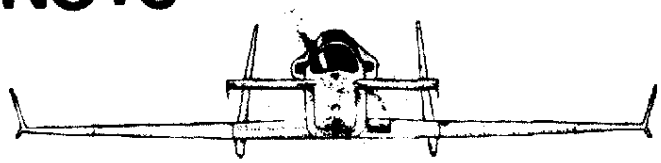
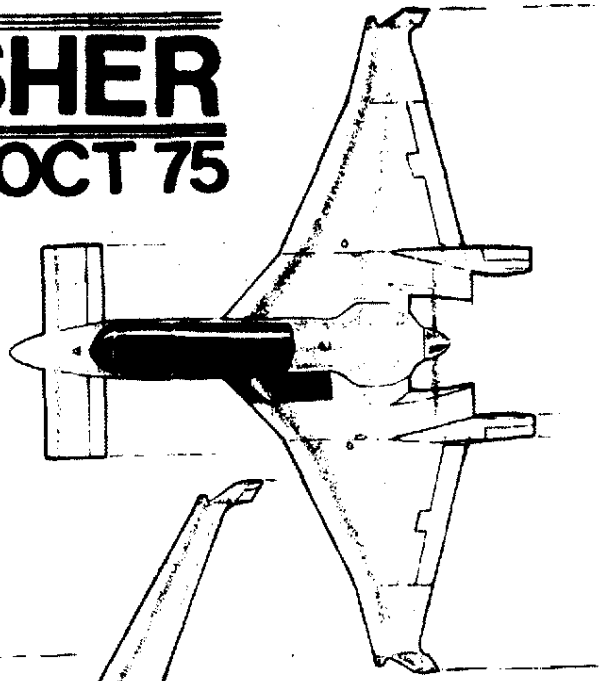
THE CANARD PUSHER

NO. 6 NEWS OF THE VARIVIGGEN & VARIEZE PROGRAMS OCT 75





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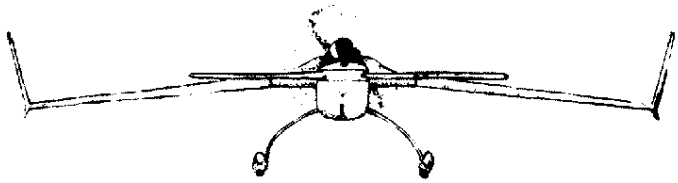
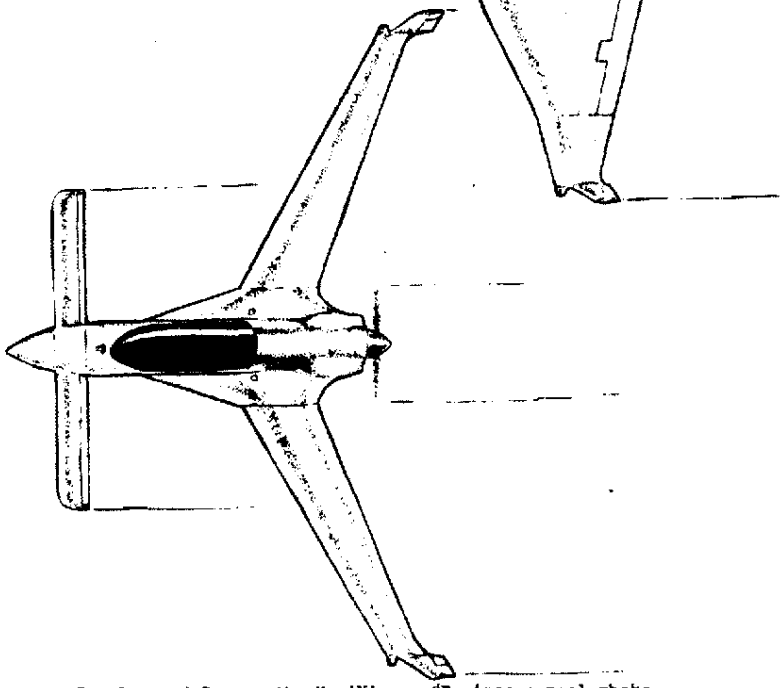




THE NEWSLETTER NAME, formerly "VariViggen News," has now changed. The suggestion of "Tail Pusher" was sent in and we modified it to"Canard Pusher." A special thanks to that person, whose name we don't have, and who gave us the idea.

Ken Ashdown's suggestion of "Canard Line" ran a close second to being picked for the newsletter name. We received many, good suggestions - thanks to all who contributed. The following list are a few of those which we thought would make interesting reading: The Canard Line, The Canardian Club, Vari New-2, Canard Time News, The Vari Forum, VariUnique Aircraft News, Canard Capers, Canard Contrails, Glass Backwards News, Vari Vignette, The Canard Rumor, Canard Disclosure, Canard Gas Line, Canard Trend, Canard Courier, The Backward Flyer, The Canard Leader, On the Nose, Canard Tales, Canard Forward.

The new name should last for some time now, until we come up with an aircraft without a canard!

RAF ACTIVITY has been brisk since the July newsletter. More tests have been completed on the new SP wings for the VariViggen. Carolyn and I flew the VariViggen to Oshkosh, including a trip to Kentucky on the way back to California. My brother, Air Force Lt/Col Dick Rutan, flew the VariEze to Oshkosh. His attempt to make the 1800-mile trip non-stop was cut short 300 miles from Oshkosh when he made a precautionary stop due to rising oil temperature. He made the 1500-mile leg in eight hours, 50 minutes for an average ground speed of 170 mph. Engine oil problems aborted a Saturday attempt to set a distance record, and the engine was changed over night. On the last day, August 4, of the EAA convention at Oshkosh, Dick set a new World's record for closed-course distance. He flew a total of 13 hours, 8 minutes; covered an official distance of 1638 miles - actual distance was about 1660 miles. Average power setting for the flight was approximately 40 to 50% power. The 1700-cc VW engine used 38.4 gallons of fuel.

Dick had an uneventful flight back to his home in Tucson, Arizona the day after the record flight; he averaged about 155 mph on his trip home at approximately 60% power, and obtained approximately 53 mpg at 10,000-ft altitude.

I understand that a detailed story of the VariEze's activity at Oshkosh will appear in the October issue of "Sport Aviation," So enough said - read your magazine.

