

THE CANARD PUSHER

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If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 42. If you are building from 2nd Edition plans you must have newsletters 18 through 42. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 42. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 42. If you are building a Long-EZ you must have newsletters from 24 through 42. If you are building a Solitaire, you must have newsletters from 37 through 42. If you are building a Defiant, you must have from 41 to current.

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

We have been working hard on the new Long-EZ canard and have almost 200 hours of test flying on four different versions of the new canard. This week we are flying the final version in its final configuration on the prototype N79RA. RAF has also provided test pilot support to Scaled Composites for Burt's latest airplane, the Predator. Predator is a new generation of agricultural aircraft (crop duster) and is a canard type airplane with a small horizontal tail, actually a three surface airplane. Look for information in the upcoming aviation magazines.

We have built an engine mount for the plans built Solitaire and actually installed it into a homebuilders fuselage. Since the plans built version of the Solitaire is a little different than the prototype, it was a big help in getting the engine installation plans done.

Defiant builder support is picking up and several builders are really going fast on their projects. Right now it looks quite possible that one or more homebuilt Defiants may be at Oshkosh 1985!

RAF travelled to the Brown Field flyin at San Diego, California with Burt's Defiant and Mike's VariViggen. VariEzes and Long-EZs as usual were far and away the most numerous types at the flyin. We flew to the Copperstate flyin in Eloy, Arizona. This is really a

fun flyin, with lots of EZs and with lots of flybys flown by more different types than you see at most flyins. Dick Kreidel won the Best Composite award for his beautiful Long-EZ.

WHAT IS THE BIG NEWS AT RAF?

New Canard for the Long-EZ? New project in the shop? Voyager flew it's mission? NO, NO, NO. BURT IS GETTING MARRIED!! On November 16, 1984, Burt will be tying the knot with a lovely lady, Margaret Rembleske (some of you met Margaret at Oshkosh). He calls her "Sunshine" as she always has a smile and sure makes Burt smile a lot!! Congratulations Burt and Margaret.

OSHKOSH '84

Oshkosh has come and gone once again. If you have never been to Oshkosh, you really owe it to yourself to go, at least once. It is impossible to describe. It is huge, it is busy, there are tens of thousands of people and thousands of airplanes. It is mind boggling. It is neat. It is Oshkosh.

RAF was well represented as usual with 48 registered VariEzes, 33 Long-EZs, 3 VariViggen, 2 Defiants, 1 Solitaire and 1 Voyager. A total of 88 Rutan designs were tied down on the field at Oshkosh during the convention. As usual several pilots did not register. Irene Rutan (Burt's Mom) knows of at least two EZ pilots who did not register but were there for all or part of the week. This gives us a total of 90 aircraft at Oshkosh '84.

As we have always said, our moldless design such as is used on the EZs, is the fastest way to build a one off airplane (which is what each of our homebuilts is!). If you doubt this, count the airplanes at flyins, not just at Oshkosh, but any flyin, the Copperstate flyin, the Brown Field flyin, Watsonville flyin, Merced flyin, Sun 'n Fun flyin etc. At all of these flyins, EZs out number any other type, including the so called prefab, snap 'em together composite airplanes. Don't just believe all the advertising you see, go to the local and national flyins and count the airplanes. Talk to the builder/pilots. You will soon find out which are the easiest and fastest to build, and the best flying and most useful cross country airplanes. Enough said!!

The big news at Oshkosh this year was the spectacular arrival of the Voyager. Dick and Jeana flew to Oshkosh from Mojave, landed at Oshkosh after the Sunday airshow, and kept the airplane on display for the entire week. The Voyager was flown several times and judging from everyone's reaction, created quite a sensation. Since Oshkosh, the Voyager has been undergoing more flight testing here at Mojave, and has been flown as heavy as it will be during testing, with no problem. In fact for the heavy weight flight, the Voyager took off with right at 60% of it's weight in fuel. The take off roll was a short 2300 feet. At this weight, the Voyager could have broken every existing distance record on the books. To make it all the way around the world, it will obviously be carrying even more fuel but at this point we do not expect any problems.

Burt has turned the Voyager over to Dick and Jeana - he is satisfied that the airplane has the capability to do the job. He has specified what the power requirement will be and now Dick and Jeana will take the Voyager through Phase II. That is to prepare it for the around the world flight, this is mainly avionics, engines as well as the human factors.

A lot of EZ builders and pilots have joined the Voyager VIP club. This has been a great help. A lot more help is needed. We would encourage anyone interested in seeing the Voyager successfully fly around the world to join the VIP club. Lets keep Voyager as a grass roots effort. Write to Voyager for details.

