying and attended the Chapter 49 Fly-In breakfast but that is all. N7EZ is still dormant but will be prepared for some serious distance record attempts. Its distance capability in class C-1A is about 3300 miles.

Every day we get a few calls asking if any homebuilders are flying yet. The answer is no, not yet, but soon. The Wicks Organ Company airplane, the Cowley's airplane, and half-a-dozen other builders may fly before this newsletter reaches you. It looks like Oshkosh 77 may be a big year for the VariEze. The coming two or three months should see the first flights of a couple of VariViggen's as well.

NEWSLETTER BACK ISSUES

For those of your who are new readers of the "Canard Pusher" and wonder what has transpired in the past, there are now a grand total of eleven issues in print. The first six are concerned with the VariViggen exclusively. Issues seven through eleven contain VariEze and VariViggen information. If you are going to build a VariViggen you will need all eleven issues to update your plans. If you are a VariEze builder you need this issue (#11) and the October 1976 issue (#10) for plans update. If you have very recently purchased plans (after February 1, 1977) a yellow sheet of changes may be bound into your manufacturing manual. If you have the yellow change sheet included, you only need newsletter #11 and on, to keep your plans current. If you sell your plans to someone else, please pass this information along with the plans.

FOREIGN BUILDERS

A package of VariEze engineering documentation has been mailed to the regulating governmental agencies of the countries listed below as an aid to homebuilders seeking permission to build. If your country is not listed and documentation is required to obtain permission to build the VariEze, have the cognizant office in your equivalent to our F.A.A. contact us on their stationery requesting a copy. Documentation has already been sent to the following nations.

Australia
Canada
Republic of South Africa
West Germany (BRD)
Belgium
Great Britain
Iceland
France

VARIEZE LANDING BRAKE SUCCESSFUL

A drag device has been developed on N4EZ to improve its previously poor short-field performance. The landing drag device was developed because the VariEze had to be approached at a low flight-path angle and used excessive runway in the flare due to its slow deceleration.

The landing brake is not a speed brake for high speed deceleration. It automatically closes above ninety-five knots to prevent overstress. As you can see in the photo, it is a very large belly-board positioned to avoid any pitch trim change. It hinges at a position just aft of the front seat bulkhead. A spring snubs it up in the closed position and provides sufficient down load in the open position that the pilot can deploy the brake with only a ten-pound force on the handle. The landing brake handle is located on the left console. The handle is immediately aft of the throttle with the speed brake closed and moves up and aft to open. In the open position the handle interferes with the pilot's arm enough to remind him that it's down, so he doesn't forget it for takeoff. Climb performance is adequate with it down, but engine cooling would suffer. There are no locks on the handle. The pilot merely moves the handle and the brake remains in the selected position (open or closed).

Now for the good news. The landing brake makes a dramatic improvement in the airplane's landing performance. Approach angles as high as seven and one-half degrees are possible with the engine at idle (about like a Cessna 150 with one-half flaps). Forward visibility is improved because the approach can be flown faster (eighty to eighty-five knots) without severely compromising landing distance. Speed bleed-off in the flare is relatively rapid, similar to most lightplanes. Touch down scatter is considerably less than without the brake. Thus, it is much easier to "put it down on the numbers." VariEzes were previously restricted to runways greater than 2400 feet. The landing brake allows a pilot with appropriate proficiency to routinely use airports with runways less than 1800 feet.

The speed brake results in a mild buffet, similar to that with full flaps in some other lightplanes. There is no pitch, roll, or yaw trim due to brake deployment. Other than the noticeable buffet, the stall characteristics are not changed. The airplane is easier to fly the approach and to land with the speed brake deployed.

While the brake does improve the short field performance, we still strongly recommend that you adhere to the field length restrictions in the owner's manual for your initial testing.

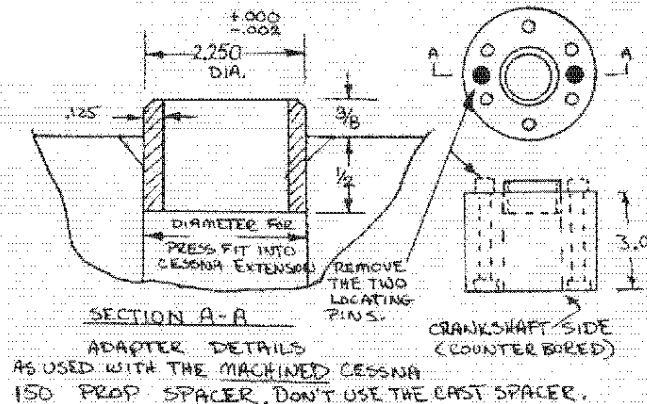
We are planning to prepare drawings for the speed brake and should have them completed before newsletter twelve. If you want to install a landing brake in your VariEze do not change anything in Section I. The brake is just as easy to install as a retrofit, as it is during initial construction. Please do not ask for the drawings before newsletter twelve; they will be available at that time.

VARIEZE PROPELLER EXTENSIONS

Now that Section IIA is out, we have received a number of requests for a recommended source of prop extensions. Suitable extensions are available from Ken Brock Manufacturing, Ted's Custom Props (9917 Airport Way, Snohomish, Wa. 98290), and Bill Cassidy (4652 Montview Blvd., Denver, Co. 80207). CONTACT THEM FOR DETAILS.

We mentioned earlier that we had used the standard Cessna 150 extension. We understand that Cessna has a newer extension out now and that it isn't suitable for a wooden prop. A wooden prop must be very accurately centered using a centering hole in the prop which mates with a centering boss on the extension or engine drive flange. The drive lugs and mounting bolts are not suitable for centering the prop. The newer Cessna extensions may also be short on surface area against the prop hub for use with wood props. We modified the older Cessna extension by adding a centering boss to it. If you have any questions about using an extension, call your prop manufacturer for his opinion.

The insert that we used to adapt the older solid type of Cessna extension looks like this:



This adaption is for a flanged crankshaft. Anyone using a tapered shaft (S.A.E.O) should specify this when ordering an extension, since these engines require a different part.

VARIEZE ENGINES

The Continental O-200A installed in N4EZ has 200 hours on it now and the crankshaft end-play measures exactly what it did on installation (.0105). We continue to believe that there will be no problem with the A-model engine installed on the VariEze. The total maintenance to date on the O-200 has been an oil change each fifty hours.

Two engines under consideration for an eventual Section IIC are being installed in VariEze airframes now. One builder is working on a stripped Lycoming O-235 installation and another group has a Honda Civic installation ready for initial testing. No data is yet available on the success of either installation but we are hopeful of good results from one or both within the year. Let's hope that both of these groups have the resources to pursue their projects to a successful completion, BUT PLEASE DON'T BUG US WITH REQUESTS FOR ADVANCE INFORMATION ON THEIR PROGRESS!

We understand that the Revmaster folks are continuing their development work on a good VW installation for the VariEze but we haven't heard from them lately.

VARIËZE CONSTRUCTION HINTS

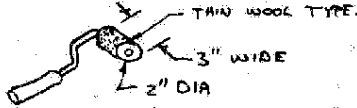
Every time we turn around it seems like we discover a little better, faster, or easier way to build a VariËze. The hints in this section are a collection from our seminars and from the inputs you builders have made. Some of the information is new and some is clarification of items people seem to have trouble with.

Basic Glass Working Techniques

Paint Roller - Tracy Saylor has suggested using a thin paint roller, cut to a three inch width to help wet out the cloth. We've been using one and are pleased with the results. Do not dip the roller in epoxy; use your brush to apply epoxy to the general area where required, then use the roller to wet out the cloth and distribute the epoxy evenly over the surface. The three-inch roller width is great for working down in the canard spar trough and other tight spots. Rollers can be cleaned in acetone or M.E.K. a time or two before you throw them away.

SEE ANY PAINT STORE.

SEE PHOTO PAGE 10



Bristle Stipple Roller - The giant pipe cleaner supplied by Aircraft Spruce and Wicks is a stipple roller. Those of you who haven't figured out how to use it on your own can look at the cartoon "wet in' it out" on page 3-17 and on page 18-2 in the photos. You build your own handle from some aluminum or steel sheet scraps.

Dry Lay-Ups - The finished parts that we have seen at seminars have generally been very good. The general tendency, however, has been to make parts a little dry. You guys are taking our emphasis on stippling and "not wet" a bit too zealously. Be sure your lay-ups are not too dry (with small white flecks of unwetted glass visible). When you think you are finished with a lay-up, **DON'T QUIT**. Take your portable light and very carefully inspect the lay-up while it's still wet. A cured lay-up that is too dry must be rejected. Also, before you leave a lay-up to let it cure, get a second opinion. Have the wife come out and inspect it while it's still wet and fixable.

The structural quality control criteria in section I, section V, and newsletter 10 are maximum allowable defects. Anything worse and the part must be repaired or rejected. Your structural parts in general should be much better than these criteria.

Do not assume that the plans do all your thinking for you. Check all sections, photos, drawings, etc., on each step. Be sure you have no bumps, depressions, or joggles on the surfaces in a spanwise direction on all structural parts.

We have been informed of two instances where epoxy has been found to be too viscous - one or two bottles in a given shipment being more viscous than the others. If your epoxy is thick like honey, return it to the distributor for replacement. Also, if any separation occurs in your hardener, shake well and warm the bottle (80 degrees); if any settling still occurs, return the hardener for replacement.

Lighting - We've found that the source of many problems has been poor lighting in the shop area. If you can't see well you can't do good work. A lot of generally well done parts have bubbles, dry areas, or wrinkles just because the builder didn't have good enough light to see them!

Flox Corners - Paint a light coat of pure epoxy inside before troweling in the flox. This improves the bond of the flox with the dry glass.

Micro Slurry - Don't be skimpy with the micro slurry over foam before you lay up glass. An incompletely slurried foam surface will allow little pockets of air to remain between the first ply of glass and the foam. The porous glass/foam interface can result in a premature breakdown of the foam-to-glass bond, and reduced surface durability. This is particularly important with urethane foam.

Micro Fills - If you fill a foam ding or nail hole with dry micro before laying glass over the surface, the micro will be soft during the lay-up and hard stippling will push the dry micro out of position. Avoid stippling ambitiously directly over a fresh micro fill with your brush. The paint roller is useful in these areas because it will bridge across the fill area and help wet the cloth without disturbing the micro.

Shop Temperature - In Section I we gave a maximum temperature range for glass laminating of sixty-five to ninety-five degrees Fahrenheit. The desirable shop temperature is about seventy-five degrees Fahrenheit. It's winter and a lot of you are trying to work at the minimum temperature of sixty-five degrees Fahrenheit. A major lay-up done at sixty-five degrees can take nearly twice as long to do as it does at seventy-five degrees Fahrenheit, because of the additional stippling time required to wet out the cloth.

"Peel Ply" - The bulk of sanding on cured glass surfaces in preparation for glass-to-glass bonding can be avoided by using a "peel" ply. A peel ply is a layer of dacron fabric which is laminated into a lay-up as though it were simply an extra ply of glass. The peel coat wets out with epoxy just like the glass cloth does and cures along with the rest of the lay-up. The dacron peel ply doesn't adhere structurally to the glass and can be peeled away from the cured glass, very easily (about like masking tape). The removal of the peel ply leaves a surface which is ready for glass-to-glass bonding without sanding. Here's an example of how to use the peel ply; in Chapter eight, Step six, lay up the top side pads, sparcap, and shear web just as the instructions on page 8-6 describe, then laminate one ply of dacron cloth over the front and back faces (shear web) of the spar. Let the assembly cure. When you are ready to lay up the bottom side, simply peel the dacron ply off on the fore and aft faces, leaving a surface which is ready for bonding. The peel ply is never left in the finished part; it is always removed as preparation for the next lay-up.

The peel ply can be used handily on the canard shear-web, leading and trailing edge glass lap joints of all aerofoil surfaces, wing shear web, center section spar, and wing tip/winglet root skins. The material for use as peel ply is 2.7 ounce/yard dacron polyester fabric. Both Wicks and Aircraft Spruce have the material or you may find Stits Polyfiber D-103 available at your local aircraft recovering shop. The dacron material is available in yardage and in conveniently-sized tapes.

Foam Core Assembly

Joining Foam Blocks - First paint a thin coat of epoxy (no micro) on the joining foam surfaces. Second, trowel a wedge of dry micro on the center of one surface. Third, squeeze the joining surfaces together, wiggling them back and forth, to obtain a thin micro joint less than one-sixteenth-inch thick. It is desirable to have the micro low in the joint about three-eighths to one-half inch (not to get squeeze-out). The low joint is filled with micro before glass is laid over the joint, allowing a wet bond between the micro and the glass. You will occasionally get some squeeze-out even trying not to, so just wipe the joint low with a mixing stick. Do not try to fill large voids with micro; you are taking a chance of getting exotherm damage. If you have a void larger than about 0.1 inch, fill it with a sliver of foam with micro on each side, rather than solid micro.

Alignment - If your foam core is cockeyed when you glass it, your airplane will be cockeyed too and probably fly that way. Get your foam cores assembled correctly. Use lots of nails to hold it straight while the micro cures. Check the depth of the spar notch and be sure that it's correct, top and bottom. Wing and canard foam cores should be assembled vertically as shown in the photos on page 6-6, nailed together firmly, and the depth of both spar notches checked before placing it in the jig blocks.

Weight - Micro is heavy and costs a lot more than foam scraps. Use a foam block to fill the big gap around the wing fitting nuts instead of the large micro fill shown on page 6-18 (inside the wing root). Even a rough fitting foam block will be much lighter. The interior foam face is given a one-ply EID protective covering.