Carolyn and I gave the VariViggen SP wings a real shakedown by taking the Denver - Las Vegas route home instead of the Albuquerque course normally selected in the summer due to the high altitude. The VariViggen performed well at the required density altitude of 16,000 ft crossing the Continental Divide. True air speeds as high as 159 mph were obtained at a cruising altitude of 7500 feet. After returning from Oshkosh the VariViggen and VariEze logbooks showed 550 and 130 hours, respectively. The VariViggen did not fly as much at Oshkosh this year as it has in the past due to our time constraints with the VariEze record attempts. However, rides were given to Jack Cox of "Sport Aviation" and Don Dwiggins of "Plane & Pilot" magazines.

We were extremely pleased to be presented the "Outstanding New Design" trophy for the VariEze. This is the same award garnered by the VariViggen in 1974. This year RAF had a booth to display plans and components for the VariViggen and to answer questions about our up-coming VariEze program.

George Mead has joined us this month. He is a capable engineer with extensive practical light-plane experience. He will be helping on both the VariViggen and VariEze programs. Many of you met Gary Morris at Oshkosh - he is as much an artist (he did the art work for the masthead) as a craftsman in fiberglass work. (Another big accomplishment was Gary having his hair cut!)

FLASH - It's now official; VariEze World's distance record has now been certified and registered in the list of official F.A.I. Records.

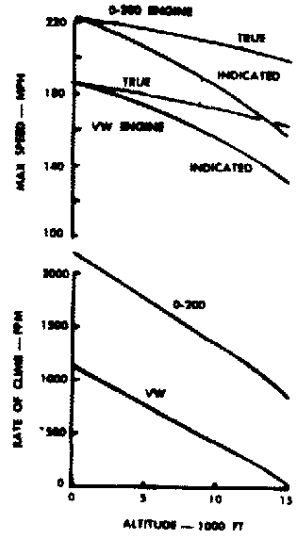
VARIEZE PROGRESS REPORT - The most important news is that we have definately solved the deficient low-speed roll rate and have lowered the stall speed by eight knots. I really wasn't too confident that the new canard with its new airfoil and elevon would make enough difference in roll rate at low speed. Before the new canard was ready for flight tests, I had made a detailed design study of a control system which included conventional ailerons on the rear wing. Those drawings are now in the trash can: we are keeping the canard elevons, the clean wing, and the super simple control system. The aerodynamic improvement with the new low-Reynolds number airfoil and slotted elevon is the most dramatic change I have seen occur without a major planform revision. Not only did the maximum lift increase by over 50%, the slope of the lift curve was increased by 30% changing the once "nose heavy" feel and high stick forces to a too-sensitive condition. I subsequently reduced the new canard's area and revised its elevon balance point to obtain what I now feel are near optimum. The new canard does not have the external trim tabs on the elevons.

With the old canard the aircraft would exhibit a nose-down stall break at 58 to 60 knots. With the new canard the aircraft can be flown at full aft stick at 52 knots and at a much greater angle of attack. Also with the old canard, roll-rate capability degraded below 80 knots and rudder control was needed for adequate roll below 70 knots. The new canard elevons result in roll performance very similar or better than the average light plane. A 60-degree bank change can be accomplished in less than three seconds even below 60 knots and roll control is adequate even at 52 knots. I have landed the airplane several times in the relaxed cruise position, with my feet in front of the rudder pedals. The overall maneuverability has been greatly enhanced.

I don't yet know if the VariEze will have the same low susceptibility to stall/spin as the VariViggen. It is possible but I won't know until all tests are completed. I do not plan spin tests on the prototype, N7EZ. The homebuilt prototype will be equipped with the appropriate instrumentation and recovery devise and a complete spin-test program will be flown before the construction plans are released.

The initial printing of the VariEze information kit stated that the aircraft was capable of 70 mpg at the economy cruise speed. This was based on flight test data at 10,000-feet altitude in which we obtained 61 mpg without a mixture control. Using standard corrections it was calculated that the carburetor was full rich and that 70.5 mpg would be obtained once a mixture control was installed and leaned to best mixture at 10,000 feet. It was later found that the carburetor was already jetted too lean and thus, only about 62 mpg can be obtained. The following table now appears in the information kit and shows the current estimates for a homebuilt VariEze.

PERFORMANCE



	With 1834-cc Volkswagen engine and 50x47 wood prop		With Continental O-200 engine**
	gross weight 880 lb two place plus baggage plus 15 gallons fuel	single place rear bulkhead fuel 625 lb	gross weight 960 lbs two place plus baggage plus 16 gallons fuel
sea-level takeoff distance*	980 ft	700 ft	700 ft
sea-level rate of climb	1100 fpm	1700 fpm	2400 fpm
economy cruise speed	128 mph at 40% pwr	—	138 mph at 30% pwr
range at economy cruise speed	900 mi	—	870 mi
max cruise speed 75% power	175 mph	180 mph	210 mph
range at max cruise speed	670 mi	—	580 mi
stall speed*	60 kt	54 kt	63 kt
landing distance*	1100 ft	850 ft	1200 ft

*These values should be improved approximately 20% with the new low Reynolds number canard airfoil to be tested this fall.
**estimated

VARIEZE HOMEBUILT PROTOTYPE

Many people have asked why we are building a second airplane; why not just sell plans for N7EZ? First of all, N7EZ was built without any tooling. Tooling will be required to build the following parts for the homebuilt kits: wing quick disconnects, cowling, main and nose landing gear, and canopy. We are building an airplane from the first parts to come from the tools; thus it will be assured that the parts will fit properly. Secondly, N7EZ was designed around the lightest (140-lb) version of the VW engine, to maximize the amount of fuel which could be carried for distance records. It has become obvious to me that many people will insist on heavy accessories and will want to adapt the Continental series aircraft engines which can weigh as much as 197 pounds even without starter and with a a light alternator. This heavy an installation would not be practical for N7EZ.

When comparing engine price based on 1200 flight hours, the price of the aircraft engine becomes quite competitive with the lower cost, less durable VW conversions. My own experience, though quite limited (N7EZ now has 160 flight hours since first flight last May), points to the advisability of paying the higher initial costs for a definately reliable powerplant. This is not to conclude that the VW cannot be converted and operated reliably by an experienced individual using aircraft-quality components and proper installation practice. There are available, however, conversion components and built-up engines which are not thoroughly proven and are not up to accepted aircraft reliability standards. For this reason I am making relatively major design changes which will allow installation of engines weighing as much as 198 pounds, and thus, make it possible to adapt Continental aircraft engines.

