

THE CANARD PUSHER

NO. 17

July 1978

Published quarterly (Jan, Apr, Jly, Oct) by

RUTAN AIRCRAFT FACTORY
Bldg. 13, Mojave Airport
Mojave, Ca. 93501
(805) 824-2645

NEWSLETTER SUBSCRIPTION - \$4.75 per year
OVERSEAS (AIRMAIL) - \$6.50 per year
BACK ISSUES - \$1.00 each

If you are building a VariViggen you must have newsletter 1 through 17. If you are building a VariEze from the first edition plans you must have newsletters 10 through 17. If you are building a VariEze from the second edition plans you must have newsletters 16 and 17.

Reproduction and redistribution of this newsletter is approved and encouraged.

RAF ACTIVITY since the April newsletter has been hectic. Builder support demands have been high with many new construction projects started and over 20 first flights since April. The excellent safety record has been marred by two fatal accidents which are discussed later in this newsletter. Also, during this time period the plans for the Quickie were completed and shipment of the first Quickie kits has begun. Our new light twin, the "Defiant" made its first flight on June 30.

We have completed additional contract work on the NASA skew wing AD-1 and have run further tests on our solar water heater. So, please excuse the patched-together appearance of this newsletter as it is being crammed together on an extremely tight schedule to get it out before our Oshkosh trip.

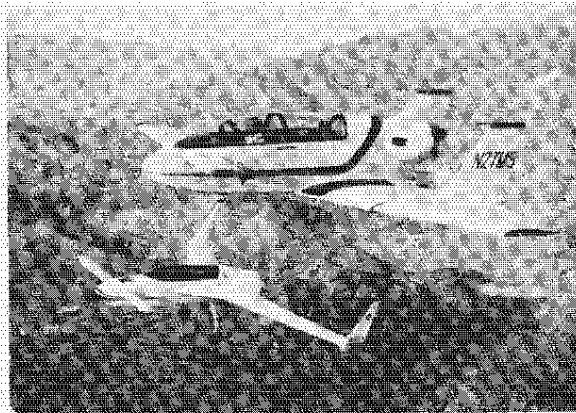
Since many of you do not know the size of RAF we are including the adjacent photo. Paul Striplin, on the left, helped us build the Defiant and has now left to pursue his own ultra-light project. Next is Dick Rutan, Burt's brother, who has worked full time at RAF since retiring from the Air Force in April. Dick has extensive flying experience both in general aviation and military fighters. He also holds an A&P license. He now owns the VariEze prototype, N7EZ, and is in the process of removing its Volkswagen engine and installing a Franklin 60-hp which he plans to use to make some record flights. Next are Burt and Carolyn Rutan, founders and owners of RAF. On the far right is Marge Merrill, with us since April.

DID YOU KNOW? Ferde Grofe's film "Flying is VariEze," has won the Aviation Space Writers Association's Award for Visual Communication. See "CP" 13 if you want a copy of this film.

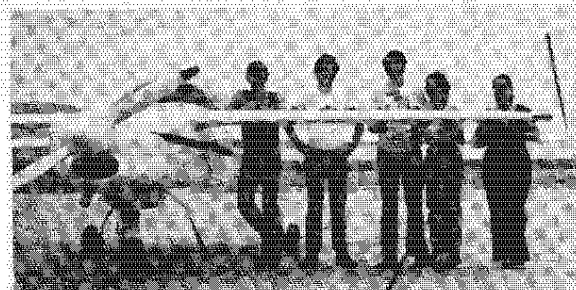
The VariEze plans (Section I) are now available in the second edition, with all revisions from the first two years incorporated. The Section I education chapter is extensively modified, incorporating all the new methods now recommended. Due to the large amount of builder support and inflation we have raised the price of Section I. Prices for all other items are the same (see attached flyer). This is our first price increase since we started business in 1973. We plan to have Section IIA and the VariViggen plans updated to a second edition soon.

The AD-1, designed at RAF and being built by Ames Industrial Corp, N.Y., is 70% finished and should be delivered to NASA late this year. The adjacent photo shows the aircraft. It is about the same diameter as an EZ, but is over 35 ft long. Its entire structure is basically similar to a VariEze.

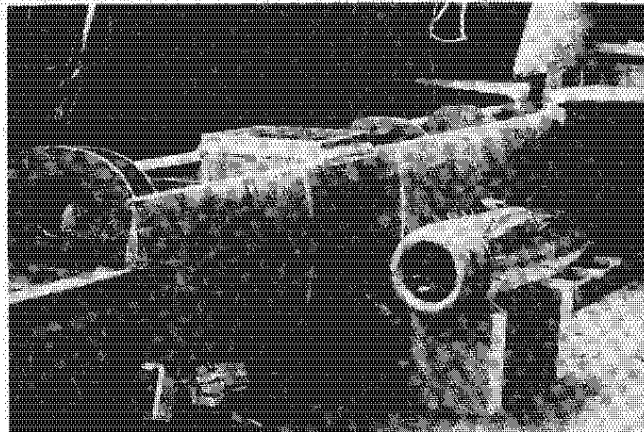
The VariEze is approved for construction in Australia, but is being held up in Canada due to a wing-loading restriction



MIKE & SALLY'S VIGGEN WITH N7EZ



AD-1 SKEW WING AIRCRAFT



The adjacent photo shows the largest gathering of VariEzes in the world. At a surprise birthday party (35th) for Burt given by Carolyn, all nine showed up at Mojave in June. Attending with EZ's were Don Shupe, John and Wilma Melville, Ed and Jo Hamlin, Jim Heitkotter, Les Faus, Hal Reynolds, Ernie Taylor, and Dick Rutan. The party was attended by over 80 people!



The VariEze/VariViggen survey results ("CP" 16) have not yet been completed since only about 10% of those flying have supplied the data. Those of you that are flying, please send in what info you have even if it is incomplete, so we can get it compiled and printed in the next "CP".

Based on information received at RAF there are about 65 VariEzes that have flown. About 90% of them are currently in active flying status. Several have been damaged in minor accidents, have been repaired and are back flying. Two have been damaged beyond repair.

We have just completed a photo session with noted "National Geographic" photographer, James A. Sugar. The photos are intended for an article to be published next year on the subject "Advances in Aviation." Mr. Sugar, who is well known for his special effects set up some spectacular shots including one with a wide-angle remote camera mounted on the nose of the Defiant looking aft. This shot was done at dusk, with colored strobe lights illuminating the inside of the cockpit and included the VariEze in close formation behind. "National Geographic" always does first-class photography, so we are certainly looking forward to seeing the article.

QUICKIE - The Quickie program is off and running! The initial kit deliveries began in early July. Current backlog on kits is approximately 2 to 3 weeks. The prototype, N77Q now has over 125 hours flying time. Tom and Gene plan to fly it to Oshkosh on the 25th or 26th of July, so if you live along Route 66, look up! The Quickie has received some excellent coverage in the aviation press, including "Flying" (color coverage in June issue), "Air Progress", "Plane and Pilot" and various others. Peter Garrison, well know to "tell it like it is", had this to say in the "Flying" article after his flights in N77Q. "The beauty of the stalling characteristics (which are shared by the VariEze) is that you get perfectly clear, perceptible stall warning without any loss of control or much loss of performance. At sea level with the stick full back and with full throttle, the Quickie will actually climb, bucking, at 150 fpm.* A high effective aspect ratio further assures that there will be little loss of climb performance in turns; so in the Quickie, you can maneuver with perfect confidence at minimum speed, all the while climbing, treating the stall regime just as you would any other portion of the flight envelope."

"The upswing in my confidence is remarkable. Suddenly I can't resist the temptation to keel over past 90 degrees and dive toward the little figures beside the runway. With the throttle back at idle, the airplane suddenly feels silken. It's delightful to fly. On the deck at almost 110 knots, I sail past the spectators, then pull sharply, watching the airspeed; it bleeds off slowly. Near the end of the zoom, I drop a wing, turn 90 degrees and level out in gentle bucking, then pick up a few miles an hour, keel over again and swoop down for another pass. The knowledge that this airplane can't run out of airspeed does wonders for my enjoyment, and I realize that unconsciously I am adjusting my climbs and descents to conserve potential energy, in the same way that glider pilots unconsciously adjust speed and course to capitalize on small upward air movements. Despite the scanty surplus of power, I am able to work up and down a block of air nearly 1,000 feet deep without devoting much time to scrambling for height. The combination of its fine, effortless, intuitive handling qualities, clean design and perfect immunity to low-speed mishandling makes it fantastically enjoyable to fly. It's a toy, but one of those high-grade toys that work sublimely well. Its long suit is gadding about on weekends, airport-hopping, dog-fighting or racing over the wilderness, belly to the ground, leaving no mark behind. It's

cheap, it's easy, it's safe, and, best of all, it's a good airplane, a pilot's airplane and really a joy to fly." Peter Lert's "Air Progress" article had quite a bit to say about stall characteristics: "Like the VariEze and Burt's earlier Vari-Viggen, the Quickie can't be stalled; the wing loading and airfoil of the canard are chosen such that it invariably stalls before the aft wing, and hence cannot pull it up to a stalling angle of attack. Thus, the "stall" consists of the canard stalling, then dropping until a knot or so of speed is gained, then stalling again, and so forth; to the pilot, this appears as a pitch oscillation of perhaps 15 degrees at the most. In the VariEze, I'd call it "nodding"; since the Quickie is so short-coupled, the motion is a bit faster, and I'd call it "bucking." After the first couple of cycles, during which it increases in intensity, it remains steady; about like running an outboard skiff over 6-inch chop at about 10 mph. This is with the stick held fully aft against the stop, mind you, and at full power in this condition the Quickie won't nose up to the vertical and roll over--it can't. It just sits there and bucks, climbing at maybe 160 fpm. Roll it into a turn (since the aft wing never stalls, the ailerons are still effective) and it just bucks its way around the turn. I was, and am, impressed--this may just be the safest plane I've ever flown, at least as far as low-speed flying qualities are concerned." The Quickie is probably the easiest single place aircraft for a low time pilot to transition to. Its pilot demands are small and its flying qualities are honest in every way. One pilot with flying experience ranging to military jet fighters commented that the Quickie was the most fun airplane he had ever flown. For further info on the Quickie, or for their excellent \$6.00 info package contact Tom or Gene at Quickie Hangar 68 Airport, Mojave, California 93501 (805) 824-4313.

