

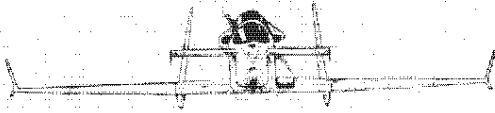
THE CANARD PUSHER No 9 JULY 76

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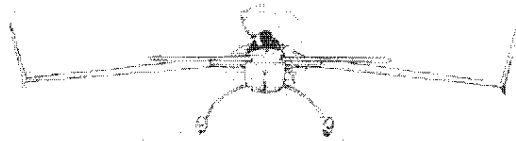
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NEWS OF THE VARIVIGGEN AND VARIEZE PROGRAMS
(very vig-in) (very easy)

NEWSLETTER SUBSCRIPTION - \$4.75/yr
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We do plan a daily construction demonstration in the synthetics workshop at Oshkosh for VariEze builders. 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.



VARIEZE FLIGHT TEST PROGRAM

- N4EZ, our Continental-powered prototype, has undergone one of the smoothest prototype test programs we have seen. In only two months and one week (March 15 was first flight, tests were completed by May 20), the aircraft completed an 85-hour test program which included development of the engine installation, all other systems, flying qualities optimization (all cg's, all weights), performance determination (with several propellers), dive tests, spin tests, and environmental qualifications (110° ramp temperature, 16,000-ft altitude cold soak, taxi/take off/landing in wind gusts to 45 knots).

No major problems were encountered during the tests. Modifications made as a result of the tests included nose gear retraction/extension system redesign, addition of roll trim (VariEzes now have three-axis trim), addition of a parking brake, modification of air inlet configuration to optimize cooling, simplification of exhaust system, and optimization of pitch and roll control system ratios. It is interesting to note that throughout the complete test program of N4EZ and N7EZ, there has been no structural rework or modification required. This involves two airplanes, over 13 months testing, and 350 flight hours. This is quite unusual; generally a prototype of a new design (even a conventional structure) will indicate a few marginal or weak areas that need local beef up/redesign/adding fasteners, etc., sometime during its tests. With the VariEze, we have used new materials, initially unfamiliar to us, and new construction methods, etc., but have found them to be so durable in service, that no failures or degradation was found that required redesign.

SPIN TESTS - FAR 23 certification criteria require aircraft to meet certain spin recovery requirements in order to receive a type certificate. This is not required for a homebuilt and many homebuilts have not been through any formal spin testing program at all.

RAF ACTIVITY since newsletter 8 has, again, been hot and heavy. All flight tests and ground tests for the VariEze were completed on May 20. The massive job of preparing and laying out the VariEze manufacturing manual was done on a six to seven-day week, 10 to 16-hour day schedule. The basic manual (section one) was delivered to the printer on June 15. We are currently on the same type of busy schedule, trying to complete the owners manual (section four) and the Continental engines installation (section IIA), before we leave for the 1976 EAA convention at Oshkosh, Wisconsin. Because of our high work load now on these items, we must ask you to continue to observe our "Saturday only" policy as far as visiting RAF to see the VariEze, at least until after Oshkosh. We will be closed for the Oshkosh trip from July 23 until August 13. Any mail orders received at RAF after July 22 cannot be processed until after August 13 and, of course, there will be no Saturday demo on July 24, July 31, or August 7.

SATURDAY DEMOS - Since November, we have had the weekly open house at RAF every Saturday, starting at noon. These demos start with a briefing at our building (100 yards S.E. of the tower building on the Mojave airport), a question/answer period, then a flight demonstration of the VariEze, followed by a brief structural demo in which we build a portion of the airplane to show the composite sandwich methods. The demos run from two to four hours. In the 31 weeks we've been doing this, the VariEze has flown and given rides on all but two occasions: once due to rain and once when we had taken the airplane to an airshow. We have never cancelled a flight demo due to an airplane problem or due to the severe wind gusts that occasionally ground most light aircraft at Mojave.

We will probably continue to give the Saturday demo after we return from Oshkosh, and will probably extend it to provide more time for the structural demo. Be sure to call ahead to confirm that the demo will be given, since we will be scheduling composite structure seminars in other cities and may be gone on some weekends. If you would like to host a seminar, please wait until after Oshkosh, then contact us. We'll include a seminar schedule in the October newsletter.

One primary reason the VariEze was designed as a canard configuration was to reduce the susceptibility to departure from controlled flight and unintentional spins. Conventional aircraft are so poor in this respect that stall/spin is the most common, fatal accident cause. A contributing reason is the FAR regulations, themselves. They are very specific in spin recovery requirements (after a one-turn spin, non-aerobatic aircraft must recover within one additional turn, with recovery controls applied), but only loosely subjective with respect to spin susceptibility. If specific resistance to departure and spin were required, as it now is for military aircraft (MILS-8369 1), few general aviation aircraft could qualify, making alot less traffic for VariEzes!

The VariEze is designed such that the canard reaches its maximum lift at an angle of attack several degrees below that for maximum lift of the main wing. Above the maximum lift angle of attack for the canard (14 to 15 degrees), the loss of canard lift produces a strong nose-down moment. The result is that the aircraft limits itself to 15 degrees and cannot be forced above that angle, regardless of cg. The aircraft also is designed to have excellent directional stability, dihedral effect, and rudder control at and above 15 degrees angle of attack, thus the airplane is not susceptible to the inadvertent departure and spin common to most conventional aircraft.

The normal operational range of angle of attack is one degree (high speed cruise) to 10 degrees (flare to land at 55 knots). Angle of attack values above 10 degrees are not required for any normal operation, but were tested to assure the safety and recoverability, if the pilot inadvertently exceeds 10 degrees.

The pilot for our spin tests was Peter Lert, an experienced pilot, who makes his living as an aviation writer for "Air Progress" magazine, and who is light enough (135 lb) to allow aft-cg testing. The following is a summary of the results of the high angle of attack testing. The VariEze owners manual will have complete details.

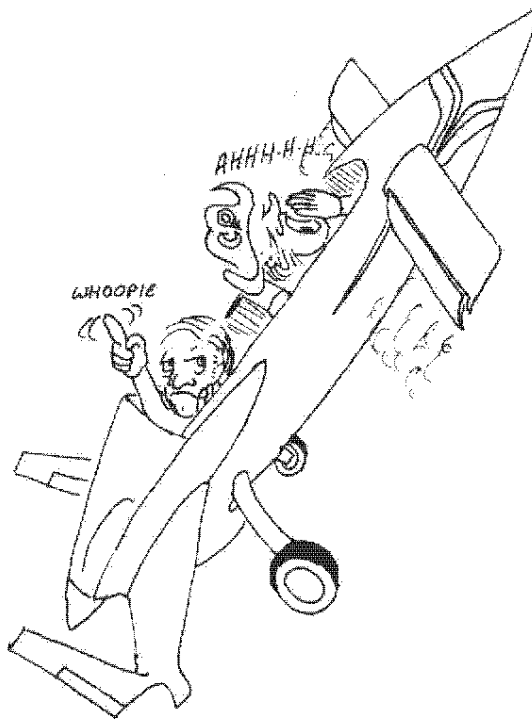
The VariEze's "stall" consists of any one of the following, in order of prevalence:

1. Stabilized flight (climb, level, or descent, depending on power setting) at full aft stick at about 48 knots. Below 51 knots there is a very definite increase in the aft stick force, such that the pilot has to pull noticeably harder on the stick to get below 51 knots. Below 51 knots, the aileron control degrades, but rudders still provide excellent turn control, even at full aft stick.
2. Occasionally, particularly at forward cg, the airplane will oscillate mildly in pitch after full aft stick is reached. This is a mild "bucking" of a very low amplitude, one to two degrees and about one-half to one "bucks" per second. If the full aft stick is relieved slightly, the bucking stops.
3. Occasionally, particularly at aft cg, the airplane will exhibit an uncommanded Dutch roll, a rocking back and forth of the wings in roll. The rock, if it exists, will be mild and sometimes divergent, reaching a large roll (30° bank) by about the fourth or fifth cycle. The "wing rock" can be stopped immediately by relaxing off the full aft stick stop, or by using the rudders to counter the rolling motion.

At any time during the "stall," power can be set at any position, or slammed to full or idle, without effecting the stall characteristics. There is a small roll trim change due to power and a very slight pitch trim change; neither effect the aircraft's controllability at sustained full aft stick. At no time did the aircraft experience a departure from controlled flight.

Accelerated stalls to three-g and steep pullups to 60-degrees pitch (min speed, 35 knots) were done at full aft stick without any departure tendency.

Intentional spins were attempted by holding full aft stick and using full rudder, with all combinations of aileron control, and at all cg positions. These controls were held through 360 degrees of rotation. Full aft stick and full rudder results in a lazy spiral which ends up in a steep rolling dive at 3+ g and 110 knots. At any time, the spiral can be immediately stopped by removing rudder control and a completely straight-forward recovery can be made. That maneuver is not a spin, since at no time is the aircraft departed from controlled flight. If the above maneuver is done at aft cg, the rotation rate is higher, so the lazy spiral is more of a slow snap roll. However, even at aft cg the recovery is immediate when controls are neutralized.



OTHER FLIGHT TEST RESULTS - N4EZ has demonstrated take off and landings in crosswind components as high as 20 knots and satisfactory taxi (all quadrants), take off, and landing in gusty winds to 45 knots. N4EZ has also flown through very heavy turbulence in a rotor cloud under a triple lenticular in which g excursions went from -1 to +3.5 g. The red line speed has been opened to 262 true/220 mph indicated, a comfortable margin (exceeds FAR part 23 requirements) even for the largest engine (100 hp) which can cruise as high as 200 true/176 indicated (at 7500 ft). Damping of all controls at the dive speed is excellent and similar to low speed. If, at a later date, we have a requirement to extend the red line to higher speeds, we will do so.

ENGINES - Cooling on the O-200 has been excellent. Ground cooling is better than most factory-builts. At a recent flyin, we had to sit in a long line on a hot ramp awaiting take off for over 30 minutes. Many of the factory-builts had to shut down to avoid over heating, but N4EZ's temperatures stayed under the normal values for cruise. The O-200 Continental engine has been trouble-free, requiring no modifications, adjustments, or unusual maintenance. This has not been true of our VW installation on N7EZ. We have flown the VW VariEze a total of about 280 hours (two different engines), which is alot of flying for one year for a VW homebuilt. We have had its cowling off an average of once per five flights, though, making minor carburetor adjustments, trying to find oil leaks, adjusting or repairing valves, cleaning plugs, checking the magneto coupling, tightening loose bolts, etc., etc. The VW-powered VariEze has never had an inflight power failure, but it has twice had to be landed within a few minutes or it would have had a failure: once due to low oil pressure, another time due to an impending failure of the prop hub/extension. We have conducted an informal survey and found that our VW experience is quite similar to others, who have high time on VW aircraft conversions. For this reason, and because of the high cost of operating these engines, we are not preparing the section IIB, VW engine installation, at the present time. This section should be made available by October as we gain some more reliability experience with the engines and

after the results of some further tests.

Those of you who plan to use a VW do not have to delay your project. The engine installation is done during chapter 23 (of 25 chapters) of section I. All items involving changes due to engine installation are in section IIA or IIB. If you can't find an engine or haven't decided which type you plan to use, we suggest you get only section I and go ahead and start building. Chances are, you will find the right engine at the right price before you get to chapter 23.

Frankly, when we went shopping for an O-200, we couldn't find one. We let several people know we were looking, then all of a sudden several weeks later, we had our choice of four O-200's. When searching through "Trade-A-Plane" for engines, don't look only at the engine section. Quite often you can buy a wind damaged Champ or Cessna-150 with alot of time left on the engine for less than a used engine!

We get alot of questions concerning the availability and cost of engines. We, of course, are not in the business of engine distribution, however, to give you an idea of the current market, we have made up the following table, based on available prices from vendors, "Trade-A-Plane," and magazine ads. Cost per hour is basic engine cost, not including fuel and oil.

ENGINE	1 TIME AVAILABLE TILL NEXT OVERHAUL (REGULAR USE - 300 HR/YR)	2 OUTRIGHT COST FOR ENGINE	3 VALUE OF ENGINE AFTER RUNOUT	4 COST TO OWNER (2 - 3)	5 ENGINE COST PER HOUR OF FLYING
A65/A75 OSMOH	1200 hr	\$1300	\$ 400	\$ 900	\$0.75
A65/A75 half-runout	600 hr	\$ 800	\$ 400	\$ 400	\$0.66
C85/C90 OSMOH	1200 hr	\$1900	\$ 700	\$1200	\$1.00
C85/C90 half-runout	600 hr	\$1300	\$ 700	\$ 600	\$1.00
New O-200	1800 hr	\$4700	\$1600	\$3100	\$1.72
O-200 OSMOH	1600 hr	\$3000	\$1200	\$1800	\$1.13
O-200 half-runout	800 hr	\$2300	\$1200	\$1100	\$1.38
Top of line VW conversion	800 hr?	\$2600	\$ 800	\$1800	\$2.25
"Low cost" VW conversion	100 to 600 hr?	\$1300	\$ 200	\$1100	\$2.20

PROPS - We have tested several propeller types and studied several others. Fortunately, the best prop has been the lightest and lowest cost - a fixed-pitch, all wood, two-blade, with plastic leading edge for rain erosion protection. These are available through several vendors. The owners manual (section IV) and section II will specify prop sizes, specifications and recommended vendors for all recommended engines.

The three-bladed prop tested, resulted in less take off, climb, and cruise performance, as compared to the two-bladed props. We do not plan to request our distributors to stock propellers. The reason for this is due to the large number of engine sizes available, and different prop extension configurations; it is better for the customer to deal directly with the prop manufacturer.

Those of you who are in a rush to be flying a VariEze as soon as possible, may not want to wait for section II to put in an order for a prop, since props are one of the hardest things to get without waiting several months. Thus, we are providing sizes and manufacturers for the O-200 props we've tested. These are listed below. Other prop manufacturers may also be able to provide adequate props. Refer to the owners manual for prop sizes on other than the O-200 engine.

