

THE CANARD PUSHER

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If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 43. If you are building from 2nd Edition plans you must have newsletters 18 through 43. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 43. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 43. If you are building a Long-EZ you must have newsletters from 24 through 43. If you are building a Solitaire you must have newsletters from 37 through 43.

A current subscription for future issues is mandatory for builders, as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

The RAF hangar is located on the west end of the flight line at the Mojave Airport, Mojave, Ca. approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any parts for our comments. We are normally open from 8:00 to 12:00 and 1:00 to 5:00 on Monday through Friday and 9:00 to 3:00 on Saturday. Closed on Sunday.

If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to flyins. When arriving at Mojave by car turn east at the Carl's Jr. restaurant to find the airport.

When writing to RAF send a stamped, self addressed envelope along if you have any questions. If you are placing 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 questions". This will speed up your reply.

RAF ACTIVITY

Last CP we announced that we would be testing the "new canard" in its "final configuration". Guess what? It did not do the job and we were ready to call it quits. John Roncz meanwhile was still working on the problem. He came up with a new airfoil that he felt would do all we wanted. We looked at his data and decided to give it one more try. We built the new canard and elevators, and flew it on N79RA, the prototype Long-EZ on January 16, '85. This fifth attempt was the charm. The new Roncz canard flies essentially identically in the dry and in the rain. RAF will be making a set of drawings available as an option to the original GU canard. We have not started the drawings as yet as we need to do more evaluating of the new canard. Don't call us for information. We will have plans available by April 1, 1985.

We have been busy modifying a second Long-EZ for the Army, and the engine installation plans for the Defiant.

We are currently planning to fly Burt's Defiant to the Sun-in Fun flyin at Lakeland, Florida. Mike and Sally will be there from March 19 through March 23.

BURT'S WEDDING

As announced in CP 42, Burt was married to Margaret in Wichita, Kansas on November 16, 1984. It was a beautiful wedding with a large crowd of friends at the church and the reception. At the reception, we were treated to something very special, a piano solo by airfoil whiz, John Roncz. What a talent!

Burt arranged a tour of the Starship I manufacturing facility, the first public tour of the facility and it proved to be extremely interesting. Anyone who still thinks Beech may not be serious about building Starships is not thinking. The amount of money that is being spent on buildings, tooling, autoclaves, ovens and man power was staggering to behold. The quality of work being done on the six Starships presently under construction was outstanding.

Mike and Sally with two of the Scaled folks plus what seemed like tons of baggage took off from Mojave in the Defiant. Cruising at 11,500 feet at 175 knots true, and burning about 13 gph (total), they flew non-stop to Farmington, New Mexico for lunch and fuel. From Farmington to Wichita, weather forced them up to 16,500 feet briefly then back down to 13,500 feet. With a little help from the west wind, ground speed for the trip worked out at close to 205 knots. Mike and Sally flew back alone with all kinds of room. Weather was IFR, so an instrument departure was made and they did not see the ground until they reached Albuquerque. A stop for lunch at Winslow and then home to Mojave. This was Sally's first cross country in the Defiant and she is now thoroughly spoiled by all the baggage room and the comfort of the Defiant!

LONG-EZ CANARD UPDATE

The standard Long-EZ canard if built according to the plans, is identical to the VariEze plans-built canard. On the Long-EZ however, there has been a history of what has become known as the "rain trim change". This trim change is usually a nose down trim change when flying into rain requiring a small aft force on the stick to maintain altitude, which is easily trimmed out, using the bungee trim system. According to feedback we have received from builder/flyers, this is what most pilots notice. For the average Long-EZ pilot, this is of course no problem, rather more of a minor annoyance and once you have experienced it a few times, you simply trim for the condition and press on. A few builder/pilots however, report that their Long-EZs exhibit a more pronounced nose down trim change, requiring most of the available bungee trim force to fly "hands off" and in a couple of cases, pilots report not having enough trim authority to trim "hands off". During the last two years we have spent a lot of time and effort to try to understand what causes this trim change.

Thanks to John Roncz (airfoil designer par excellence) we now do understand it and have the analytical tools to predict and to overcome this phenomenon. We have built and tested five completely different canards with different airfoils. Many flight hours have been flown and a considerable data base has been generated. Also, a video camera was used to document tuft behavior on each airfoil. The lift and hinge moments with and without rain were documented. A method to simulate the rain effect was developed. Surprisingly one airfoil had no rain trim change at approach or cruise speed but had a considerable reduction in max lift, resulting in a nose drop if rain were encountered in the flare. The result of this extensive testing was the data John needed to model the rain trim change in his computer program. Soon he was able to duplicate the flight test results on the computer and from there was able to produce a brand new airfoil, the Roncz R1145MS, which we have recently tested on the prototype Long-EZ, N79RA.

This completely new and never flown before airfoil is far the best we have seen. It has a negligible rain trim and the rain only adds 2 knots to stall speed. Of course some more flight testing remains to be done, however, we are confident that we do indeed have what we have been looking for. The R1145MS produces considerably more lift than the original GU-5(1)8 airfoil, and in fact more than any we have tested so far. This enables us to reduce the span, reducing wetted area, and thus drag. The basic airfoil is also very low drag. Its trailing edge shape provides the correct stick forces without external devices.

At this time, the span from the outboard tip of the left elevator to the outboard tip of the right elevator is 130". This compares to 140" on the original GU canard. We have incorporated the John Roncz designed curled-up wing tips first seen on Mike and Sally's N26MS. These

tips are specifically optimized to enhance the vortex coming off the tip of the canard and position this vortex in the "sweet spot" over each main wing. The remaining test and preparation/printing of the plans should be completed by April 1.

The new Roncz 1145MS canard will not be recommended for the VariEze. The airfoil used on the VariEze main wing, is working very hard to maintain attached flow even with the GU canard. This new canard may ruin the stall characteristics of a VariEze. Feedback from VariEze flyers indicates that while most VariEzes do have a small trim change, it is just that, a small trim change that in most cases is not significant enough to warrant the flight test program that would be required to qualify a new canard for the VariEze.

SUN 'N FUN

Mike and Sally will be flying Burt's Defiant, N78RA to the Sun 'n Fun this year. They plan on arriving March 19 and staying through March 23. They will bring a few sets of Defiant plans as well as other RAF items. RAF will not have a booth but Mike will give a Defiant talk on Thursday, March 21. Hopefully we will be able to impose on Johnny Murphy and Charlie Gray to help answer builder questions on the Defiant. Of course, bull sessions at the airplanes will be conducted and we invite you to come and ask questions and share ideas.

The EZ Race, started several years ago by Steve Woods and Tim Gheres is being revived by Charlie Gray this year and is being called the "Sun 50 Airplane Race". The Sun 50 will be run on Wednesday, March 20. This race is an all out speed race of approximately 50 miles against the clock. The Sun 50 is open to experimental homebuilts, non racing type aircraft only. There are 3 classes, one of which is specifically for VariEze and Long-EZ. This is a fun race and should be very popular. Entries are limited to the first 35 airplanes. Call or write Charlie Gray, 398 Palm Drive, Oviedo, Florida, 32726. (305)365-2735. If you are interested, you will need an entry blank and a copy of the rules, so get in touch with Charlie.

Note - The EZ Builders of Florida Banquet will be held on March 22, Thursday, cocktails at 6:30 pm and dinner at 7:30pm. The Banquet will be at Sweetwaters Restaurant, 101 South Florida Ave, Lakeland. The tickets are \$14.00 per person for either a mixed seafood dinner or a filet which includes salad, bread roll, beverage and dessert. Please contact Charlie Gray - Charlie needs to know by Monday the 19th of March. 305-365-2735

DEFIANT NEWS

Fred Keller has been at it again, working hard on the engine installation plans and as we go to press, we are expecting to receive his drawings. We will correlate the drawings, add baffling templates as required and prepare the words, music and drawings for the printer. Usually it takes 3 to 4 weeks to get the prints back. So realistically we should have the engine section available for sale around the end of March.

We continue to hear from Defiant builders who are progressing at almost unbelievable speed. Dr. Yost, from Sheffield, Alabama has his fuselage on the gear, nose gear retract mechanism is installed and operating, wings are complete and mounted, the canard is complete, canopy and turtle-deck and is building dynafocal engine mounts to mount his IO-320, 160 hp engines. We have been giving him information over the phone as he needs it to build the mounts. We would never have thought anyone would be this far along so soon!