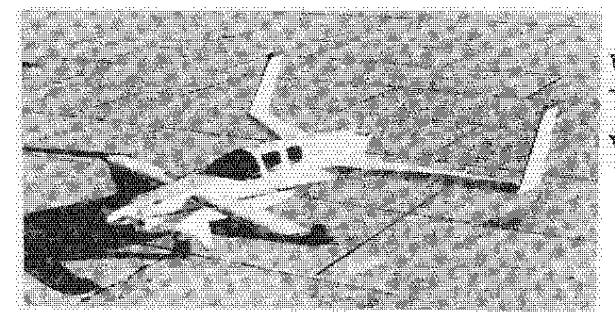
* Later data show this to be 300 fpm at sea level.

**CAN I BUILD A COMPOSITE AIRPLANE?
WILL I ENJOY WORKING WITH GLASS & FOAM?
IS MY WORKMANSHIP ADEQUATE TO BUILD AN AIRPLANE?
WHAT ARE THE TECHNIQUES USED IN VARIEZE & QUICKIE
CONSTRUCTION?**

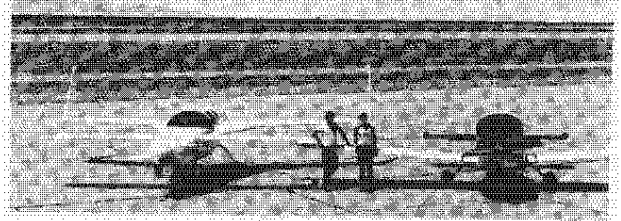
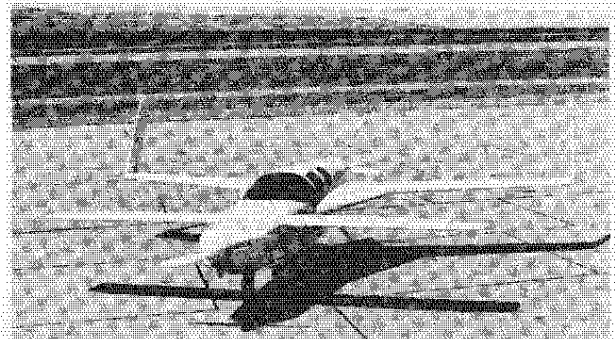
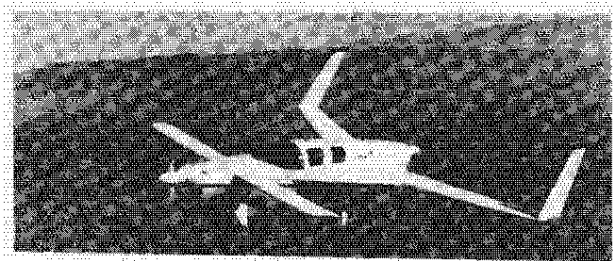
There is now available an introductory kit to answer these questions for you. The kit consists of a book and sample materials, or the book can be purchased separately. The book, "Moldless Composite Sandwich Homebuilt Aircraft Construction" consists of 26, 11x17 pages (equal to 52 pages) describing how the material is applied, education on the materials, tools required, inspection and repair methods. The bulk of the book is the new second edition education chapter from section I. Sample materials include: foam, fiberglass (2 types), epoxy, microspheres, floc, peel ply, wire for hotwire saw, etc.

The book is \$14.50, and is available from Aircraft Spruce, Wicks Aircraft Supply, and Rutan Aircraft. (Add state tax, if resident).

The kit (book and materials) is \$45.50, and is available from Aircraft Spruce and Wicks, not from Rutan Aircraft. (Add state tax, if resident).



ROLLOUT
FIRST
FLIGHT



DEFIANT - Our new light twin made its first flight on June 30, 1978, with Burt at the controls. Within one week Burt and Dick had logged enough flying for FAA to remove its area restriction and had obtained all basic performance verifications. The only maintenance or adjustments required has been changing the stiffness of the nosegear steering pushrod. This has been the cleanest initial test program we have seen on any type aircraft.

Curtis Barry, Port Jervis, N.J. won the "Name-the-Plane" contest. He added that defiant infers, "the aircraft defies all the common assumptions about current production twin engine aircraft - in pilot skill required, safety, performance, construction, and handling." We waited until after the aircraft had flown to name it, as we wanted to be sure it did indeed meet the above definition. As those of you that have recently visited know, we are extremely excited around here, since we are finding that Defiant actually is exceeding the estimated performance estimates and is verifying the no-procedure-for-engine failure design goal. It doesn't take alot of study to realize the impact on flight safety of a twin that not only has no appreciable trim change at engine failure, but requires no pilot action when it does fail. You can fail an engine at rotation for takeoff or during a go-around in the landing flare. The pilot does nothing, he climbs out as if nothing happened. He has no prop controls to identify and feather. He has no cowl flaps to open, no wing flaps to raise, no min control speed to monitor (he can climb better than the other light twins even if he slows to the stall speed), no retrimming is required, he can even leave the gear down with only a 50 fpm climb penalty. The only single engine procedures are the long term ones: (1) cross feed if you want to use all fuel on operative engine, (2) magnetos off. Note that, in general, you do not lose the alternator or vacuum pump on the failed engine since the engine windmills at 1000 rpm (fixed pitch prop). Why no cowl flaps? The two updraft cooling systems were designed to have large positive cooling pressure increases with power and angle of attack. When you are cruising the cylinder head temps stabilize at 370° F. If you then fail an engine and execute a full power climb and slow to best single-engine climb speed

the full-power engine will cool to 350° F with no pilot action (same mixture). The engine installations are simpler than the most simple single. Baffling is less complex, blast tubes for mags or ram air plugging for carb and carb heat are not required. There are no oil coolers. Oil temps run to 200° F during a climb to 15,000 ft and stabilize at 190° F at high cruise at outside air temperatures of 40 deg above standard conditions!

The most surprising good news is that the Defiant does not have the annoying, loud out-of-sync noise common to the Skymaster. The pilot has to split the throttles considerably to detect out of sync at high power, and at low or medium power the sync noise is not detectable. The sync noise is more objectional on other twins than Defiant, even though they use constant speed props mounted on wings. We feel the main reason is the high damping of the Kevlar/wood props and composite structure. Using Flight Research mufflers, the Defiant makes less perceived noise for a ground observer than the average medium performance single.

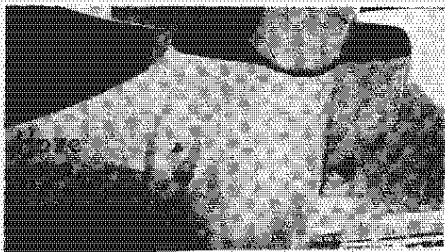
The airplane is a stable IFR platform, with less trim changes than conventional twins. It has a very solid "big airplane" feel. Approach speed is 75 kt at light weight and 85 kt at gross. We are withholding detailed performance data until it is completely generalized and presented for all weights, but the following is typical of that being obtained: Cruise at 65% power (maximum cruise) at 12000 ft is 188 kt (216 mph) without wheel pants. Single engine climb gradient (ft increase per mile) is almost twice that of the new light-light twins at any given loading condition. Single engine service ceiling is well above these aircraft even with the gear down and the airspeed 15 knots off the best climb speed, and this is obtained instantly, not after a clean up procedure! We gave Joe Tymczyszyn, FAA test pilot from the Los Angeles AEDO a ride that included single engine go-arounds initiated in the landing flare. His comments "unbelievable, single engine procedures are refreshingly simple."

The Defiant is big inside - 2 inches wider elbow room, 8 inches longer cabin, 6 inches more knee room in back seat and 3 ft³ more baggage volume than the Beech Dutchess. To get to gross weight in a Defiant you can top the tanks for 1100 NM range, add four 175-lb adults and add 75-lb baggage to an IFR-equipped airplane.