The homebuilt prototype will have a Continental O-200B engine (100 hp) which I estimate will climb nearly 2500 fpm and cruise 210 mph at 75% power. The C-90, C-85, C-75, and C-65 Continental engines will also be ideal. The empty weight of the O-200-powered aircraft will be about 480 lb, gross about 980.

A 1700 cc to 2100 cc VW conversion can also be adapted. Empty weight of the VW-powered aircraft will be about 430 lb, gross about 880 lb.

The additional wing area and stronger landing gear needed to provide for the heavier engine will compromise the cruise speed of a VW-powered aircraft, but by only four to seven knots. Do not write us at this time for advise on the VW engine. We will not be in a position to make any recommendations until the plans are available. I plan to keep flying N7EZ as much as possible to gain more experience with the VW installation. After some modifications we will make an assault on the straight-line distance record with a San Francisco to Miami flight (2600+ miles, including extensive night flying), possibly this fall/winter.

Additional changes being incorporated in the homebuilt prototype include

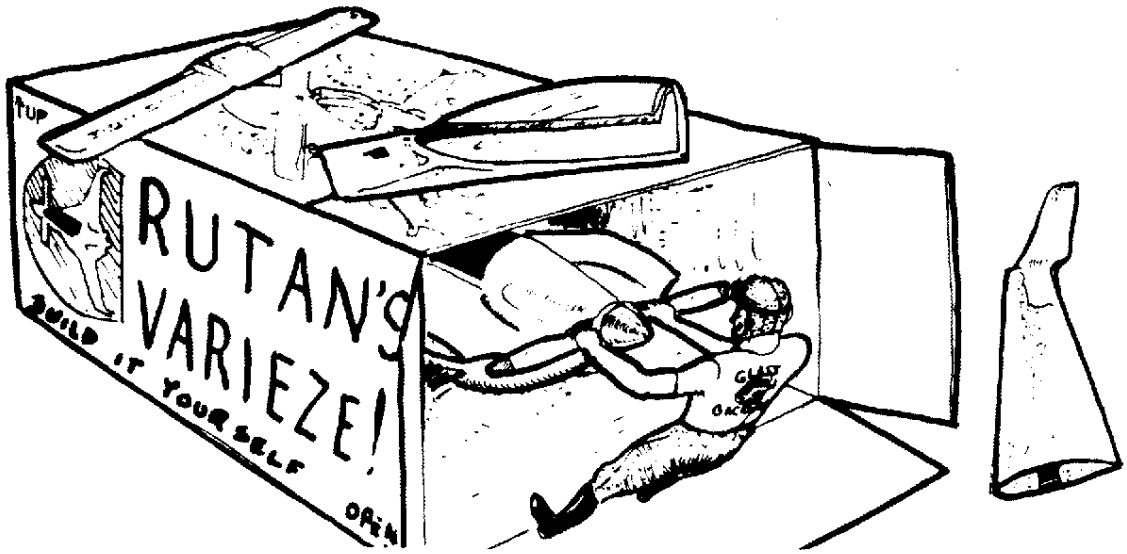
1. shallower fuselage and taller canopy to improve downward visibility over the side
2. roll-over structure
3. longer nose and locations of instrument panel further forward to allow knees to be placed forward <u>after</u> sitting down
4. more room in the back seat and more baggage room
5. instrument panel which can house NAV COM, transponder, eight 3-inch instruments plus all engine instruments. This allows IFR equipment <u>without</u> need for the expensive miniature primary instruments.
6. revised side-stick control configuration which greatly improves human factors and further simplifies control system (don't call - we cannot release details yet).
7. fuel capacity increased to 20+ gallons
8. increased aspect ratio on canard
9. improved nosegear retraction mechanism (N7EZ's nose gear retracted during landing rollout at Oshkosh probably due to inadequate down-lock indication - damage was minor.)
10. larger maingear tires and improved brakes (N7EZ had difficulty taxiing through the large ruts off the runway at Oshkosh).
11. elimination of plywood formers - these are being replaced with glassed high-density PVC foam, thus saving 4-lb weight and eliminating any possibility of deterioration
12. further simplification of the fuel system
13. use of special resins in landing gear to eliminate slight tendency to creep
14. further simplification of the structure and about a 5% reduction in the number of parts. We are confident that the airplane can be constructed in 400 to 700 man-hours from to-be-available components and materials.

The wing-disconnect system will not be as shown in the VariEze information kit. We found that production of the three-piece glass spars would be too expensive. In the interest of keeping kit price as low as possible we are using a machined assembly at each wing attach point. Half of the assembly is installed on the wing during wing construction. The other half is installed on the center spar during its layup. Removal of each wing for trailering will involve removal of two bolts, each holding two large taper pins. Removal of the canard is by two shear bolts reached through the cockpit rather than by the two external tension bolts previously used on N7EZ.

While the larger main tires will improve rough field operation, it is not yet known whether routine operation from other than smooth surfaces will be advised. I will have an answer on this by the time the plans are available. I do <u>not</u> plan, though to compromise the efficient high-speed cruise to provide rough/soft field capability.

VARIEZE TO BE OFFERED AS COMPLETE KIT

The VariEze info kit explains that RAF will make available the machined parts and several components such as landing gear, canopy, cowling, and wing fittings. We are, however, now working with several companies to supply portions of <u>all</u> the materials required. The selection of these companies is being based primarily on their delivery history - for example the company which will be authorized by us and supported by us from an engineering standpoint to supply the foam kit, will be the one which we think will be most likely to provide prompt, quality delivery of the foam. We must work directly with them, since it is essential that the proper type and amount be used and that they respond immediately to any engineering changes.



It would be unwise for RAF, itself, to expand to produce the entire kit, since it would take years to attain the efficiency of established companies in a variety of parts and materials. The fiberglass cloth, previously available only from Europe will be woven in the U.S.A. and distributed by a company equipped to deliver. When the customer receives VariEze plans, he will be referred to specific U.S. companies, authorized by us and who have our engineering support, to purchase the following kits or individual items: 1. machined parts, 2. foam kit which consists of three types in five different densities, 3. glass, epoxy, flox, and microballoons, 4. hardware, 5. landing gear, 6. canopy, 7. cowling, 8. finishing materials. It may seem awkward to deal with three or four companies to obtain a complete VariEze kit, but this is not the case, since each is selected for its record of capable and prompt delivery service. Each company selected will not only receive our continuous engineering support but must live up to our contractural delivery schedules.