General Hints/Clarifications

Page 6-5 - The seventh ply of EID, fifty-three inches by twelve inches, is used for the wing root and mid spar ribs shown on the top of page 6-6, same step.

Wing Jig Blocks - Jig block "F" may need to be shimmed slightly to get the leading and trailing edges straight. Jig block "E" must be notched slightly to allow the wing fitting to nest properly.

Wings - Above all else, both wings must have the same twist and be set at the same incidence.

Brakes - Use Rosenhan master cylinders with Rosenhan brakes. The Gerdes or Rosenhan master cylinders can be used with Cleveland brakes. Do not match Cleveland or Gerdes master cylinders with Rosenhan brakes.

--Ed Hamlin reports that a Dremel #128 wire brush works beautifully for cleaning the residual foam and micro off of the canard, wing, and winglet trailing edge overlaps in preparation for the top skin lay-ups.

--Builders wishing to use enamel or acrylic enamels may want to use Dupont 3011S enamel primer surfacer in place of the 70S laquer primer surfacer. 3011S provides the same ultra violet barrier that 70S does (see section V).

--Be sure you have at least the overlap shown at the trailing edge for the top and bottom skins (0.4 inch on canard; 0.5 inch on wing and winglet). Be sure the overlap area is sanded well before top skin layup.

--Do not pressure-check the fuel tanks before installation of the outside skin, unless a low pressure (five hundred feet) is used. (Page 21-6).

--Elevons must be free of friction.

--Use a lubricant on the mating surfaces of the wing fittings and NGL3 guides (Lubriplate, Molycoat or eq.).

--When mounting NG6 and NGL5 to NGL, layup a two-ply BID patch between NGL and the castings. Mount wet, with floc filling any voids.

--One builder moved his canopy forward two inches from the position shown on the plans to obtain more room for the pilot to lean forward in flight. (This is being done on Jiraná prefab canopy frames.)

--The NG6 casting supplied by Ken Brock is narrower than is shown on page 17-3, a change dictated by production tooling. Nothing is changed because of this; Brock is simply including two spacers to center NG6 in the airplane. NG7 should be 2.75 inches long.

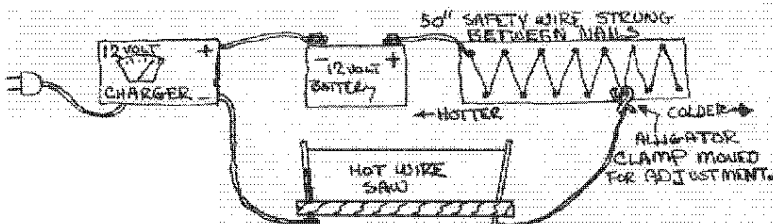
--Don't be concerned if you find it necessary to grind some of the MG-1 landing gear leg away to set the proper toe-in. A little grinding is normal and up to one-fourth inch of the gear leg thickness can be removed without structural concern. The mains should have about one degree toe-in.

--The basic bill of materials doesn't include the eight AN4-15A bolts and MS21042-4 nuts required for installation of the Cleveland axles. We have now flown Cleveland brakes and are happy to confirm that they provide excellent braking effectiveness.

--The sketch at the top of page 18-2 has confused some builders. The seventeen-inch dimension is correct, and the gear leg sweeps forward as the three-view drawing on the back cover shows.

Hot Wire Controls - The simple wire-and-nails voltage control shown in newsletter #10 can be hazardous if improperly used. Do not use it if the floor is damp. And, be sure you have the correct end to ground. Careless operation could ruin your whole day!

The schematic shown below is another possibility for a good hot wire control. This one cannot shock you.

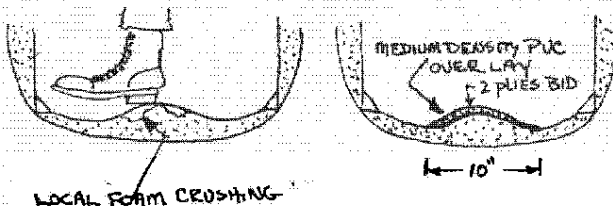


C.P.#11 - PAGE 4

URETHANE FOAM DETERIORATION

Newsletter #10 reported on the urethane deterioration in the fuselage side on N4EZ and its repair. Since then the airplane has had some rugged use including large temperature cycles. Recent inspection revealed that there has been no further deterioration. The repair is sound and there appears to be no cause for concern in this area.

N4EZ has had some urethane foam damage in another area. This is in the center of the fuselage floor from F.S. 80 to F.S. 95. As shown in the sketch this occurs only in the center where the floor surface is convex and where high concentrated loads are applied when a heavy backseater with hard soled shoes puts all his weight in one local area. The glass skin is not damaged but the foam is locally deteriorated under the glass. This was repaired by gluing a piece of nine-millimeter, six-pound PVC (red) foam on top with wet micro. The PVC is heat formed (three hundred degrees oven or heat gun) to hold its shape and weighted in place. After cure, layup two plies BID over the PVC. This provides a very durable surface. The PVC piece is fifteen inches long and ten inches wide. It is recommended that you install this piece in your airplane to prevent damage. It is not required over the entire floor. The concave surfaces spread the load out and no damage occurs. If you have no six-pound PVC you can substitute balsa wood.



VARIIZEES HAVE MODERN CABIN HEAT SYSTEM

Those of you northern die-hards that still think the VariEze needs an exhaust-powered cabin heat system should go to the library and look up a book on solar heating systems. You will find that the VariEze fuselage is strikingly similar to a well-designed solar heat collector--a urethane foam box, diffused surfaces inside, glazed on top with plexiglass. It is well ventilated for summer cooling but with the vent closed and a good canopy seal you can maintain seventy degrees Fahrenheit inside temperature, with and outside air temperature of ten degrees Fahrenheit! This heating system, of course, does not work at night, but good fighter pilots fly in the daytime and love at night.

QUESTIONS/ANSWERS

We continue to be asked questions about our opinion of systems or configurations different from those we have tested and recommend on the Viggen or Eze. Please remember that if we haven't built or tested a given aerodynamic configuration, engine installation, avionics system, etc., our answer must be that we "don't know." We will continue to support builders by helping them with any problems or questions they have, relative to the basic airplane and systems as shown on our plans, but we cannot serve as a clearing house or consulting service for items different from those in which we are familiar, particularly different engine systems and avionics.

Remember, your letters can be promptly answered only if you provide a self-addressed, stamped envelope. If the S.A.S.E. is not included, we will answer your question in the next newsletter.

Q. I want to keep my VariEze as simple as possible and plan to eliminate the roll and yaw trim. Is ground-adjustable trim okay?

A. We appreciate your desire to keep it simple, but do not eliminate inflight trim. The VariEze is a real pleasure to fly in-trim or hands-off (which requires three-axis trim) but is quite a nuisance when out of trim, particularly in roll. We consider the ability to adjust roll trim with major power changes a mandatory item.

Q. I haven't been able to get to one of the demos--when can I see the VariEze?

A. We have not been showing it on an individual basis since this requires locking up, traveling a mile and opening the hangar. The response has been so great that this would take all our time. This situation will be resolved by about the end of February since we will be moving into a hangar on the flight line so you can visit anytime and inspect the airplane.

Q. I don't want to build an airplane that is still undergoing changes. When are you going to freeze the design and stop making changes?

A. We are more interested in the research and development aspects of aircraft than in marketing/promotion. Trying different things to improve an airplane is where our expertise lies. We expect to continue to use the VariEze as a research test bed for a long time, experimenting with several interesting concepts and may be making changes ten years from now.

Q. I'm just about ready to make the first flight in my VariEze. What words of wisdom do you have to the "about to be" test pilot?

A. The best thing we can tell you is to read your owners manual very carefully and follow exactly all the information and limitations shown. The VariEze is a very stable airplane but has lower stick forces than the average lightplane. So, get some time in a Yankee or other "sensitive" airplane. Also, remember that your rudders are a more powerful roll control than the elevons, and if your new airplane is crooked you may need rudder to keep things upright. In fact, you should fly the airplane primarily with rudder, since if there is anything that takes getting used to on the VariEze it is the tendency to input pitch when trying to use only aileron. So, if you use the stick only for pitch and the rudder to turn, things will seem easier, particularly if your proficiency is not good. Also, remember to keep the airplane in trim by adjusting pitch, roll and yaw trim. When in trim the airplane will hold speed and level flight even in turbulence without pilot effort. This will make your initial flights much more comfortable than fighting an out-of-trim condition. On final approach, set up roll and yaw trim for coordinated level flight, then the rest of the landing is VariEze indeed.

Too many people do a professional job of building their airplane then lose everything because they do a non-professional job of flight testing. If something is not quite right--fix it before you fly. Be sure your pilot proficiency is sharp and current.

Add these words to Owners Manual

The fuselage tank is filled when the aircraft is fueled--it has its own cap (same cap as on wings). The fuel system is operated as follows: The fuselage tank is normally used only for starting the engine with the nose down. The wings are selected after the nose is up and the pilot gets in. If the flight is planned so that the descent is done with less than two gallons in each wing, the pilot selects the fuselage tank for the descent and landing. Regardless of the flight planning, the pilot can use all the wing fuel in level flight or climb (there is less than 0.1 gallon unusable). He can use all but one gallon per wing in a normal descent and all but two gallons per wing in a steep descent. All fuselage fuel can be used in any attitude.

Addition of the selectable fuselage tank gives the pilot a much more accurate indication of his last few gallons fuel, thus increasing range and decreasing his concern of exact usable fuel state when fuel is low. It also gives redundant backup for things like fuel vent blockage, loss of fuel cap, etc. It does require fuel management though, but not more so than with the pump. The fuel selector is designed to mildly interfere with the pilots wrist to remind him not to take off with the fuselage selected, thus depleting descent fuel first.

The selector handle is positioned left for wings, up for fuselage, and right for off. The selector valve is operated directly with a torque tube running forward. The torque tube is easy to install even with the side consoles in place. The torque tube has a mild curve which positions it against the fuselage side from F.S. 70 to F.S. 90, thus it does not interfere with the suitcase. Rout holes in bulkheads as required.

The system low point is provided with a drain adjacent to the selector valve. The drain is installed by drilling a five-sixteenth inch hole in the AN910-2D coupling and tapping with a 1/8-27 NPT tapered pipe tap.

The fuselage tank is located forward of the firewall over the wing spar. The fuselage tank in N4EZ (see photo) is fiberglass. The front and back sides are three-eighth inch urethane (or PVC) foam with one ply EID on the inside. The top, bottom, and sides are two plies EID, laid up flat like the practice piece on page 3-13 of Section I. The pieces are assembled with epoxy, then the corners are rounded and two plies EID are layed over all the outside (overly wet layup to avoid leaks). The sight gauge, vent, cap, strainer, and fuel outlet are made similar to the wing tanks.

The tank was bonded to the spar on the bottom with wet micro and a block of six-pound PVC foam and bonded to the roof at the top (around fuel cap) with a ring of PVC and wet micro. While this looks like it will work okay, it's probably a better idea to fabricate some metal straps and bolt the tank to the firewall. If your tank interferes with the canopy brace bar, move the bar forward. A welded aluminum tank could be substituted if desired, or better yet, maybe we can talk Ken Brock into making a rotary-molded one like the original header tank.

One builder has told us that the Bendix-Strongberg carburetor will function satisfactorily with a very low fuel head and should work well with this new fuel system. We have not tested the Bendix carburetor so we have to leave verification of this up to you.

Some of you may not like the idea of a fuel tank within the confines of the cockpit. This is, however, a fairly common practice for many lightplanes. We feel that the advantages of more reliable fuel flow near zero fuel level, outweighs any disadvantages and thus recommend that you install this new system in your VariEze. DETAIL DRAWINGS ON PAGE 6.

Make the following changes to your Owners Manual, Section IV.

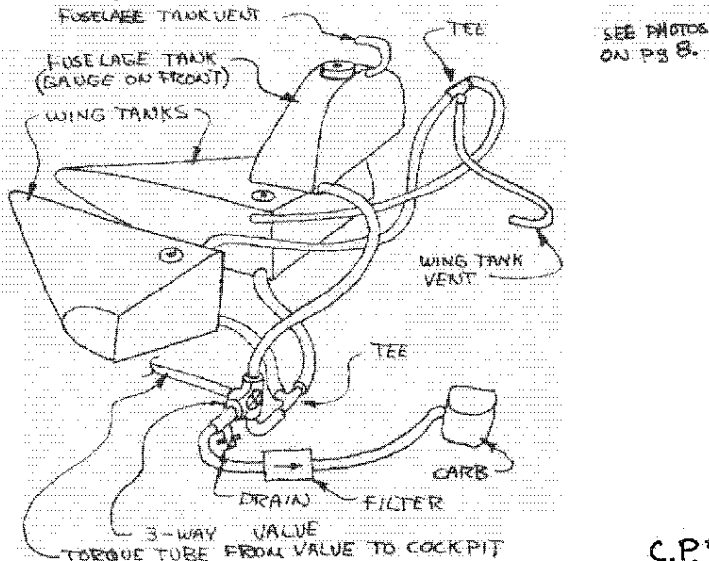
Check List

Engine start--add "select fuselage tank" before "mixture rich." Before takeoff--add "wings" after "valve on." Descent--omit "if low fuel refill header tank each six minutes." Add "select fuselage tank if wings are less than two gallons each."

OWNERS MANUAL CHANGES CONTINUE ON PAGE 7.