Johnny Murphy is also working on engine mounts and has all of the major parts built. Hopefully we will see at least two new Defiants at Oshkosh, 1985.

A group of Defiant builders have gotten together in the general vicinity of Houston, Texas. They are comprised of 12 plans owners, with at least 3 of them going great on their projects. A group of builders like this really speeds things up, one jig works for everyone and shared knowledge of short cuts, sources for parts and even potential pit falls are all among the advantages of forming and maintaining a group.

1/5 SCALE LONG-EZ MODEL UPDATE

Four different model airplane magazines are doing "in-depth" reviews of the 1/5th Scale Long-EZ. Look for them on the newsstands. We read an article in March 1985, "Flying Models" by Nick Nicholson, who built and flies one, and for anyone interested in the model, this is an outstanding article. The kit is really top class and easy to build. RAF has kits in stock for pick up or you can write to St. Croix Models, P.O.Box 279, Park Falls, WI 54552. (715)762-3226. Talk to Jim Schmidt.

HOMEBUILDER RESPONSIBILITY

Reading through Rex Taylor's "Dragonflyer" newsletter #17, we noted an excellent article covering homebuilder responsibility. We would like to reiterate on this because we believe that you the homebuilder should be aware of what you are taking on when you build your own aircraft.

The FAA has set up the Experimental Amateur built category (thanks mainly to EAA) to allow an individual to design, build and fly his own aircraft. The FAA lists that individual as the manufacturer. As the manufacturer, the builder is entirely and totally responsible for that aircraft. The builder has passed judgement on the quality of workmanship and he alone has made the decision that each and every part that he has put into that aircraft, is in his opinion, airworthy.

A lot of builders are under the mistaken impression that the FAA inspector will guarantee that the aircraft is airworthy when he inspects the aircraft and issues an airworthiness certificate. The FAA does not decide your aircraft is airworthy, you do.

For this reason, every builder should become involved with the EAA. Join your local EAA chapter. Attend their monthly meetings, talk with other EZ builders. Many good books are available from EAA. Supplement your plans with a few, such as Tony Bingalis' "Firewall Forward". After you have got something built, get as many people as you can, to look over your work. Don't be embarrassed. If someone critiques your work, take a strong look at it. If it is not right, throw it out. Your best assurance of success is to adhere strictly to the plans and to build it from the correct materials. In order to be positive that you are using the correct materials, buy them only from the recommended suppliers.

The same philosophy is also true for engines. Almost daily we receive calls or letters from builders wanting to substitute some wizz-bang engine for the recommended one. RAF can not ethically recommend an engine we have not installed and tested. For the Long-EZ we recommend any model of the Lycoming O-235. If you wish to install some other engine, please do not call us. We can not help you. As an experimenter, you can of course, use any engine you want to. You should be aware that you will be involved in redesigning engine mount structure, cooling may not be adequate and you will be testing an unknown when you fly your airplane. You should expect surprises.

If you want a reliable cross country airplane, do yourself a favor and buy a real aircraft engine such as a Continental or Lycoming. These engines have literally millions of hours of field testing on them and have a proven record of reliability.

You the builder have the sole responsibility to produce a safe, reliable aircraft. Take that responsibility seriously. The bottom line is this: The designer has absolutely no control over what materials, power plants, etc go into your aircraft. No control of quality of workmanship and no opportunity to inspect work or materials and therefore cannot be responsible for your actions. Most designers will do everything in their power to ensure your success with one of their designs, since problems are just plain bad for business. The best advertisement for the designer, is an airplane that does what the designer said it would and a builder/pilot who is happy with what he builds.

Learn to Fly in a Long-EZ?

Dick Prentice built his Long-EZ as a non-pilot with the intention of using it to obtain his pilots license. Dick built his Long in the San Diego area, a hot bed of EZ activity. When it was complete, he trucked it to Brown Field, where VariEze builder/pilot, Al Coha did the first flight in May 1984.

Dick installed a throttle, mixture, and push-to-talk transmitter switch in the back cockpit. He found an excellent instructor who was very interested in the Long-EZ who gave him dual, soloed him and signed him off for his cross country and night flying. Ultimately Dick was signed off for his private check ride, when a possible stumbling block was thrown at him. The FAA could not decide if Dick should be issued a restricted license, since he had not done any stalls! After some hassling around, Dick decided to end the problem by renting a Cessna-152 for 1 1/2 hours. During this time his instructor put him through all the required stalls and finished up his night flying requirements. He took his private check ride in his Long-EZ and received a normal private pilot certificate.

This is the first case we know of, of a builder obtaining his pilots license in his own Long-EZ. Congratulations Dick! Dick would like to give credit to his wife, Joy, who was the driving force behind getting the Long-EZ built and who is now taking flying lessons in their Long. He also wants to thank the EZ Squadron in San Diego for all their help and encouragement.

VARI-EZE VORTILON UPDATE

We are very pleased with the positive feed back we have received from VariEze pilots who have installed the vortilons per CP #42. Steve Sorenson writes:

"Dear RAF,
I wanted to give you a testimonial for the new vortilons I installed on my VariEze. I installed them exactly as per the plans in the last Canard Pusher except I used super glue instead of epoxy or silicon. As you know my airplane has never had wing cuffs and I have always found the airplane extremely stable and easy to fly despite the wing rock at full aft stick. As a result I was a little skeptical about the performance improvements promised by the use of the vortilons but I figured I should try them since they wouldn't take much time to make and install. After having flown the plane now about 8 times with the vortilons, I am sold on them. I found that the wing rock at full aft stick is completely gone and I can now do any maneuvering I want at full aft stick without departures that I would occasionally get before. The biggest improvement, though was the stability improvement in the landing pattern. I have always flown final approach at about 90 mph or a little higher if I had a passenger. I could fly at 80 when lightly loaded but I got a high sink rate that was a little uncomfortable and gave me much reduced visibility over the nose. With the vortilons, I can very comfortably fly final at 80 mph, even with a passenger and have full control and a reasonable sink rate. The result is that I can now make the 1000 foot turnoff on the runway at my home airport, something I could never come close to doing before. I haven't noticed a significant increase in climb performance, but I haven't done any real tests of that yet. In short, I am sold on the vortilons and would recommend them to all VariEze pilots.

Steve

Jerry Gardner was up at RAF last Saturday and claimed that after making over 1000 landings in his VariEze, now that he has vortilons, he is having to learn to land his airplane all over again! The glide is better, power must be reduced further out and visibility over the nose is much better during both take off and landing.

Gary Hertzler writes, "I tried 'em, I like 'em! Everyone should try them, in a word "fantastic".

If you have not yet tried them, do, even if you temporarily "Hot Stuff" them on. You will be glad you did.

NOTE: A few dimensions were omitted in the last CP.

The value of "X" (top left) is:-

at B.L. 81.6 "X" is 0.3"

at B.L. 102.7 "X" is 0.25"

at B.L. 122.4 "X" is 0.2"

These dimensions are not critical and if you made accurate copies of the full sized drawings of each vortilon, they will in fact fit at the appropriate B.L. with the above dimensions or very close.

We would appreciate feed back from the VariEze builder/flyers who install and fly the vortilons. Look for better visibility over the nose during take off and landings due to lower deck angle, better glide performance and better climb.

FOR SALE

Lycoming O-235-L2C, runout 2400 hours since new. No damage. Complete except for carburetor, with logs. \$3000.00

Contact: 714-241-1809

Lycoming O-235-C1, 115 hp with all accessories including primer lines. 40 hours since major. Super clean, removed for more power. \$4000.00

Contact: Bob Orhletz.

714-681-4488.

Lycoming O-320-E2G, 2542 total time, 485 hours since major. Firewall forward, \$2800.00

Contact: Gene Croghan,
Great Falls, MT
406-761-7346.

Lycoming O-235-C2C, zero since major by A & P. 1900 total time. All accessories, mags, starter, alternator, carburetor, fuel pump and vacuum pump. Includes logs. \$4850.00/or best offer.

Contact: Doug,
805-824-4541 (work)
805-824-4860 (home)

Marvel Shebler float kit, P/N666-915 for MA-3 and MA-4 models. \$72.50

Contact: Bud Gross
619-365-8492

Narco Escort II, 720 com, 200 nav, in one 3 lb package. Fits into a standard 3 1/8" diameter instrument hole. For a limited time only, factory fresh from Narco, delivered for \$1149.00 (plus tax in Texas).