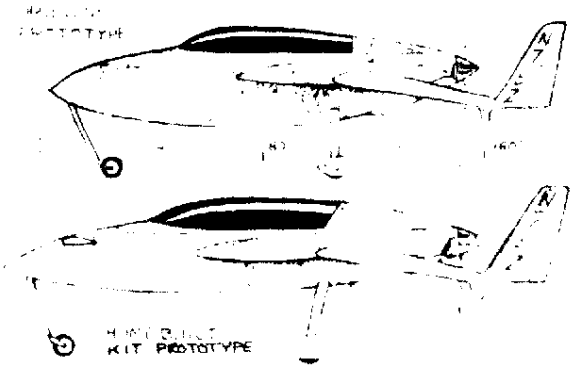
Only two of the eight kit areas have been specifically selected at this time. If you are a good, established company, currently handling any of these type items, and would like to supply kits, please contact us.

BUYER BEWARE - Buying the wrong fiberglass, epoxy, etc., can be the same as using conduit to build a steel-tube airplane instead of 4130. Remember, the years of testing and flight experience of glass aircraft points to a very important fact:

You must use the correct materials. True, it is possible that another product could do the job, but to verify this would mean starting from zero with tests for strength, workability, weight, compatibility, exposure to environment, etc. Since we do not want to take years more to develop the structure, we must insist that the builder use the products we will specify in the plans. Do not buy any product now. We have already had companies indicating that their products can be used on VariEze construction without having even a grasp of the structural requirements!

QUESTIONS/ANSWERS ABOUT THE VARIEZE

The following are some answers to questions asked about the VariEze. If you have further questions, write them down and send them in and we will answer them in the next newsletter. Do not visit RAF expecting to see N7EZ or anything related to the VariEze. We have been working at low efficiency recently because of the flood of visitors. N7EZ is shown only when it is out of the hangar flying - otherwise we have to keep it locked up so we can work. We cannot answer questions individually which aren't answered here or in the VariEze information kit. This policy will change as soon as we have the plans on the market - after that time, you will be welcomed to come up for a flight demo/ride, structural demo, construction methods demo, etc. We just can't afford to demonstrate something we aren't currently selling.



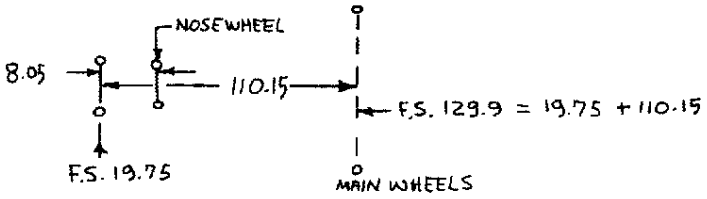
1. Isn't the small cockpit cramped?
   No, infact the seat has been very carefully engineered for long term comfort. Dick found more discomfort with four hours in a Cherokee than 13½ hours in the VariEze. I've spent as much as seven hours per day in it without even wanting to get out to stretch after landing. The comfort is obtained by a combination of the high thigh support, lumbar support, and correct height of arm rests, which relieves the back. The variety of foot/leg positions and ability to trim hands-off for long time periods, also adds to comfort.
2. Is cockpit heat required?
   No, due to the excellent insullation provided by the composite structure, the canopy will even keep the feet warm. Cold night flying is generally rare enough to not justify a heat system.
3. What is the glide ratio?
   At idle power (close to zero thrust) and 72-knots airspeed, glide ratio is 18.8.
4. Are dual controls planned?
   No. Again, I do not plan to compromise the design simplicity to do a mission other than that of efficient cruise. Learn to fly in an airplane which was designed as a trainer. Dual controls would triple the number of parts in the control system and eliminate one suit case. Also, controls could be jammed when flying solo with baggage in the back seat. Currently there is nothing in the back seat which moves (except Carolyn). Four pilots have been successfully checked out in N7EZ - none of them had side-stick experience.)
5. Is the VariEze an aerobatic airplane?
   No, providing for that capability would mean compromising the design goal of best efficiency at high-speed cruise. However, it does appear that the basic aerobatic maneuvers will be satisfactory. By the time the plans are available, I will list any allowed maneuvers and limitations.

VARIVIGGEN WEIGHT AND BALANCE METHOD

Since several VariViggen builder's are getting close to first-flight time and will be needing to do an accurate weight and balance, the following is provided to add some details not shown in the plans:

Materials Required - Three scales, two must be capable of weighing up to 500 lb, the other can be a bathroom scale - although I've seen someone do a reasonable job with five bathroom scales, placing a board (weight of board subtracted later) between pairs of two for each main wheel. (Borrow the scales!) Assure that the scales are accurate - test each with a known weight in the expected range. Caution on low cost bathroom scales - you may have to make a board to distribute the load to prevent warping the table, which will give an inaccurate weighing. You will also need a level, plumb bob, 12-ft tape measure, and chalk line. The average VariViggen will need nose ballast to sit comfortably on its three gear in a level attitude. Place a known weight at a known fuselage station - 50 lb in the front seat at F.S.60, for example.

Level the aircraft, using a carpenter's level on the flat bottom of the wing. Adjust it down by bleeding the air from the nosegear strut or up by placing a block under the nose tire. Now take the plumb bob and mark a point on the floor corresponding to each maingear axle centerline and both sides of the nosegear axle centerline. Use the plumb bob to mark a line on the floor corresponding to a known fuselage station - the most convenient is F.S.19.75, holding the plumb in line with the joint of the nose cone and the forward edge of F20. Now move the aircraft and make chalk lines on the floor as shown between the mainwheel reaction points, the nosegear points, and the two F.S.19.75 points. Measure the distance between F.S.19.75 and the nosegear and maingear reaction



points, for example 8.05 in and 110.15 in making the nose gear at F.S.27.8 and the main gear at F.S.129.9.

Now, get the help of a couple of friends to lift the wing tip while you slip the scale under each main wheel, one at a time, and a scale under the nose wheel. Recheck level attitude and read the scales - tap them to be sure friction is not effecting the readings. Remove the aircraft and record tare weight - chocks, boards, etc. Now setup the following table - be sure to state status of equipment. Note that ballast weight and moment are subtracted.