Teds Custom Props 9917 Airport Way Snohomish, Wa. 98290 56" dia 70" pitch VariEze SAE#1 flange	Bill Cassidy 4652 Montview Blvd. Denver, Co. 80207 58" dia 67" pitch VariEze SAE#1 flange
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Maximum speeds for the above props is identical. The Ted's prop provides a small edge in take off and climb. This is backwards from what you would think considering the diameter and pitch values, the blade design being considerably different on the two props.

NOSE GEAR RETRACTION - We told you in newsletter 8, that we were making a major change to the system that retracts and extends the nose gear, to incorporate a jacking mechanism to give the pilot a better capability of raising and lowering the nose for nose-down, parking with the pilot aboard. This system was built and installed in N7EZ, however, like the four other mechanisms used before, it was not satisfactory. It did allow the pilot to jack the aircraft up to level after entry, but the work required for him to do this (600 ft-lb) was still objectionable. The spring systems (needed to pull the strut up in flight) and the reversing system made the complete package too complicated and time consuming to build and maintain. We found that we had more complexity in the nose gear retraction system than in the entire pitch, roll, and yaw control systems combined! This was completely against the design concept of the airplane.

After, again, backing off and taking a look at the problem, we found that it is considerably easier to lift the airplane's nose up from the nose-down parked position, lock the gear down, then enter the airplane by climbing over the side, like we do on the VariViggen, using a kick-in step in the fuselage side. This allows a very simple, lightweight pushrod system to work the gear up and down, and allows an instant-acting inflight retraction/extension. The design and installation of this new system in N7FZ took only one day.

It consists of a single pushrod to the gear strut from a knob at the instrument panel. The pushrod is bolted to a block which slides in guides such that it locks up or down by locking the knob in its lowered position.

We have been very pleased with the new system; it has required no maintenance and appears to be one that will not give problems, due to its simplicity. Retraction of the gear in flight consists of moving the knob out of its lock, raising it and pulling aft 6", then locking it in its lowered position (one smooth motion). Retraction/extension forces are only about 5 lb since airloads balance the gravity loads. Ground operation of the gear for nose down parking works as follows: back seater and suitcases go in while the nose is down. Manual engine starting is done while nose down on the rubber bumper (no chocks or tiedowns are required for manual start by yourself). The pilot then walks to the side of the cockpit, unlocks the gear knob and raises the airplane to a level attitude. This is easily done by grabbing the leading edge of the canard and lifting (requires only about 30 lb, even with the backseater in). The pilot then locks the knob and uses the kick-in step to climb in. We have modified the yaw trim system to also provide a parking brake to keep the airplane from rolling (while the pilot climbs in) if the airplane is parked on a downhill slope. The new nose gear system now compliments, rather than distracts from, the overall design philosophy of simplicity and low maintenance.

VARI-EZE STRUCTURE - To certify an aircraft for production, FAA requires the manufacturer to load the flying surfaces to 150% of design limit load. After that loading, it is acceptable for the surface to be damaged beyond repair, but it must be in a condition to allow a safe landing. To demonstrate the structural adequacy of the VariEze's wing and attachment, we had someone, who had no previous fiberglass construction experience, build a wing from our plans. We mounted that wing in a test fixture and loaded it to over 200% of design limit load. The wing had absolutely no damage, not even the transverse matrix cracking that occurs with composites at about 2/3 ultimate load! Just for kicks, we rounded up eight people and had them all stand on the wing - that was as many as could crowd onto the wing, but resulted in much less load than the formal test done with lead shot bags.

Structurally, the Eze has some very important advantages over conventional metal or wood: greater redundancy, less susceptible to catastrophic failure due to fatigue, less susceptible to corrosion or deterioration, higher safety factors, easier to inspect and repair and less susceptible to surface damage. With proper ultra violet protection (as shown in VariEze section V), the composite structure should outlast metal or wood in any type environment.

Do not compare the VariEze's glass/foam/glass sandwich structure to the method used on the KR-series, WAR-series, etc. The VariEze structure does not use foam to transmit primary/secondary loads, does not mix materials in a manner to result in thermal stresses, does not mix structural materials with highly different modulus of elasticity, does not seal off internal void areas where moisture can collect, does not have any bare foam surfaces that can flex and fatigue the foam, does not use a low modulus skin that results in high foam stresses, does not use inadequate skin close-outs at trailing edges and joints, etc. If you are not familiar with the structural techniques used in advanced composite sandwich design, you are in for some real surprises when you see the VariEze manufacturing manual. Don't expect the structure to even remotely resemble anything you have seen in any homebuilt aircraft!

You are going to be building sandwich panels, joints, local reinforcements, attachments, spars, compound curves, etc., very similar to those used by large manufacturers for new military fighters and portions of new airliners. The methods to fabricate the parts are quite different though, since you will be doing the work without special equipment and tooling.



VARI-EZE PLANS - You will find a sheet enclosed with this newsletter that describes the five-section package of VariEze documentation that is now being made available. Section I, the manufacturing manual (composite education, complete plans and construction manual for the VariEze, except for engine installation), is the major bulk of the documentation. This section was delivered to our printer on June 15 and should be back, ready to mail out by about July 1. We have completed the draft of section IV, the owners manual, and will have it printed and ready to mail by about July 10. We are also making a strong attempt to complete section IIA (Continental engines installation) during July. Hopefully, it will be completed before we leave to attend the EAA convention at Oshkosh. If it's not done by then, it will not be ready to deliver until late August. Section III (avionics and lighting) and section V (finishing) will not be completed until September. Section IIB (Volkswagen engines installation) should be completed by October.

PRICING PHILOSOPHY - VARI-EZE PLANS - We think that its of some interest to discuss the items considered in determining the price to charge the homebuilder for his set of plans. Plans prices for other homebuilts vary from just a few dollars over printing/handling costs, to several hundred dollars. Designers who sell plans for a small amount over direct costs, in order to sell thousands of sets of plans, generally find that they have sold the customer only the stack of paper, but not the service of assisting him to assure his success in completing his project. Often, designers will put an extremely high price on a set of plans and will thus receive about the same income, but have alot fewer customers to assist. Sometimes a designer will do this to quickly recover development costs, without planning a long-term support program.

The VariEze plans have been priced to compliment our entire program of supporting each homebuilder's project to assure his success, and to provide a return on our investment in development costs within the next two years. About \$50 of each set of plans sold, goes directly towards paying back the \$100,000+ required to develop the design. We are both quite fortunate that that the airplane was developed, to a complete homebuilt program, for this relatively small sum of money. If any major problems would have been encountered, such as engine/prop compatibility/reliability, or spin characteristics, or structural failures, etc., the development costs could have been considerably higher. It is not uncommon for a new design to require three or four times or even 30 times that amount by the time it successfully completes the testing we have finished on the VariEze. It is not unusual for a new design, particularly one with marginal structure or systems, to end up costing so much for development that it is never satisfactorily completed. This is why it is impossible to market an aircraft before its development is completed.