Contact: Chuck Jordan,
502 E. Huitt,
Euless, TX 76040
817-267-2840

NACA air vent door for VariEze and Long-EZ. Simple, light weight, only minutes to install. \$6.00 each plus .50 postage and handling.

Contact: Gene Zabler,
48 Robin Hill Drive,
Racine, WI 53506

WANTED

VariEze Prefab fuel strakes and cowling for Lycoming. Sell or trade Bendix mags for Slicks.

Contact: Tom Wilson,
2643 Amy Court,
Duluth, GA 30136
404-476-3264

Wanted space to share to build Long-EZ. Long Beach area.

Contact: Doug Domurat
714-642-3910 - day
213-549-9497 - evening

PLANS CHANGES

We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification requirements. This allows experimentation by the homebuilder, giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.
OBS	Obsoleted by a later change.
MEO	Minor error or omission.

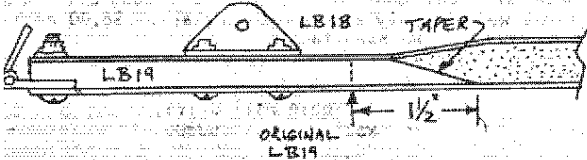
PLANS CHANGES

VariEze - The 'X' dimension for the vortilons was omitted on Page 6, CP 42.

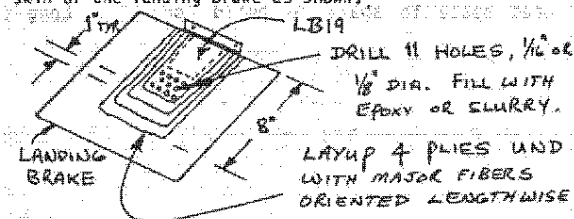
B.L.	X'
81.6	0.3"
102.7	0.25"
122.4	0.2"

VariEze and Long-EZ - Landing Brake.
A few builders have reported noticing a softening or weakening of their brake. We checked ours here at RAF and sure enough, when we wiggled it fore and aft we could feel and "hear" the damaged urethane foam "working". The glass of course was not damaged and no builder has reported any more damage than this. This repair should be done within the next 25 hours.

The landing brake is called out to be made from urethane foam. Anyone who has not built the landing brake, should build it from PVC (Klegcel, or Divinylcol) 3 or 4 lb/ft³ foam. Increase the length of LB19 (plywood insert) by 1 1/2" and taper it as shown to reduce the concentrated loads at the end.



If you have already built your landing brake or are already flying, an appropriate repair/reinforcement is as follows: drill several 1/16" or 1/8" diameter holes through the skin below (or aft) of LB19 plywood insert. Inject pure epoxy or a very liquid slurry into each hole, forcing the slurry/epoxy into the damaged urethane foam. When this cures, it will greatly stiffen this area of damaged foam. Remove the LB18 brackets and layup 4 plies of UND over the plywood insert and down the inside skin of the landing brake as shown.



Long-EZ

LPC #119: Section I, page 14-7, parts #LW44 and LW45. Increase the size on 8 LW44 from 1 1/2" x 2" to 1 3/4" x 2" and on two LW45 from 2" x 2" to 2 1/4" x 2". The increase is in the vertical dimension and is to allow more leeway when drilling the 5/8" wing mounting holes. Several builders have come very close to the edge of these parts, a couple have actually broken out. Breaking out is cause for rejection.

LPC #120: Section III, page 6, 2 paragraph. There should be 4 AN509-10R8 screws in each top attach point. LPC #100, CP32, page 7, incorrectly called this out as 3 screws.

Defiant

DPC #22: Page D-38. Fuel sump tanks should have a nylon float switch (fuel warning system, sensor \$26.00, light \$6.10, Aircraft Spruce catalog, page 121) installed in the side of each sump tank near the top of the tank, such that when your main tanks are empty and you begin to use fuel out of a sump tank, it will trip the float switch and light a red warning light on the panel. This alerts you to the fact that you are down to sump fuel, approximately 4 gallons, which you can accurately monitor on your electric fuel gauge.

DPC #23: Bill of materials. You will need a piece of 4130N steel, .040 thick x 6" x 12" for various small steel parts.

Solitaire Plans Changes

SPC #52: Section I, Page 2-2. Bill of materials, add 4 each CS-201 to the parts call out. Order from Ken Brock Mfg.

Solitaire Builder Hint

We have not called out the exact clearance between the ends of the control surfaces and the wings. Set the clearance to 0.1". Do not try to fit the control surfaces closer than this because under high 'g' loads with lots of bending on the wings these could bind. Another consideration is flight through rain into freezing temperatures which could freeze up the controls.

We had a builder write and tell us he did not have the required clearance on the aileron bellcrank, page A-23, view H-H. He extended the pivot bolt and put some washers above the bellcrank to get the 0.2" clearance on the pushrod bellcrank bolt as called out in the plans. You must have the required clearance here, do not short cut this dimension.

When you are installing the control system we have had complaints that the holes in the F.S. 22.5 bulkhead are too small to reasonably assemble the elevator bolts. It is acceptable to open these holes up to a 3" diameter.

DEFIANT PROPELLER INFORMATION

Based on our considerable experience with wood props, we have designed a prop extension that Ken Brock will be manufacturing and selling to Defiant builders, that is optimized to reduce or eliminate many of the problems associated with wood props. This extension is 8" long, a length required to fair the engine nicely. The flange that bolts to the engine is standard. The flange that the prop bolts to is 7" in diameter, 1" larger than standard. The crushplate also is 7" in diameter and 1/2" thick in order to be able to spread the local force exerted by the bolts. This additional 1" of diameter gives us approximately 20 square inches more area to drive the prop. Also the threaded drive lugs are 3/4" diameter instead of 5/8" and are threaded for 1/2" x 20 bolts instead of 3/8". This allows us to torque the bolts to 375 to 400 inch lbs. (instead of 220 in/lb) without crushing the wood. We have tested this system on the O-320 as well as the O-360 engines with excellent results.

These prop extensions are the only RAF recommended prop extensions for Defiant. We have informed the prop

manufacturers of this change which requires a larger prop hub, and 3/4" countersunk holes. Of course, if you use constant speed props, none of the above is applicable.

Mooney Nose Gears for Defiant.

Caution: Old gears can accumulate considerable rust in the weldments. Careful inspection is required to be sure you have a good one. Note that you need the entire Mooney nose gear from the fore/aft pivot down. This includes the vertical steering pivot. You do not need any retract parts from the Mooney.

BUILDER HINTS

VariEze and Long-EZ - Hot Stuff model airplane "instant" glue. A cyanoacrylate glue, Hot Stuff can be extremely handy to "tack" pieces in place; to essentially give you a third hand, by almost instantly glueing small parts and firmly holding them in position. Hot Shot, a spray accelerator that speeds up the curing time of Hot Stuff glue can also be used to great advantage. We like the thick glue as opposed to the thin, and when used with Hot Shot accelerator, can produce an unbelievably strong bond between glass pieces, plywood or even PVC foam pieces (do not use on Styrofoam). We have tacked winglets to wings with Hot Stuff, instead of Bondo. The advantage is, it cures instantly and you can layup glass right over the tiny drops of Hot Stuff. We also have found it a great time saver when jigging parts. Experiment and you will find all kinds of places you can use this material.

HOTWIRE TEMPLATES - VariEze and Long-EZ - We have found that the best material to make hotwire templates is from 1/16" thick phenolic. This is readily available from Aircraft Spruce or Wicks. The next best material is formica, then 1/16" or 1/8" aircraft birch plywood, then possibly 1/32" aluminum.

Glueing the paper template to the phenolic, formica or whatever you use, should be done with Safe-T-Poxy or a quality glue that does not shrink or distort the paper. A better method is to use carbon paper over the phenolic, and trace the airfoil through the carbon onto the phenolic. Using a french curve and a sharp, hard pencil, you can produce a very accurate template, with no distortion and still have the original paper template for reference. Just be sure that the phenolic and the paper template can not slip relative to each other. Masking tape will position them securely.