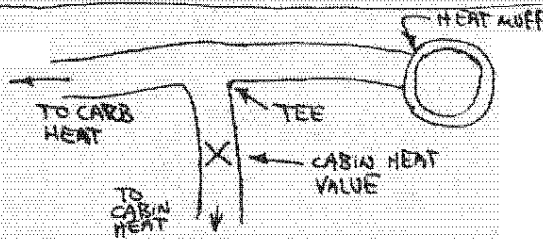
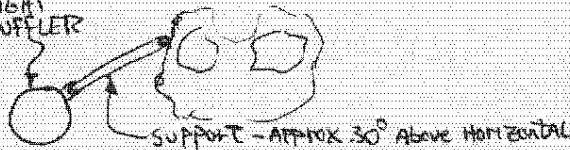
We will continue to keep you informed about the Defiant through this newsletter and other magazines. Please do not ask about further information at this time. We have no plans to market Defiant at this time. It is merely a proof-of-concept prototype for aerodynamic research.

VARIZE'S FLIGHT RESEARCH MUFFLER SYSTEM - We have received the first VariEze owners' comments on the new muffler system ("CP" 1b) - Lee Herron's comments follow: "Mufflers arrived Thursday evening, built the blisters on cowl Friday evening and Saturday and flew to two fly-ins on Sunday. Technically they look great and blowing the exhaust in-board at the fuselage boundary layer then through the low speed area of the prop is brilliant! As for noise, it is much quieter but now the cabin air intake (vent) makes too much noise - any ideas? As for speed about 4-5 mph penalty. Heat buildup around mufflers was a problem on the 1st test flight, but we cut outlets in the rear of each blister (see photo) and it cured the problem - cylinder head temp was not affected by mufflers. The small bump on the left blister is to clear the carb heat hose - carb heat is 15° better now." Note that Lee carefully sealed around the exhaust pipe outlet. On N4EZ we left about 0.3" gap around the pipe to allow excess heat to escape and we don't need the outlets.

Additional comments on the F.R. mufflers: Do not omit the support on the front of the right muffler. This is a piece of 3/8x.035 steel tube flattened on each end. It bolts to the tab on the muffler and to an accessory case stud on the engine as shown. If you want to use cabin heat you can plumb it as shown.



FRONT OF
RIGHT
MUFFLER



VARIZE FUEL SYSTEM - We have had reports from several builders indicating that the fuel valve has become stiff and hard to turn in service. One builder solved this by lapping the valve with valve-grinding compound and substituting a lighter spring for the one in the valve. If your valve is hard to turn (over 5-lb force at handle) fix it before you fly. One builder had to make a forced landing because the valve was so stiff that it was not completely in the "wings" position when selected. If it is only 20° toward the "fuselage" position it will drain the fuselage fuel into the wings! Thus, when he selected fuselage for the descent after nearly depleting the wings, he ran out of gas since the fuselage tank was empty. Also, note that the rivet that attaches the valve to the universal should be changed to a #8 screw so the valve can be easily removed.

One EZ owner stuffed baggage into the compartment behind the seat in such a way to pinch off the fuel lines and restrict fuel flow - be careful about this.

COMPOSITE CONSTRUCTION

A problem area has been discovered recently that is very important and should receive the utmost attention of everyone building foam and glass. Nat Puffer noticed a debond bubble on his wing after the aircraft had been painted. A similar debond was noticed on the Quickie vertical tail (a debond is where the glass layup detaches from the foam, a delamination is where individual layers of glass cloth detaches from each other). Nat and RAF traced the problem to the following: the debond occurred in areas where the glass layup was slightly dry, i.e. where pin holes from the surface can reach down to the blue foam. Nat wiped his wing down with solvent before applying the primer. The solvent and traces of the primer reached the foam surface and locally dissolved it. Note that this occurs only with the blue foam, not PVC or urethane. These debonds were easily repaired by drilling holes at opposite ends of the debond area and injecting epoxy in one hole until it came out the other, then weighting down the bubble during cure.

Because of this possibility we are insisting that you: (1) Never wipe down wings, canard, vertical fins, or control surfaces with any type solvent. (2) Before applying materials that can attack blue foam (featherfill, primer, etc.) inspect carefully for dry areas and fill them by wiping on epoxy (RAEF), then sanding dull after cure. (3) Inspect your critical structural areas ("CP" 15, pg 5) for debond by tapping the surface with a 25c coin - a debond will be indicated by a "dull thud" rather than a sharp "knock" when the coin is lightly struck on the surface. This can (and must) be done on both a finished or in-construction aircraft.

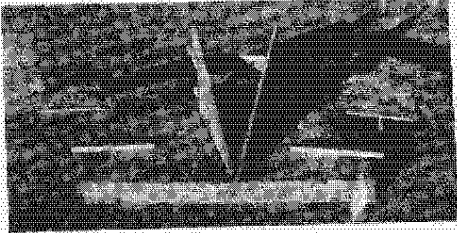
Shelf Life - Epoxy which has exceeded its two year shelf life should not be used in any critical aircraft parts regardless of its apparent acceptability. This is always the case in aircraft manufacturing and of course should be followed by the homebuilder.

Workmanship - Always question yours and others' quality of construction. Remember, the quality control criteria represents absolutely minimum acceptable quality - yours should be much better on the average. Never accept voids where complete surfaces should contact. Be sure to get complete squeezeout of bonding materials. If you see someone doing marginal or unacceptable work, suggest that he review all the QC requirements, chapter 3 material and all hints in newsletters. Then he should build a noncritical part and inspect it. If it does not look good he should consider not completing his airplane. The only thing worse than no airplane is an unsound airplane.

Peel Strength - We have received several comments on how easy it is to delaminate fiberglass plies after they begin to peel. Large difference between tensile and peel strength is one of the primary factors that determine the ply configuration during design. The following values are averages and you can test for them if you wish to check your workmanship. A 1-inch wide strip of UND has a tensile strength of about 660 lb. If it is peeled up from a surface it will peel off with a 20-lb pull at 45 degrees from the surface and only 7 lb if the strip is pulled at 90 degrees (straight up from the surface).

VariEze Main Gear Torsion Stability - Les Faus had a strange thing happen to his main gear. While his airplane was sitting in the hangar on a hot day his gear twisted to an exaggerated toe-in angle on one side. This should not have occurred, as it is believed the temperature did not exceed 130 deg F. His gear was removed and placed in Jiran's oven where it promptly returned to its correct shape. We suspected the

primary cause to be that Les had not installed the 45-deg BID wrap on the strut ("CP" 13 and 15). The BID wrap stabilizes the strut in torsion if the epoxy should soften at high temperature. To verify this we built the rig shown in the photo. It is a VariEze gear with an unwrapped strut on one side and a wrap (per "CP" 15 using RAEF) on the other side. It is loaded to simulate the torsion of a parked airplane, full of gas. The struts are painted black so their temperature stabilizes at 140+ deg in our desert sun.



While we were unable to obtain the exaggerated twist of the Faus gear we did verify that the BID wrap must be used. After one week of exposure the wrapped gear had a sag of 0.3 inch. The unwrapped side sagged as much as one inch then returned (still loaded) to about 0.8 inch. Be sure you have correctly installed your wrap. If you have fibers at 90° instead of 45°, for example, there is no torsional support. If you have noticed excessive tire wear, check your toe-in - it can have long term creep if the BID wrap is not installed properly. This has not occurred on N4EZ even though it is continuously parked either outside or in a non-cooled hangar with outside temperatures as high as 115° F (46°C). N4EZ has never required toe-in adjustment. It averages 80 to 100 landings on a set of the 4-ply tires. If your gear appears to have BID on it as received from Jiran this is only a cosmetic repair of mold surface voids, not the required homebuilder-installed wrap.

BUILDING HINTS

A carpenter's square is handy for checking gear toe-in; hold one leg on the axle and sight down the other leg to a target in front of the airplane. Be sure CS12 arms are lined up to sight into the pivot holes of all CS2's. CS12 may have to be rotated to line up all pivot holes (pg 5-4 of Section I).

We have noted some inaccuracies in the Westline tachs (RPM indicators). The best way we have found to check them is to build a low-cost Heath kit "Thumb Tach" model GD#69. This little hand-held box will indicate RPM by pointing it at a propeller, measuring the frequency of sunlight reflected from the blades. It even works well from the back seat of an EZ in flight. It is accurately calibrated by pointing it at a light bulb (60 cycles/sec).

When finishing glass in preparation for featherfill, use coarse 36-grit paper, since featherfill requires a mechanical bond, not a chemical bond. Do use the 25% micro in the featherfill. We finished the Defiant twin with featherfill, 70S primer lacquer putty for pin holes then painted with Dupont Centari white acrylic enamel. We had excellent results. The Defiant has 2-3 times the surface area of an EZ. We used 4 gal featherfill, 5 gal of 70S, and 1-1/2 gal of Centari. Total finishing weight growth was 18 lb.

It is acceptable to use soapy water if required to check for fuel tank leaks (repair per "CP" 14, pg 10). If you do, be sure to rinse the area well with clean water and allow it to thoroughly dry before applying epoxy or primer.

