THE CANARD PUSHER

NO. 8 APR '76

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

PUBLISHED QUARTERLY BY JAN, APL, JLY, OCT

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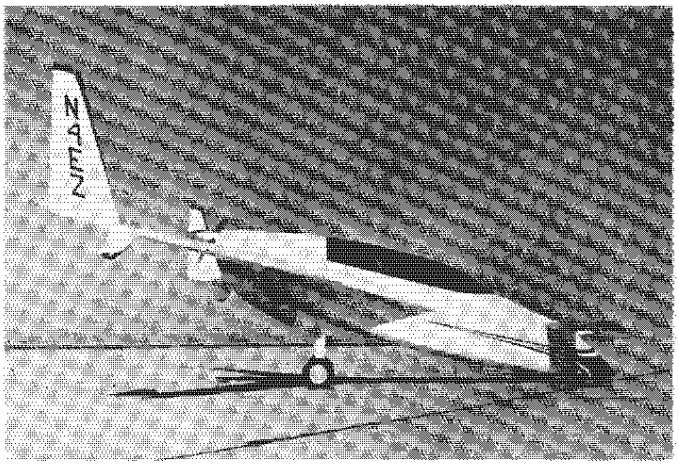
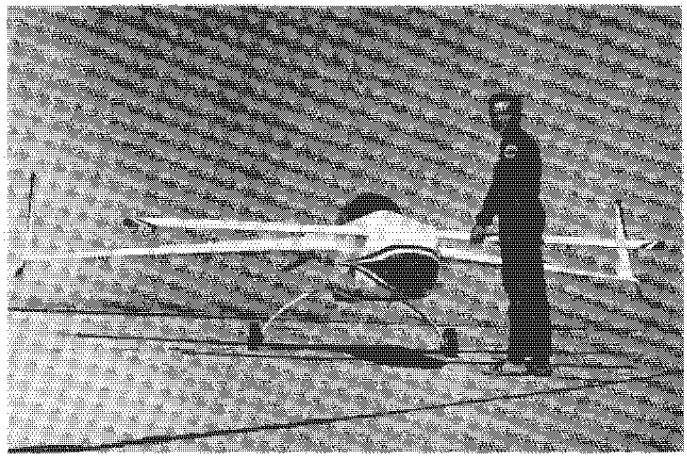
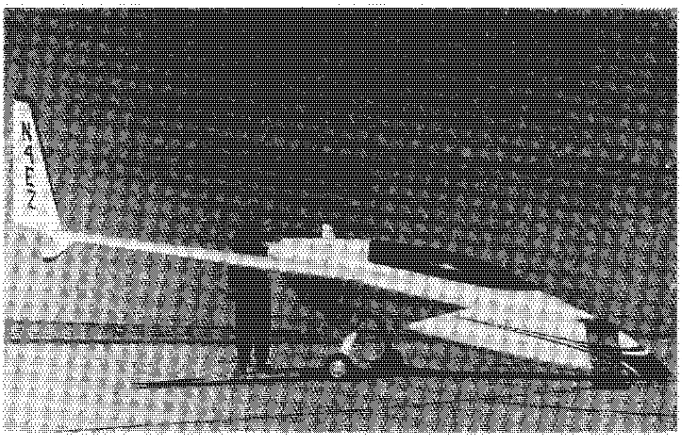


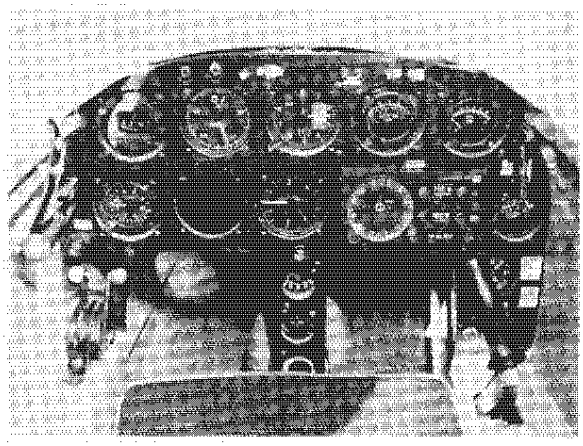
N4EZ with 3rd generation inlet airscoop. Scoop has since been made smaller.



Ground handling is VariEze.



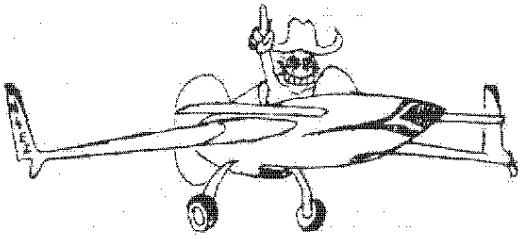
Hand propping is VariEze and requires no chocks or tiedowns. Rubber bumper on nose is better than a chock.



Panel on prototype - see text for other layouts. Note the stick and throttle quadrant - these will be offered as 'ready to bolt in' parts.

RAP ACTIVITY since our January newsletter (no. 7) has been hot and heavy. We've spent considerable time refining our composite construction methods (VariEasier), conducting structural tests, and flight testing the Continental-powered VariEze, N4EZ. In addition to supporting our VariViggen builders and writing the Viggen owners manual, we've been burning the midnight oil releasing VariEze manufactured items and materials for production and working on the Eze plans. Regrettably, we've also spent a full third of our time answering letters and telephone calls from people requesting a personal Eze program update. We know that you folks are excited about the program and we really appreciate the interest, but please save your dime so that we can get the job done! Once we have the plans done, we'll gladly answer all of your questions. Until that time, we must ask you to leave us alone so that we can work. Preparation of the manufacturing manual for the Eze homebuilder is a very big job. It can be completed by late May if we can reduce the interruptions. You are welcome to visit us from noon to 2 P.M. any Saturday for our weekly demo, but don't come during the rest of the week. We cannot show you the airplanes during the week.