IMPROVED VARIEZE FUEL SYSTEM

We have recently tested a new fuel system in N4EZ that offers some significant advantages over that currently shown in Section IIIA of the plans. The following schematic shows the system. Note that the pump and the small header tank on the vacuum pump pad are both eliminated.

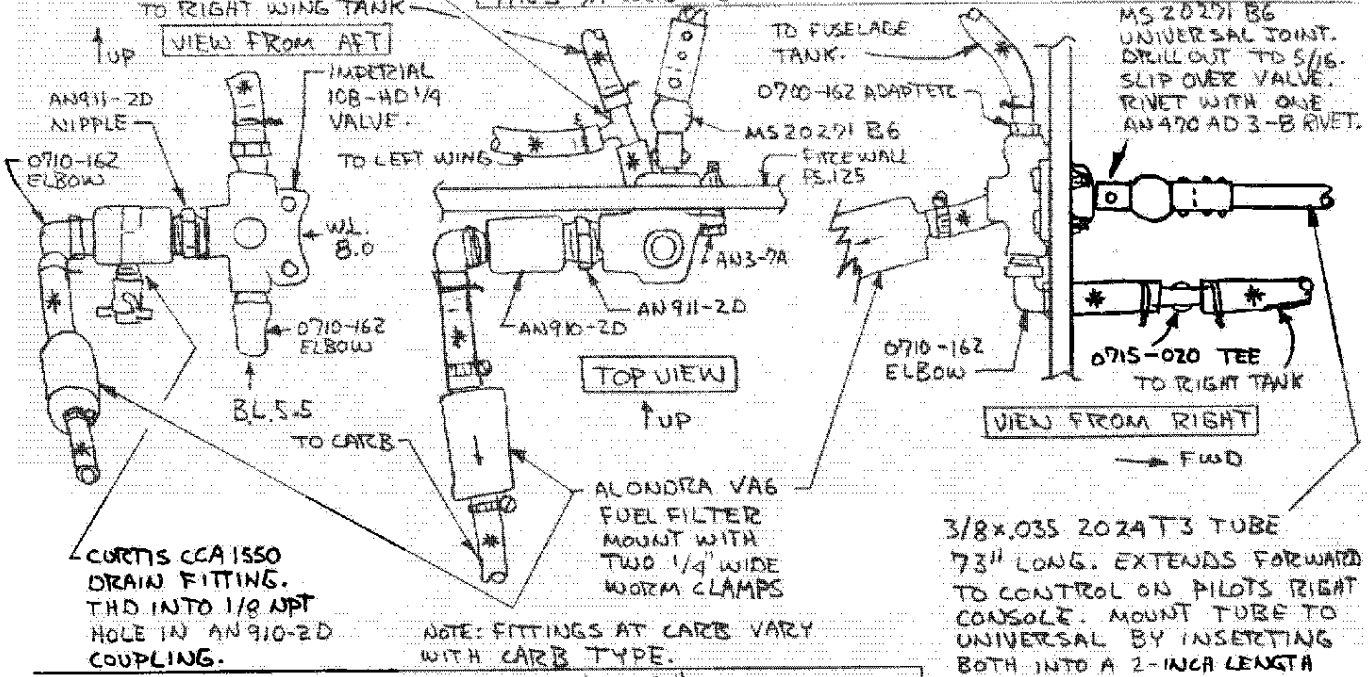


SELECTABLE FUEL SYSTEM | REPLACES THAT SHOWN IN SECTION IIA.

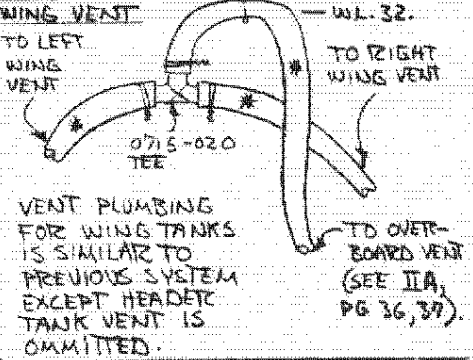
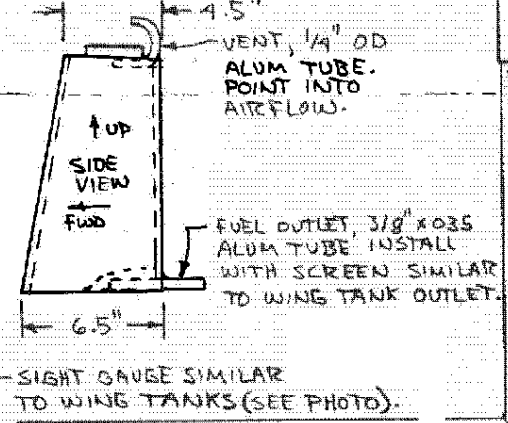
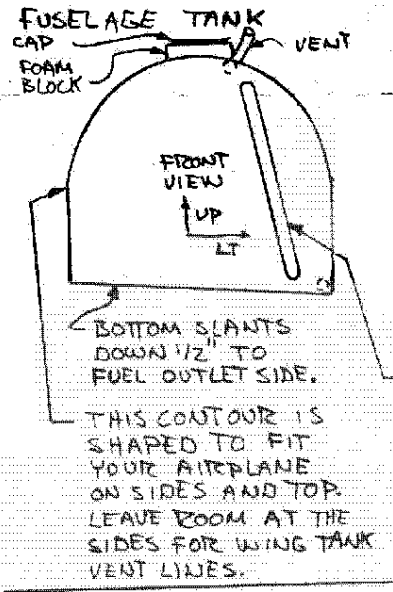
VALVE DRAIN

* ALL HOSE IS TYGOTHANE 1/2 x 3/8. SEE SECTION II. ALSO SEE PHOTO ELSEWHERE IN THIS NEWS LETTER.
0715-020 TEE

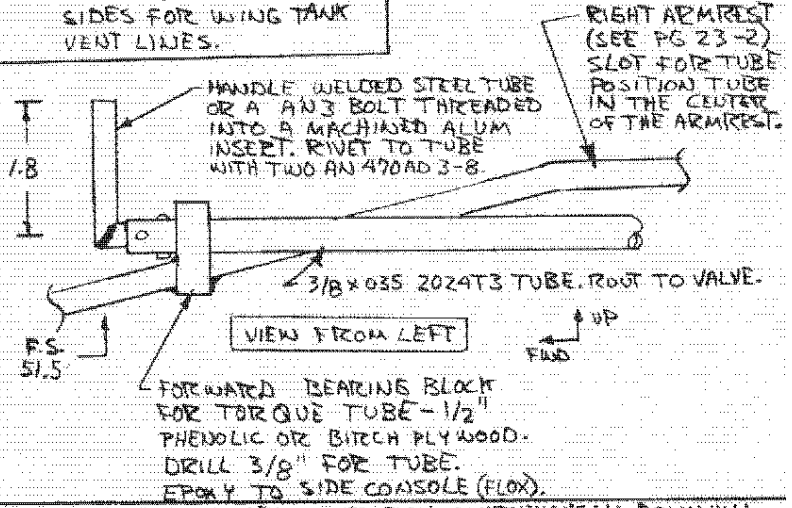
SAFETY ALL HOSE AS SHOWN IN SECTION IIA. THE VALVE MOUNTS ON THE FIREWALL AT BL=5.5, WL=8, JUST TO THE RIGHT OF WHERE THE FUEL PUMP WAS ON THE PREVIOUS SYSTEM. DRILL A 1.05" DIA HOLE (FLY CUTTER) THERE AND A 0.50" DIA HOLE 1.8" BELOW IT. INSTALL THE PARTS SHOWN USING TWO AN3-7A BOLTS TO MOUNT THE VALVE. REMOVE VALVE HANDLE.



3/8 x .035 2024 T3 TUBE 73" LONG. EXTENDS FORWARD TO CONTROL ON PILOTS RIGHT CONSOLE. MOUNT TUBE TO UNIVERSAL BY INSERTING BOTH INTO A 2-INCH LENGTH OF 0.5 x 0.58 2024 T3 TUBE AND RIVET WITH 3 AN470AD3-10 RIVETS.



PILOTS FUEL VALVE CONTROL



FUEL SYSTEM REVISED HARDWARE LIST. AVAILABLE FROM BROCK, AIRCRAFT SPECK, OR WICKS).

- 15 FT TYGOTHANE 0505-107 1/200 x 3/8 ID
- 2 ea 0715-020 TEE (RYAN HERCO)
- 2 ea 0710-162 ELBOW (RYAN HERCO)
- 1 ea 0700-162 ADAPTER (RYAN HERCO)
- 1 ea IMPERIAL 10B-HD 1/4 VALVE
- 2 ea AN3-7A, MS21042-3, AN960-10
- 1 ea AN911-2D NIPPLE
- 1 ea AN910-2B COUPLING
- 1 ea CURTIS CCA 1550 DRAIN VALVE
- 1 ea ALONDR A VAG FUEL FILTER
- 2 ea 1/4" WIDE 1/2" DIA WORM CLAMP
- 1 ea MS 20271 B6 UNIVERSAL JOINT
- 5 ea AN470AD3-B RIVETS
- 3 ea AN470AD3-10 RIVETS
- 1 ea FT-18 CAP ASSY (BROCK)

THIS LIST REPLACES THE ONE ON PAGE 2 OF SECTION IIA.

DO NOT SUBSTITUTE VINYL, POLYETHYLENE, POLYPROPYLENE, ETC FOR TYGOTHANE.

WING TANK FUEL LINES MUST RUN CONTINUOUSLY DOWNHILL TO THE VALVE. ALL VENT LINES MUST RUN CONTINUOUSLY UP HILL TO ALLOW DRAINAGE IF FUEL-FILLED.

Page seven-
Fuel System

Omit entire section. Add "The fuel system consists of two wing tanks and a small fuselage tank, all equipped with visual sight gauges. A three-way selector is located on the pilot's right console. The selector is positioned left to select wing fuel, up to select fuselage fuel, and right to off.

The wings hold about twenty-four gallons total, all is usable for climb or level flight. One to two gallons per tank are not usable for steep descents. The fuselage tank holds about 2.5 gallons, all is usable in all normal attitudes.

Drains are provided at the wing tanks and at the fuel valve (system low point). The wing tanks are vented together to maintain equal tank fuel levels."

Page fifteen-
Descent

Omit last paragraph. Add "If a long normal descent is made with less than one gallon of fuel in each wing tank, fuel starvation may occur. Fuel flow can be regained by selecting the fuselage tank or by reducing descent angle. Starvation can occur during long steep descents with two gallons per wing tank. Because of this possibility, the fuselage tank should be selected for all descents and landings, with less than two gallons per wing tank.

Page thirty-two-
Appendix I

Omit sentence on safeting fuel valve. Under weight and balance add "check aft cg limit with full fuselage fuel."

Page twenty-two-
Engine Failure

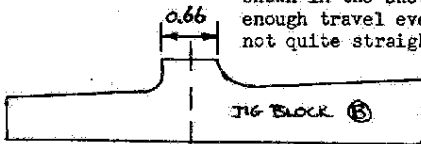
Omit all of the top paragraph after "fuel starvation." Add "select fuselage tank. If wing fuel starvation occurred during descent, the wings may have one to two gallons of fuel that is still usable during level flight or climb."

VARIETZ PLANS CHANGES

We are still getting a large volume of questions from builders over the phone and by mail that are answered in the plans or in newsletter #10. Read everything thoroughly before you start bugging us! Transcribe all plans changes into your plans--don't try to memorize them.

Page Number Changes

5-6 A few builders have had problems getting enough elevator travel. We now recommend that you modify the elevator location template--jig block "B" as shown in the sketch. This will give enough travel even if your canard is not quite straight.



Split and spread apart to obtain dimension shown.

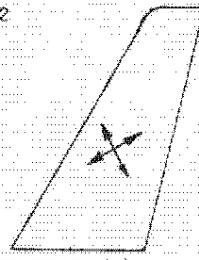
6-21 The Radio Shack switch is not a spring-to-center type. A Micro switch #BA-2041 should be used.

7-1 The four UND skin plies are considerably oversize as shown (fifty-five inches by thirty inches) and may be reduced to fifty inches long and twenty inches wide at root.

17-3 1.15" SHOULD BE 1.25" (N56)

C.P. #11 - PAGE 7

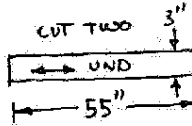
7-2



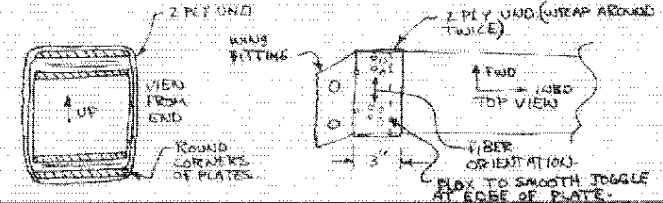
The middle sketch at the top of the page should look like this.

USE THE DRAWING AT THE BOTTOM OF 7-2 TO CUT THE WINGLET PLATFORM, NOT THE INFO AT THE TOP OF PAGE 7-1

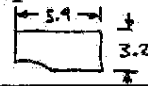
8-7



Add these instructions to the end of Step 8: Before mounting the fuel tanks, round the edges of the wing fitting plates and layup a three-inch strip of UND wrapped twice around the centersection spar as shown. This provides a glass surface for the cowling lip layup (see Section IIA), stiffens the spar end, and safeties the wing fitting screws.



15-1



The two 5.4 by 2.7 inch pieces of medium density PVC foam should be 5.4 by 3.2 rough to allow for matching the contour of the seat back.