Be sure to check the thickness variation of your brake discs before you taxi, particularly if you have an early Rosenhan set. Uneven discs or unbalanced wheels can cause main gear vibration.

EPOXY SENSITIVITY - The U.S. Department of Health, Education and Welfare has a booklet on practices for fiberglass layup - HEW publication (NIOSH) 76 - 158; contact HEW, 4676 Columbia Parkway, Cincinnati, Oh 45226

VARIIZE PITCH CONTROL SENSITIVITY - The VariEze pitch control system was intentionally designed for lighter control forces than a conventional aircraft. The reason for this is that a side arm control is used, whereby the pilot rests his arm on the side console and uses only his wrist muscles to fly the stick. The lower control forces (higher sensitivity) have nothing to do with the aircraft being a canard configuration. We have found that in a large percent of cases (at least half) that this has not been desirable for transition of pilots who have never flown a sidestick. Most pilots on their first flight in the VariEze make the takeoff with a hard grasp of the stick and use their biceps to fly, much like they would in a Cub or Cessna. In this configuration the airplane feels overly sensitive and is difficult to fly smoothly. While we know of no accidents caused by this it is not unusual to see a VariEze bob up and down during its first few seconds of flight with a new pilot. Using some hindsight, which is always more accurate than foresight, we have concluded that in general it would be better to have much stiffer controls in VariEzes, with more stick force required to change attitude (less sensitive). Within the last two months we have tested a wide chord elevator on N4EZ and on two other VariEzes. This modification moves the center of pressure of the elevator further away from the pivot and results in the stick forces being nearly double their original value. This does not make the controls overly heavy, merely more solid. We like the new elevator enough that we have made it standard on the 2nd edition of the VariEze plans. This is not a mandatory change for those of you flying, since most of you have adjusted to using the wrist for control and most of you like the light responsive control feel. However, many of you do feel that the elevator is alot lighter than the ailerons and will like the better harmony provided by the wide-chord elevator. We do recommend that you extend the chord on any airplane that has not yet flown unless the pilot is confident that his proficiency in sensitive aircraft is good. The new elevator cross-section is shown, full size in this newsletter, along with a foam template to be used in original construction. Note

that to retrofit you can merely add material to your completed elevator. This can be styrofoam with one ply BID @ 45° on each side, lapping onto the original skin, or you can bond on balsa wood, carve to shape and cover with a light dacron or glass cloth. Use the templates to carefully check the shape of your elevator. Any variance in the shape can effect the trim capability of your airplane. For example one airplane, N37EZ had an elevator in which the bottom was kinked, as shown, not flat. This airplane exhibited a very strong climb tendency and had to be flown with a firm forward stick force to fly level. This airplane was extremely hard to fly and was overly sensitive. Now, after the elevator was extended to the new shape this airplane has excellent pitch stability and flies very solid.

Note that the new wide chord elevator is reflexed up at the trailing edge with the bottom flat. This is required so that the trim system has enough authority to trim hands-off at low speeds. Check Your Elevators. If they do not have the correct cross section, your aircraft will be difficult or even dangerous to fly.

VARIVIGGEN ACCIDENT

The following report was written by Mike Melville who flew his VariViggen up to aid in the FAA investigation of this tragedy.

On 21 May 1978, Harold Reiss lost his life when his VariViggen N29HR crashed 1/4 mile off the end of runway 10 at Illini Airport, Indiana.

Burt called and asked if I would go to the crash site and assist the FAA in their investigation. I agreed and was on scene by noon the next day.

Along with the two FAA investigators we determined that there was no mechanical problem with the aircraft.

Flight and engine controls were attached and functional. There was fuel in the lines, the engine had good compression on all 4 cylinders and the mags were operational. The engine was running on impact as evidenced by prop blade failure due to powered rotation. The aircraft hit the ground 60° nose down and 100° angle of left bank. The canard hit first, followed by the left wing and nose. The canard came off in one piece and the fuselage failed at bulk head F20 and F32. The left wing failed down due to the 100° bank angle. The S.P. wing outboard sections failed from foam crush and skin splitting at the leading and trailing edge. The outboard stub spar did not fail. The engine and mount was undamaged but the mount did push the F152 bulkhead about 12" forward but did not enter the passenger compartment.

Lack of any impact damage to the front canopy locks and outward failure of the canopy open retainer cable indicated the canopy was open on impact.

At the moment of impact Harold was struggling to close the canopy and still had his hand on the canopy bow after impact.

The FAA findings were that Harold took off with the canopy closed but not locked and at 300-400 ft alt on takeoff the canopy blew open.

Eye witnesses reported the aircraft pitched up and down rolled left and right before rolling left and pitching down into the ground.

The conclusion was that Harold became more concerned with the open canopy than aircraft control and crashed. He probably thought the canopy would come off and go through the prop. In actuality the canopy would not have come off and even when open would not have caused any unmanageable flight control problems. An old Air Force adage is certainly applicable in this situation:

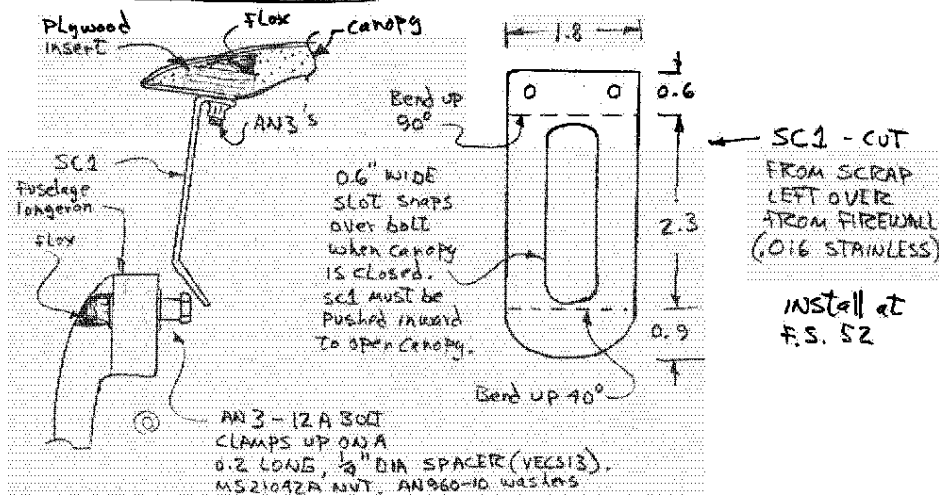
---TO HANDLE ANY EMERGENCY---

- (1) Maintain aircraft control.
- (2) Analyze the situation.
- (3) Take proper action.

NOTE THAT NUMBER ONE PRIORITY IS AIRCRAFT CONTROL.

On one occasion each, both Mike Melvill and Burt Rutan forgot to lock the Viggen canopy for take-off. Mike's opened at 300 ft on climb and he was able to catch, close, and lock it inflight while maintaining control. Burt's opened during take-off roll. He closed, locked it, and continued the takeoff. Do not assume it will not happen to you. If you are flying a Viggen or a VariEze, ground your airplane until you install the secondary catch.

Since both VariEze and VariViggen aircraft are both susceptible to the pilot taking off with the canopy unlocked we are asking all VariEze and VariViggen owners to install the secondary safety catch shown in CP15 pg 8. We consider this modification a mandatory safety change and ask your help to insure that all VariEze and VariViggen, are grounded until this safety catch is installed. The one we installed in N48Z is simpler than the CD 15 design and is more positive - see below. Note that the safety catch will prevent the canopy from opening more than one inch even if the pilot forgets to lock it. To open the canopy normally, raise it one inch, push in on the catch then open. This works the same as the secondary catch on a car's hood.



VARI-EZE ACCIDENT

On 3 July 1978, Jim Boyd was fatally injured in the crash of his VariEze about 18 miles south of his take-off point (Klamath Falls, Oregon Airport). Dick flew up to Klamath to help with the investigation.

The following is capsulization of what he found:

a. The aircraft impacted in a steep left bank (35° plus) at least 20° nose down at a high rate of speed. There was extensive damage to the left wing, canard and fuselage forward of the main center bulk head. All aircraft components were located at the crash site thus no in flight structural failure was indicated.

b. Observers thought that Jim was only going to make a high speed taxi test. Tower personnel reported he made one smooth and normal runway flight and landing then reversed direction, took off and departed the traffic pattern. Jim reported "he was indicating 145 MPH and going to the south practice area". The weather was 1500 overcast, good visibility at the airport but lower ceilings to the south with rain showers. One controller thought he saw Jim fly into a cloud. Local people living near the crash site said the weather was "bad" that morning. But exactly how bad could not be precisely determined. There was heavy rain on the wreckage between the time of the crash and when it was discovered some 5 hours later. No one observed the crash.

c. Jim had done an outstanding job of building the aircraft. Excellent workmanship was evident throughout. Even the interior of the cockpit was sculptured and finished with feather fill to a high gloss. He had a VOR receiver, VHF com radio, transponder and a stereo cassette tape player. With that finish, a Continental O-200 engine with alternator and a 25 lb battery the aircraft was considerably over weight. (705 lbs empty) other than the weight there were no builder discrepancies noted.

d. The prop was virtually undamaged. However, nothing could be found to indicate that engine could not produce power. Good compression, both mags normal, fuel on, filters clean, carb float bowl full of clean fuel. One reason for no power at impact could have been the key type mag switch was OFF and the key was out and found 20 feet away from the cockpit, indicating that the pilot had shut the engine down before the crash by removing the key.

e. Jim's friends including Larry Burton, the local EAA Designee, had all advised Jim to get someone more experienced or get more recent experience himself, before he flew his aircraft on its first flight. Jim was a commercial pilot with an instrument rating 200 hours total time, but he had not flown in the past two years except for a one hour biennial flight review the day before in a Cherokee 140. Jim had never flown an aircraft with a stick.

f. Jim's wife said he was very anxious, up tight and on kind of an ego trip that if "I built it, I can fly it". She said she tried to talk him out of flying it, "but you can only tell a husband so much".