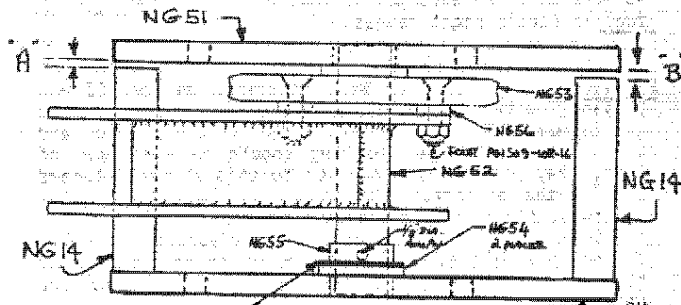
VariEze and Long-Ez - Nose gear chattering. George Dyer is a gear expert and we sure appreciate this excellent hint.

The following procedure will reduce and in most cases eliminate the chattering of the nose gear during lowering and some reported cases of inadvertent lowering in flight during turbulent weather conditions. This condition is caused by the weight of the nose gear wheel assembly pulling the gear housing arm (NG50) and causing it to over run the speed of the rotating worm gear (NG58) during lowering. An axial thrust load on the low speed shaft (NG52) will resist the weight and over running condition. The nose gear housing sides (NG51) and (NG30) are considered a flexible gear housing and require a greater axial thrust load present on the low speed shaft (NG52) than a rigid gear housing to eliminate the low speed gear (NG53) over running the worm gear (NG58) during lowering which results in a chattering sound. This can eventually result in gear fatigue.

To accomplish the axial thrust load, washers (AN960-1016), regular or light thickness, need to be added on the low speed shaft between the NG55 spacer and the NG53 bearing as required to achieve an even clearance of .030" to .060" at points A and B shown on figure #1. Clearance should be set before the gear housing is installed in the plane since you will be unable to determine the thrust load clearance when installed.

Both bearings (NG54) should be lubricated with a grease type lubricant before installation.

If there are any questions or problems, please feel free to give me a call or write: George Dyer, 6221 Chapman Ave, Garden Grove, CA 92645; 714-894-6448.



Long-EZ - Builder feed back indicates that most builders are finding that they need more epoxy than what is called out in the plans. Keep this in mind, and when you order your epoxy, order only what you think you can use in the next 12 months. Be realistic with yourself, there is no sense in buying 15 kits of epoxy, using only 5 in the first year and being stuck with 10 kits of out of date epoxy. The manufacturer has put a 12 month shelf life on the Safe-T-Poxy. You are the aircraft manufacturer and you have to be responsible to make the right decision when a primary structural material goes over its shelf life. Stay away from this problem by buying only as you need, keeping only fresh epoxy to build the structure of your aircraft.

VariEze, Long-EZ and Defiant - Glueing hotwire template paper material. Punch a few holes through the paper along and on the waterline. Draw a line with a straight edge on your phenolic, formica or plywood template material. Now it is easy to line up the water lines since you can see through the paper. This also helps prevent warping or distortion of the glue soaked paper.

VariEze, Long-EZ and Defiant - Trimming and squaring foam blocks can be done quickly and accurately if you take a couple of carpenter squares and drill nail holes every inch or so. Nail the squares to the foam and use the square as the hotwire guide. This works great, especially if your work table is flat.

VariEze, Long-EZ and Defiant - Drill a couple of tiny holes through your hot wire templates right on the W.L. and put a couple of small brads part way through the templates. This allows you to rest your level on the brads, assures that the level and the W.L. are correct to each other, and the short point of the brad sticking through the template helps hold the template temporarily in position on the foam block without slipping until you can nail it in place.

CAUTION

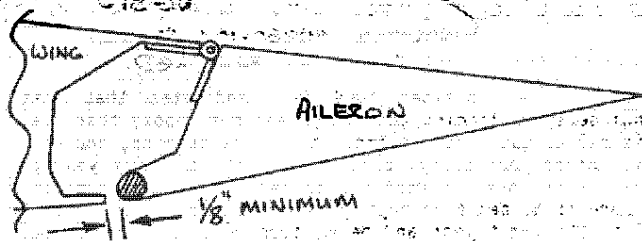
A possible bad batch of Safe-T-Poxy hardener may be out in the field. Only two reports have been received to date. Symptoms are slow curing or no cure at all. Be sure and ALWAYS check yesterdays mixing cup with the classic scratch test. 24 hours after mixing epoxy in a cup, the surface of the residue can be scratched with a sharp object, such as a pocket knife or a nail and this scratch should look white and the cured surface should not feel gummy. Do this test 24 hours after every layup. This is the same test that is used throughout the industry and will guarantee that you never use a bad batch of epoxy. It will also show up a poorly mixed batch or a batch mixed using an incorrect ratio.

CAUTION

Paul Prout's fuel sight gauge as advertised in previous CPs should not be used with auto gas. Av gas is no problem at all and the pair installed in N26MS over a year ago have worked perfectly using only av gas. Paul is working on an auto gas option, but until then no auto fuel in Paul's sight gauges.

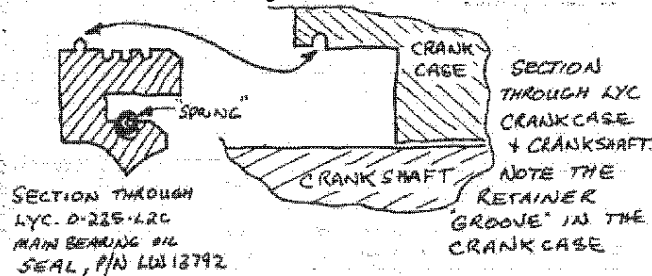
CAUTION

Aileron to Wing Clearance on Long-EZ and Defiant. With the ailerons in the neutral position, the gap between the lower leading edge of the aileron and the trailing edge of the wing should be a minimum of 1/8". Pay particular attention to this at the outboard end of the aileron. You may have nice free moving ailerons, static on the ground, but when the wings start to carry the load and bend, this clearance actually closes up a little. This is a point to inspect if you have an airplane flying. Look for worn spots in the paint.



Lycoming O-235 Main Bearing Oil Seals

We have had two reported cases of these seals blowing out and falling into the cowling. This is a serious situation, which in one case resulted in an off-field landing with considerable damage to the airplane. At least one of these occurrences was the result of the wrong seal being installed. The O-235 crankcase is machined with retainer groove as shown.



The correct oil seal (Part #LW12792) has a corresponding retaining "lip" that should "pop" into the groove in the case. The Lycoming O-320 seal does not have this lip to mechanically retain the seal and it could pop out if inadvertently installed in an O-235. Oil seals do occasionally come out but it is rare, according to Lycoming. When they do, it is generally because the breather has become blocked or restricted, or the wrong seal was installed, or the retainer groove in the case had become caked and filled with old permatex and was not cleaned out properly prior to installing the new seal and of course the new seal's lip was not able to snap into the groove.

The best way to install these seals is to thoroughly clean the inside of the crankcase where the seal will go with MEK solvent. Use a bent wire or small screw driver to clean out the retaining groove. Don't neglect the crankshaft. It should be cleaned and polished where the seal will be. Clean the new seal thoroughly with MEK as well. Use Goodyear Pliobond (contact cement) and paint the seal and the inside of the case with two coats (allow the first coat to tack). Press the seal into the case while the Pliobond is still wet, and do not run the engine for at least 24 hours.

Carefully check your breather system. If you have an oil separator, be sure that there is no restriction in the line. Check that your plastic breather line is not kinked or folded over. Be sure this cannot occur once everything gets hot. It is very important that the breather line is kept open and clear so that no pressure can build up in the crankcase.

VARIVIGGEN NEWS

Wayne Wilkins flew his first flight in his Vigggen on November 29, 1984. Congratulations Wayne! Nine years is a long time to work on an airplane, but Viggens don't come easy! To the best of our knowledge, there have been eighteen VariViggens completed and flown. Vigggen pilots are really quite a select group. Frank Stites visited RAF recently and he reports that his Vigggen is flying well, but that bad weather at this time of the year was making it difficult to put many hours on his Vigggen.

Sally and I have decided to donate our VariVigggen, N27MS to the Museum of Flight in Seattle, Washington. There are many reasons for this decision, but the main one is that the airplane is not flown very much any more and we just hated to see her rotting away in a hangar. We decided against selling, the her due to the liability. The Museum of Flight is a relatively new museum and they have expressed a desire to display our Vigggen, which would assure that it is preserved for everyone to enjoy. N27MS was started in August 1974 with first flight being on September 22, 1977. She has always flown very well and has been extremely reliable over the past 7 years. She never failed to get us where we were going or to get us back.