DATE 25 SEP 73
VARIVIGGEN N15VV
S/N 394
FUEL DRAINED TO UNUSABLE
OIL 6 QT
NARCA XYZ RADIO
BASIC INSTRUMENTS

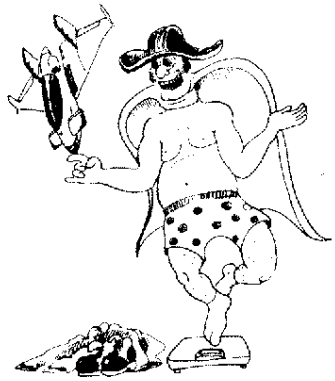
LOCATION	GROSS	TARE	NET	ARM	MOMENT
RT MAIN	481	+2	479	129.9	62,222
LT MAIN	497	+3	494	129.9	64,170
NOSE	12	+1	11	27.8	306
SUBTRACT BALLAST			-50	60	-3,000
TOTAL EMPTY WT			934		123,698

EMPTY CG = $\frac{123,698}{934} = 132.44$

You now know the empty weight and empty cg and are ready to calculate your weight and cg for your first flight. Assume you weigh 175 lb, your parachute weighs 18 lb, and you will carry 25 gallons (150 lb at F.S.137) fuel. Make up the following table:

	WEIGHT	ARM	MOMENT
EMPTY AIRCRAFT	934	132.44	123,698
PILOT	175	62	10,850
CHUTE	18	64	1,152
FUEL	150	137	20,550
TOTAL	1277		156,250

CG = $\frac{156250}{1277} = 122.36$



Now, checking on page 3 of the plans, a cg of 122.36 is within the envelope suggested - so follow the maiden flight procedure in newsletter #2 and happy flying.

VARIVIGGEN SPECIAL PERFORMANCE WING

The new composite outer wing panel for the VariViggen has been flown about 80 hours now. The performance figures stated in newsletter #5 are accurate and the structural durability is excellent.

We are now working with various suppliers for foam, epoxy, and glass, so there should be no problem obtaining any of the materials. The SP wing plans will be available the first week of November, but we won't know the price of the plans until October 22. Those who need the plans before the January newsletter can contact us after the above date to receive further information. Complete details will be in newsletter #7 for those who won't need them before January. The special unidirectional fiberglass which is being woven for us, will be available by mid December. Those who will need it before then can contact us and we can supply a substitue from our stock. Please don't unless you absolutely need it right away, since we're not presently equipped for a large volume. The price will be much lower after the manufacturer weaves the large order.

Should your VariViggen have the SP wing? The decision is yours. Personally, I like the extra climb, cruise performance, and lower rate of sink, but the roll rate is lower and the stall margin is less. Tuft tests have shown some stalling of a small amount of the SP wing near the tip at less than 47 knots - this is very close to the minimum attainable speed. This tip airfoil separation results in a slight buffet and "wander" in pitch and roll when near and at full aft stick. Full aft stick can be maintained with power for level flight (or greater) without any stall break or roll-off, and roll control at full aft stick is good. However, the aircraft doesn't have as solid a 'feel' as the standard wing below 50 knots. Accelerated stalls (in a turn) are smooth and solid with power settings of 2100 rpm or more. Accelerated stalls with less power do result in some bucking and slight wing rock.

In one instance, George Mead experienced a ½ snap roll as he was pulling up from a dive and rolling. This occurred during simulated air combat with the VariEze. I haven't done a complete spin program with the SP wing, so I don't know if it could be spun. This brings up another point: Someone mentioned to me at Oshkosh that he was flying his radio-controlled model VariViggen (I assume with the standard wing), and he experienced a spin which was entered when the engine quit in a turn and was not recovered. This is baffling to me, since my spin test model would not spin, regardless of the control or throttle inputs. At least 75 spin attempts were made. Also the full-size aircraft can maintain full spin controls indefinately without spin entry. In fact, for airshows I have done a pass by the crowd many times with full rudder and full aft stick at low altitude. I asked the gentleman, who's name I don't have, to send me a complete report of the models configuration, incidences, cg, and control deflections, but I haven't heard from him yet.

Now back to your decision. While the SP stall margin is less, the airplane is still quite resistant to stall during <u>normal</u> flight maneuvers, is very maneuverable at low speed, and quite safe. I strongly recommend the SP wing for those installing 125-hp engines or those with 150-hp engines who plan to routinely operate near gross weight, from short fields, or at high density altitudes. The additional directional stability provided by the winglets also improves high-speed flying qualities. If you don't plan to operate heavily loaded and like the fighter-like roll rate and extra stall margin, then select the standard wing.

In newsletter #5, I passed on to you some <u>preliminary</u> thoughts regarding reflex and nosegear length with the SP wing. First, concerning the nosegear length, I do <u>not</u> recommend lengthening the gear to obtain lower rotation speed. The maingear position (F.S.129.8) is already moved approximately 1½" forward of that on N27VV to lower the rotation speed and lessen the load on the nose gear on rough fields. I think that lengthening the nose gear would make the airplane too difficult to handle when sitting on the ground without someone seated in the cockpit. It would take more load to hold the nose down before getting in and would make that first step too high.

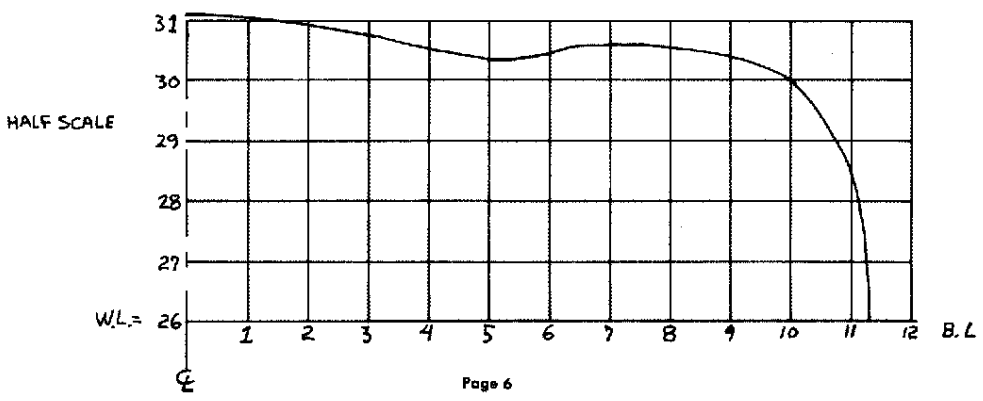
I do recommend that you retain the variable reflex with the SP wing. You will find the up-reflex helpful to obtain minimum ground run for short fields and having the reflex down or neutral adds more stall margin for the aft wing. If you are a nut for simplicity and aren't planning short field operations, you <u>can</u> disregard the reflex. Merely rig the neutral-aileron position of the AB8 belcrank to the zero reflex position shown on page 40 of the plans. The SP wing plans will show you the correct reflex of the aileron.