If it can be determined that the prop was stopped at impact, then it indicates that the aircraft at some time before impact was traveling at less than 60 knots and had the switch off or a fuel interruption. VariEzes windmill at speeds above 60 knots with fuel off or ignition off. Once the prop stops (below 60 Kts) you then have to speed to above 120 knots to start windmilling again. This points to speculation that he was disoriented in cloud, since it would be highly unlikely that he was practicing stalls to below 60 Kts on a first flight with a low ceiling, particularly with ignition or fuel off.

FLIGHT TESTING - We continue to see examples of homebuilders not following recommended procedures in their flight testing. We cannot emphasize enough that the information in the owner's manual and newsletters is based on actual experience with our aircraft and that of other homebuilders. Do not expect success unless you follow all the recommended procedures! We are summarizing a checklist below of some items from previous newsletters. Be sure to follow all of them.

CHECKLIST FOR INITIAL VARI-EZE FLIGHT TESTING

1. Follow Appendix I of 2nd edition Owners Manual to the letter for inspection and weight/balance.
2. Check that canard is trimmed to 142" unless limited by fwd cg ("CP" 14).
3. Check elevator dimensions and contour of canard and elevator ("CP" 16 & 17). Wide chord elevator is recommended.
4. Canopy latches, seals and locks must be secure. Hood latch (page 6) must be installed.
5. Fuel system - valve must work smooth & positive. Use full fuselage tank and 6 gal per wing for first flight.
6. Weight must be below 900 lb gross. Cg should be in the forward part of the first flight box for first flight ("CP" 14 & 13).
7. Remove all equipment not absolutely required for flight, to get weight as light as possible. Do not fly first flight with a starter or alternator - These are double-penalty items, requiring nose ballast to get to the fwd cg for first flight ("CP" 13 & 14).
8. Airport must be smooth surface, runway length at least 6000-ft to allow runway flight. 4500-ft at sea level is absolutely minimal (Owners manual).
9. Pilot proficiency - current and comfortable in at least two different types - one should be high performance. Runway flights in two types made before conducting tests ("CP" 12 & owners manual). Note that the VariEze is a high performance aircraft and is "hotter" on takeoff and landing speeds than the slow training type aircraft. Do not try to learn proficiency at the same time as you are making flight tests on a new airplane. "Learning to fly in a VariEze is like learning to drive in a race car or learning to ride on a competition dirt bike." Study the owners manual before beginning tests.
10. Weather - See owners manual. Ceilings should allow glide to the airport during the entire first 25 hours of testing, preferably first 50 hours.
11. Stay in the traffic pattern or in radio/visual contact with your ground crew or be sure to have a chase if you depart the airport traffic area. Flight testing is not something to be done alone.
12. Check your mental state; be sure you are calm and can think straight. Ask someone else to evaluate your state of mind. Be sure your "ego" doesn't get in the way of good judgement. If all is not well fix it first, then fly (mechanical or mental). Above all don't let a big crowd, TV/news reporters pressure you into anything dumb. Best to have no spectators, just minimum necessary ground crew.
13. Wear a parachute and be at least 8000 ft AGL when expanding your high speed envelope above 160 mph or when expanding your low speed envelope below 70 mph.

CP 7 Pg 7

VARIIZE PLANS CHANGES - Incorporate these NOW

Owners Manual Appendix I Add "check freedom of fuel valve. If it requires more than 5-lb force at handle the valve must be overhauled. CAUTION - if valve is selected between wings and fuselage position, the fuselage tank will drain into the wings."

Newsletter II pg 6 & Section IIC pg 8 Substitute a AN 525-832-12 screw and a AN 364-832 nut for the rivet that attaches the universal to the valve. This allows easy removal of the valve.

Section I Chap 22 Add: The hood-catch shown on page 6 of this newsletter is mandatory and must be installed before flight. This protects the pilot should he takeoff without locking the canopy. Do not omit.

Section I pg 17-9 Refer to the two AN3-11A bolts on NG11. The aft bolt should be installed with the head on the bottom to definitely avoid it interfering with the NG14 spacer when the gear is locked down check for positive clearance in the down position. Grind material from NG14 if necessary to provide clearance. We have determined that this interference, (which prevents NG11 from reaching its full locked position) is the cause for the inadvertent nose gear retractions during taxi that were reported in previous newsletters. Confirm this clearance, even if you have had no trouble with yours.

Owners manual pg 30 Add "torque prop bolts 180 inch-pounds"

Section I Chap 5 (1st edition only) Add "refer to CD17 for the recommended (not mandatory) wide chord elevator."

BUILDERS CLUBS - Bob Zahner, 906 Millard, Tallahassee, Fla. 32301 is organizing a VariEze builders club for Florida and South Georgia - contact him directly.

QUESTIONS/ANSWERS

Q. I see that when you shut the engine down on the O-200 Continental VariEze that the prop stops windmilling if you slow to below 60 knots and stays stopped until you increase speed above 120 knots. Is this true of the Lycoming too?

A. Probably not, since the compression is more. Ken Swain has the extra high-compression O-235-FZB in his EZ and reported that when he stopped his he had to go to nearly red line speed to restart. We suspect that the O-235 C will windmill down to about 70 knots and will restart at about 150 knots.

Q. Do you advise doing the speed brake depression when carving the fuselage in chapter 12?

A. No. This is best done later, exactly as shown in Section VI.

Q. I'm now using the CP16 pg 9 method to jig the winglets to the wing. I've noted that this method results in the top of the winglet being further inboard than the plumb bob method. Is this intentional?

A. Yes. We failed to mention that in CP16, but we did intend to remove some of the 'cant' to reduce dihedral effect. The EZ is less susceptible to wing rock at low speeds and is a bit easier to fly with rudders with some dihedral effect. The Defiants winglets cant inward from vertical about 3 inches. Some builders have found some mis-match of the winglet incidence template at the trailing edge and rudder hinge line. This is of no concern since the incidence template is not needed when using the CP16 method.

CP17 Pg 8

Q. Good to see that the new CP16 method of attaching the NG15 to the strut has eliminated the holes thru NG1 giving it full strength. My problem is I have already drilled the two holes thru NG1. Do I have to buy a new strut?

A. No. If you remove NG15 and shorten the strut about 3/4-inch you can reinstall it exactly per CP16 and obtain essentially full strength, since the old hole will be well within the socket. This makes the aircraft sit 0.5 degrees lower during taxi (no problem). Remember, the new method eliminates all holes thru the strut at the lower end. The strut is no longer the weak point in the nose gear. The fork or NG10 will now fail before the glass strut.

Q. I am considering adding a few extra plies of glass in a few areas to beef them up for extra strength is this OK?

A. No! More than likely the extra material will not be added where first failure will occur anyway. The extra weight in most places will actually weaken your airplane in that its maximum 'g' capability will be less and failure on hard landings will be more likely. The best thing you can do for optimum safety is to do perfect workmanship with the exact ply arrangement in the plans. Also, stiffer structure can change flutter modes.

Q. I am having trouble getting a smooth hole drilled in fiberglass on diameters over 1/4", any suggestions?

A. Yes. A piloted spot-face, countersink, or counter-bore bit works excellent. In fact this should be considered a must on the 1/2" holes in the landing gear tabs. These are very difficult to do adequately with a drill bit.

Q. I want to find out exactly how much the VariEze materials and prefab parts cost, and how much optional prefab parts are available. How do I find this?

A. Refer to the flyer in this newsletter. Contact each distributor and obtain his catalog for price and availability. Its generally best to study the plans carefully to decide if you want to build or buy the prefab parts. If you build most of them yourself you can save a great deal.

SHOPPING - Aircraft Spruce & Wicks report that all VariEze materials are readily available with no major backlogs. They have the Composite Introductory Kits in stock for immediate delivery.