You may note that the VariEze plans are higher cost than some of the other small, simple-airplane plans. However, considering the fact that they include a complete education of the materials and structural methods, and are a fully illustrated step-by-step manufacturing manual, they are actually quite inexpensive; for example, when compared on a page-for-page, word-for-word, photo-for-photo, or drawing-for-drawing basis, the VariEze plans cost less than one-third the price of the KR2 plans.

VARI-EZE MATERIALS/COMPONENTS DISTRIBUTION - Okey, this is it; the big secret is out! The distributors we have been working with for the last nine months on the VariEze program are listed on the last page of this newsletter. Included in the list are the general items of the bill of materials that they stock. Unless you are in a big rush, wait to get your plans before contacting

the distributor. Your plans has the complete bill of materials with each item specified as to its use and availability. Both the major raw materials distributors (Aircraft Spruce and Wicks) are presently preparing new catalogs, which list the specific VariEze materials. These catalogs will be available from them in early July.

We have been indicating to you in recent months that the distribution system will be able to supply all materials and components on very short notice, because of their stocking items ahead of time. They have done an excellent job in this respect, but the apparent initial demand for the VariEze may have exceeded our expectations. Certain items and materials may initially be in short supply and some delays are now anticipated. If you are planning to build your aircraft in a rush over the next few months, we suggest that you get your orders in immediately for the following items. These are the greatest potential 'bottle-neck' items that we can foresee at this time. Foams (manufacturer's recent specification revisions have delayed early high volume stocking), wing attach/quick-disconnect fittings (Brock), and landing gear struts (Jiran).

FOREIGN customers who are interested in making volume purchases to minimize import duties and shipping costs should contact the distributors directly for volume purchasing information. The distributors are equipped to handle this type of order.

VARI-EZE QUESTIONS/ANSWERS - Thanks so much for those of you that have had the patience to wait for the newsletter to get your questions answered. If you have a question you need answered right away, state it, with room for our answer, and include a self-addressed, stamped envelope.

- Q. My wife is 6 ft, 5" tall - can she fit in the back seat?
- A. The front seat allows "stretch out" comfort (feet in front of the rudder pedals if you desire) for pilots to 6' 7" and 210 lb. Back seat is comfortable for pilots' passengers up to 6' 5" and 220 lb. In fact, those of you who were at the Watsonville flyin, may have seen a 6' 9", 210 lb man get in the back seat, with the two full suitcases. His comment - "relatively comfortable." Even he was not pressed up against the canopy.
- Q. Can one person remove/install the wings and canard?
- A. Yes, the specific procedure is in the owners manual. It takes one tool and about two minutes per wing/canard. Instead of trailering, we suggest you remove one wing and store your aircraft under the wing of a Cessna in a T-hanger or in an unused corner of a larger hangar. In this way the availability and high cost of hangars can be avoided and the big job of tying down on a trailer is avoided.
- Q. What percent of construction work requires more than one person at a time?
- A. Required, about 15%; desired, about 50%.
- Q. Can a 197-lb, 160-horse power engine be used in a VariEze?
- A. No.
- Q. Will you offer dual controls?
- A. We plan to develop dual controls later, possibly this winter. It's not as easy as one might think. It will greatly complicate the control system and may eliminate one suitcase. The Eze is easy to fly and pilots can be checked out safely if they follow the owners manual procedure. Its hands-off flying qualities lowers the need for backseat controls for pilot fatigue relief.
- Q. Is an intercom necessary?
- A. No, pilot and passenger can easily converse in a normal level of conversation at cruise power settings.

- Q. How does a composite aircraft behave in a fire?
- A. First of all, the VariEze's susceptibility to an airframe fire is far less than the average light plane. The flow of air through the engine area is aft and up, so an engine-area fire is drawn away from the airframe, rather than being impinged upon the firewall as in conventional installations. Also, the fire which results from a crash is generally due to oil or fuel being ignited by sparks from steel on rock, etc. The Eze's fuel tank durability and fuel line routing is a plus factor. The lack of steel items that can cause a fire's ignition source, is also an advantage. Now, if a fire does exist, the rate at which burning progresses in the glass/foam/glass sandwich structure, ranks between an all-metal airplane and a wood or fabric airplane.
- Q. Minimum size door in the shop to hatch a finished VariEze?
- A. If you leave the main gear off until after the airplane gets out of your shop, a 30-inchx68-inch door or window is enough.
- Q. How do you air-start a VariEze without electric start?
- A. Due to the high pitch of the prop, the engine windmills at all speeds down to about 60 knots,

- Q. Cabin heat?
- A. Drawings for cabin heat are included in section II, however, due to canopy radiant heating and the excellent insulation of the sandwich structure, cabin heat is not needed for day-VFR, even at cold outside temperatures.
- Q. CAN I get color photos of the VariEze?
- A. RAF has none for sale, however, Jim Jeffries Productions, Inc., has been up taking photos of N4EZ and has expressed an interest in making a color photo set available for sale. Contact him at Box 14, Santa Paula, Ca. 93060, for details.
- Q. I have a 900-ft grass strip out back. Should I build a VariEze to operate out of it - it's a little rutted in the winter.
- A. No. Buy a Cub or build a Volksplane. Lift off speed and landing speed of a VariEze is 55 to 60 knots (63 to 69 mph), which takes it out of the "backyard patch" category. We have increased the tire size from the prototype Eze to help its rough field capability, but the 55-knot touch down is definitely not recommended for your pasture. The best rule is this: "If you would operate an American Aviation Yankee from your field, it's okay for a VariEze."

SOME PERSPECTIVES ON ENGINE DEVELOPMENT

We are probably going to hear a lot of anguished cries from would-be engine developers, but we are taking a hard line on "other" engines in the VariEze. We have had many calls and letters from people wanting to install all kinds of converted boat, snowmobile, auto, turbocharged trash compactor, etc., engines in a VariEze. Also, there is an interest in all kinds of unproven modifications to the VW (fuel injection, turbocharged, electronic ignition, etc.). Frankly, we're scared stiff by this. Aircraft engine development is a very risky, horribly frustrating, and enormously expensive business. Please don't kid yourself into thinking that you can do a successful engine development program in order to save money! Please don't kid yourself and think your new engine conversion isn't going to fail a few times during initial flight testing. Even a professionally trained, educated, and experienced engineering organization with a barrel of money, can't do these things, so don't try it in your garage. More over, don't believe anybody who says he can do it for you, unless he can show you excellent maintenance records taken during hundreds of hours of flying with the engine.

We are very much afraid that if a lot of homebuilders start trying to develop new engines on homebuilt airplanes, that EAA's accident record will look horrible. When that happens, look out for the FAA to really clamp down on homebuilding. We have gotten warning indications that this situation is already bad and getting worse. Doing engine development on an amateur-built airplane hurts everyone of us by further endangering the lenient rules that we now have. Please don't do it.

This isn't to say that some very good engines aren't hiding out there, waiting to be developed for aircraft use. We wish the best of luck to those who have the funding, ability, and ambition to do the job well. Doing an engine development job well, implies that you have the professional ethics not to endanger the hard won privileges of others.