VOR ANTENNAE LENGTH

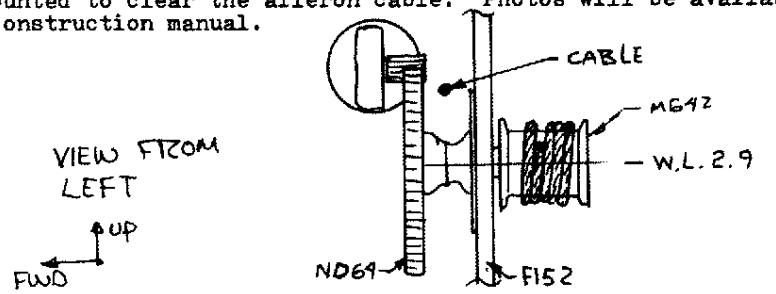
Someone told me that the 14-inch length VOR antennae should be 16.6"; another said 26" but it depends on the balun, or coax loop. I have the system shown on the plans on N27VV and I get excellent accuracy and about 80-mile range. Is there an antennae expert out there who would like to write a blurb on homebuilt VOR antennaes for a future newsletter??

VARIVIGGEN BUILDING TIPS

Fit of F41 Bulkhead to F27 Visor - A previous newsletter suggested that you leave excess plywood on the top of F41 to fit it to the RAF-supplied F27 fiberglass visor. The following drawing shows the F41 contour required to fit F27:

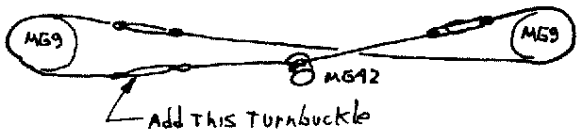


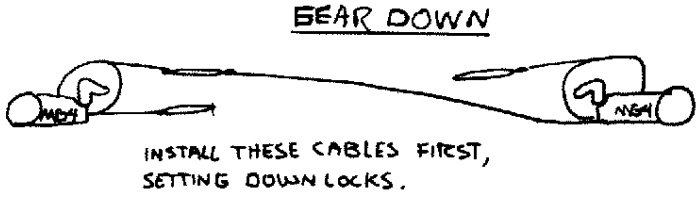
Wayne Koch reports that the gear on the Ford window-motor assembly is a 9-tooth, 12-pitch 14½-degree gear, and that the extra gear shown in newsletter #4 can be eliminated. This is true only of the Ford, not the Dodge motor. A Boston # ND30 will mesh directly with the Ford motor and provide the correct ratio for the nose gear. For the main gear use a Boston # ND64. Unfortunately the 12-pitch gears aren't available in a light narrow flange variety, however, the 3/4-inch flange can be turned down to save room and weight. The following drawing shows how the 5.5" dia. main gear can be mounted to clear the aileron cable. Photos will be available with the 2nd part of the construction manual.



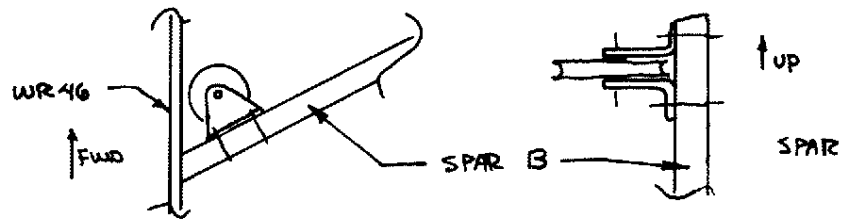
Be sure to follow the order shown on the plans when rigging the main gear. First, adjust pushrod MG6 to obtain correct down lock action. Then retract gear and position the correct over center position of MG5, adjusting the uplock action with the uplock turnbuckle. Then drill MG14 into MG12 and install bolts through MG14. Extend gear and accept the extended position.

The following are tips sent in by Jim Cavis concerning the main gear.
"When welding pivot on MG16, put a bolt through it so it will keep its shape. After making and drilling MG16, use it as a guide to drill through spars. Cable can slip on MG42 unless it is passed through spool like on nose gear. Once this is done, you can't get the cable and MG42 through the holes in the ribs. I made my cables up in three sections, so motor and MG42 can be removed without removing MG9 pulleys."





"I used a 5/8"x.125 steel tube for MG36. I tapped the end and used a fabroid 77330 rod end threaded into the end in place of the Heim HF-5C (plans page 47)."
Jim also made an acceptable substitution to the MG20 bracket. Instead of bolting to WR46 rib and the spar, he just bent up two aluminum angles (top and bottom of pulley) and bolted them to the spar.



Bulkhead Assembly - Remember, if you are assembling the bulkheads from several parts rather than cutting them out in one piece (to save plywood) you don't have to make scarf joints - just overlap the pieces, giving at least 3 square inches of overlap at each joint. This applies to the bulkheads sold by RAF. The bulkheads are sized to provide sufficient glueing area to the skin and are much stronger than they need to be for all other loads.

Inclined Bulkheads - Use a plumb bob from the bulkhead tops to the jig to check incline. This assures an accurate slant. If the F121 bulkhead is not slanted enough, the F28 tank cover may not fit. If this is the case, you can knock the bulkhead loose from the stringers and move it back, provided you haven't already skinned the fuselage sides.

Maingear Rigging - If you move the pivot for MG5 and MG9 pulley to B.L.34.15 as suggested in newsletter #4 (when using RAF-supplied MG4) you may have to bend the uplock belcrank (MG29) outboard more and cut away a portion fo rib 36.5A for clearance.