In the last few weeks during the Saturday afternoon demos, we have been giving composite construction demonstrations. We will continue these construction demos to give our Saturday afternoon visitors a first-hand look at the methods used in VariEze construction. Flight demonstrations will not always be given on the Saturday demos since we plan to take the VariEze and VariViggen to several flyins this summer, including Corona, Watsonville, and Oshkosh. We will plan to have a construction demo set up though for any Saturday visitors.



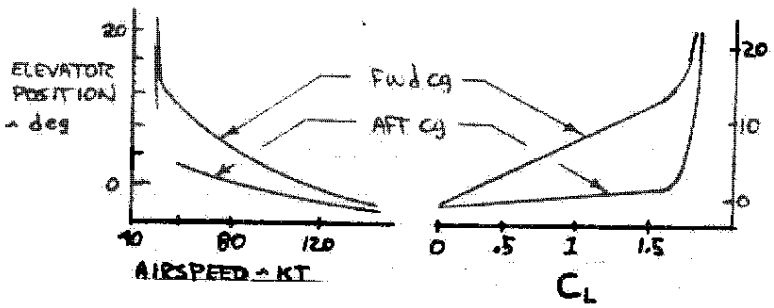
VARIEZE DEVELOPMENT FLIGHT TESTS - The prototype for the homebuilt program (N4EZ) made its first flight on March 15. As of this writing (15 April) it has logged 35 flight hours. The test program has progressed very well to date, the aircraft being in flight-ready status essentially all the time. There have been a number of changes required as a result of the tests. These are all covered in the following:

Flying Qualities - The aircraft initially had poor harmony between the pitch and roll forces - pitch too light and roll too heavy. We made two gearing changes in the control system (different length arms) to tailor the forces to what is now considered optimum. Pitch forces are now about three to four lb per g, which is just about right for a side stick control. Roll rate without rudder is slower than the average light plane, but when co-ordinated with rudder, the roll rate is more than adequate at all speeds.

Hands-off stability is better than the average light plane. Trimmed up, it will hold altitude and heading, even in turbulence, without touching the controls. I recently flew a 3-1/2 hour flight, while touching the controls only for about 10 minutes - take off and landing. Turns were made by leaning in the cockpit and the aircraft held altitude between 10,500 and 11,000 feet for three hours.

Dynamic damping is dead beat in pitch and roll and one-overshoot in yaw at all speeds. The phugoid damps in one cycle, which is quite good for a clean, fast aircraft. There is no pitch or yaw trim change due to power changes. There is a roll trim change, and we have verified this to be due to direct engine torque, not aerodynamic effects. It was not significant on the VW powered aircraft, since the torque is low on the 60-hp, high rpm engine. The difference of roll trim from full power climb to idle descent is enought to be a nuisance, so we added roll trim to the aircraft. This is a small tab (1½"x10") at the wing tip, actuated by a model airplane servo. This "separate surface" trim is preferable to elevon trim since it does not effect elevon authority and is a handy inflight adjustment for any wing twist tolerances.

Stalls in the VariEze can best be described as 'boring.' The design of the two wings are such that the aircraft is self-limiting to about 14-deg angle of attack. The technical reasons for this are beyond the scope of this discussion, but the result to the pilot is as shown in the accompanying graph. A normal relationship of elevator position required to hold airspeed (or C_L) exists up to about 12 degrees angle of attack, which corresponds to about 52 knots or C_L=1.5. This is also about the angle of attack of maximum C_L of the canard surface. As the stick is brought further aft from the 52-knot position, the pilot notes four things: 1. It takes alot more stick motion to get just a little slower speed and full aft stick is reached in a nice stable flight condition at 48 knots (C_L=1.66). 2. There is an occasional mild pitch bucking motion below 50 knots, but no g-break, yaw, nor roll motions. 3. Power required to fly level is not greatly increased (I was climbing at 14,000 ft, 48 kt, and 1/3 throttle!). 4. Roll control with the ailerons begins to degrade below 52 knots, however the airplane is VariEze to fly with the rudders at any speed, including full aft stick (48 kt). At 48 kt the airplane cannot be rolled with the elevons (somewhat like a Cub near stall).



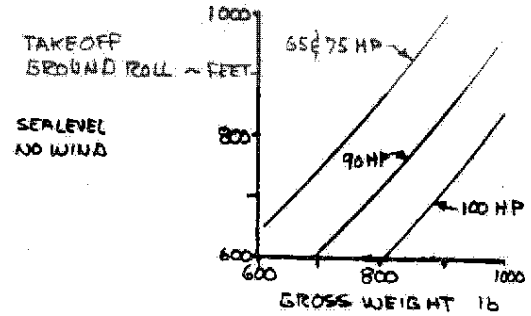
Tuft tests show excellent attached flow on the vertical fins at all speeds, and some trailing edge local turbulence near the wing tips and canard below 50 knots.