Now, if you have an engine, it looks good to you, and you really want to prove it out for aircraft use, here's what you do: fly it. There is no substitute for flight experience. Not in a homebuilt,

though! Get yourself a Cub or Champ that is a very forgiving airplane, easy to land safely in a pasture. You are going to make several emergency landings, so plan on it. If things really get bad and you have to plant your test vehicle in the trees, then for FAA it's just another Cub that crashes, not a homebuilt. Also, you can buy another Cub and get your test program rolling again, quickly. If you had used a homebuilt, you would have to build another airplane instead of getting on with your engine development work. Once you get your new engine working like you think it should, fly the pants off it, maintain detailed maintenance records, and find out just how well it really holds up over a full overhaul period. Find out how much it really costs you to fly each hour, considering initial cost, operating costs, maintenance, replacement, and everything else. We once participated in a "low cost" engine program where the initial engine cost was less than 10% of the 100-hp Continental, but taken hour-for-hour of service, the cheap engine costs more than eight times as much! Remember, an aircraft engine is the very definition of dependability and reliability. An aircraft engine must tolerate abuse and still keep pumping along.

Right now there is a promising looking engine powering a Cub that is being considered for section IIC of the VariEze manufacturing manual. The gentleman behind this effort was originally going to do his development testing in a homebuilt Cassutt racer. Fortunately we were able to talk him into using the Cub. During the initial flights, at least four precautionary landings had to be made (this is perfectly normal in initial flight testing new engines). In the Cub, it was no sweat; in the Cassutt (high wing loading, fast on landing, high rate of descent), it might have meant a broken airplane, possible injury to the pilot, and another statistic to hurt our EAA safety record. These fellows are to be congratulated on a very sensible, professional, and ethical test approach. Now we just hope that they are successful, so we can have an alternative to the Continental, but even if they aren't, they will have helped to preserve the good name of EAA and the freedoms we now have.

VARIVIGGEN ACTIVITY - The VariViggen portion of this newsletter is quite short. We haven't heard much from you VariViggen builders lately, and no one has noted any plans corrections since newsletter 8. I guess you are all busy building! I understand that at least three VariViggen's are nearly completed and we hope to have some first-flight reports in newsletter no. 10. Let's hear from you!! Ken Guscott (S/N 129) has a VariViggen construction article in the June 76, "Sport Aviation" magazine.

N27VV has undergone no modifications or maintenance since the last newsletter. It has only flown about 25 hours in the last three months, mostly for chase during the VariEze spin tests and for cross-country trips. Those of you who may be close to finishing your airplanes, be sure you have the VariViggen owners manual. It has very important operational data, amendments to the operating limitations and a specific recommended procedure for the conduct of your initial flights.

VARIVIGGEN PROJECT REPORTS -

Doug Dennis, SN 421, reports that he has one rudder, his canard and both elevators ready for skinning. Doug is assembling his fuselage jig and frames now. Sounds like a good start; hang in there! Doug is 15 years old, by the way!

John Poehner, SN 156, fuselage and in-board wing about ready for skinning.

Harold Reiss, SN 267, has his fuselage skinned on the sides and the aircraft is ready to turn over for bottom skinning. The instrument panel, wiring, nose and main gear, controls, seats, carpeting, etc., are installed. He started his Viggen 13 months ago.

Jim Cavis, SN 31, has his aircraft completed and painted except for outboard wing panels and canopy.

VARIVIGGEN BUILDERS' HINTS -

Harold Reiss, SN 267, is using an "A" frame made of 2x4 lumber which bolts through the four engine mount bolt holes in the firewall. He uses this to support the fuselage while it's inverted to skin the bottom, rather than using saw horses under the spar. Harold also reports that he used five, 16" door springs for each of the main gear helper springs, stretched to about 24".

Wayne Wilkins, SN 208, has an interesting method for making WR25 in three pieces so that spar E can be assembled completely off of the airplane (see photo).

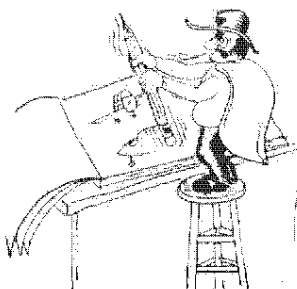
More on the prop situation for the 180-hp Lycoming (see newsletter 8) - There is an excellent article on this subject in the June issue of "Sport Aviation." Note that while insufficient driving area is available in the studs, the friction face provides ample safety factors even for the 180-hp engine. Those using the 180-hp engine and a wood prop should carefully follow the recommended procedure for torquing and checking the tightness of the prop bolts at the intervals indicated in newsletter 8.

Clarification - The MG37 tube on MG14 is open at the top, not welded over (plans page 47 & 48).

VARIVIGGEN SP WING BUILDERS - To avoid the exotherm noted in newsletter 8, and to obtain the benefits of increased fatigue strength and low toxicity, it is recommended that you use the long pot-life epoxy developed for the VariEze. This is RAES epoxy (four or five one-gallon kits are required). This epoxy is available from Aircraft Spruce or Wicks; see last page of this newsletter.

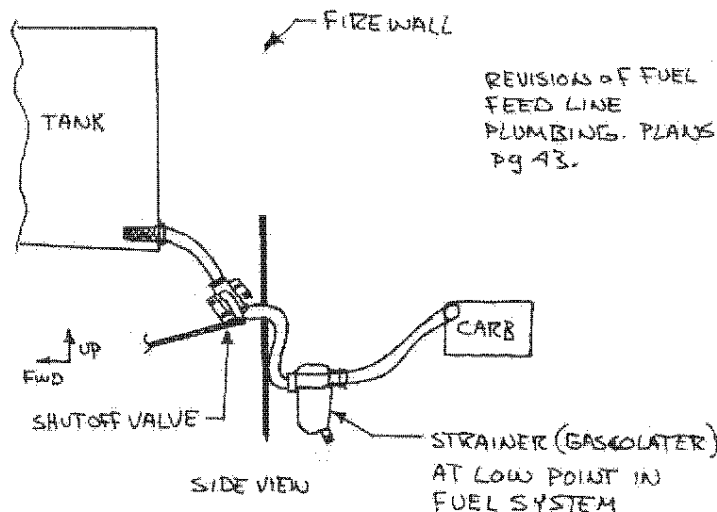
VARIVIGGEN PLANS CHANGES

Mandatory Change - The fuel system drawing (pg 43) Plans page 43

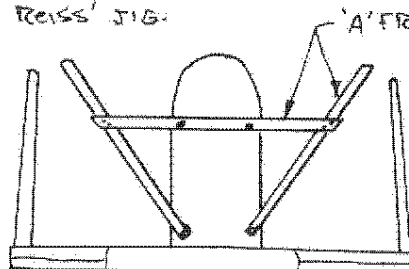


The fuel system drawing (pg 43) shows the fuel valve located slightly above the level of the bottom of the tank. Revise this drawing as shown in the accompanying sketch. The fuel lines should run continually downhill to the strainer, then continually uphill to the carburetor. If there are loops that can trap air, the amount of unusable fuel will be increased, particularly during a steep nose-down descent.