The only problems we had with her were a few minor electrical (alternator) problems. Almost 650 hours of fun flying and many unforgettable trips are over. It was a tough decision, an emotional time but we have decided and N27MS will be delivered to the Museum of Flight in Seattle in April, 1985.

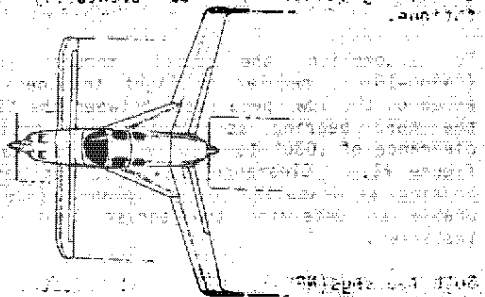
Of course this does mean that RAF will not be able to do any more pilot checkouts for Vigggen builders. Hopefully one or more of the currently flying Vigggens could help out in this area. The Vigggen Club, a group of 39 active Vigggen builder/flyers/fans, is still quite active and is the source of moral support and information sharing.

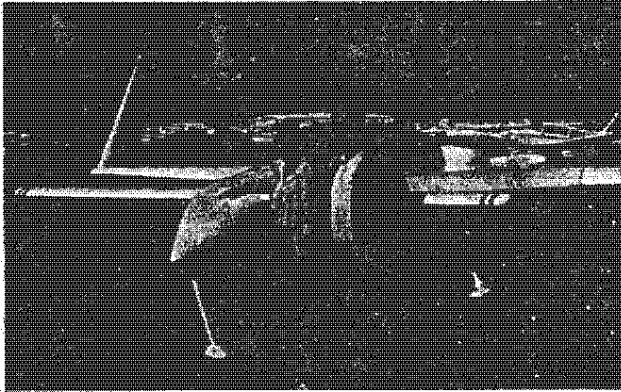
The VariVigggen is the airplane design that started the whole canard revolution and will always have a special place in history. Anyone tenacious enough to complete one will be a member of a very special group - Vigggen builder/pilots.

SHOPPING

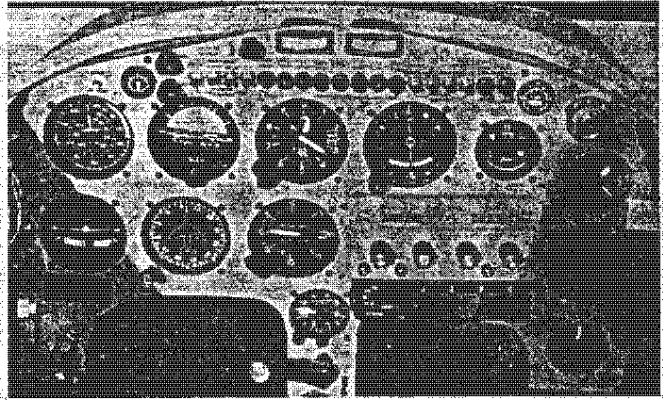
Aircraft Spruce and Wicks Aircraft are now carrying the essential Solitaire kits. This kit is made up of the fuselage shells, main wing spars with fittings, canopy in the frame, turtle deck and seat pan. Please contact the distributors for prices.

At Oshkosh we received many requests for the white polo shirts that we were wearing. We now have these in stock. They are white, three button with pocket, polo shirts. At this time we have them with the Long-EZ with "Rutan Aircraft" under the plane. The shirts are a good Hanes quality. Cost is \$14.00. We also have the second edition of the "Complete Guide to Rutan Aircraft" by Don and Julia Downie in stock. Cost \$13.50. We also have the book "Canard: a Revolution in Flight" by Andy Lennon. Cost is \$17.95. This is a history of the canard.

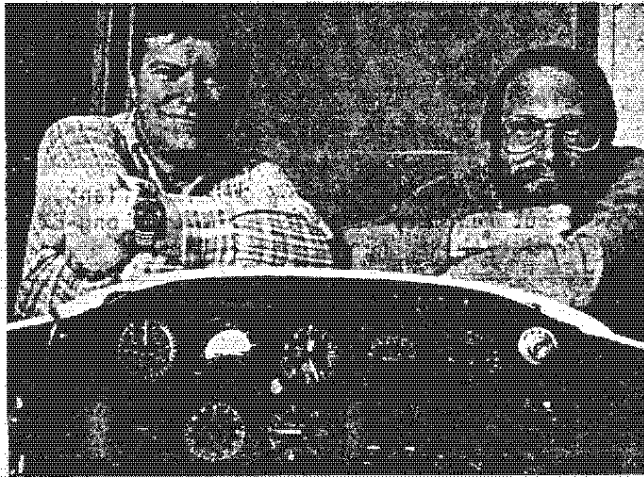




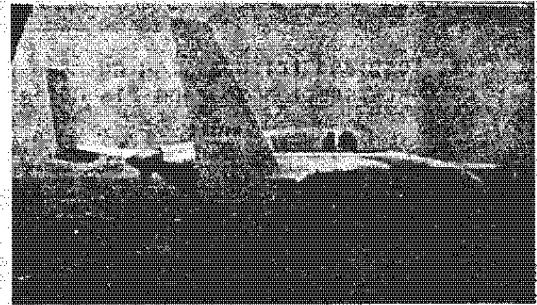
Dick and Joy Prentice with the Long-EZ they built and learned to fly in, N93DJ.



Dick and Joy's instrument panel.



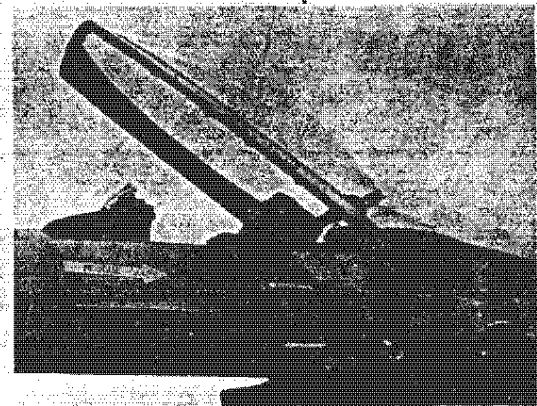
Buzz Talbot and Mr. Gooch, partners on their Long-EZ, N112TG. Note the 720 channel "Becker" comm radio on the right. It fits into a 2 1/4" hole!



Captain Peter Magnuson flying his Long-EZ. When he is not flying the Long, he flies an Electric Jet, (F-16)



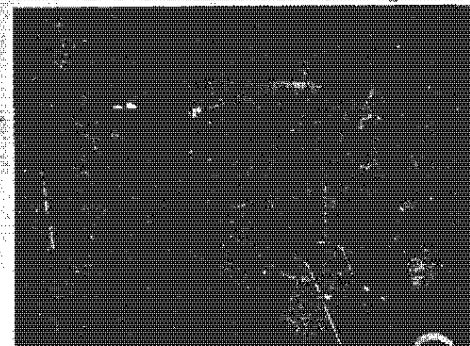
Jimmie Dallas' newly completed VariEze, N39760. Jimmie flies out of Anderson, Indiana.

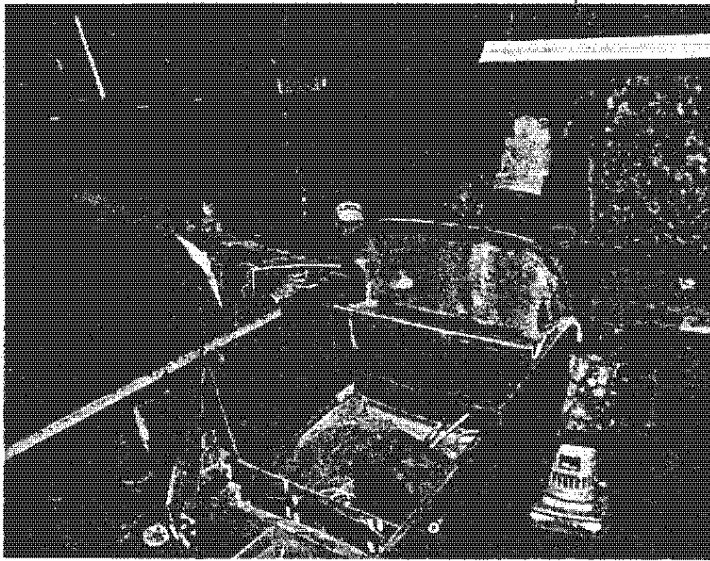


Phillip Wessel, Scottsdale, Arizona carving his Long-EZ fuselage.