17-5 2-2 2-3

(One each) AN5-37A bolt should be AN5-40A. The 37A is adequate if your pad was not laid on too wet.

(Two each) AN4-36A bolts should be AN4-40A.

(Eight each) AN509-10R-9 should be AN509-10R-14.

20-2

#38 drill should be #42

21-6

3000 feet should be 1500 feet.

22-8

You may want longer canopy hinge screws than the 509-10R-6's shown if your canopy frame is thicker than the prototype NLEZ. GET AS MUCH GRIP AS POSSIBLE.

22-7

Blank should read "See page 25-1."

22-8

AN509-10R-12 should be AN509-10R-10.

Section IV
Owners Manual
Page 48

Add the following notes:

Subtract one hundred feet from the ground roll if landing brake is used.

Also:
Subtract four hundred feet from the landing distance over a fifty foot obstacle if the landing brake is used.

Section IIA
Page 5

B.L. of lower mount points should be B.L. 5.25, NOT 5.5.

Section IIA
Page 10

All three weatherhead fittings should be drilled out to an inside diameter of .281 (9/32) to increase fuel flow.

Also:
AN42B-4 should be AN42-7A. (These do not apply to the new fuel system).

Section IIA
Page 13

Continental #53627 should be #530627.

Also:
AN844 should be AN884.

VARI EZE PLANS CHANGES, CONT.

Canard Pusher #10

Page 5

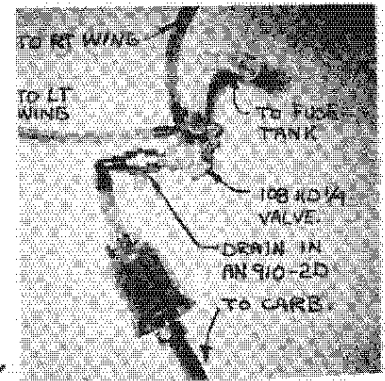
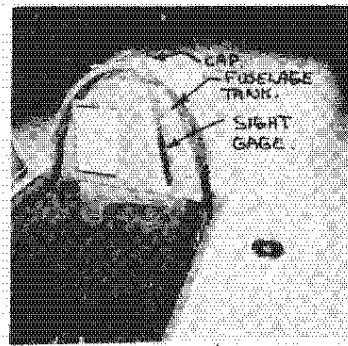
Page 6

Section IIIA

K1000-3 should be K1000-4.

Top right-hand corner, 10-5 should be 10-3.

Omit Step four and Step twelve. Modify Step five as shown in this newsletter. Omit photo of valve on page twenty. Substitute fuel system shown in this newsletter. Do the fuel flow checks in Step twelve for the wing and fuselage fuel.

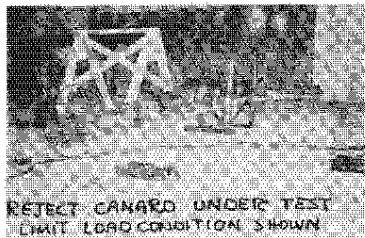


STRUCTURAL TESTING

We have conducted another VariEze static load test since newsletter 10. A homebuilder brought his canard to our shop to show the problems he had in construction. He knew that the canard did not meet the quality control criteria (a large depression in the spar at B.L.42, many dry areas, and inadequate skin overlap at the trailing edge) so he had rejected it. He left the canard with us so we could use it to show others how not to do the work. We decided to load it to destruction to determine its actual strength.

The canard was mounted in a fixture (see photo) that mounted it by the lift tabs and trailing-edge pins similar to the normal mounting on a VariEze fuselage. Test results showed that the strength of the canard was considerably reduced due to the construction errors, but the canard was still strong enough to meet FAR 23 (failure above 150% of limit). Failure occurred at the depression in the top spar.

Another builder showed up at a workshop with a test fixture he had constructed. His eyeball engineering had told him that the canard lift tab was too weak, so he built a 2-ft span of a canard complete with lift tab built to the plans. The canard section was supported at the tips and he applied 2200 lb to the single lift tab - no failure occurred. Needless to say he is no longer worried about lift tab strength!



HAM RADIO OPERATORS

Ivan Whitehouse (Goldensle, Washington), K7ATX, reports about twelve hams have joined the "VariEze" net. He reports poor luck with the Tuesday evening net and says that they will try Thursdays at seven a.m. on 3900 Khz.

ED HAMLIN WANTS YOU!

Ed Hamlin (8377 Seeno Ave, Roseville Ca 95678) was the host of the Sacramento VariEze seminar. He is organizing a "squadron" - a club for EZ builders in central/northern Calif. Purpose is to work together to help each other with building and flying problems and to promote Sport Aviation. If you are interested, send him a S.A.S.E. for his newsletter. Ed has done real first-class work on his half-completed VariEze.

Minnesota already has a VariEze club. Contact George Wilson 2924 108 th Lane NW Coon Rapids MN 55433

NEW FUEL SYSTEM IN N4EZ-SEE PAGE 5 AND 6

VARI EZE DISTRIBUTOR STATUS

JIRAN - Producing 4 main gear per day and 3 cowlings. Current backlog approximately 9 weeks.

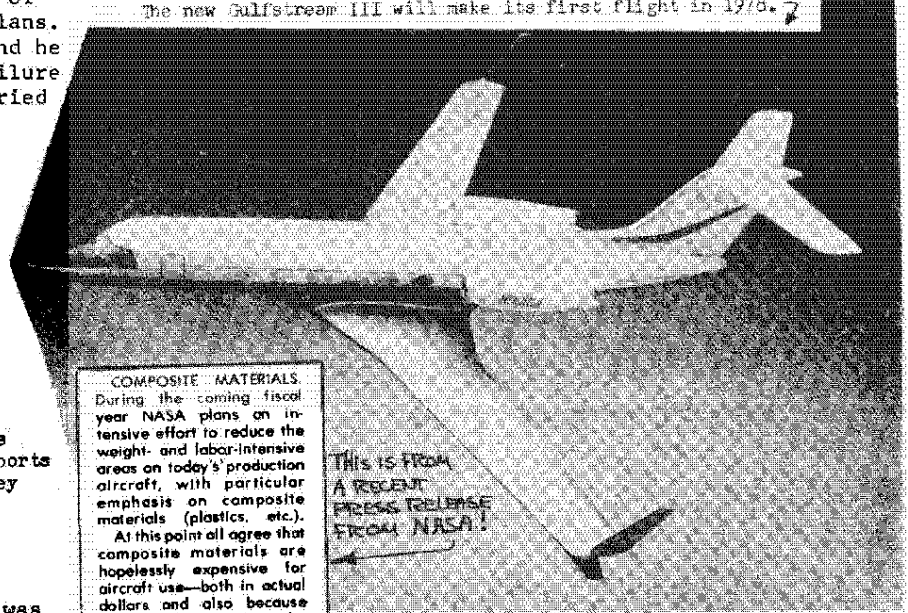
COWLEY - Shipment within two weeks

BROCK - Most items available for immediate shipment. Wing fittings, engine mounts, and nose gear castings backlogged about 2 months.

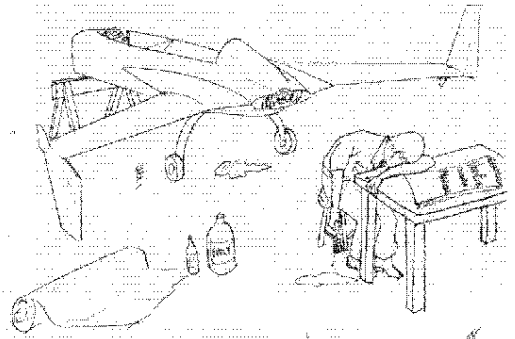
AIRCRAFT SPRUCE & WICKS ORGAN - most items available immediately; a few long lead items make full shipment deliveries about 1 to 2 months.

On the average, two complete shipsets per day have been delivered to homebuilders in the first 5 months of the VariEze program. This is an excellent record, unsurpassed by any other homebuilt kit supplier.

The next generation of business jet may have winglets too. The new Gulfstream III will make its first flight in 1978.

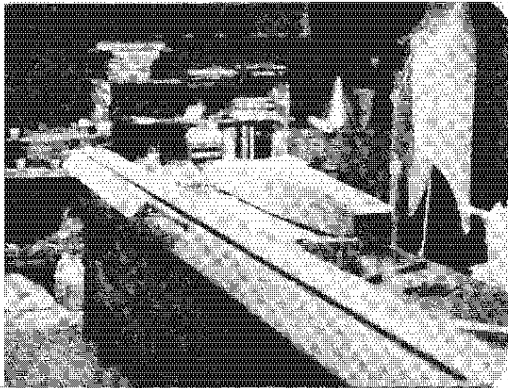


COMPOSITE MATERIALS
During the coming fiscal year NASA plans an intensive effort to reduce the weight- and labor-intensive areas on today's production aircraft, with particular emphasis on composite materials (plastics, etc.). At this point all agree that composite materials are hopelessly expensive for aircraft use—both in actual dollars and also because (again) they raise the specter of enormous product liability insurance cost. NASA is coordinating its research with that of others in the "consumer item" fields (principally auto manufacturers) to try to bring costs down and technology up. NASA admits there is much still unknown and expects that it will be a 6-7 year effort before results appear in the tie-down areas.

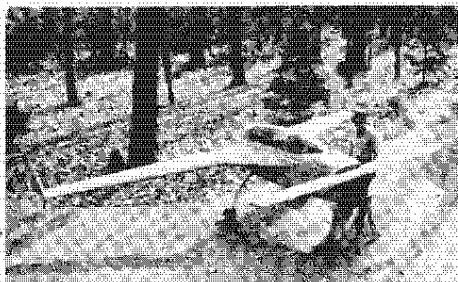


VARIIZE BUILDER REPORTS

You guys don't write much but we do get a few pictures.



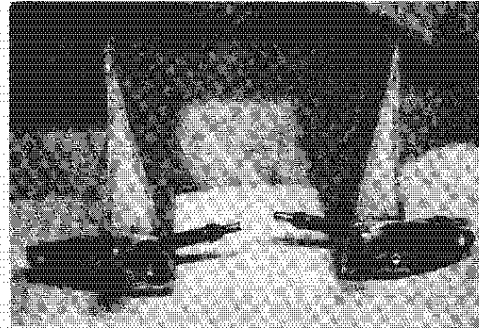
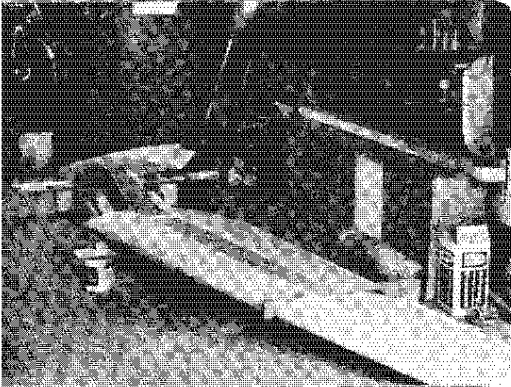
NAT PUFFER'S CANARD, SEASIDE AND CENTER SECTION FORM COKE



Cy Mehling's (Doylestown, Pennsylvania) airplane as of early December. PART TAKEN 3 MONTHS AFTER RECEIPT OF KIT

Tom Kuffelle (Anchorage, Alaska) first knife trim...at three a.m.! That's loyalty!

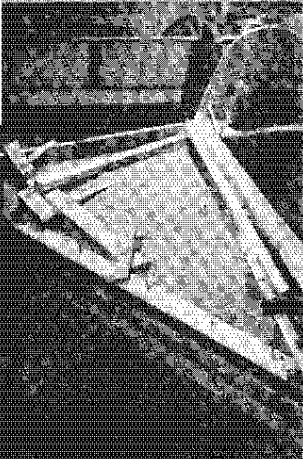
Nat Puffer's wings and center section spar completed and aligned. Anybody recognize the thing hanging from the roof?



Puffer's rudders ready for the bottom rib.



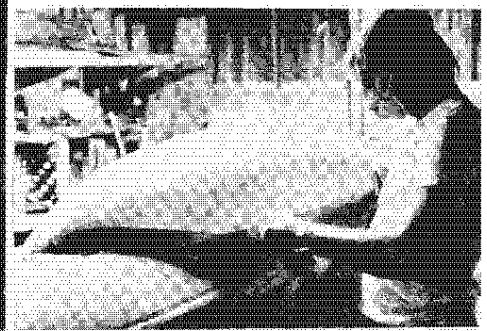
T. Kuffel - The first hot wire cut.



Wagner's fuel tank going together.



Hans Steinhoff (Coleta, California) has the right idea on weight--his wings and canard had to be tied down! (Well... it's a nice idea anyway.)



Dr. John Wagner shaping his canopy frame.



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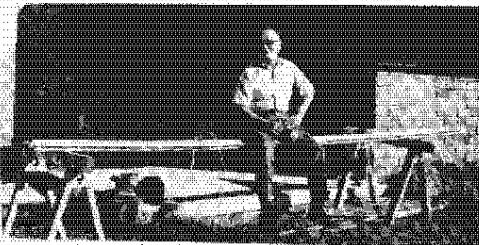
EAA, BOX 229, MALES CORNERS, WISCONSIN 53130

WHO'S BUILDING

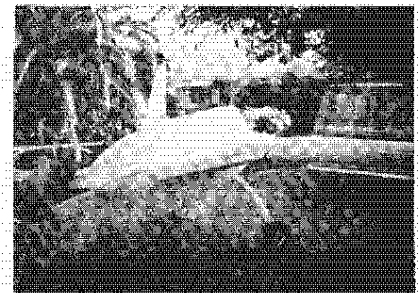
The best way to find VariViggen or VariEze builders in your area, is to attend your local VA meeting and ask who is building. If you're building a VariViggen or VariEze, clip out the card slow, fill in, and mail to EAA, PO Bx 229, Males Corners, WI, 53130, atten A/C Records Dept.