Add the following note to page 12 of your VariViggen owners manual: "NOTE: If a sustained steep descent is made when the fuel level is less than six gallons, a temporary fuel starvation may occur. This is characterized by a surging of the engine. If this occurs, level out and slow up (nose up, 70 mph if necessary). Normal fuel flow will resume and the engine will begin operating normally."

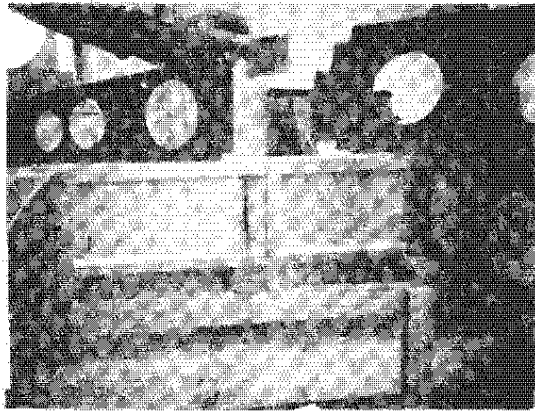
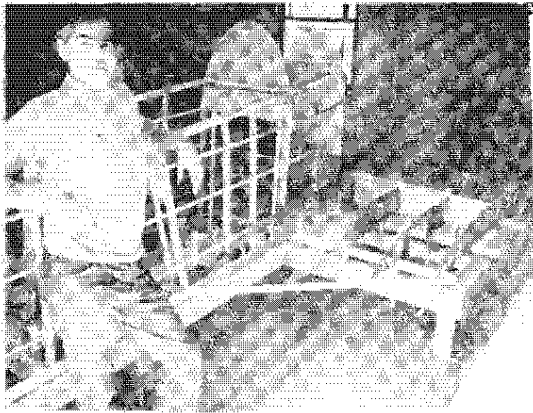


HAROLD REISS' JIG:

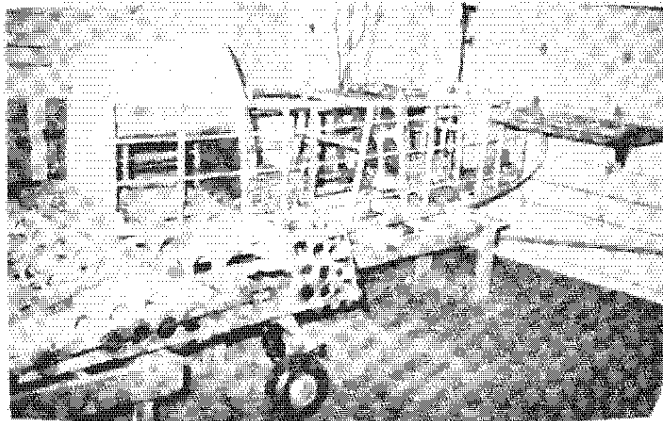
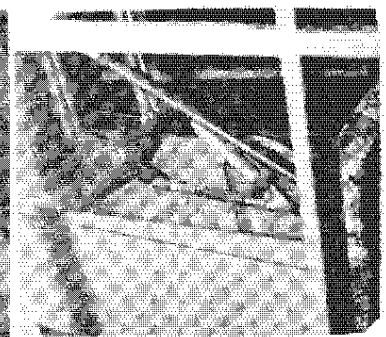
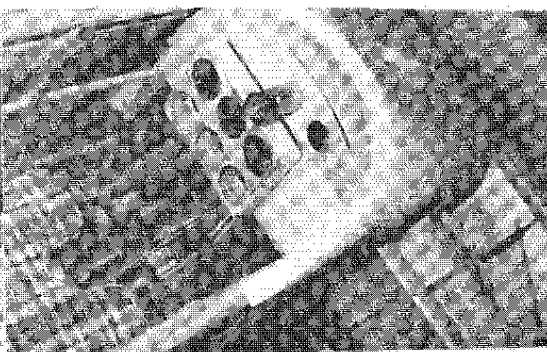
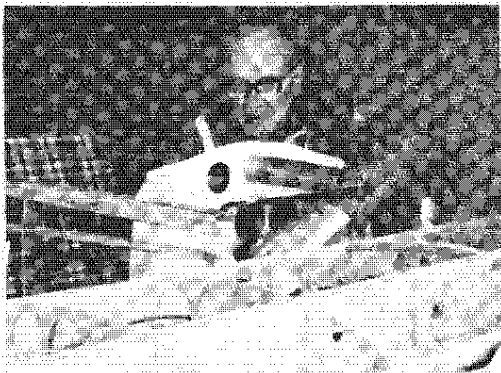


REAR VIEW

Bob Tate, 4800 Mayfair Drive
Oklahoma City, Oklahoma (405) 946-7839
wants to purchase a partially-built VariViggen.
Contact him.



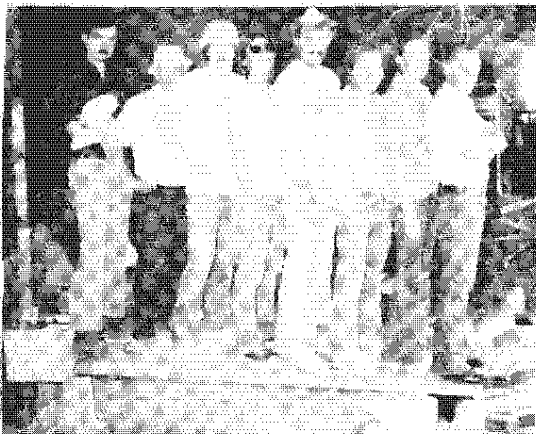
WAYNE WILKINS
S/K 208 NOTE THE
2" X 3" DOUBLET
USED TO JOIN
FRONT & REAR
HALVES OF
WR 25 RIB.



JOHN POEHNETZ
AT "WORK" ON
THE INSTRUMENT
PANEL

JOHN ADDED A IDENT-TYPE
HANDLE TO THE MANUAL
PITCH TRIM SYSTEM.

JOHN POEHNETZ'S VARRIVIGGEN
JUST READY TO COME OUT
OF THE JIG.

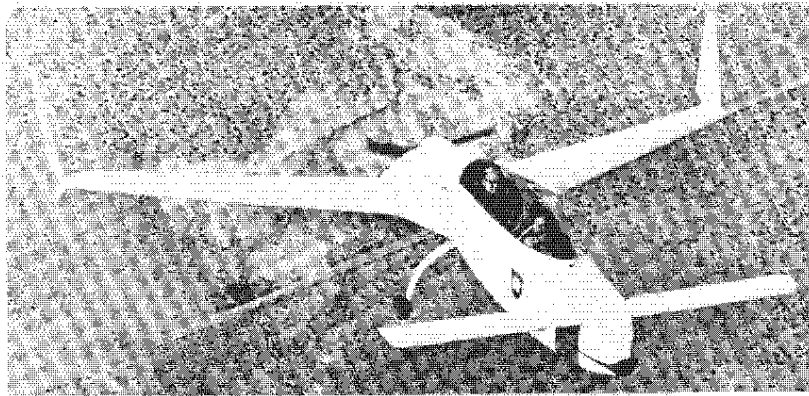
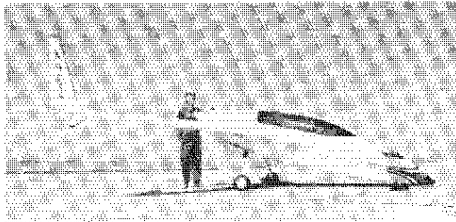


"INFORMAL" STATIC TEST OF THE
VARRIVEZ'S WING - ANYONE CARE TO
JOIN US?