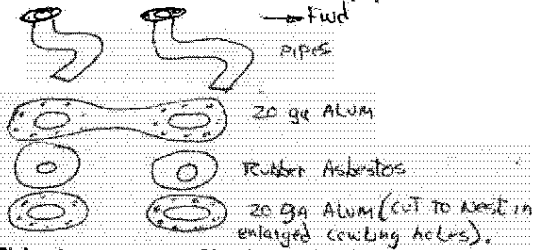
Ken Brock - no major backlogs; plenty of new 3-inch prop extensions and face plates for wood props are in stock. Be sure you are using the correct face plate for your wood prop. Minimum thickness is 1/4" to avoid local crushing. Ken also has NG25 and NG26 in stock now. Jiran - all items now being shipped well within the 8-week backlog. Fred reports that the prefab VariEze wings and center spar should be into static test within 3 weeks with flight tests to follow. These may be available in Kevlar, to save weight. Jiran also reports that he has produced a prototype vacuum-bagged Kevlar cowl for the VariEze. These will be expensive, but at a 10 lb savings it may be justified for you guys with the big heavy engines.

Canopies - we finally have a solution for those who have been complaining about how expensive it is to get a canopy out to the east coast. Walt Hoy of The Airplane Factory, 7111 A Brantvista Ave., Dayton, Ohio 45424 (513) 845-9872 or (513) 233-7754, who has been building VariViggen canopies for the last 2 years is now producing an excellent VariEze canopy. Compared to the original, it has a bit more forward-cockpit head room and visibility. Walt also offers a 1/2-price replacement for any breakage within the first two years. Send Walt a self-addressed, stamped envelope for his flyer on the EZ canopy. We have a Hoy canopy here at RAF if you want to inspect it.

Cowley has notified us that he is phasing out the canopy production, but will still have some available for the next 2 or 3 months.

VARIIZE HINT FROM NAT PUFFER:

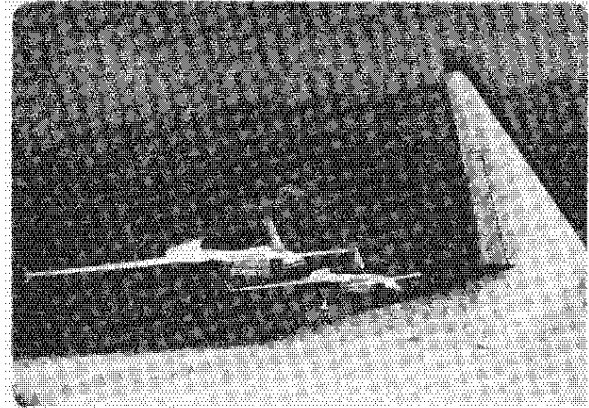
"If you wish to get a tight seal where the exhaust pipes exit the cowling, and still be able to remove the cowling easily, especially if you curve the exhaust pipes aft as I did - make a gasket plate that stays with the exhaust pipes where you remove cowling. It takes only a few flat headed screws and nut plates to hold the gasket plate to the cowling when assembled. Rivet assembly together on exhaust pipes.



This is a custom fitting job, but it gives tight seal, makes cowling removal easy, and allows more freedom in configuring pipes to individual taste. Also it relieves bending forces on cantilever pipes; especially if you do this, as I did on the right side.



N4EZ & N7EZ
PHOTO TAKEN FROM
ED & JO HANLIN'S
EZ OVER THE
MOJAVE DESERT ON THE
WAY TO LUNCH.



VARIVIGGEN - Mike and Sally Melvill have really been giving their Viggen a workout. They visited RAF in May during a 6000-mile trip (see photo on cover). Mike and Sally were alternating front/back seat pilot chores. They were loaded down with baggage and handled a 9000-foot density altitude takeoff at Albuquerque with no problem. His summary after arriving home "once again the Viggen has prove to us what a really practical cross-country machine it is. We love it and would not trade it for anything".

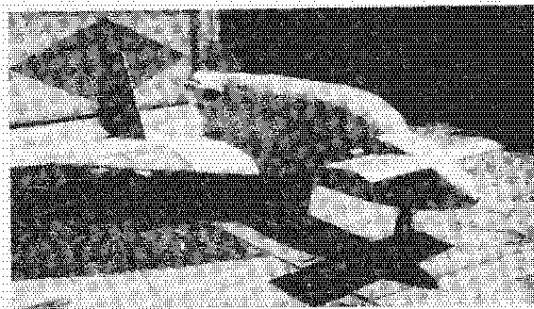
Mike designed and built a very clever angle of attack instrument for his Viggen. Instead of a potentiometer on the vane (the one that's so hard to find) he made up a wiper with 3 electrical contacts. These go to 3 lights on the visor arranged in a vertical format. When the center light is on (green) the airplane is "on speed". When the top light is on you are too slow, too fast if the bottom one is lit. This system automatically makes you fly the correct approach speed regardless of weight. It works exactly like the indicator lights in an F-4 jet fighter, yet Mike built it for \$5.00! Mike, how about a drawing of this for CP#18?

We have no reported VariViggen plans changes since CP16. We have been able to inspect the Melvill drawings for the worm-drive main gear modification. They do add some complexity, but in the long run we feel that it's well worth it. We highly recommend it and plan to incorporate it when the Viggen plans are updated in the 2nd edition.

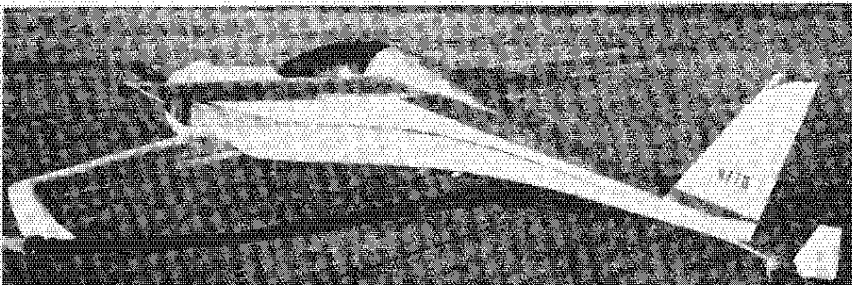
Jesse Wright is continuing to provide a very beneficial service in helping Viggen builders with his well-built parts and installation instructions. Thanks, Jesse - we've gotten alot of compliments on your parts (Jesse's address is on the Viggen flyer).



FRANK TOMKO'S VIGGEN AT RULLOUT!



JOHN POEHLER'S VIGGEN, READY FOR PAINT.



Quickie. N77 Q now has been refinished for Oshkosh.

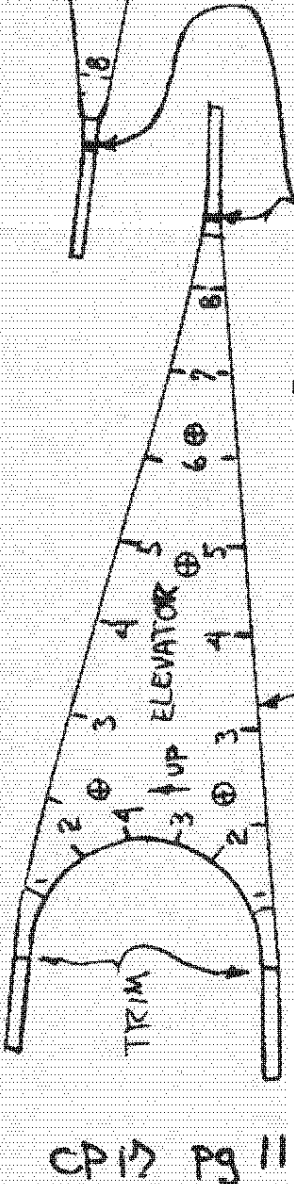
COMPARISON
GRUMMAN COUGAR and RAF DEFIANT

<u>SPECIFICATIONS</u>	<u>COUGAR</u>	<u>DEFIANT</u>
Number of seats	4	4 + 2
Engines, Lycoming	160 hp	160 hp
Props	73" c/s	69" fixed
Span	36', 10"	29', 2"
Wing area	184 ft ²	127.3 ft ²
Wing loading	20.7 psf	22 psf
Power loading	11.9 lb/hp	9.06 lb/hp
Empty weight (IFR)	2645 lb	1585 lb
Useful load	1155 lb	1315 lb
Gross weight	3800 lb	2900 lb
Payload with full fuel	459 lb	775 lb
Full fuel	696 lb	540 lb
Fuel with 4 175-lb people & 75-lb baggage	375 lb	540 lb
 <u>PERFORMANCE</u>		
Max rate-of-climb at gross	1200 fpm	1750 tpm
Single engine R/C with one feathered, gear up, blue- line speed & best flap angle	280 tpm	390 tpm
Single engine R/C initially at failure, gear down, prop windmilling, Flaps down	negative	+340 fpm
Max cruise 75%	165 kt	Not applicable
65% cruise (max for Defiant)	154 kt	188 kt
Miles per lb fuel at max cruise	1.58 nm/lb	2.08 nm/lb
Range, full fuel, max cruise, no res.	1100 nm	1120 nm
Range, with 4 adults & 75-lb baggage, no reserve	593 nm	1120 nm
Stall speed clean	68 kt	64 kt
Stall speed ldg. config.	61 kt	64 kt
Stall speed with 2 crew & 1/2 fuel	57 kt	56 kt

The RAF hangar is located on the west end of the flight line at the Mojave airport, Mojave Calif, approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any part for our comments. We are normally open from 9 to 12 and 2 to 5 on Wed thru Sat, but you should call first to check, since with the fly-in season starting we will be gone alot.