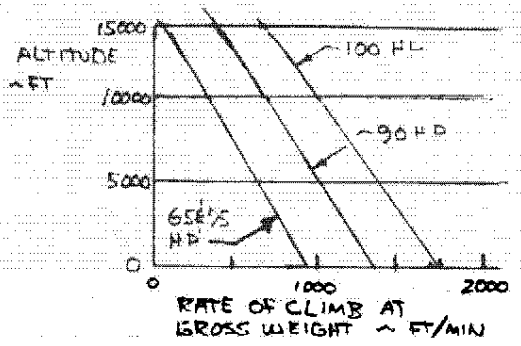
Accelerated stalls are similar. We don't know yet if the VariEze will spin, but we do know an even more important fact: it is much less susceptible to inadvertent spins than the common light plane.

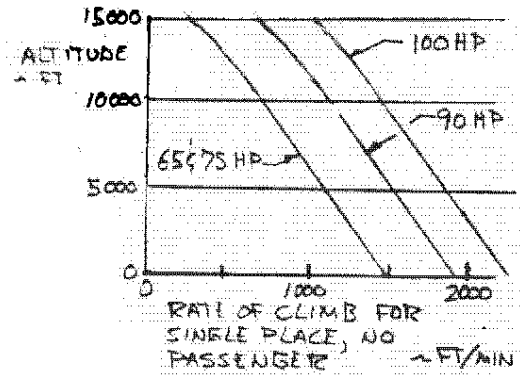
The independent rudders move a total of about 50 degrees which makes them effective as speed brakes. If you're high on final approach, the rudders can be extended to add about 200-ft-per-minute rate of sink.

The overall flying qualities can best be described as "comfortable." Certainly not aerobatic, due to the low roll rate, but excellent for its primary mission: travel from point A to point B with little fuel used, and at a high cruise speed.

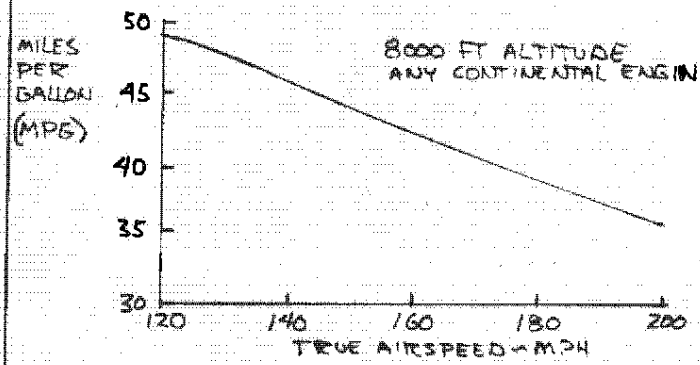
Performance - The following performance data are from flight tests with N4EZ. They are based on a plans-built aircraft with wheel pants. All data are for a fixed-pitch cruise prop except for the 65-hp engine - we are recommending a climb prop for the 65-hp installation to improve takeoff performance, at a 10-kt cruise penalty - this is why the 65-hp takeoff and climb performance is the same as the 75-hp data.







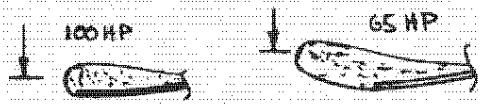
ENGINE BHP	65	75	85	90	100
MAX SPEED @ SL ~MPH/KT	170/148	188/163	198/172	204/177	212/184
CRUISE SPEED 75% PWR 7000 FT ~MPH/KT	158/137	178/155	188/163	192/167	201/175



Fuel tanks hold 24 gal. To obtain range, multiply mpg by 20 - this gives allowance for climb and unusable fuel.

MISC VARIEZE DEVELOPMENT ITEMS

Cooling - N4EZ overheated on its first flight. The original cowl inlet was designed more for low cost production than for pressure recovery. We instrumented the high and low pressure plenums and built a large, ugly scoop for the bottom. This gave more than adequate cooling, but resulted in a five-kt drag penalty. We then built the 55 square inch inlet shown on the pictures in this newsletter. It gave a 3-kt speed increase and still cooled as well. Since the pictures were taken we have reduced the inlet to about 42 square inches and have found this to be optimum for the 100-hp engine. Cruise temperatures are oil=170° F, cylinder head=360° F, both well in the green. Concerning the inlet, different inlet areas will be required for the different hp engines. To keep the cowling price low, we plan to offer the basic shape and have the homebuilder build up a foam/glass lip as shown, to

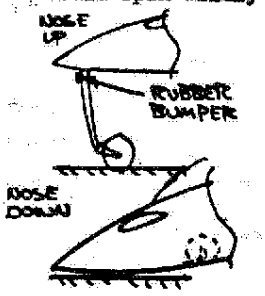


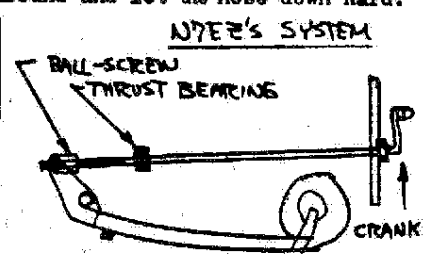
match his engine size. We now also know that the outlet area is too large and that some more performance can be gained by a better cowl/spinner fit. However, we feel that it is much more important to get the plans out first, rather than spending the next two weeks going after four more knots speed. Therefore, we are not going to change the outlet until after the plans are out. This means that the cowlings will not be available until about two months after the plans are out. This will assure you of an optimum cowl, without us delaying the plans.