G-IVAN, Ivan Shaw's gorgeous VariEze, seen here at the Popular Flying Association Flyin in Cranfield, England.





Dr. Yost and friends jugging main wings to centersection spar on his Defiant.



Charlie Gray, working on his Defiant, but remember Charlie built two Long-EZs! Nice shirt Charlie!!



Dr. Yost's Defiant is on the gear and the turtledeck and canopy section is hung up in the ceiling ready to mount!



Michael Marks and builder assistants trying it on for size. I guess we all fly 'em around the yard before we get done, we certainly do at RAF!



Nose gear retract mechanism in Dr. Yost's Defiant. Very nice workmanship.



Dr. John Steichen, Defiant builder in Downers Grove, Illinois has his fuselage in the jig. John reports that so far, building the Defiant has been easier than building his EZ, N27EZ. John started construction on Serial #13 on Sept. 1, '84

DEFIANT

HOMEBUILT FOUR-PLACE TWIN

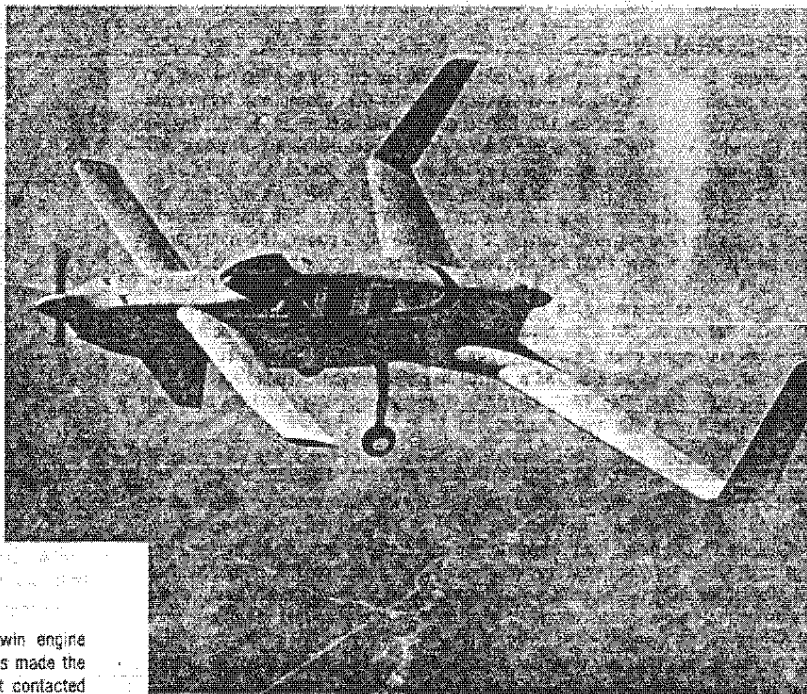


Photo by Don Downie

INTRODUCTION

For some time you have been reading about the four-place, push-pull twin engine Defiant. After five years of enjoying a "one-of-a-kind" aircraft, Burt Rutan has made the decision to release Defiant drawings to the homebuilder. In late 1981 Burt contacted Fred Keller of Anchorage, Alaska, and asked if Fred would be interested in building a Defiant and keeping a complete log with updated drawings and photographs as he was building. Fred agreed and at the EAA convention in Oshkosh 1983, Fred's Defiant was on display. Some changes have been made to the original aircraft such as, an increase in span on both main wings and canard and a revised aileron for lighter control forces. The back seat folds forward for a "station wagon" effect that allows two people to use the baggage area for sleeping. The canopy opening has been improved for easier entry. The fuselage has been changed to allow more head room for the back seat passengers.

Fred Keller is now completing the detailed plans for the Defiant. These will be available from RAF in March 1984. The builder support will be from Fred for plans interpretation, and from RAF for general "how to" in the construction.

DESCRIPTION

The Defiant is a four-place, canard-type twin with two 4-cylinder Lycoming engines. Engine power can be 150, 160 or 180 horsepower per engine. Its canard configuration provides several important benefits as compared to conventional twins: (1) Packaging is considerably more efficient — it has a standard-size cabin in an airframe whose whetted area is only 60% that of a conventional light twin. (2) The smaller airframe also has reduced structural load paths allowing a structure much lighter than a conventional twin while having better durability and a higher "g" capability. (3) The tandem wings allow natural aerodynamic angle-of-attack limiting, thus, the airplane is stall resistant. (4) The tandem wings, using winglets for directional stability provide a 30% reduction in induced drag compared to a conventional aircraft with the same span loading. (5) Flight control systems are simpler and lighter. Elevators are only two feet from the control sticks, and they provide a flap effect without having separate flaps, thus, at low speed the canard has a deflected full span slotted flap, yet the pilot has no flap control to adjust.

The rudder is only one foot from the pilot's rudder pedals. It is designed to provide control, yet have no effect on stability. Ailerons on the aft wing are controlled from their inboard end such that the entire wing and vertical fin assembly is built without any moving parts.

The small chord elevators and ailerons allow control forces compatible with a side-arm control stick. This allows more precise, less fatiguing control and provides improved use of primary instrument panel space.

Instead of the complex electrical system with one buss and battery tied to two alternators, the Defiant has two simple separate electrical systems, each with its own battery and alternator. IFR avionics are split to both systems so that no single failure can effect the essential equipment. Both engines can be started simultaneously. The two systems can be tied together to run all equipment from one alternator in the event of a failure. Also, a low battery can be charged by the other engine without ground electrical equipment. Thus, the electricals are much like conventional fuel systems, i.e., completely independent but with "crossfeed" available in an emergency.

The fuel system consists of a 58-gallon tank with a large sump for each engine. The two systems are independent and require no pilot action for normal operations. Crossfeed is available. The sumps are accurately gauged and are equipped with low level warnings, such that when 45 minutes fuel remains, the pilot not only has a

warning light, but has a gauge that moves full scale for the last 45 minutes of fuel. He can then intelligently plan his options when fuel is low, knowing quantity to within one-third gallon of fuel. The last one-half gallon of fuel can be used in all normal attitudes.

While appearing small outside, the Defiant is quite roomy inside. It has a cockpit width at the elbows of 46 inches (43 inches at rear seats). Knee and leg room for the back seats is a full eight inches more than current light twins. The Defiant has a large baggage area aft of the back seat and even larger if the back seat is laid flat. Two six-foot people could use this area to sleep in. The unique semi-supine seats provide a significant advantage in comfort over conventional seats. With a conventional seat, the upright pilot carries all his weight on the buttocks and small portion of the thigh. The Defiant's seat is reclined a full seven degrees more and armrests and headrests are provided for all seats. Thus the body weight is distributed over the lumbar, forearms, thighs and head, rather than being concentrated in the tailbone area. In general, a person who normally finds himself fatigued after a two- to three-hour flight, will be comfortable even twice that long in a well supported reclining seat.

The side arm controller and throttle system places the pilot's arm in a more natural position while flying and frees his lap area so he can use the airline type lunch tray for maps, approach plates, computers or lunch. Space efficiency and panel visibility is considerably increased when the control wheels are eliminated.

The aircraft is very basic in its systems. It will never require maintenance nor have an AD issued on its flaps, retractable main gear, cowl flaps, governors, hydraulic system, oleos, stall warning, nor emergency gear extension system, since these were eliminated in the basic design. The remaining systems (flight controls, power plant installation, electrical systems, fuel system, etc.) are all very basic and simple compared to the conventional light twin. This saves weight, reduces maintenance and increases availability and reliability.

Visibility, particularly in the pattern, is superior to current light twins. The canard wing is approximately the same height as the nacelles on the Seneca II. Forward downward visibility is adequate over the canard during normal climb, approach and landing flare. Absence of a wing above or below the cockpit area results in a welcome improvement in visibility over conventional aircraft.