EAA AIRCRAFT REGISTRATION CARD

NAME _____ EAA NO. _____
 ADDRESS _____
 CITY _____ STATE _____ ZIP _____
 CUSTOM-BUILT ORIGINAL DESIGN BUILT FROM PLANS
 AIRCRAFT NAME _____
 FIXED WING ROTORCRAFT MONOPLANE BIPLANE GLIDER
 (NO NUMBER IF ISSUED) _____ THING MAKE AND R. P. _____
 SEATING CAPACITY 2 WING SPAN _____ LENGTH _____
 DATE STARTED _____ DATE COMPLETED _____
 (OPTIONAL) OCCUPATION _____ BIRTHDATE _____ APPROXIMATE COST _____



Vari Eze S/N 124's canard doubling as a park bench. This is not recommended. That much weight concentrated on a sharp saw horse can damage the structure. If you do this, place a foam block on the sawhorse first.



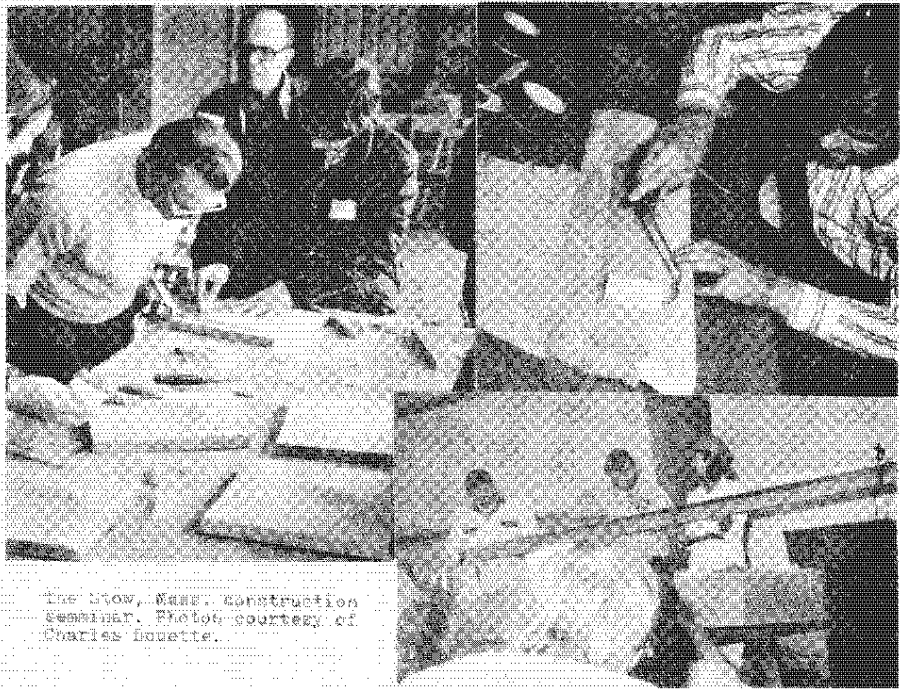
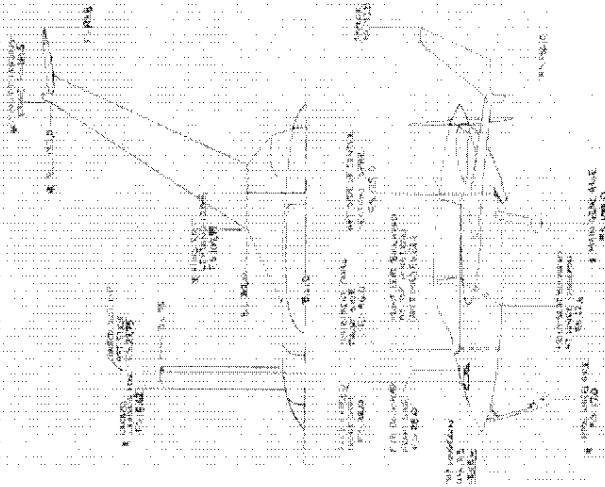
A.G. Ebel's airplane after four months work. December 8, 1976.



Cy Mehling's airplane in October.

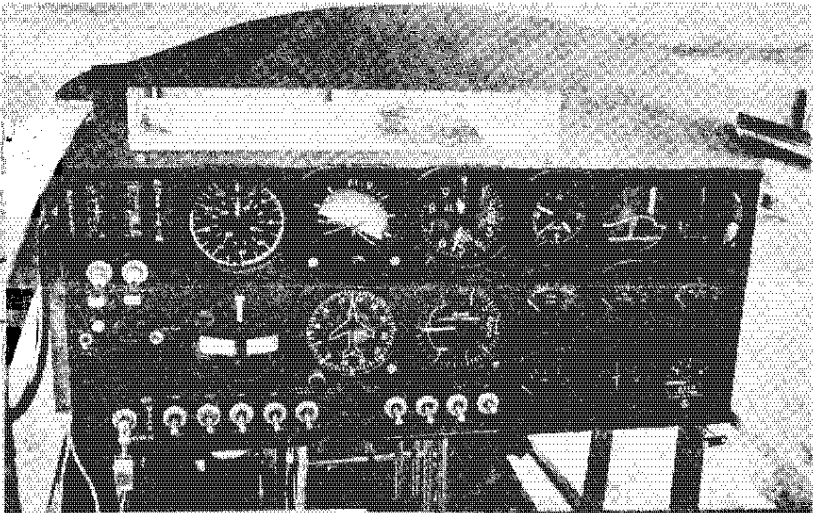
VARI EZE REFERENCE DIMENSIONS

This sketch gives a summary of fuselage stations and butt lines which are easily checked on the completed airplane. All of this information is in the plans but some of it you have to hunt for. The points marked by the asterisk (*) should be checked during final weight and balance and the real values recorded in your airframe log (Drop Plumb-bob TO LINES ON FLOOR).



VARIVIGGEN PLANS CHANGES

Page	Change
VariViggen Plans Page 5	Top of WS 28 should be 3.1 not 3.0 as shown.
SP Wing Plans Page 14	AA-3 should be two required-1/4 inch 2024-T3 aluminum 1.0 by 12.4.
SP Wing Plans Page 13	Under wood--two pieces 1.0 by 1.5 by 24 should be four pieces.



VARIVIGGEN BUILDER REPORTS

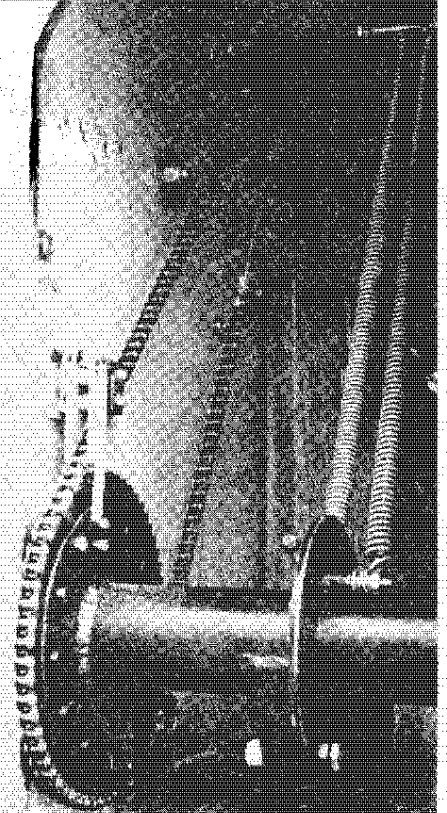
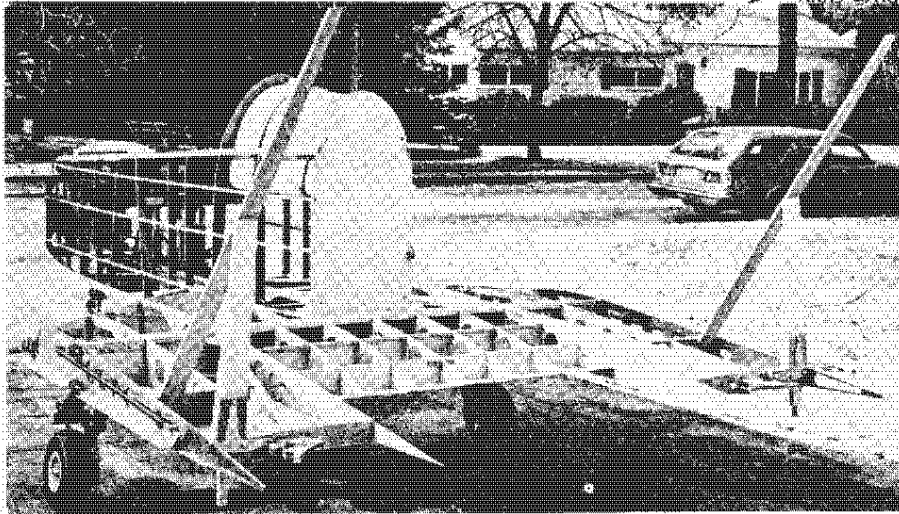
Ken Guscott, S/N 129, reports that he has the fuselage and inboard wing complete and ready for cover. Ken says that he's disappointed that more VariViggen builders haven't been sending information in for the newsletter. We agree. What are you guys up to?!

Jim Cavis reports that his airplane is ready for first flight, paint and all. He is mounting the canopy plexiglass now and as soon as he finishes we'll have a genuine flight report for you to read. Jim has the standard wing plan form on his airplane but built it from foam and glass. He plans to fly it in standard configuration and later add winglets. This should be interesting.

KEN GUSCOTT'S FRONT COCKPIT LAYOUT. NOTE THE ELECTRIC TRIM & REFLEX.

GUSCOTT'S FUSELAGE AND WING READY FOR SKINS

KEN GUSCOTT'S CHAIN DRIVE NOSE GEAR RETRACTION MECHANISM



AFTER NEWSLETTER 11 had gone to press we invited Peter Garrison, an aviation writer for "Flying" magazine, to fly N4EZ. He flew it several times and was pleased with the improvements due to the speed brake; however, he expressed concern that the airplane may be a "handful" for a low-proficiency pilot, due to its relatively sluggish roll rate and due to a tendency to pitch nose-down with aileron inputs. These comments caused us concern, and a little surprise, since we hadn't really been aware of a significant pitch change with aileron. We flew the airplane again and noted that, yes, indeed there is an objectionable nose-down pitch change, but only for large aileron inputs. Apparently we generally use only small aileron inputs and alot of rudder when needed for high roll rates and, being accustomed to flying the airplane in this manner, we were not of the opinion that the airplane was difficult to maneuver. Trying to put ourselves in the place of a low-proficiency pilot on his first VariEze flight where he may be flying an airplane out-of-trim and might be unable to roll at all, if he is using alot of opposite rudder, led to the conclusion that Peter was right; the airplane does need to be improved to make it safe for some pilots.

We have always been reluctant to put rear-wing ailerons on the VariEze due to the control system complexity, the need to hookup controls for wing removal, and the addition of a new possible flutter mode. What we needed was some additional roll rate, a slight nose-up pitch change with roll deflection, and perhaps some proverse yaw. We rigged up a small spoiler on the cowl just aft of the center-section spar, and found that its deflection almost exactly cancelled the nose-down pitch and made the roll rate higher. Addition of this spoiler made the roll response more crisp and made the VariEze feel more like a conventional airplane. It was a little hard for us to believe that this small spoiler, mounted that far inboard, was really making that much difference; so we invited Peter up again to fly our modification. He was skeptical because of the small size and placement of the spoilers, but after his flight, which included maneuvering at all speeds and several landings, he agreed that all pitch change due to roll was gone and that roll control was more like a conventional aircraft. When asked if the aircraft was safer for the low proficiency pilot he replied, "Definitely." We agree, and are therefore recommending the simple spoiler system shown below as a mandatory addition to your VariEze.

The spoilers have a negligible effect on cruise speed. They are far enough from the leading edge to be included in the boundary layer. There are no changes to the current control system. The elevons still work normally; the spoilers are merely an addition. A bracket (CS18) is bolted on the stick using the existing bolt. Cables (in nyloflo conduits) are routed aft along the fuselage side (no interference with the suitcase) and through the centersection spar. These cables rotate tubes which directly deploy the flat-plate spoilers, through four slots in the top cowl. One light spring per spoiler holds them down against the cowl. CS18 is offset such that only a very minor slack exists in one cable when the opposite spoiler is fully deployed. The complete system was designed to be easily installed in a completed airplane. It was built and installed in N4EZ in one day. The front half of the pilot's ararest was removed for access and reinstalled with flox after spoiler installation. Note that the ararest side must be hollowed locally to provide clearance with CS18. No turnbuckles were used. The cable Nicopress sleeves were swaged as accurately as possible, then final adjustment was made by moving the CS19 block up and down. The spoilers are rigged to start moving up just as the stick moves away from neutral and to reach full deflection (about 50 degrees with no airload) at full roll control. Spoiler rigging is effected only slightly by fore-aft stick motion (pitch control). Be sure it's hooked up so the left spoiler deflects when the stick goes left (the cables cross under the rear ararest). The cables are routed on both sides of the front seatbelt attachment.