Engine Installation - All aspects of the Continental engine installation have worked out excellent. The simple homebuilt carb heat box is mounted on the airframe, free from engine vibration. It mounts on an automotive-type air filter which is much more effective than the average aircraft filter. Induction system losses and mixture distribution is equal to the best systems we've seen. The carb heat muff is a very simple two-piece, easily built part that provides a 90° F temperature rise using only the left exhaust system. This leaves the right side available for a simple cabin heat system. However, as long as the aircraft is flown day-VFR, a heater is not required - the canopy traps radiant heat that is held by the foam-insulated fuselage structure. We are using a low cost exhaust system with a homemade glass-pack muffler. The lightweight muffler removes most of the engine noise, the remaining noise being mostly from the propeller. The VariEze cockpit noise level at cruise is about like a late model Cessna, allowing conversation at a normal voice level. Absolutely no indication of any problem has been seen with the pusher thrust bearing, using the tractor engine (see newsletter 7). Crank end play shows no wear and case temperatures are normal.

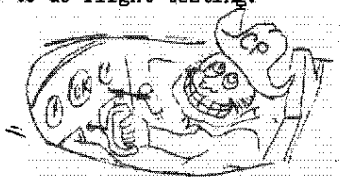
Pitch Trim - Pitch trim initially was done by a handle that operated a spring, connected to the stick. After we changed the pitch gearing, the trim loads were increased such that it was difficult to precisely trim the aircraft. We then changed the handle to a 1.5-diameter knob that the pilot turns for pitch trim. The result is a precise trim system that has fewer parts and is easier to build. The obsolete handle is in the panel photo in this newsletter (Pg 1).

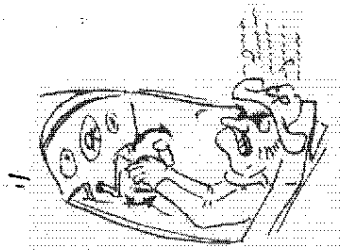
Nose Gear Retraction - An important design feature of the VariEze is its retractable nose gear with capability powerful enough to raise and lower the nose on the ground with the pilot and passenger aboard. This allows the aircraft to be parked in a very stable attitude on the ground, "chocked" for starting the engine and allowing easy pilot entry and exit without a ladder. Development of this feature, however, has been a very difficult and frustrating experience. N7EZ had a simple-concept system as shown in the sketch, using a recirculating-ball screw assembly to provide low friction. The system allowed the pilot to crank himself and a passenger up and down, (33 turns) but if he let go of the handle in the process, it would spin wildly around and let the nose down hard.





I didn't like the system, primarily because the ball screw assembly was expensive. We used the same concept on N4EZ, but replaced the ball screw with a lower cost Acme screw threaded rod, hoping that the extra friction would solve the spin problem. We found that even with a 45-turn gearing, the system would bind up under load, requiring a heavy two-handed effort to crank the nose up with the pilot in. We installed an electric auto window motor which works okey, but takes 35 seconds for gear retraction, requires an electric system in the airplane, and costs over $50 just for the motor. This, of course, was not the most satisfactory approach. Sometimes it is best to back off and look at the forest instead of the trees - I did, and realized the basic problem was that the hand is very inefficient in turning a small crank with the arm in line with its axis of rotation. The most efficient manual capability is an aft pull of the arm, using the bicep muscle. We found a low cost jack-type mechanism that can be installed and easily rigged to allow gear extension/retraction with 10 pulls of a D-ring handle mounted on the instrument panel. This should allow a much faster, easier to build, much lower cost gear transit system. We are now installing this system on the VW-powered prototype, N7EZ, for testing. Incorporating this change will, of course, cause some delay but that's what our type of business is about. If we knew exactly how everything would work, we wouldn't even have to do flight testing!



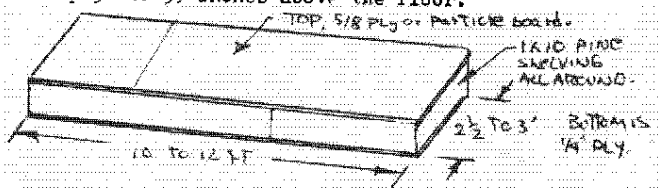


Static Test Wing - Our static load test wing is completed and will undergo proof-load tests soon. After proof load testing the wing will be given to another organization for fatigue testing. The glass layups on this wing were done by an aviation writer who had no previous fiberglass experience. He was curious if he could do the work and we wanted a first-hand look at how well a beginner followed our wing plans. His work looked fine to us and he was pleased with the ease of construction.

VARIEZE WORK AREA AND TOOLS

Shop Size - Of course, a nice roomy 20'x30' work shop is ideal, but a VariEze can be built in an area as small as a single-car garage (10'x18'). The new epoxies used are less toxic and have less odor than contemporary ones, but we still strongly recommend a well ventilated work area. If you are considering a stuffy basement, rig up a small ventilation fan to move out fumes during the glass layups. The temperature of the shop must be maintained between 60 degrees and 90 degrees F during the glass work, 75 ±5 degrees being ideal.

Table to Jig Wings and Canard - This is any relatively flat surface at least 10 ft long x 2 ft wide. Any larger than 4 ft by 12 ft will just get in the way. The sketch shows the one we built and it works fine. The box design makes it stiff in torsion. Don't get carried away with surface finish: you will be gluing jig blocks to it with Bondo and chiseling them off several times. Set it up with the top 34 to 39 inches above the floor.



Tools - There are certain tools required to build a VariEze. Three lists are provided here. The first one is the absolute minimum required, sacrificing efficiency; the second is a recommended list for a good compromise of cost and work efficiency; the third is a list for the "Cadillac" of shops, where ease of construction is more important than money. Don't call us now asking how to find the odd-ball items. These will be available where you buy VariEze raw materials.