FLYING QUALITIES

Flying qualities are conventional with the following exceptions: (1) Spiral stability is positive and speed stability is high, such that the aircraft files "hands off" indefinitely once trimmed, even in turbulence. (2) There are no pitch or roll trim changes due to configuration or power. Once trimmed at approach speed it will hold that speed hands off during power changes and landing gear extension. The airplane is very stiff in yaw with high damping. Yaw oscillations damp in one or two cycles after a side slip release, as compared to three to six cycles for a conventional light twin. Roll rate is excellent. Adverse yaw is low enough that all normal maneuvering can be done with "feet-off-pedals" resulting in less than one-half ball yaw excursions.

The Defiant is a very stable IFR platform with a very solid "big airline" feel. It holds a desired approach speed with less attention than a conventional light twin.

PERFORMANCE

In general, simplified systems means reduced performance. Not true for the Defiant. Overall performance and efficiency is significantly better than conventional light twins. Data discussed below are for 160 BHP engines. Time-to-climb to 10,000 feet is 10.3 minutes with full fuel and four adults and 7.7 minutes with two adults and 400 nm fuel. At maximum cruise speed of 184 knots (75% power), total fuel flow is only 17.8 gal/hr giving a 1.74 nm/lb economy and a range of 1044 nm with reserves. At 55% power (168 knots) total fuel flow is 13.9 gal/hr giving 2.00 nm/lb economy and a range of 1208 nm with reserves. At low cruise (40% power, 150 knots) range can be stretched to over 1300 nm with reserves. At equal loading and speeds, Defiant gets over 50% more miles per gallon than a conventional light weight twin! Holding capability is also impressive. A medium weight Defiant can remain aloft on only 40 thrust horsepower (64 brake hp) for a maximum endurance of over 14 hours. The excellent two-engine climb capability allows cruise altitudes as high as 18000 feet with four adults and full fuel. The prototype has climbed above 28000 feet at light weight, single place. This climb capability is far in excess of similarly equipped aircraft. (Fixed pitch prop and no turbocharger.)

SINGLE ENGINE CAPABILITY

In contrast to all other light twins, in which after engine failure a many-step procedure must be accurately followed during which the aircraft control and airspeed control are critical, the Defiant makes no demands on the pilot to follow procedures. He can even use any excess airspeed over the minimum full-stick speed to zoom over an obstacle. Once over the obstacle he can maintain aft stick and climb away (single engine) or accelerate without altitude loss to best climb speed. This unique capability is best shown by comparing the Defiant's takeoff profile with that of a conventional light twin (figure 1). Both airplanes are at maximum gross weight. Both aircraft experience a failure of the critical engine at 10-foot height. Neither aircraft can land and stop in the remaining runway, so they must continue to take off. The conventional twin pilot must immediately do the following: (1) raise gear, (2) identify failed engine, (3) retard throttle on failed engine, (4) cut off mixture on failed engine, (5) feather failed engine, (6) bank five degrees toward operative engine, (7) carefully raise flaps, (8) maintain 82 KIAS to 50-foot altitude. After 50 feet (accel-go procedure) he accelerates to best angle of climb speed (95 knots) and thus, does the best he can do to clear any obstacles. Height-distance profile for this is shown as the lower line in Figure 1. Note that even though his eventual climb gradient is adequate, (193 feet per nautical mile) the 310 is nearly 4500 feet from brake release, before reaching the 50-foot height, and unless airspeed control and procedures are accurate he will likely crash during this climb segment.

The 310 is one of the best light twins to perform this profile. The "light-light" twin types will either have less performance or will strike the ground during segment A.

The other lines on Figure 1 represent the performance obtained by the Defiant for several conditions. The lower lines are obtained if the pilot elects to fly at the best single engine rate-of-climb speed. Note that if the pilot does nothing but maintain airspeed he will clear the 50-foot obstacle at 3300 feet, even with the gear down.

The upper lines on Figure 1 indicate an even more interesting capability of the Defiant. Suppose a tall obstacle exists at the end of the runway. The Defiant pilot can pull back the stick to zoom over the obstacle, even slowing to his minimum speed of 65 knots. After clearing the obstacle he can merely hold the stick aft and safely climb away even if he leaves the gear down (no procedure). If any conventional light twin attempts this, an accident will result, since, they cannot climb when near min control speed or stall speed. If desired, a standard rate turn can be initiated following an engine failure during lift-off at gross weight.

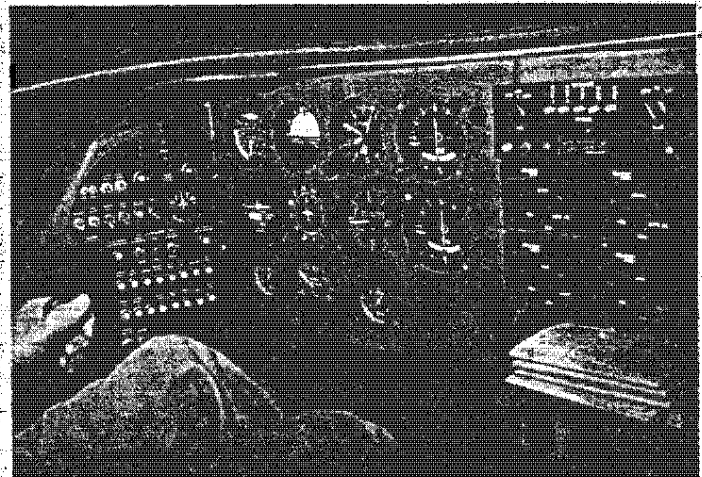
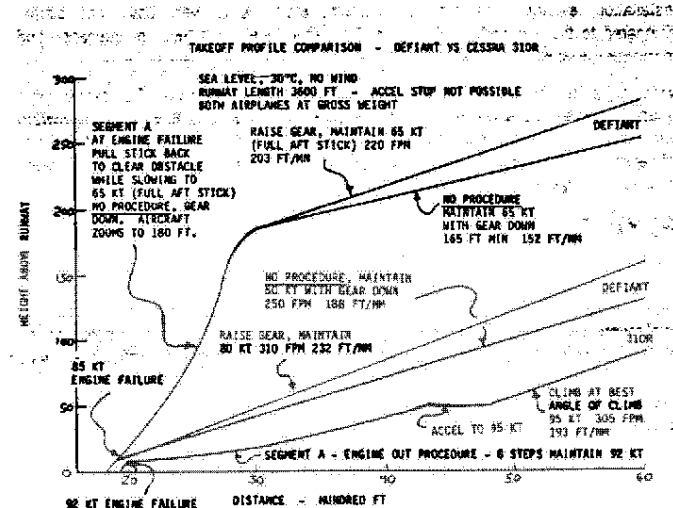


Photo by Don Downie

SPECIFICATIONS AND PERFORMANCE

(with 160 BHP engines, fixed props)

Engines (2)	Lycoming O-320 A1
Seats	4
Basic Empty Weight	1600 lbs.
Equipped Empty Weight	1680 lbs.
Equipped Useful Load	1270 lbs.
Gross Weight	2950 lbs.
Fuel Capacity	115 gallons
Wing Span	31.4 feet
Wing Area	133 ft.
Wing Loading	22.2 lb ² /ft.
Canard Span	24 ft.
Power Loading	9.2 lbs./hp
Payload with full fuel	660 lbs.
Max Cruise (78%)	184 knots
Fuel flow at max cruise	17.8 gph.
Range at max cruise (45 min. reserve)	1044 nm
Economy Cruise (55%)	168 knots
Fuel flow at economy cruise	13.9 gph.
Range at economy cruise (45 min. reserve)	1208 nm
Climb Rate (2950 lbs.)	500 fpm
Climb Rate (2220 lbs.)	1900 fpm
Single Engine climb (2950 lbs.)	310 fpm
Single Engine service ceiling (2950 lbs.)	6500 ft.
Single Engine climb (2200 lbs.)	550 fpm
Stall Speed (2950 lbs.)	64 knots
Stall Speed (2200 lbs.)	58 knots
Baggage Area Seat Up	16.5 cu. ft.
Baggage Area Seat Down	41 cu. ft.
Take off roll at sea level (2950 lbs.)	1480 ft.
Take off roll at sea level (2220 lbs.)	950 ft.
Take off roll at 5000 ft. Density altitude (2950 lbs.)	2500 ft.
Take off roll at 5000 ft. Density altitude (2220 lbs.)	1960 ft.

COST AND TIME TO BUILD THE DEFIANT

The cost of the materials list has not been completed at this time, but we estimate the cost of building the Defiant will be approximately "two Long-Ezs", between \$20,000 and \$30,000. Remember that avionics can cost you as little as \$1,000 or as much as you wish to pay.