The spoilers are plates of .063 2024T3 aluminum. At neutral, they sit flat on top of the cowl. They are attached to a weldment with two AN525-10R6 screws per spoiler. Cowling removal requires removing the four screws, or the cowling can be slotted forward to allow removal without disturbing the spoilers. The weldment consists of 1/2-inch dia. steel tubes with pivots and brackets. The right side has two hinges: one at B.L.8.4R where the cable attaches and the other between the two spoiler mounting tabs (CS24's). The left side has three hinges: one between the CS24 tabs, one at B.L.13L, and one at the cable attach point. Because of the spar dihedral, a universal joint is required at B.L.12L.

Four hinge brackets (.063 alum formed angle) are bolted to the centersection spar (CS20 and three CS21). They are mounted wet with flox and the excess flox squeeze-out prevents rotation should the metal bond fail, thus only one mounting bolt is required. These brackets are drilled in last, with the entire assembly bolted together, to allow adjustment so the spoilers sit flat on top of the cowl.

A small steel spacer, the same as that used at the bottom of the rudder pedal (VECS13), is used at each of the five hinge points. The 1/4" OD spacer is clamped to the aluminum brackets by the AN3 bolts and the steel brackets rotate on them.

One spring is used per spoiler. It is installed as shown using an AN100-3 thimble through one of the CS24 brackets. The spring is sewn to the thimble and to the bottom cowl flange with two loops of .041 safety wire. Adjust for a very light snub in the neutral position. The spring is a C-133 type (Century Spring Corp., L.A.). We found it at the local hardware store. You can substitute any spring with a spring rate of about two pounds per inch deflection. Do not substitute a heavy spring like a screen-door type.

Full-size patterns are shown, to be used to make the required brackets. When the brackets are welded to the tubes be sure to align them as shown. Install the Nyloflo conduits as follows: first sand their surface dull for bonding, string them into the airplane as shown. Bond them to the spar and ararest in the rear (flox/5-min); let cure. Pull them tight at the front to straighten them, tape to the side between FS65 and 95 and bond every eight inches with a blob of flox/5-min. Glue the forward block (CS19) to the side, floor, and ararest, potting the formed curve in the tube with alot of 5-min/flox. CS19 is glued in last, so its vertical position can be adjusted to final-adjust cable rigging. With the Nyloflo tubes mounted straight, very little cable friction will exist. Do not use Nyloseal tube.

OWNERS MANUAL ADDITIONS

ADD THE FOLLOWING to page 7 of your owners manual: "small spoilers located on the centersection of the aft wing are used to augment the roll control."

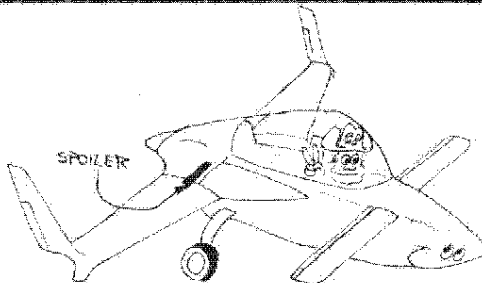
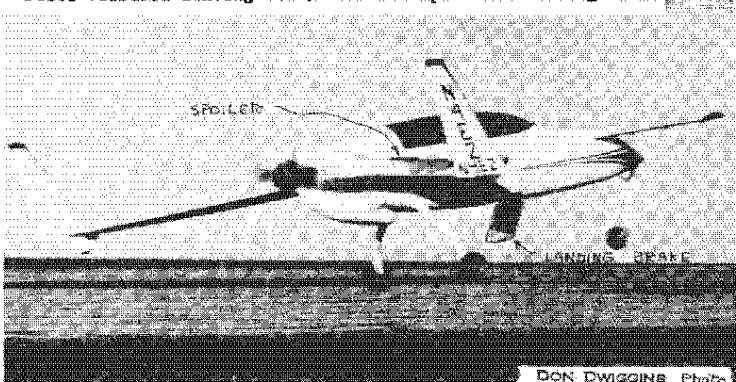
INSERT the following to replacethe landing gear speed data on page 17 of your Owners Manual- "Dont extend gear above 100 kt(115 mph)- at higher speeds the airloads make it hard to extend. Gear can be down or can be retracted at speeds up to 140 kt(163 mph).

ADDITIONAL NEW ITEMS

THE PLANS AND PREVIOUS newsletters indicated that it may be acceptable to use larger tires on the main gear of the VariEze. This may not be so. Cowley's VariEze has experienced a severe fore-aft resonance (vibration fore-aft) of the wheel when taxiing at a medium speed (about 15-20 mph). This may be due in part to a high spot or grabbing of the brake disc (his disc thickness was not uniform), but it may also be caused by resonance excited due to the larger (and heavier tire). This vibration at 20 mph is sometimes evident on N4EZ with the 3,40x3x5 tires but it is only mild and intermittent. It does not occur at higher or lower speeds. CHECK YOUR DISC THICKNESS!

One builder brought in a canard/elevon assembly in which he thought his elevon up-travel was only 21 deg, instead of the required 24 degrees. On closer inspection we found that the trailing edge of his canard was a bit high, making his elevon template read -3 degrees when the elevon was at zero, and thus his elevon travel was adequate (24 deg). If you suspect that your elevon degree template is giving the wrong information, place jig block B, page 5-6 under your canard to line up zero elevon deflection, then check that the elevon degree template reads zero.

Peter Garrison landing N4EZ. Note new spoilers& landing brake

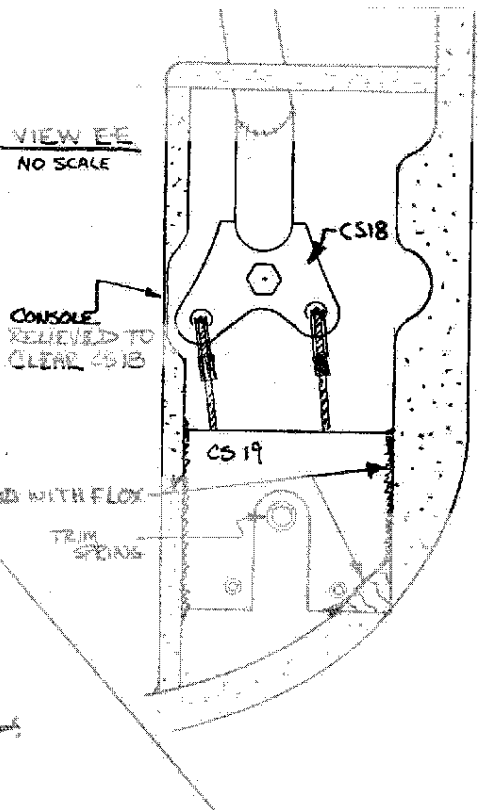
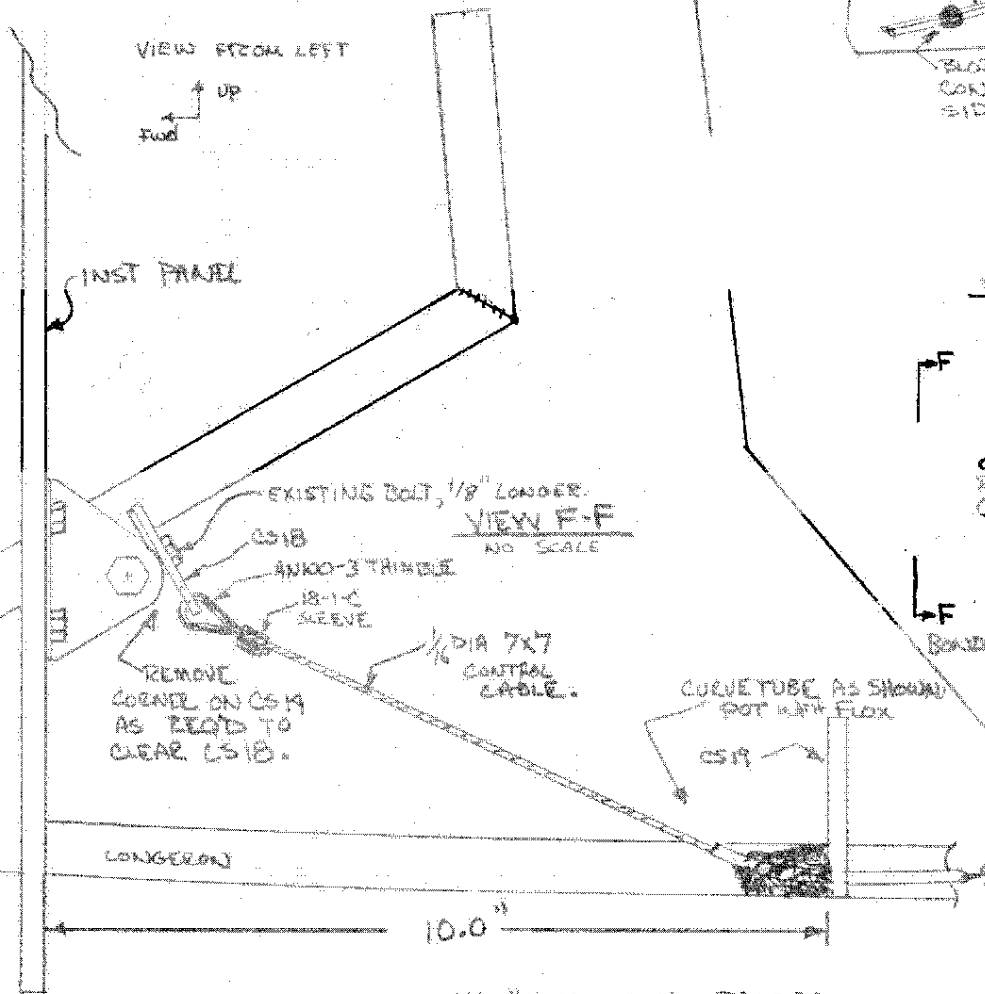
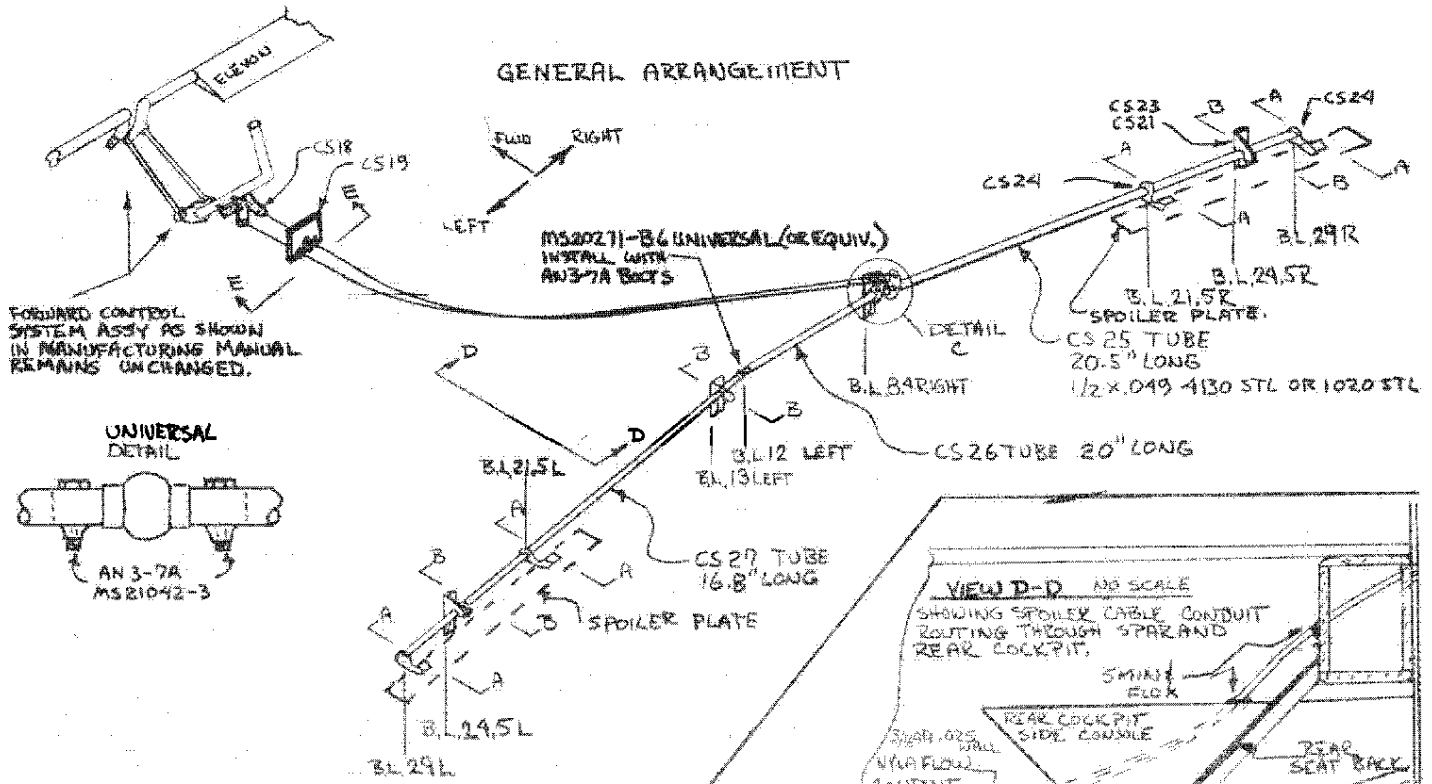