When writing to RAF always send a stamped, self-addressed envelope along if you have questions. If you are making an order, it's best to keep it separate from a request for an answer to a builder-question. Mark the outside of your envelope "builder question". This will speed our reply.

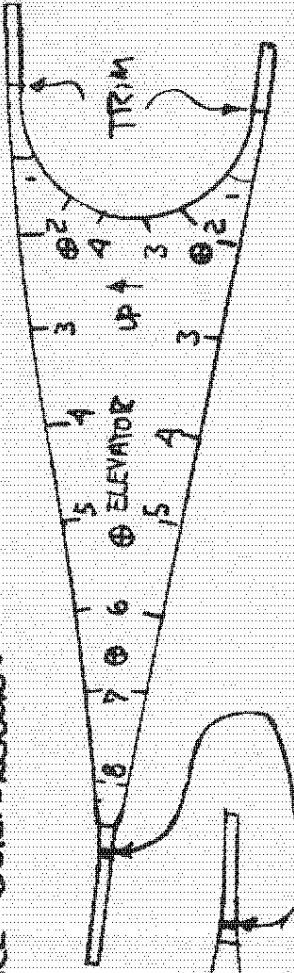
ELEVATOR FOM TEMPLATES - THESE ARE OVERSIZE TO ACCOUNT FOR HOT-WIRE BURNDOWN.



FINAL TRIM LINE UP TO FOAM EDGE

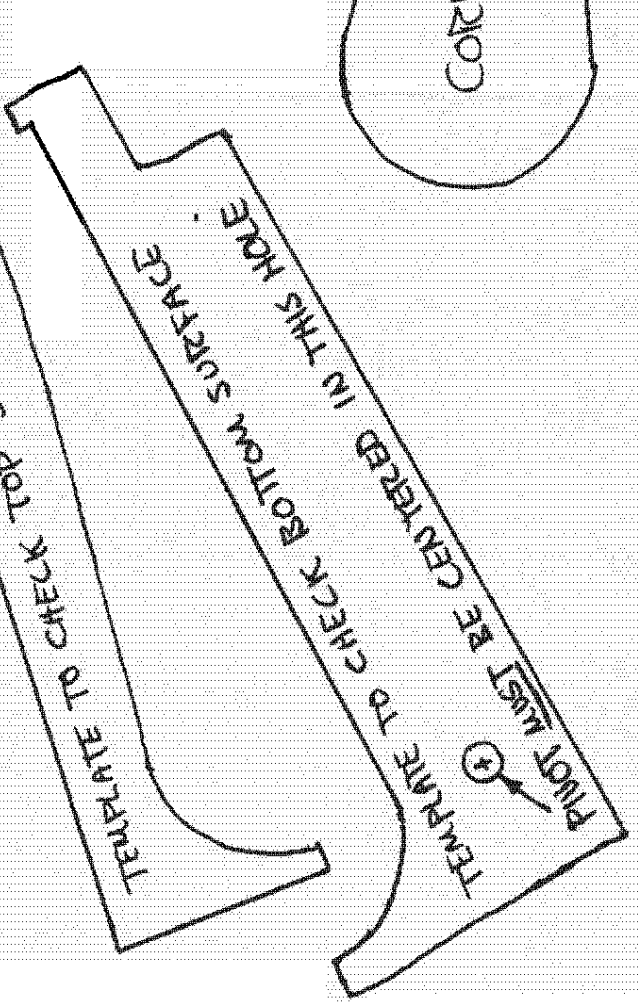
LEVEL BOTTOM FOR NO TWIST

FULL SIZE WIDE CHORD ELEVATOR



N37EZ'S ELEVATOR WRONG! (DANGEROUS)

KINK IN BOTTOM



TEMPLATE TO CHECK TOP SURFACE

TEMPLATE TO CHECK BOTM SURFACE

PIVOT MUST BE CENTERED IN THIS HOLE

PIVOT

NEW TOP SHAPE

THIS AREA IS TO BE ADDED FOR RETROFIT

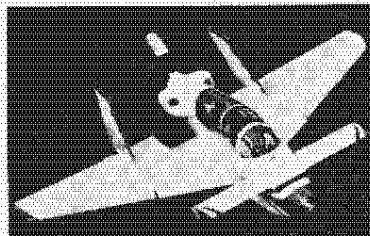
CORRECT

ORIGINAL TOP

BOTTOM MUST BE FLAT.

THANK YOU 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 Landing 500 ft	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
Performance with 150-hp. Special Performance Wings	Climb 1000 fpm Cruise 158 mph	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, & ALAA. 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.

EXCEPTIONAL 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.

THE FOLLOWING DISTRIBUTORS MARKET VARIVIGGEN PARTS:

AIRCRAFT SPRUCE & SPECIALTY CO, 201 W. Truslow, Box 424, Fullerton, Ca. 92632 (714) 870-7551.
VariViggen spruce kit, plywood kit, hardware, aluminum and fiberglass. Catalog cost \$2.

KEN BROCK MANUFACTURING, 11852 Western Ave, Stanton, Ca. 90680 (714) 898-4366.
VariViggen prefabricated components: all machined parts. Catalog costs \$2.

THE AIRPLANE FACTORY, 7111-A Brandtwista Ave, Dayton, OH 45424.
VariViggen plexiglass canopy.

MONNETT EXPERIMENTAL AIRCRAFT, INC, 955 Grace St, Elgin, IL 60120 (312) 761-2223.
VariViggen welded fiberglass parts.

COUCEON BROTHERS, 706 Martin, Bay City, MI 48706.
VariViggen 105/206 epoxy and 403 fibers for wood construction.

GEORGE EVANS, 4102 Twining, Riverside, Ca 92509.
VariViggen welded nose and main landing gear, 1-1/4" sq. steel tube.

MIKE AND SALLY MELVILL
Part Two of Construction Manual
Box 561, Frankton, Ind. 46044

JESSE WRIGHT (VariViggen builder), 7221 S. Colorado Ct, Littleton, CO 80122 (303) 771-5140.
VariViggen prefab wood parts. Send \$0c for list.

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

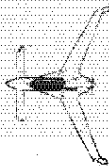
VARIVIGGEN PLANS - NASAD approved in "AA" category. Sixty-one sheets, completely detailed. Also included are builder's handbook information, step-by-step construction guide, complete bill of materials, flight operating limitations, parts lists. Section breakdown: 1. Introduction, 2. Operating Limitations,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

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

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

VARIVIGGEN CONSTRUCTION MANUAL Part 1 of a photo-illustrated construction manual, written by Jim Cavis, 5/8 31. Includes fuselage, canard, inboard wing, vertical stabs, control system, and landing gear, along with approximately 100 photos. Part 1 also includes helpful sketches on jigs and numerous building tips. The written information is similar to plans chapter 5, except expanded to about 30 pages.
Price: \$18.50 first class mail, \$20.50 airmail overseas.

VariEze

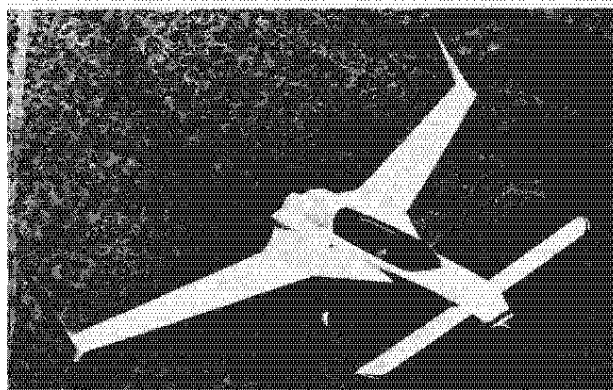


TODAY'S HOMEBUILT WITH TOMORROW'S TECHNOLOGY

THE AIRPLANE The VariEze is a small, high-performance home-built sportplane. It can be built from raw materials costing approximately \$2600 (less engine) in about 1000 man-hours, or from prefab parts and materials, costing approximately \$4000 in about 600 man-hours (about eight months spare time work). Its structure is a sandwich of high-strength fiberglass, using low-density, rigid foam as core material. The structure is fabricated directly over the shaped core, thus expensive tools and molds are not required. Composite-sandwich structure offers the following advantages over conventional wood or metal: less construction time requiring less skills, improved corrosion resistance, improved contour stability, better surface durability, dramatic reduction in hardware and number of parts, easier to inspect and repair. The VariEze uses the small four-cylinder Continental aircraft engines. The O-235 Lycoming, stripped of starter and alternator, is now being tested and should be available soon. The airplane has exceptional climb and cruise performance. It can carry two people 700 miles at 185 mph on less than 20 gallons of fuel. Frontseat passengers up to 6' 7"/250 lbs and backseat passengers up to 6' 5"/220 lbs can be accommodated plus a modest amount of baggage in two custom suitcases. The airplane does not have full dual controls, but does have a backseat control stick. Due to its small size (only 67-sq.ft. wing area) it is not the airplane for installing extra equipment for IFR, night flying, etc. It can handle a simple electrical system with a single NAV COM and gyro instrument. These can even be powered with a solar panel, thus eliminating the heavy alternator. The VariEze is recommended for day-VFR operation only. Due to its relatively high landing speed (60 kt/70 mph) and small tires, it is acceptable only for smooth, hard-surface runways. Its stability and overall flying qualities are superb. Once trimmed, it will hold attitude and level flight "hands-off" even in turbulence. Trim changes due to power, gear retraction, or landing brake are all very small. Its unique aerodynamic design allows it to be flown with full aft-stick, at less than 50 knots, without a stall departure or loss of control, and without altitude loss. 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 system's design eliminates or combines complex control systems, which saves weight, cost and building time while increasing reliability and lowering maintenance.