1. Basic Minimum: Common household butcher knife, coping saw, pliers, 1/4" drive socket set, set of small open end wrenches, 1" putty knife, hacksaw, screwdrivers, box of single-edge razor blades, 24" carpenters level, carpenters square, 3-ft straightedge, 12-ft steel tape, 1/4" drill, roll of grey duct tape, box of 1" and 2" paint brushes, several 6" plastic squeegees, scissors, wire brush, pop rivet puller.

2. Recommended (in addition to #1): Dremel-type miniature high speed hand grinder (set no. 261 is okey), 1" and 1/2" chisels, small set of X-acto knives and razor saw, stipple roller, 100-deg. countersink, 6" steel ruler, 6" to 9" disc-type hand sander, saber saw, Stanley surform plane, square and half-round files, several 6" C-clamps, vacuum cleaner.

3. First class shop (in addition to #2): Drill press, bench mounted belt sander, 18-inch band saw, epoxy ratio pump, 90° drill adapter, air compressor with blow nozzle.

4. Items used only occasionally and can be borrowed: Nicopress sleeve swage tool, 12-volt battery charger for hot wire cutter, one dozen 1/8" clecos.

VARIEZE MATERIALS - It still looks like the materials cost (less engine) for the Eze will be about $1300 for those willing to build everything. If you buy all prefab parts that will be available (landing gear, axels, engine mount, rudder pedals, stick assembly, elevon pivots, wing attach fittings, fuel caps, canopy, cowling, etc.) the cost, including all raw materials and instruments, should be about $2600. You can pick any number between these values, depending on how much you want to build.

Our distributors are already stocking most of the items. The manufacturers have already built several hundred of many of the prefab parts. We expect that all raw materials, tools and prefab parts (except cowling) will be available in quantity when we release plans. We will identify all distributors in newletter 9 and in the plans.

VARIEZE PLANS - We really don't like to call them plans - a better description would be manufacturing manual. They include a 30-page educational section that gives you a very complete introduction to the materials and detailed methods used to build the VariEze. The plans themselves are not just engineering drawings, but a very complete step-by-step manual showing each operation required. If you're curious about the format, find one of your wife's Simplicity dress patterns and look at the instruction sheet that comes with the pattern. We have found that this format of words, photos, and sketches, to supplement the normal drawings, is a very effective approach. Each major job is detailed and in each step you are told how many man-hours should be required.

The basic plans will consist of about 150, 11"x17" sheets, plus some larger full-size drawings. The plans will be offerred in several sections:

Section I - Composite structures education, construction manual and drawings on entire aircraft except engine installation and optional electric/avionics systems.

Section IIA - Continental Engine installation. Complete instructions and drawings for 65 to 100-hp Continental engine installation: baffling, fuel system, mounting, exhaust system, carb heat system, engine instrumentation, cowling installation, propeller and spinner and engine operating specifications.

Section IIB - Same as IIA except for aircraft conversion of the Volkswagen engine.

Section IIC - Same as IIA except for alternate engine.

Section III - Electrical/avionics: drawings, specifications and installation instructions for optional electrical system, night lighting systems, avionics and antennaes, and instrumentation associated with electrical system.

Section IV - Owners manual; flight and maintenance manual for the VariEze similar to the VariViggen owners manual. Includes normal and emergency procedures, loading graphs, operation checklists, detailed flying qualifies descriptions, performance charts, maiden flight test procedures, pilot checkout procedures, maintenance checklists and a record keeping section.

So, if you want to build a basic VFR VariEze with a Continental A-75, and without electrical system, you will need sections I and IIA and then section IV before your aircraft is ready to fly. If you insist on loading your aircraft up with avionics and lighting, you can get section III. Section IIB should be available as soon as the VW engine installation is completely proven out, possibly within three months after section I is released. If you want to use a VW conversion, you can get section I, start building your aircraft and then get section IIB when its ready. Section IIC is being pursued now, because it is obvious that the supply of used 4-cylinder Continental engines will be quite short within about two years. As these engines start getting scarce it will be important to have an alternate engine to keep the VariEze program alive. There are actually four different engines now being considered, all in the 80 to 90 hp range, light weight, and relatively low cost. These are being developed by other organizations; RAF does not plan to undertake engine development. But, don't get excited about getting these real soon. Aircraft engine development is a very big and expensive job and, while I have every hope of getting an alternate engine soon, I think it will be about a year until one of these "new" engines proves adequate. Do not contact us to consider any engine you may have in mind, unless it has at least 800 hours of reliable flying time.

Now for the big question - when will the plans be ready?? They are now more than half written and layed out. We have been, and will be, working days, evenings and weekends on the plans. We think they well be done in late May. The new nose gear extension system may delay this, but we don't think by much. Due to our policy of not selling anything we don't have, we cannot let you order plans at this time. We do have a plan to notify all subscribers of "The Canard Pusher" when they are available: as soon as we take sections I and IIA of the VariEze plans to the printers for printing and binding, we will immediately write newsletter 9, in it giving all information for ordering the plans. Thus, "Canard Pusher" no. 9 may be published in early June, giving you firsthand notice of plans availability. So, please do not call or write asking when they will be available; we will notify you as they go to the printers.

Initially, we do not plan a large promotional campaign to advertise VariEze plans. We want to wait until a few months after the plans are on the market to be sure the distributors are keeping up with demand on the raw materials and prefab parts. Our announcement of plans availability in newsletter 9 and in "Sport Aviation" is our only planned initial promotion.