THANK YOU FOR YOUR INTEREST IN THE

VariEze

TWO-PLACE SPORTPLANE



THE STORY

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

THE TEST PROGRAM

The VariEze test program was probably the most extensive and successful ever conducted on a homebuilt. It included basic flight tests for flying qualities, performance and systems, spin and dive tests to FAR part 23 requirements, static load tests and landing gear drop tests exceeding part 23 criteria, environmental/thermal tests on structural materials/components, manufacturing methods testing, and many others.

THE RESULTS

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

THE MISSION, PRACTICAL UTILITY

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

THE DESIGN

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

THE STRUCTURE

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

THE HOMEBUILDER SUPPORT

The manufacturing manual is a literal education in using the materials and is a detailed step-by-step guide to construction using an illustrated format not common in aircraft plans. The Rutan newsletter, "The Canard Pusher," published since mid 1974, updates plans, provides building hints, etc. Complete owners manual provides all necessary information for safe initial testing and for normal and emergency operations. Construction seminars are provided at RAF and elsewhere.

THE AVAILABLE HOMEBUILD

Established, competent distributors have stocked materials and components before the aircraft was marketed. All raw materials are now available plus many prefabricated items including canopy, landing gear, wing quick-disconnect fittings, cowling, all machined items, rudder pedals, engine mounts, suitcases and upholstery. If you choose to purchase all prefab parts, you can build your VariEze in about 500 man-hours - really!

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 IIB - VW engines (avail. Oct '76)

SECTION III - ELECTRICAL - This is an optional (not required) set of drawings and installation instructions for electrical system, avionics, landing and position lights antennas, starter. AVAIL SEPT '76

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. AVAIL SEPT '76

Specs & performance with 100-hp Continental, fixed-pitch prop. @ gross weight	Take Off	800 ft	Range @ Max Cruise	720 mi	Canard Span/Area	12.5' / 13ft ²
	Climb	1700 fpm	Range @ Econ Cruise	980 mi	Wing Span/Area	22.2' / 53.6ft ²
	Max Cruise	200 mph	Min Speed (full aft stick)	49 kt	Empty Weight	520 lb
	Econ Cruise	165 mph	Landing	900 ft	Gross Weight	1050 lb

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

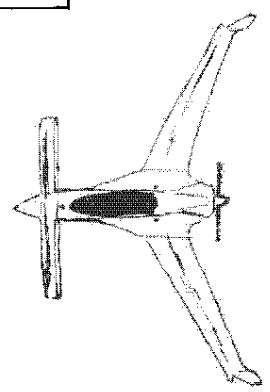
Check items desired:	Price, including first class mail U.S. and Canada	Air mail Overseas*
<input type="checkbox"/> VariEze info kit, includes current issue of "Canard Pusher" newsletter	\$5.00	\$6.00
<input type="checkbox"/> "Canard Pusher" newsletter, published quarterly. One-year subscription	\$6.75	\$6.50
<input type="checkbox"/> Section I	\$94.00	\$108.00
<input type="checkbox"/> Section IIA or <input type="checkbox"/> Section IIB	\$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

Calif. residence add 6% tax on all items except newsletter

* U.S. funds only

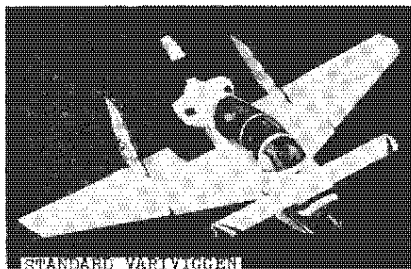
Rutan Aircraft Factory

BUILDING 13, MOJAVE AIRPORT
 P. O. BOX 656, MOJAVE, CA 93501
 TELEPHONE (805) 824-2645

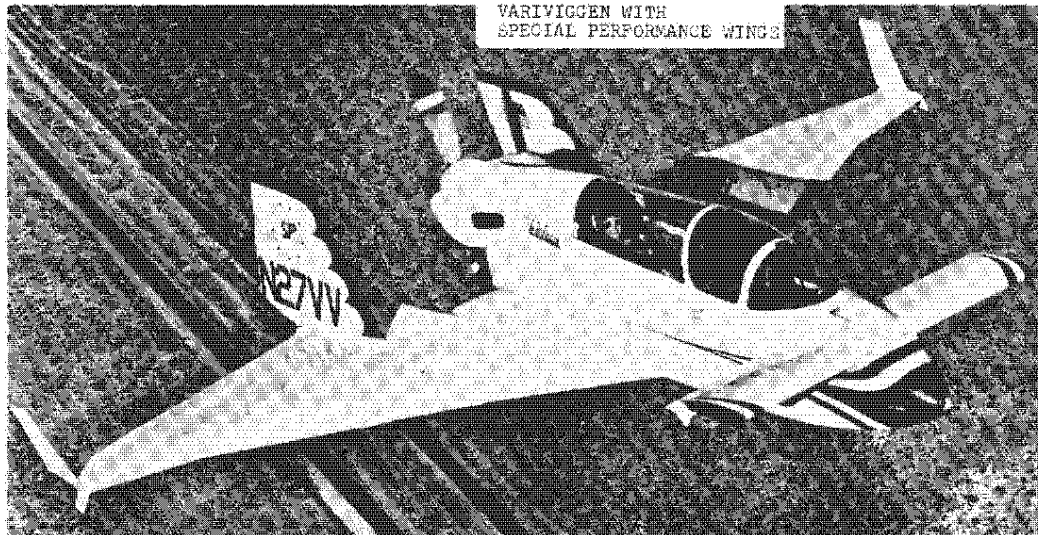


THANK YOU FOR YOUR INTEREST IN THE VARIVIGGEN

TWO + TWO SPORTPLANE



STANDARD VARIVIGGEN



VARIVIGGEN WITH SPECIAL PERFORMANCE WINGS

Performance with 150-hp, fixed-pitch prop, gross weight.	Take off	850 ft
	Climb	800 fpm
	Cruise	150 mph
	Full Aft stick	49 mph
Standard VariViggen	Landing	500 ft

Performance with 150-hp Special Performance Wings	Climb	1000 fpm
	Cruise	158 mph

Specifications Standard VariViggen	Canard Span/Area	8 ft/18.3 ft ²
	Wing Span/Area	19 ft/119 ft ²
	Empty Weight	950 lb
	Gross Weight	1700 lb

Specifications Special Performance Wing	Wing Span/Area	23.7 ft/125 ft ²
	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 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 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 (Lofing), 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.