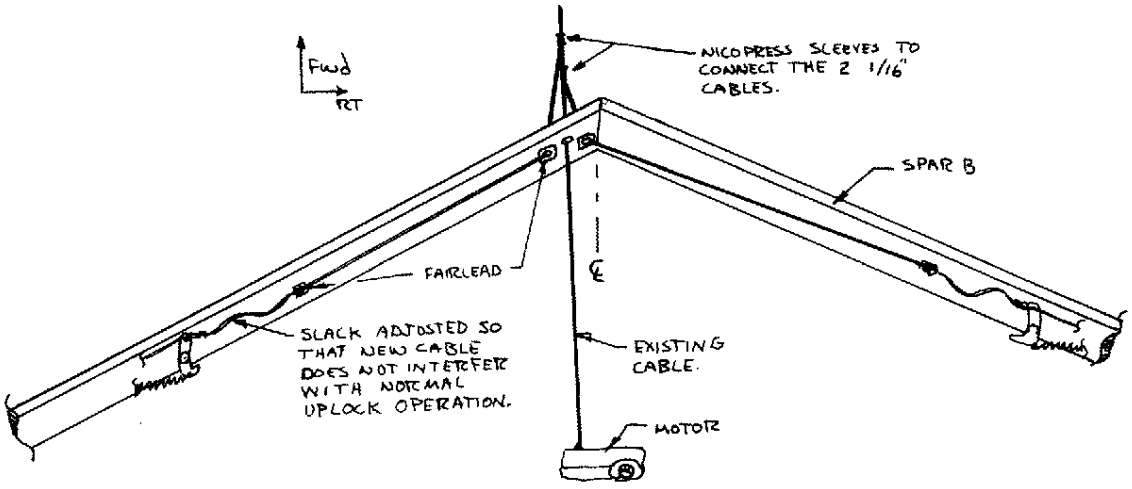
VARIVIGGEN GEAR-UP LANDING SAGA #2 & #3

On our way to Oshkosh this year, Carolyn and I again were faced with having to land N27VV with the main gear retracted. We landed on a hard surface runway with the nose gear exteded. We got the prop stopped before touchdown and slid out on the rear skids and nose gear. Again, the nose gear took the load with no damage; all damage was limited to the two aft skids and a non-critical scrape on the aileron control arms. Inspection revealed the problem to be the same uplock spring which caused the gear to remain locked up three months earlier at the Corona flyin (see newsletter #4). We were on our way that afternoon again, after pinning the main gear down, and flew the remainder of the trip to Oshkosh with the main gear down. The next day at Oshkosh we repaired the skids and rerigged the main gear to put it back in operation.

This time the uplock springs loop had somehow slipped out of the bracket rather than failing like it had at Corona. The spring loop was returned to the bracket, this time twisting it backwards so its own torsion wouldn't tend to remove it.

I feel quite embarrassed by having this spring fail - twice! After all, a spring is something to trust, like gravity. I am recommending that you install a simple addition which consists of adding a branch to the existing emergency extension cable. The present emergency extension cable removes the electric motor from the system, allowing the uplock return springs to push the gear overcenter so it can freefall down; this only backs up a failure of the electrical motor, and cannot extend the gear if the uplock springs fail or if the uplock would jam. By simply adding cables to the existing emergency cable and routing them to the top of the uplock belcranks, the emergency handle would not only remove the motor, but would pull the uplocks out and force the gear overcenter and on its way down. Thus, the emergency handle overrides a spring failure and any jam of the gear. The following drawings show how this is done:

Rig the cables so the motor is removed first, then a further pull of the handle forces the uplocks out and the gear down.



Gearup landing #3 - This one is of no real concern to builders, since it does not involve a problem which can occur with your aircraft, since an obvious design improvement was incorporated into the plans before they were first released. The failure allowed the MG5 bolt to slip past the MG29 bolt during gear retraction. As such, the microswitch on MG29 was not activated and the gear motor continued to run, jamming the gear way over center and failing the cable. This failure occurred on the third flight of the day at the EAA Western flyin at Tulare, California; with Bob Eldridge in the back seat, I had taken off to compete in the spot landing contest. Since there was alot of activity on the runway at Tulare, we decided to fly to another airport about 20 miles away to do our gear-up landing there. The landing on the nose gear and aft skids was uneventful (routine?), the gear was fixed and we flew back to Tulare to compete in the spot landing contest.

NOW- I don't expect to hear from any more of the VariEze fans about wanting to retract the main gear!

Surface Finish - There are many acceptable ways to apply finish over the external wood skin. The following is the procedure used on N27VV: The wood is sanded with 80 or 100-grit sandpaper on a hard block, taking care to level areas around skin splices. Mix up a mixture of epoxy and microballoons (available from Gougeon Brother) and trowel into low places, fill gaps around joints, and form a 1/2" radius at the wing-fuselage and wing-vertical stab junctions. When dry, sand again. Apply the lightest available ceconite (available from Stitts); I think its 1.7-oz weight. Shrink down smooth and apply two or three coats of dope to fill the weave. Be sure to run the ceconite around easily-damaged areas like trailing edges. Sand when dry with 220 grit. Apply two coats of laquer primer/surfacer (Dupont or eq), wet sanding after each coat with 320 grit. Finish by spraying on your favorite color Dupont Dulux enamel. Finish internal wood surfaces with epoxy as shown in the plans.

The glass SP wings are finished differently. Finishing details will be supplied with the plans. Remember if you use the glass SP wings, they (like all glass sailplanes) must be painted white. This keeps the glass resin below 120° even in the hot sun and prevents it from losing its stiffness. An alternative is to use a high temperature phenolic resin in constructing the wings, but that can triple the resin cost. (For the same reason all VariEze aircraft will be all white, with a limited amount of trim color.) We are testing a polyester white finish which can be sanded and buffed the next day after spraying. More details on this later.

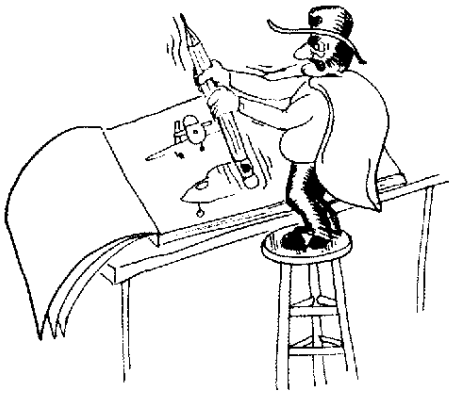
If anyone has wood aircraft finishing suggestions, send them in for future newsletters.

VARIVIGGEN PLANS CHANGES

Be sure to incorporate these revisions into your plans now.