CONSTRUCTION SEMINARS/AIRSHOWS - Due to the uncertainty of exactly when the plans will be finished, we cannot schedule specific seminars now. Newsletter 9 will announce any seminars we can schedule by then. We do plan a daily construction demonstration in the synthetics workshop at the Oshkosh, Wisconsin EAA convention. VariEze forums at Oshkosh this year have been scheduled for Monday, August 2 and Thursday, August 5. A VariViggen forum will be Wednesday, August 4. We plan to have the VariEze and VariViggen at the Corona, Ca. (1 & 2 May) and Watsonville, Ca. (29 & 30 May) flying.

VARIEZE QUESTIONS

ATC Radar - I'm not sure why, but the VariEze is picked up on Air Traffic Control's radar similar to light planes built from metal.

Ultra Violet Protection - While glass needs no protection, the epoxy and foams do require an UV barrier to protect against long term degradation in sunlight. A UV barrier is sprayed on before final color paint. All finishing materials required and methods to get that "competition sailplane" contoured finish we put on our airplanes, will be published in a booklet "Finishing the Composite Homebuilt Airplane." This booklet will be available this summer - it is applicable to any aircraft with an epoxy/fabric exterior.

Very Low Temperatures - Several people have asked how the structure withstands the low ambient temperatures common to the North. I think this concern stems from thermal stress failures that have occurred on another homebuilt that has a relatively weak surface skin and a highly insulated main spar. The VariEze structure bears no resemblance to that structure - spar caps and skin being at the surface minimizes thermal stress. The glass/epoxy matrix actually has improved physical properties at low temperatures. These same materials are used in structural areas of military aircraft whose high altitude envelopes requires them to be qualified to below minus 70 deg. F.

Instrument Panel Room - The accompanying sketch shows three different instrument panel layouts. The first one is what we recommend for the VariEze - a low cost, lightweight panel for high performance day VFR utility. A com radio is needed to get any cross-country utility now days, but the rest is bare bones, giving more leg room. The other two layouts show the capability to stuff different type equipment in, for those who like to gaze at clocks.

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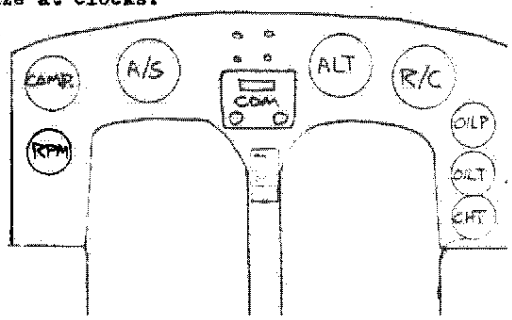

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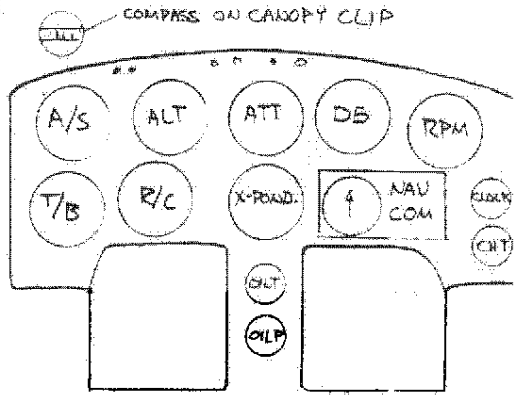

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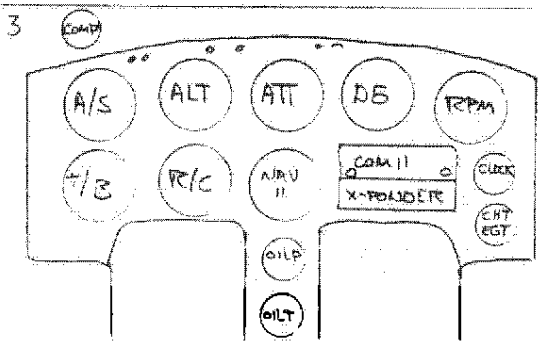


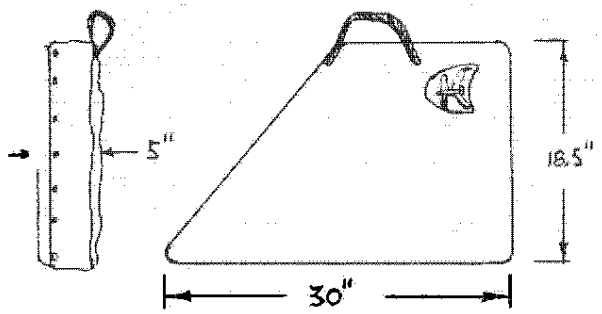
Closure Inspections - When does FAA inspect the structure? The glass is applied over a solid foam core - thus there is nothing to inspect before skinning. All joints and all structure is inspectable from the outside, and must be done after the structure is built but before it is painted. You will be given specific inspection criteria in the plans. In addition, since not every FAA inspector is familiar with composite structures, we plan to supply recommended inspection criteria to all FAA regional offices and to the foreign agencies.

Suitcase Size: Two suitcases, size as in sketch, fit into the back seat area on the sides up against the front seat. When empty, they take up little room. When full, they take up some of the lateral (sideways) leg room of the back seater. These suitcases will be available in completed form from VariEze distributors. In addition the Eze has two map cases (under front seat thigh support and in roll-over structure) and baggage areas behind the rear seat and in the center section spar.

Prop Sizes - We have tested four different propellers, including a three-blade. We plan to test at least two more before we finalize the prop specification.