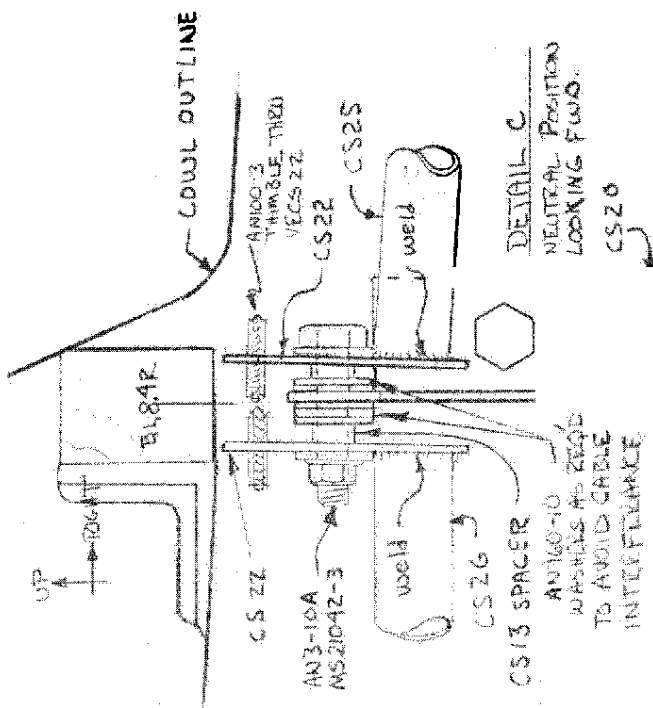
Material List - SPOILER SYSTEM

- 15 ft Nyloflo tube 3/16 O.D. .025 wall
- 16 ft Aircraft Cable 1/16", 7x7
- 7" x 4" .063 2024 T3 alum
- 2" x 2.5" .125 2024 T3 alum
- 2.8" x 2.5" 1/4" birch plywood
- 1 ft 1" x 2" x .063 formed 2024 T3 angle
- 35 sq inches .063 4130 or 1020 steel N
- 5 ea VECS 13 steel spacers .25x.19x.15long
- 1 ea universal MS20271 R6 or equiv.
- 5 ft 1/2 x .049 steel tube 4130 or 1020

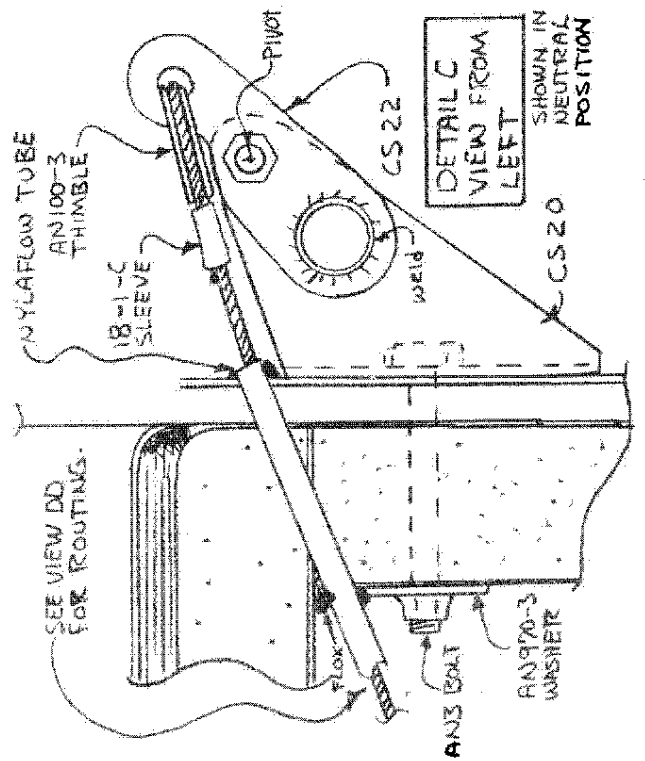
SPOILER SYSTEM

GENERAL ARRANGEMENT

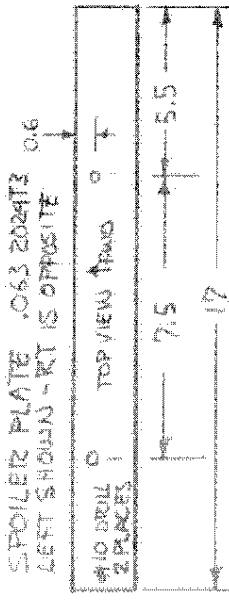
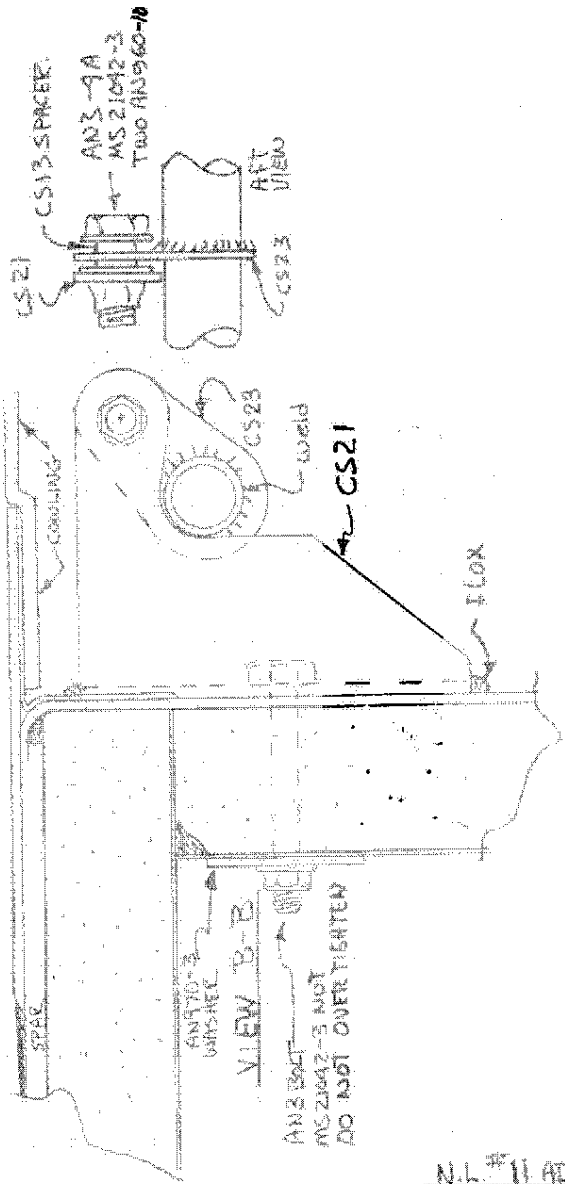




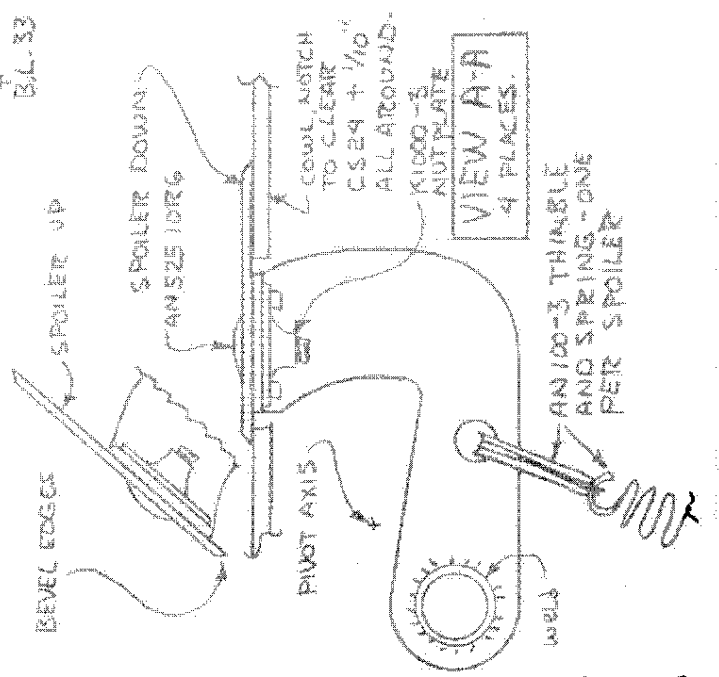
DETAIL C
NEUTRAL POSITION
LOOKING FORWARD
CS20



DETAIL C
VIEW FROM
LEFT
SHOWN IN
NEUTRAL
POSITION

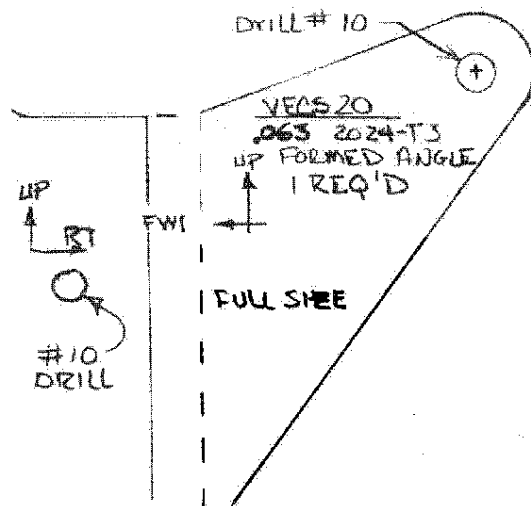
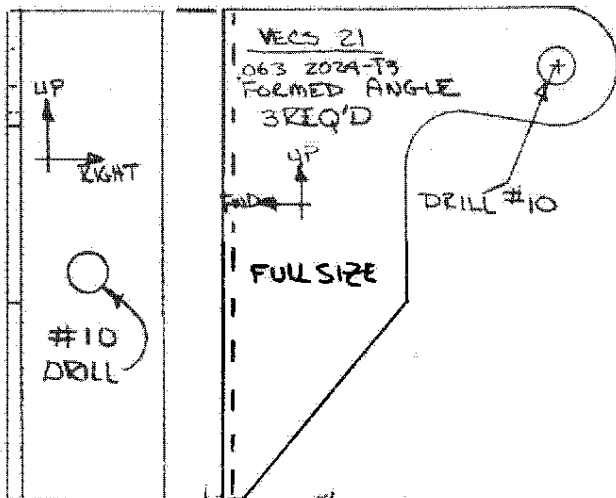
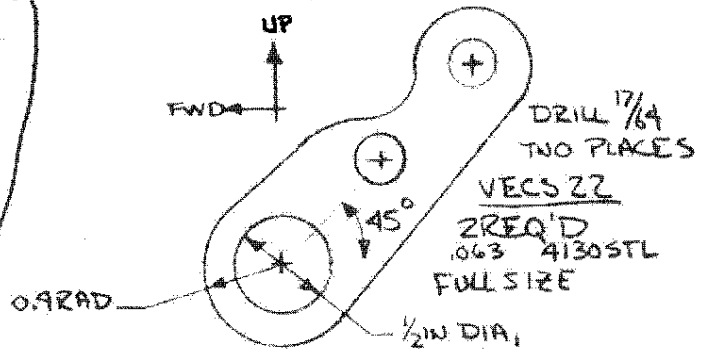
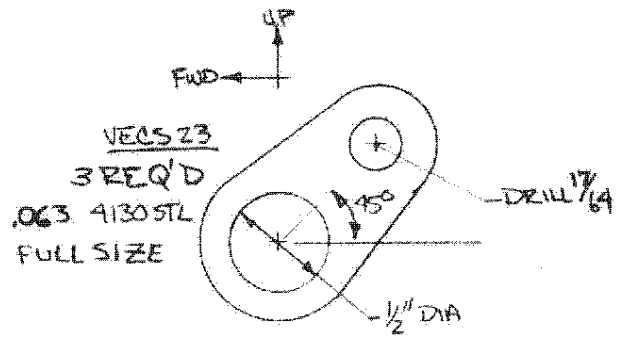
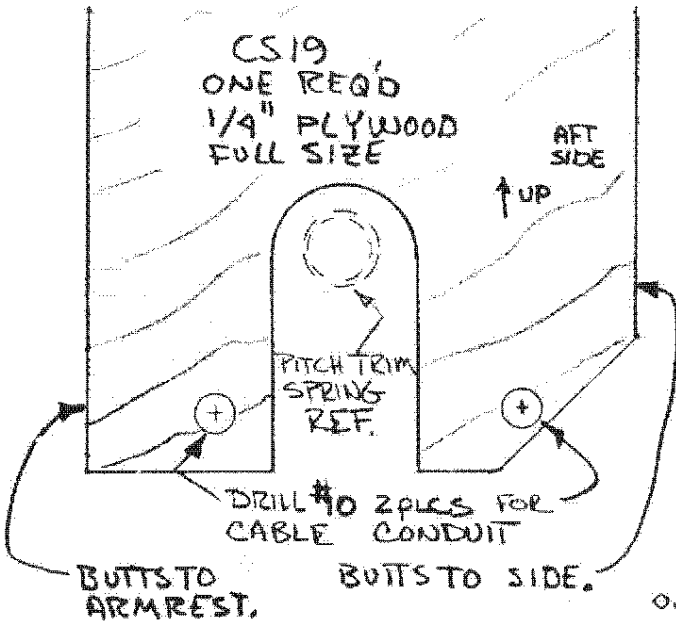
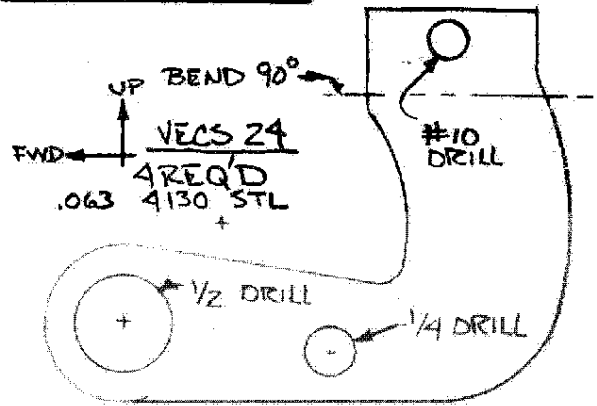
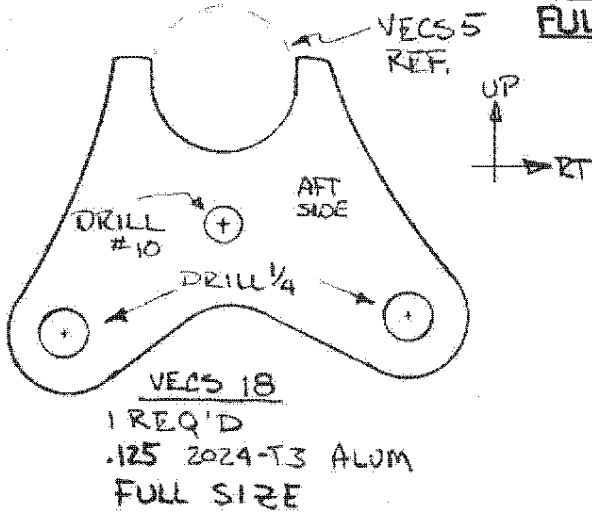


NOTE: SPOILER LAPS ABOUT
1.0" OUT ONTO SURFACE
OF OUTER WING PANEL.