Time to build the Defiant, again will be "two Long-Ezs" as it is the same type of construction, just more. A competent builder can build a Defiant in as little as 2000 man hours. Until the plans are completed, it is difficult to say how many of the parts will be available prefabricated and this would make a difference to the time to build.

Canard Pusher Newsletter	\$ 6.75	Overseas \$ 8.75
Defiant Plans - Section 1	\$490.00	\$510.00
Defiant Engine Installation	not available at this time	
Defiant Owner's Manual	not available at this time	

Rutan Aircraft Factory, Inc. BUILDING 13, MOJAVE AIRPORT
MOJAVE, CALIFORNIA 93501
TELEPHONE (805) 824-2845

SOLITAIRE —

A Self-Launching Sailplane

THE PROBLEM

For a long time soaring has been an exclusive sport requiring a special license and training. Soaring in a glider of enough performance to allow the average pilot to feel the true thrill of 'engineless' flight has been expensive enough to severely limit the number of people who enter the sport. The current interest in ultralight and light sport aircraft has reached an all-time high.

THE CHALLENGE

The Soaring Society of America recognized the problem. Other segments of homebuilt aircraft were experiencing great interest and activity on the part of designers and the general public. The sailplane market was not getting its share of the attention. To correct this, the SSA issued a challenge in the form of a contest. Develop a self-launching sailplane capable of take off and the ability to climb to altitude without the use of a tow plane. The new design could be flown without the special license required of a sailplane pilot, just a private pilot's license. The aircraft must be easy to fly, as well as quick and easy to build. Strict rules were set up and an actual structural test of the finished aircraft was required. The Solitaire was designed around these goals and achieved these and more.

THE WINNER

At the flyoff held in Tehachapi, California, on September 6, 1982, the judges studied the entries, flew the SOLITAIRE and unanimously declared it the winner.

WHAT

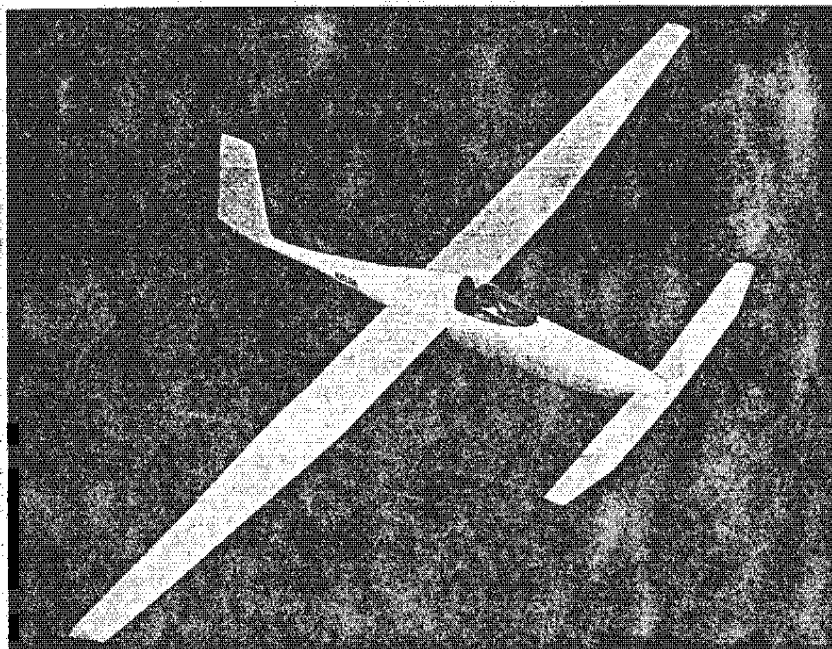
The SOLITAIRE is a single-place self-launching sailplane that is fitted with an engine package that folds into the nose of the aircraft after it pulls the SOLITAIRE to soaring altitude. With the engine folded, it has a L/D of 32 to 1 giving it true soaring capability. The engine can be deployed and restarted in flight using its electric starter. The canard concept results in high resistance to inadvertent stalls and spins. Its 'snufflap' descent control system has been acclaimed as "excellent" by all evaluators, providing crisp, variable glide path control without trim upsets. Unlike conventional sailplanes the pilot sits within the allowable cg range.

HOW

The SOLITAIRE uses the proven materials and methods pioneered by Burt Rutan and used in the VariEze and Long-EZ, two of the most successful aircraft ever designed for the homebuilder. The wings are special uni-directional fiberglass cloth and epoxy resin. They are built using the moldless composite technique developed in the VariEze and consist of prefabricated 'S' glass spars and a solid foam wing core. The fuselage comes as two prefabricated halves. The bulkheads are available prefab and the wooden fixtures and templates will be available premanufactured. The canopy comes installed in the frame and the turtle deck is available prefabricated. All of the metal parts and complete landing gear components are available premachined. The pre-molded parts are of aerospace quality. Construction consists of prepreg fiberglass skins with a honeycomb core and an adhesive film to bond them together. These parts are then vacuum bagged and cured in an oven. In short, this aircraft will have more prefabricated parts than any previous design from Rutan Aircraft Factory. Of the available prefabricated parts, the builder can buy all or as few parts as he wishes. We estimate that an average builder, purchasing all the available parts could build the aircraft in 400 hours at a cost of between \$7000 and \$9000. When the quality of the parts and the ease of building is considered the value of the SOLITAIRE becomes apparent.

SUPPORT

Rutan Aircraft Factory support has been a key factor in the history of success with homebuilt aircraft. When you buy plans, you become one of a family of builders. Rutan Aircraft prides itself on its builder support program. We will answer questions either by phone or in writing. Builders are also welcome to bring parts to Mojave for inspections and advice. The quarterly newsletter is mandatory when you are building, as it provides continuing builder hints, ideas and plan updates.



ALL RAW MATERIALS.

Near Los Angeles,
AIRCRAFT SPRUCE
201 W. Truslow, Box 424,
Fullerton, CA 92632
(619) 870-7551
Catalog \$4

Near St. Louis,
WICKS AIRCRAFT
410 Pine Street,
Highland, IL 62249
(618) 654-7447
Catalog \$3

ALL PREFAB MACHINE PARTS.

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SPECIFICATIONS

SOLITAIRE - RAF Model 77-6

Empty Weight	380 lbs.	Fuel	5 gal. premixed @ 40:1
Gross Weight	620 lbs.	L/D	32/1 at 50 knots
Total Wing Area	102.44 ft. ²	Min. Sink	150 ft./min @ 40 knots (approx.)
Span	41.75 ft.	Descent Control	Spoilflaps usable to V _{ne}
Wing Loading	6.05 lbs./ft. ²	Min. Flying Speed	32 knots
Engine	KFM 107E	V _{ne}	115 knots
BHP	23 at 6000 RPM	CG	unaffected by pilot weight

SOLITAIRE DOCUMENTATION

Canard Pusher Newsletter published quarterly.

One year's subscription \$ 6.75

Section I - Manufacturing Manual \$225.00

This is the complete education and construction manual for building the entire SOLITAIRE except for the engine installation. This manual consists of a spiral bound book 11" x 17" together with a set of 23" x 33" drawings, which include all necessary full-size templates, jigs and cross sections.

Solitaire Owner's Manual \$ 8.00

This is the required operations handbook and checklist for flying the SOLITAIRE.

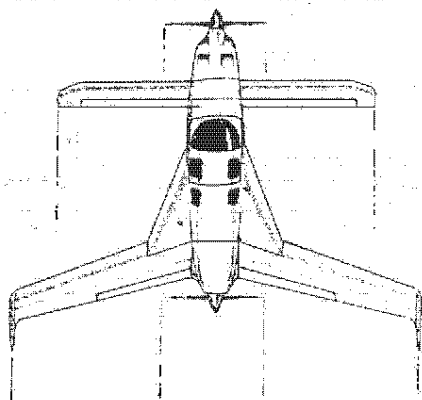
Rutan
Aircraft
Factory, Inc.

BUILDING 13, MOJAVE AIRPORT
MOJAVE, CALIFORNIA 93501
TELEPHONE (805) 824-2645



Our intrepid leader, Burt with his latest flying model, "Rusty" a Blue & Gold McCaw. Burt is studying Avian Aerodynamics! Photo by Don Downie.

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



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