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 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.



VARIEZE DOCUMENTATION is available in six 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"x 17" 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. **NASAD approved**

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

SECTION IIA - Continental A65, A75, C85, C90, O-200
SECTION IIC - LYCOMING O235 - No accessories.

SECTION III - ELECTRICAL - This is an optional (not required) set of drawings and installation instructions for electrical system.

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.

SECTION VI - LANDING BRAKE - Complete full size drawings for an optional drag device. The brake dramatically increases the airplane's glide angle and deceleration in the flare. Without the brake the airplane is limited to runways at least 2400-ft long. With it, runways down to 1800-ft long can be used with appropriate pilot proficiency.

SPECS & PERFORMANCE WITH 100-HP CONTINENTAL, FIXED-PITCH PROP @ GROSS WEIGHT:

Take Off	900 ft	Range @ Max Cruise	700 mi
Climb	1600 fpm	Range @ Econ Cruise	850 mi
Max Cruise	195 mph	Min Speed (full aft stick)	55 mph
Econ Cruise	165 mph	Landing Distance	900 ft
Empty Weight	560 lb	Wing Span/Area	22.2'/53.6ft ²
Gross Weight	1050 lb	Canard Span/Area	12.5'/13ft ²

SPECS & PERFORMANCE WITH 75-HP CONTINENTAL:

Take Off	1050 ft	Econ Cruise	145 mph
Climb	900 fpm	Empty Weight	530 lb
Max Cruise	172 mph	Gross Weight	950 lb

THE FOLLOWING ARE RAF-AUTHORIZED DISTRIBUTORS OF VARIEZE MATERIALS AND COMPONENTS. CONTACT THE DISTRIBUTORS AT THE ADDRESSES SHOWN FOR THEIR CATALOGUES AND DESCRIPTION OF ITEMS.

AIRCRAFT SPRUCE & SPECIALTY CO. or **WICKS AIRCRAFT SUPPLY**
201 W. Truslow Ave. #424 410 Pine
Fullerton, Ca. 92632 / ALL RAW MATERIALS. Highland, Il. 62249
(714) 870-7551 (CATALOGS COSTS \$2.) (618) 654-7447

KEN BROCK MANUFACTURING, 11852 Western Ave, Stanton, Ca. 90680
(714) 898-4366: Prefabricated components - wing attach assembly, nosegear machined parts, control system components, fuel caps, engine mount, rudder pedals. Catalog costs \$2.

FRED JIRAH GLIDER REPAIR, 6 Mojave Airport, Mojave, Ca 93501, (805) 824-4558: Prefabricated components - cowling, fuel tanks, wheel pants, maingear & nose gear struts, strut cover & nose gear box. Send SASE with 3-oz postage for brochure.

THE AIRPLANE FACTORY, 7111A Brandt Vista, Dayton, OH 45424 (513) 845-9872 or 233-7754 - Canopy.

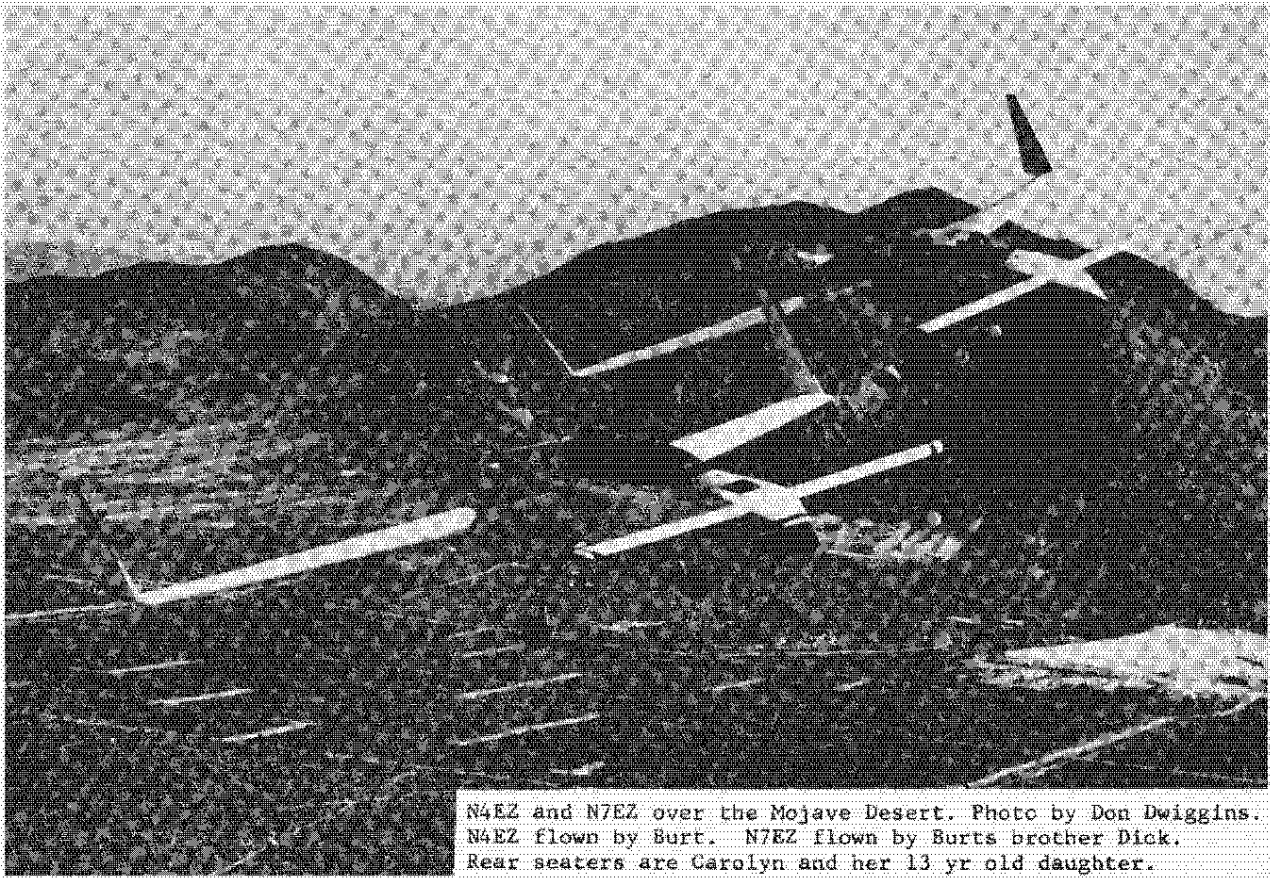
H.C. COMMUNICATIONS, Bx 2047, Canoga Park, Ca 91306, (213) 882-0422. Custom COM & NAV VHF antennae.

DONLEY ENTERPRISES, 170 Mojave Airport, Mojave, Ca 93501 (805) 824-2368. Canopy.

Check items desired	Price, including first-class mail U.S. and Canada	Air Mail Overseas*
<input type="checkbox"/> VariEze info kit, includes current issue of "Canard Pusher" newsletter	\$5.00	\$6.00
<input type="checkbox"/> "Canard Pusher" newsletter, published quarterly. One-year subscription	\$4.75	\$6.50
<input type="checkbox"/> Section I	\$139.00	\$153.00
<input type="checkbox"/> Section IIA	\$19.00	\$21.00
<input type="checkbox"/> Section IIC	\$21.50	\$23.50
<input type="checkbox"/> Section III	\$8.00	\$9.50
<input type="checkbox"/> Section IV	\$8.00	\$9.50
<input type="checkbox"/> Section V	\$7.00	\$8.00
<input type="checkbox"/> Section VI	\$10.00	\$11.00
<input type="checkbox"/> 3" tri-colored jacket patch Add \$6 if Calif resident - newsletter is not taxable.	\$1.95	\$1.95
*U.S. FUNDS ONLY		
TOTAL		

**Rutan
Aircraft
Factory**

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



N4EZ and N7EZ over the Mojave Desert. Photo by Don Diggins.
N4EZ flown by Burt. N7EZ flown by Burts brother Dick.
Rear seaters are Carolyn and her 13 yr old daughter.

**Rutan Aircraft Factory
Building 13, Mojave Airport
Mojave, CA 93501**

first class mail

TO:

The number which appears on your label before or after your name, is the last newsletter **issue** which you will receive and requires you to renew to receive the next issue. If your label has a 17 on it, then #17 is your last issue and you need to renew.

PLEASE STATE THAT YOU ARE A RENEWAL!!

17