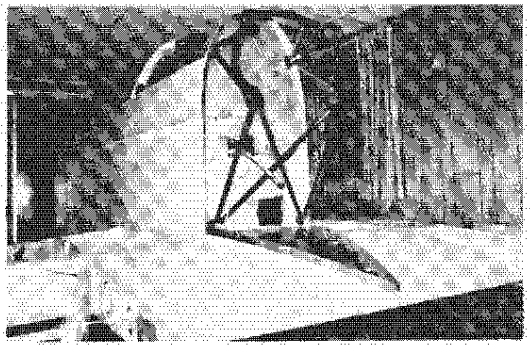
80-Octane Gas Availability - Continental engines offer a conversion to all the 65 to 100-hp engines that allow continuous use of 100 octane low lead gas. This kit can be installed at top overhaul.

Foreign Country Homebuilt Approval - We have received requests for assistance from New Zealand, Australia, Canada, and England to provide the engineering documentation required to gain approval for amateur building. We intend to supply all these requests for stress data and static test documentation, but we must wait until after the plans are out.



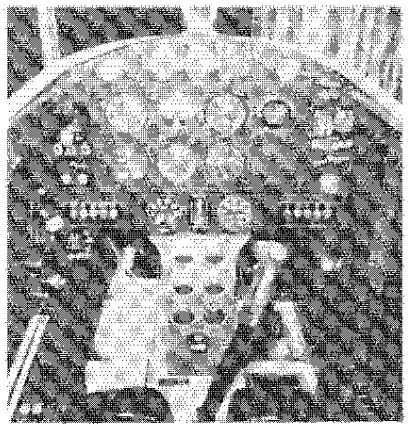
Other Questions?? Each newsletter we try to answer the questions sent to us which have not been answered in previous newsletters or the information kit. If your question needs and deserves an immediate reply, please include a self-addressed stamped envelope.

VARIVIGGEN PROJECT REPORTS - Only three projects reported since January. Let's hear from the rest of you!

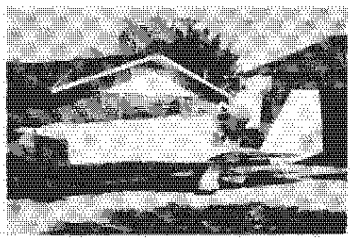


Mike Melvill's mount & firewall. Note the cabin heat control box at the bottom.

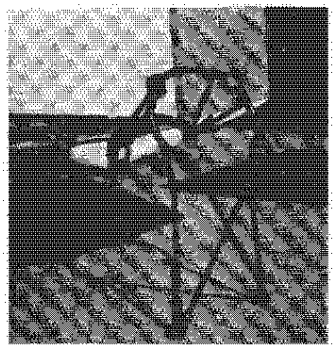
Jike Melvill's, SN 115, 1st class cockpit! Note engine instruments in lower center, radios at right console. Any fighter pilot should feel right at home!



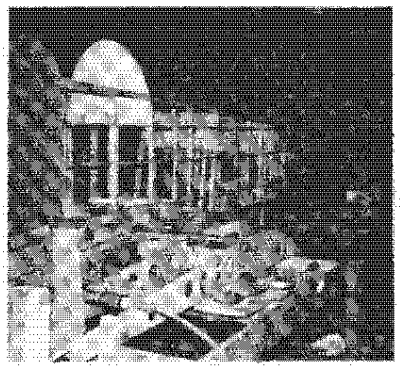
This VariViggen being built near Toulouse, France will be powered by two Microturbo jet engines (200-lb thrust each). It is being built in co-operation with the engine manufacturer as a flight test article for engine development. Expected take off and climb will be similar to a 150-hp VariViggen. Cruise should be about 190 mph; range, only 250 miles on 50 gallons!



N31VV, by Jim Cavis, SN31; All work done except canopy and outer wings.



Glass/foam composite rudder and engine mount on Jim Cavis's VariViggen. The dynafocal mount is available for $180 from Starfire Aviation, 4225 S. 37th, Phoenix, Az. 85006.

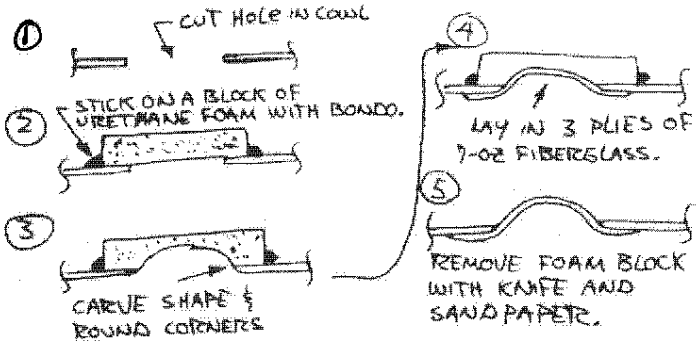


Membership in the Experimental Aircraft Association is $20.00 annually which includes 12 issues of SPORT AVIATION.

Experimental Aircraft Association
P. O. Box 229
Hales Corners, WI 53130

VARIVIGGEN BUILDER TIPS

Those of you with dynafocal mounts may find an interference with the cowling at the mount point. The following method is an easy way to put a streamlined "blister" on the cowl anywhere you need more room.



Tension on the aileron control cables should not be real tight. Proper tension is only 10 to 15 lb. Adjust the turnbuckles to take out the slack, then tighten about two turns for a light snub - exact tension is not critical.