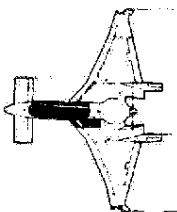
VARIVIGGEN SPECIAL PERFORMANCE (SP) WING/RUDDER PLANS - Construction drawings and assembly manual for glass composite outer wing panels and rudders. These are optional wings, replacing the aluminum surfaces shown in the VariViggen plans. The SP wings are easier to build and provide increased climb and 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.

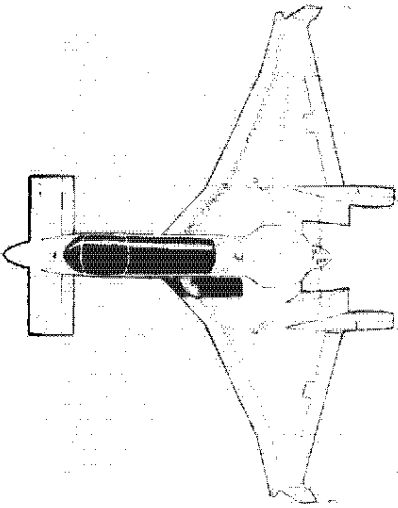
VARIVIGGEN R/C MODEL PLANS - Complete construction plans for the 18% size radio-controlled model airplane built & flown to evaluate VariViggen spin characteristics. Designed for 4-channel proportional radio equipment & engine in the .35 to .65-cu. inch size. 555-sq inch wing area. All balsa or foam/balsa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

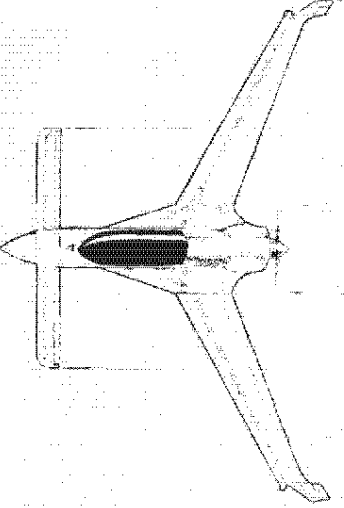
**Rutan
Aircraft
Factory**



BUILDING 13, MOJAVE AIRPORT
P. O. BOX 656, MOJAVE, CA 93501
TELEPHONE (805) 824-2645



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



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

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

OR

H. C. COMMUNICATIONS Write for brochure.
Box 2047
Canoga Park, Ca. 91306

Catalog cost \$2 - Refundable at first order.

VariEze and VariViggen custom COM & NAV VHF antennae.

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.

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

VariEze - None
VariViggen - All molded fiberglass parts

KEN BROCK MANUFACTURING
11852 Western Ave.
Stanton, Ca. 92680
(714) 898-4366

Catalog cost \$1 - Refundable at first purchase.

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

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

Write for brochure.

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

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

Write for brochure.

VariEze plexiglass canopy - Light bronze tint or clear.

BILL CAMPBELL (VariViggen builder) Contact him for list.
Box 253
Phelan, Ca. 92371

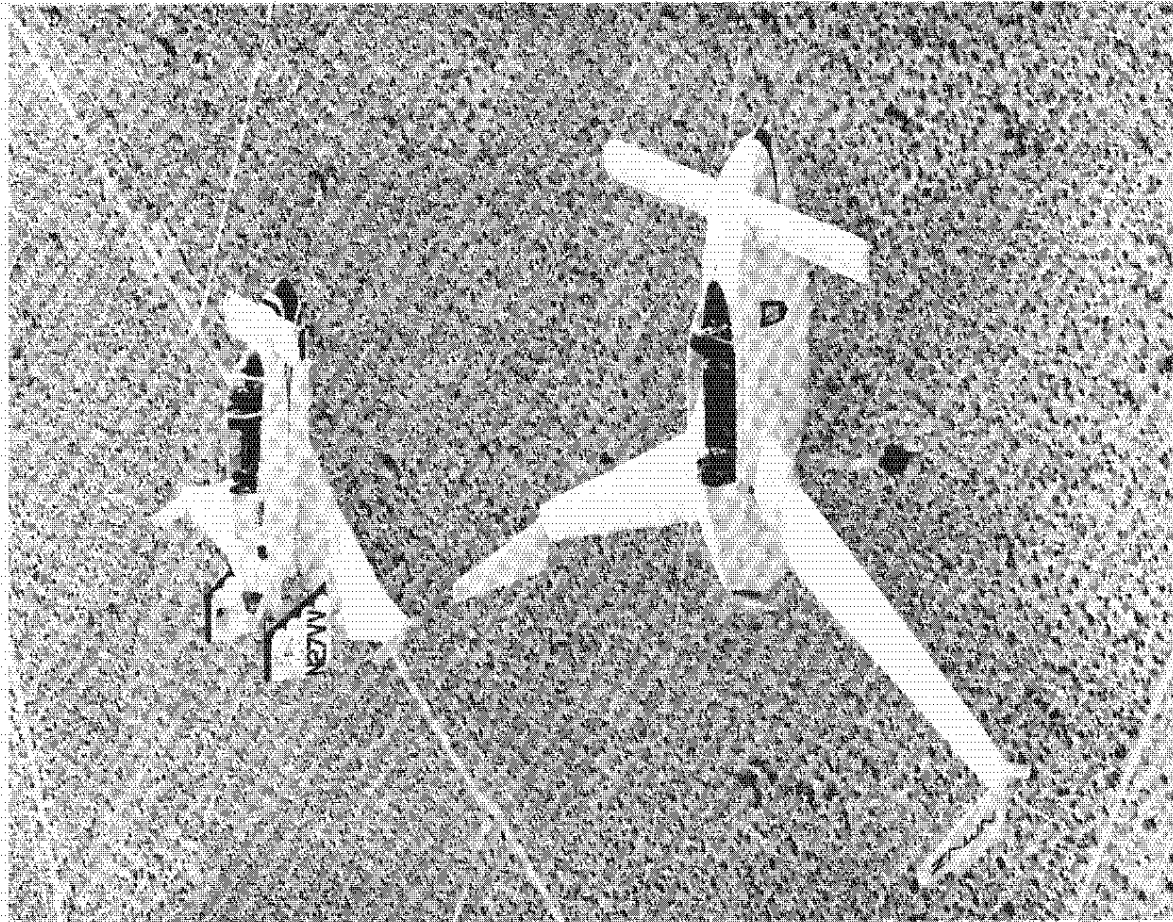
VariEze - None
VariViggen - Prefab brackets and fittings.

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

Contact him for list.

VariEze - none
VariViggen - prefab wood parts.

Contact him for list.



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

first class mai

TO:

IF THIS BLOCK IS CHECKED, YOUR SUBSCRIPTION HAS EXPIRED. YOU MUST RENEW TO RECEIVE NEXT NEWSLETTER. PLEASE STATE THAT YOU ARE A RENEWAL. IF YOU ARE A VARIVIGGEN BUILDER, INCLUDE AIRCRAFT S/N.