Location PL - Plans
TR - Tech Report
NL - Previous Newsletters
CAT - Catalog

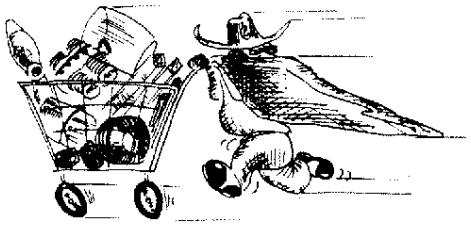
Category of Change
MEO - Minor error or omission
OPT - Optional improvement
DES - Desirous change - does not effect flight safety but should be incorporated to improve aircraft or correct a fault
MAN - Mandatory change - must be incorporated as safety of flight is affected



Category	Location	Change
MEO	PL pg 52	Nosegear door attaches to F32, not F20.
MEO	PL pg 14	View BB (from page 13) should not show C6 on the aft side of the forward spar. C6 is not required on the aft side outboard of B.L.24. See top view.
MEO	PL pg 13	The four bolts which attach canard spars to bulkheads are at W.L.22.85, not W.L..85. Be sure to epoxy, as well as bolt the canard to the bulkheads.
MEO	PL pg 25	SPAR D - The solid line drawn between the W1 gussets on the left should be erased - its presence indicates a spar web which isn't there.
MEO	PL pg 37	F.S. of trim pivot is 35.6, not 135.6.
MEO	PL pg 4	Aluminum tube - RM1 is fabrictaed from an aluminum bar, not from standard tube stock. Erase it from the tube bill of materials.
MEO	PL pg 25	Spar F butts to WS28, not to WS29.
MEO	PL pg 38	SA1 square tube forward end is at F.S.54.2, not F.S.154.2
MEO	PL pg 51	Upper left of page, MG20 center of pulley is at W.L.5.0.
MEO	PL pg 41	Faded words to left of brake master cylinder read "1/4" bulkhead fitting through F31-AN833-4D".
MAN	PL Chapter 19	Add the modification shown in this newsletter to expand the capabilities of the emergency maingear emergency extension system.

SHOPPING

If you are having trouble finding the DOAN#31-2014 rubber shocks, it may help to know that they are also listed as American Parts #2-2014 or Borg Warner #31-2014 or Anchor #31-2014.



I understand that a substitute for the Stanley 61-112 is a Lufkin # C9212-X. This is available at most surveying supply houses or through Robert Lamishaw - Lamco Enterprises, 3660 Wilshire, L.A., Ca. 90010. Also Francis Falejczyk, 7881 Seneca St., East Aurora, N.Y. 14052 says he has decimal 12-foot chrome cload tapes for $5 - postage included. Be sure you get one graduated in inches and decimals (10th & 100ths) of an inch. I've seen some rules graduated in decimals of feet - these are worthless to you.

We're still recommending Gougeon's west system epoxy as one of the most economical and convenient adhesives. The tests I am running with this epoxy are most encouraging. An added advantage is its low toxicity - it doen't effect the skin as much as most others. Be sure to add the 401 short fibers to increase viscosity to fill gaps greater than 1/32". The following order will go a long way and the mixer pumps save alot of time weighing out each batch:

105 Resin	1 gal	$19.35
206 Hardener	1 qt	5.00
401 Shortfibers	1 lb	1.90
Mini pumps	1 set	2.75
Applicators	3 doz	3.00

Order from Gougeon Brothers, 706 Martin St., Bay City, Mi. 48706.

Jesse Wright S/N 91, is now manufacturing a kit of parts for the canard and elevators. The kit includes the following parts - routed to final shape and tapered where required: C-6, ER, ER1, E4, E6, C11, E5, CR1, CR and CRT1 - a total of 75 parts in all. I have inspected the kit and found it to be of excellent quality, using birch plywood. The kit does not include the spruce spars - those are in the spruce kit already available from Aircraft Spruce & Specialties, Fullerton, Ca. 92632. With these kits available, the homebuilder has only to assemble completed pieces, with little fitting or shaping required.
Do not order the canard kit from RAF. Contact Jesse Wright directly at 7221 S. Colorado Ct., Littleton, Co. 80122 (303) 711-5140. His price is $116.00, which includes all packaging and shipping, anywhere within U.S.A. or Canada.

Jesse will also have a complete kit of manufactured (routed parts to final shape) bulkheads available by November 15th. Contact him after that date for price and availability. We have not been satisfied with the service provided by the vendor of the drawn bulkhead kit now shown in the RAF catalog. Once the routed parts are available from Mr. Wright and have been approved by us, we will discontinue the drawn bulkhead kit. The routed bulkheads will save the homebuilder a considerable amount of work and guarantee him accurate, splinter-free edges. Mr. Wright plans to offer routed inboard wing ribs by mid December.

Good news for those who have asked us to make MG14 maingear legs available, George Evans, 4102 Twining, Riverside, Ca. 92509 has already made three shipsets for local VariViggen builders. They are of first-rate quality, welded of 4130 steel, heat treated, cadmium plated, and baked. The lower tube is honed for a perfect fit on the MG30 trunions. All tabs are welded in place and the uplock bolt hole is drilled/tapped (see plans page 48). We are working with Mr. Evans on this item, but will not handle this in the RAF catalog; call (714-683-3963) or write Mr. Evans directly to order. He will also make available the MG32 trailing arm aluminum bars and the welded steel NG25/NG26/NG24/NG23/NG27 assembly.

VariViggen angle-of-attack system, fully assembled with or without meter, all components assembled to back of meter on printed circuit board - write Allen Vaughn (S/N 348), 1915 Florida St., Huntington Beach, Ca. 92648, or call (714)-5368122, for price and availability.

1. Carrol Holzworth's (SN 2) VariViggen with vertical fins in place & RAF fiberglass parts. 2. VariViggen exhaust system in jig ready for welding. 3. Beginning the takeoff roll for the World's record flight. 4. Carolyn, Dick, Burt, & Prof. Ed Lesher getting N7EZ ready for the record attempt (note fuel tank in back seat). 5. N7EZ arrives at Oshkosh. 6. N7EZ & Ed Lesher's Teal - the Teal was the previous distance-record holder. 7. Dick climbing out after 14 hours in the cockpit & Harold Best-Devereux removing the barograph. 8. Dick on N27VV planning the "VariEze" trip home.