You may want to carve the center notch on F20 up higher than shown on the plans to allow the nose gear to go further up and hold more securely in the up position.

The Gougeon Brothers brochure recommends three coats of epoxy to protect wood surfaces. This is for boats! Three coats are too heavy for your airplane. Paint one full coat to interior surfaces. Finish the exterior as shown in newsletter 6.

We understand from Jim Saunders, SN 396, that some manufacturers of wood props are hesitant to build a wood prop for a 180-hp Lycoming unless the builder supplies a spacer to provide a larger bolt radius for the prop. While it is completely satisfactory for the 150-hp Lycoming, they are concerned about the bearing strength of the wood on the short lugs used on the 180-hp engines. This may or may not be a problem. If anyone knows of any problems with a 180-hp wood prop, let us know. Actually, the primary torque-transmitting surface is friction between the flange face and the prop face. If you don't believe this, run your engine with loose bolts so all the torque is on the lugs - they will fail within a few minutes running. Just kidding, of course, about doing this - Never run an engine unless you're sure the bolts are properly torqued. After installing a new prop, retorque after the first run and each 10 hours until it sets in well. Recheck torque each 100 hours. Proper torque for a prop (with a hub depth of 4" and 3/8" bolts) is obtained after the bolts take out all slack and are then turned one more full turn. This provides the correct percentage squash of the hub. If you're using a 180 HP engine, contact your prop manufacturer about prop installation.

VARIVIGGEN PLANS CHANGES

Plans page 11 and construction manual page 10 - Install F3 before F5.

VARIVIGGEN SPECIAL PERFORMANCE WING

The VariViggen owners manual gives a detailed discussion of the performance and flying qualities differences between the standard and SP wings. If you can't decide which wing you want to use, check your owners manual.

Jim Cavis is building the standard shape wings with the glass/foam composite SP structural method. RAF is working with Jim on the design details of this modification and on sizing winglets for the standard wing. The results will be passed along in following newsletters or the 2nd half of the construction manual. Jim has finished the glass/foam rudders. His report: "Construction was done in two days, mostly waiting for one side to cure so the other could be skinned. I really had fun with the new method of yours - put me on the list for some EZ plans!"

BUILDING TIPS FOR THE SP WINGS

The best way to leak-check your fuel tanks is to plug the vent and hook a standard altimeter to the feed line. Suck or blow a 3000-ft pressure difference and check that it can hold pressure for 24 hours. Do this before cutting the tank cap hole.

The two yellow sheets of the SP plans are printed on card stock paper. This is so they can be tacked to your shop wall for easy reference for the glassing methods. We feel the stippling action (step 6 on the yellow sheets) needs more emphasis since, on a given layup, about 1/2 of the time is spent stippling. Add the following words: Where multiple plies are required, the first plies may be layed up overly wet and the excess resin brought up by squeegeeing and stippling to help wet out the middle plies. The final plies are ambitiously stippled instead of adding alot of resin. "When in doubt - stipple." Don't hesitate to stipple after squeegeeing. If you use care to not apply too much excess resin, you can do the entire layup with stippling and no squeegeeing.

When bonding the large blocks of foam with wet micro it is possible that the insulation of the foam will not let the epoxy heat excape and an exotherm can occur down in the middle of the joint. This exotherm can be hot enough to melt the foam locally and weaken the joint. We have formulated a special long pot life epoxy for the VariEze to avoid this problem. This epoxy will be on the market when the EZ plans are out. In the mean time, if you are joining large blue foam blocks using Shell epon/teta or Gougeon 105/206, you should do the bond at an ambient temperature of 65 degrees or less. This will prevent the exotherm.

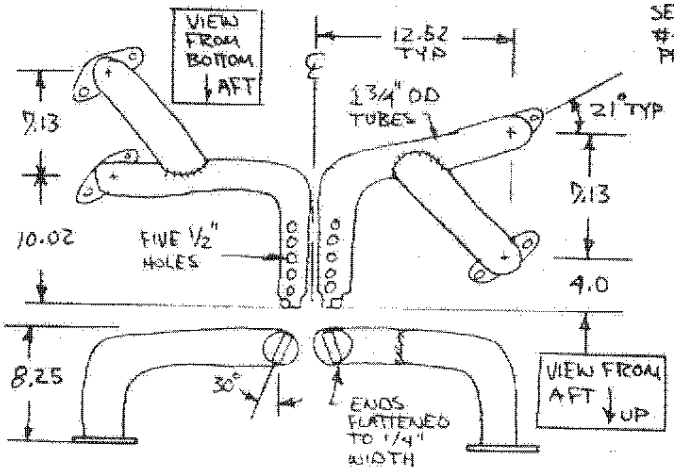
SHOPPING

See the back page of this newsletter for VariViggen parts and materials. Note that RAF no longer handles any parts. You are referred directly to the manufacturer for the VariViggen machined parts. We, of course, will continue to help builders on installation problems with parts obtained from RAF distributors.

Pistol grips with switches - R. Williams tells me these are available at Goff Aircraft, 8131 E. 40th, Denver, Co 80207, but their price ($38.50) is much higher than you need to pay, if they are still available on the surplus market. Anyone know where these can be found?

THE FOLLOWING SKETCHES OF THE VARIVIGGEN EXHAUST SYSTEM AND HEAT MUFF HAVE BEEN PREVIOUSLY INCLUDED WITH THE COWL INSTALLATION INSTRUCTIONS.

EXHAUST JIG DIMENSIONS O-320 LYCOMING



SEE NEWSLETTER #4 & 6 FOR PHOTOS.