VIEW A-A
4 PLACES.

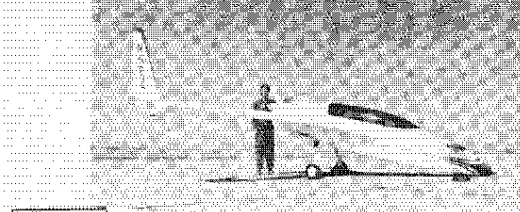
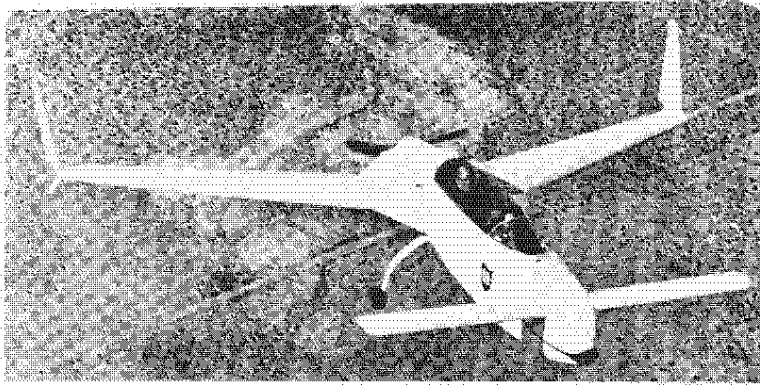
SPOILER SYSTEM PARTS PATTERNS



THANK YOU FOR YOUR INTEREST IN THE

VARI-EZE

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 pre-fab 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, 0-200

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

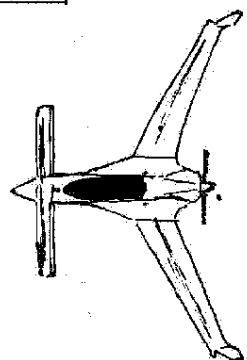
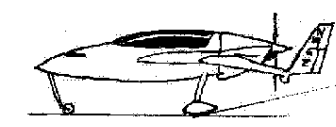
SECTION V - FINISHING THE COMPOSITE AIRCRAFT - Applies not only to a VariEze, but to other epoxy/composite aircraft. Includes filling/contouring/priming/U.V. barrier/color and trim.

Specs & performance with 100-hp Continental, fixed-pitch prop. @ gross weight	Take Off 800 ft Climb 1700 fpm	Range @ Max Cruise 220 mi Range @ Econ Cruise 980 mi	Canard Span/Area 12.51/13ft ² Wing Span/Area 27.21/53.6ft ²
	Max Cruise 200 mph Econ Cruise 165 mph	Min Speed (full aft stick) 49 kt Landing 900 ft	Empty Weight 520 lb Gross Weight 1050 lb

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

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

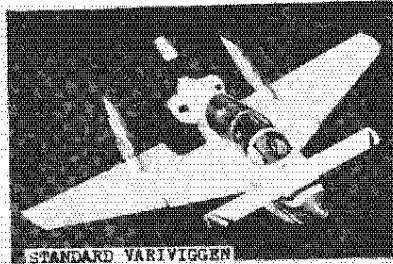
* (U.S. funds only)



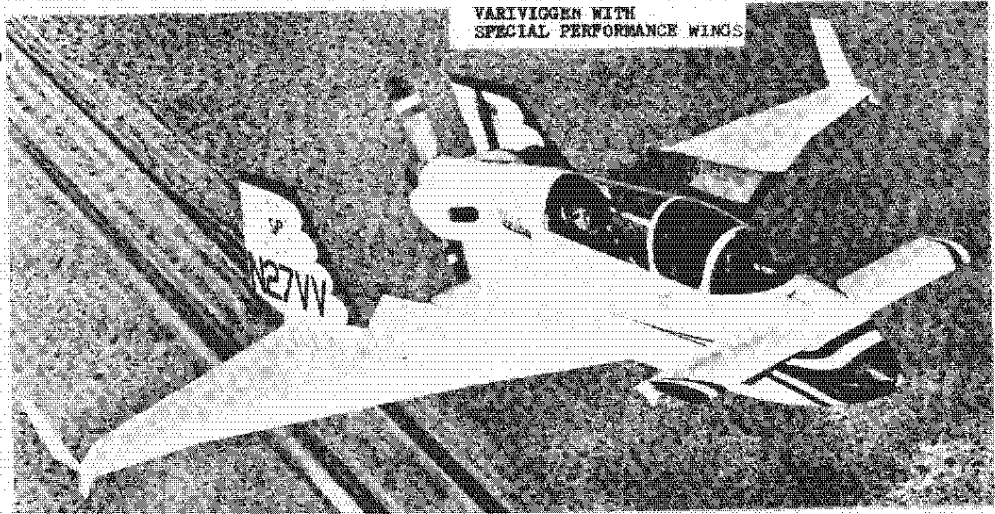
Rutan Aircraft Factory

BUILDING 13, 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



VARIVIGGEN WITH SPECIAL PERFORMANCE WINGS

Performance with 150-hp, fixed-pitch prop, gross weight.	Take off	850 ft	Specifications Standard VariViggen	Canard Span/Area	8 ft/18.3 ft ²
	Climb	800 fpm		Wing Span/Area	19 ft/119 ft ²
	Cruise	150 mph		Empty Weight	950 lb
	Full Aft stick	49 mph		Gross Weight	1700 lb
Standard VariViggen	Landing	500 ft			
Performance with 150-hp. Special Performance Wings	Climb	1000 fpm	Specifications Special Performance Wing	Wing Span/Area	23.7 ft/125 ft ²
	Cruise	158 mph		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 outstanding 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 VariViggen's 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

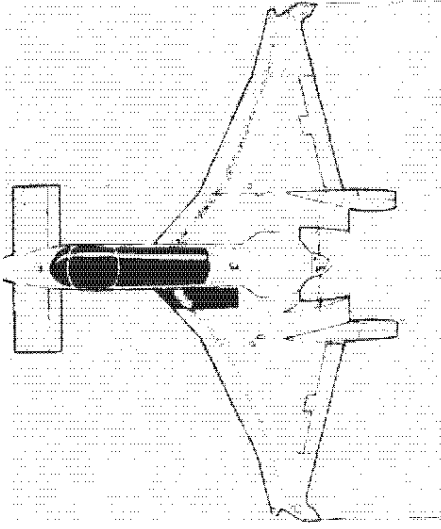
VARIVIGGEN PLANS - NASAD approved in "AA" category. Sixty-one sheets, completely detailed. Also included are builder's handbook information, step-by-step construction guide, complete bill of materials, flight operating limitations, parts lists. Section breakdown: 1. Introduction, 2. Operating Limitations, 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.

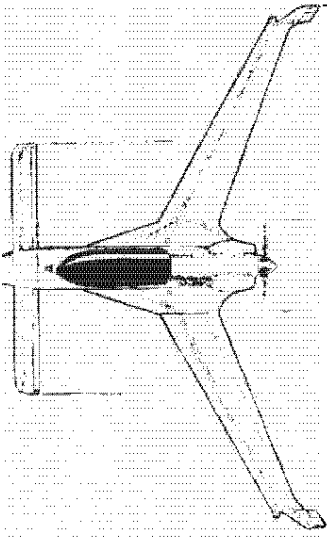
VARIVIGGEN R/C MODEL PLANS - Complete construction plans for the 18"-size radio-controlled model airplane built & flown to evaluate VariViggen spin characteristics. Designed for 4-channel proportional radio equipment & engine in the .35 to .65-cu. inch size, 555-sq inch wing area. All balsa or foam/balsa 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.

**Rutan
 Aircraft
 Factory**

BUILDING 13, MOJAVE AIRPORT
 P. O. BOX 456, MOJAVE, CA 93501
 TELEPHONE (805) 824-2645



When ordering catalogs from Overseas, please add airmail postage.



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 distributor at the address shown for his catalog and description of items. Indicate to him that you are a VariViggen or VariEze builder.

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

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) 838-4366

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.

COMLEY 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 antennae.

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

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.

Contact him for list

GEORGE EVANS
4102 Twining
Riverside, Ca. 92509

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

Contact him for list.

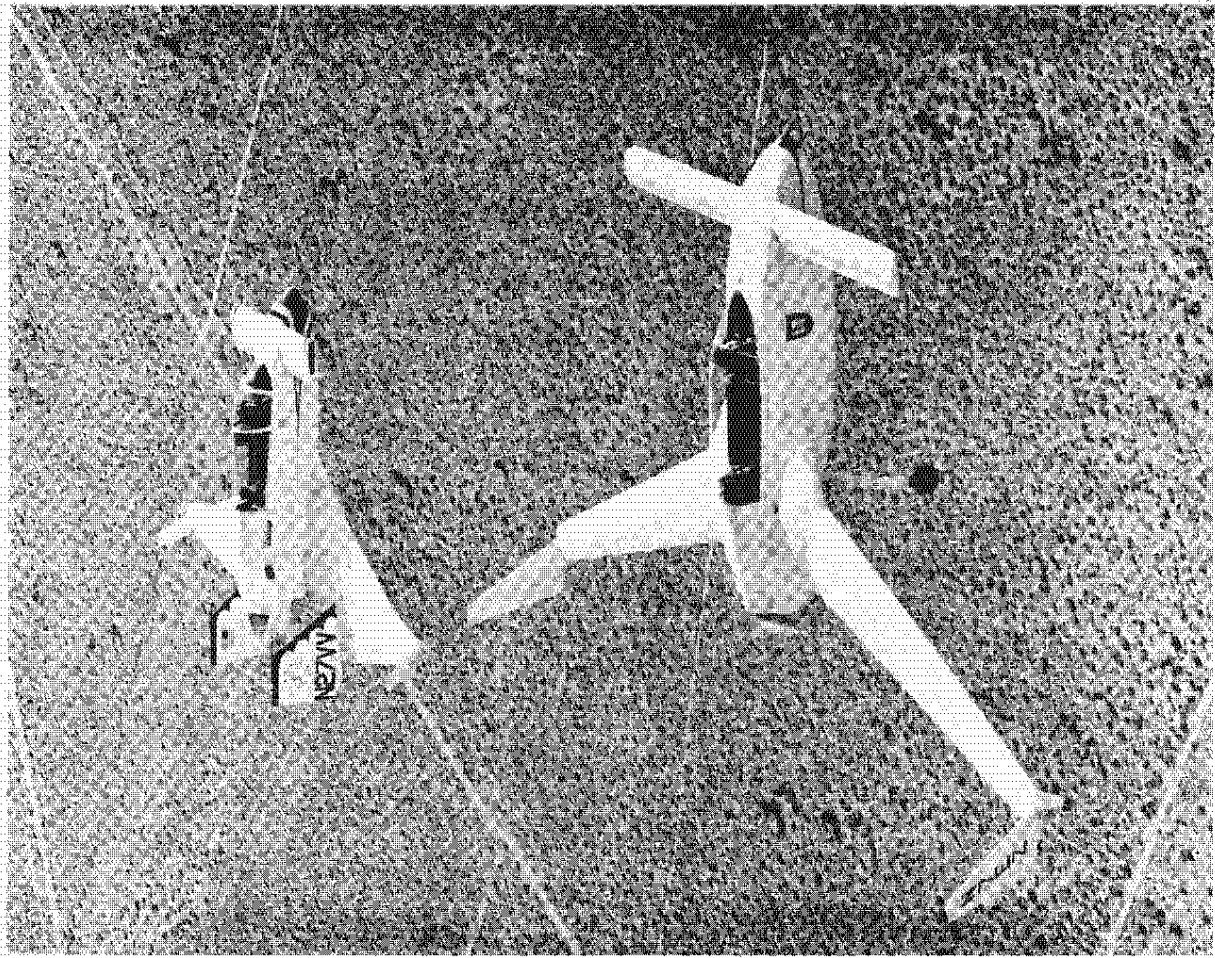
BILL CAMPBELL (VariViggen builder)
Box 253
Phelan, Ca. 92371

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.



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

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TO:

The number which appears on your label before or after your name, is the last newsletter issue which you will receive and requires you to renew to receive the next issue. If your label has a 10 on it, then #10 is your last issue and you need to renew.

PLEASE STATE THAT YOU ARE A RENEWAL!!