Voyager Aircraft Inc.
Bldg 77, Mojave Airport,
Mojave, CA 93501
805-824-4790

Aircraft Registered at Oshkosh 1984

<u>VariEze</u>		<u>Long-EZ</u>	
John Levy	CA	Joe Sabo	NY
Byron McKean	TX	Jan Van Noord	CA
Greg Coin	OH	David Domeier	CT
Shirl Dickey	UT	Norman Howard	CA
Delmar Hoagland	IL	Errol Mann	MN
J. Armstrong	TX	Robert Prior	CA
Bruce Stephens	MA	Donald Livengood	NY
Jack Day	CA	Joe Yasecko	FL
Mike Slingluff	ME	Jack Hare	MI
Gary Price	ME	Neal Johnson	LA
Steve Wright	FL	Sam & Dick Kriedel	CA
Jack Fehling	FL	Richard Dorman	NH
Gerry Mason	MI	Darwin Esh	WI
Frank Dudley	FL	Beau Wold	MN
Gary Hertzler	AZ	Tom Garrison	TX
John Faulkner	CT	Harris Howard	TX
Richard Wallrath	CA	Kenneth Hanson	CA
Gerald Edmonds	WY	Sheldon Olson	WI
Bob Evans	WY	Bruce Tiffit	CA
Wes Gardner	CA	Steve Bowser	CA
Harry Robins	MO	Mike Melvill	CA
Jim Bair	IO	Don Maher	FL
K. Speckman	MN	Lynn Burks	CA
Fergus Fay	CA	Paul Adrien	NH
Quinton Daniel	MI	Curtis Baker	AZ
Bill Cormier	MA	Ferris/Johnson	CA
Ray Lancaster	TX	Sidney Stiber	NY
T. Thornhill	TX	Judge King	MN
W. Butters	MO	George Scott	TX
Mule Ferguson	NC	Phil Supan	CA
Don Jones	TN	A. McCumber	MN
John Frilling	IL		
Roy Blaha	FL	<u>VariViggen</u>	
Robert Beard	CA	Ken Winters	OK
Ken Swain	NB	Bernard Duneman	MN
Lynn Coltharp	OK	Arthur Schwartz	NY
Leonard Brown	NY		
Stephen Sorenson	CA	<u>Defiant</u>	
Bob LeMaster	WI	Burt Rutan	CA
Michael Marker	NM	Fred Keller	AK
Thomas Hazelrigg	IL		
Ron Menzie	AT	<u>Voyager</u>	
Cy Gaskey	IL	Dick Rutan	CA
Steve Kelly	CA		
Ronald Kapperman	OK	<u>Solitaire</u>	
Gene Zabler	WI	RAF	CA
James Townsend	CT		

SHANANDOAH VALLEY 500 (The old Dulles 500)

Vic Mondary in his VariEze came in First place in the two place category, First place in the homebuilt category, First place using auto gas and Second place overall. He was beaten by Mike Smith in his Bonanza but only because Vic got a "little" lost on the way to the first pylon. A Long-EZ came in Third. Vic averaged 146.6 mph for 500 kilometers (310 miles) and carried a 513 lb payload. Congratulations Vic, you done good!!!

AVIATION ART SHOW

St. Joseph's Hospital in Tampa, Florida is planning on holding an aviation Art Show and they would like to hear from artists (painters, photographers, or others who produce hanging art) who would like to show their works at this event. It will be held this fall.

Contact: Lize Kalashian
813-870-4340

CLUB NEWS

Long-EZ builders in the Chicago area, interested in getting together and exchanging information and experiences, contact:

Roger Shem,
14540 Oakley,
Orland Park, IL 60462
312-349-0510

Defiant builders in the Chicago area, VariEze builder John Steichen, is working on his Defiant and would like to share information, skills, possibly even jigs and fixtures with other area builders.

Contact: John Steichen,
960 86th Street,
Downers Grove, IL 60516
312-985-6671

NEW AIRFOIL FOR LONG-EZ CANARD?

As many of you know, Mike and Sally had a different airfoil canard on their Long-EZ at Oshkosh. The purpose of this airfoil was to try to lower rotation speed, to try for a little higher performance (lower drag) and to try to eliminate the small nose down trim change that occurred at cruise power in the rain. The new airfoil in fact achieved all three objectives. However it had a glitch at 70 to 80 knots, in other words right in the approach to landing mode. We have made several changes since Oshkosh in an attempt to cure this small corner of the envelope. Unfortunately, when we fix this, we lose it somewhere else. We have recently built an entirely new canard, new airfoil and new plan form that is currently being flown on the Long-EZ prototype. We do not have sufficient data to release any information in this newsletter, but we will continue to work on it. When we have it refined to our satisfaction, we will make an optional set of plans available for it. It is difficult to predict when this will be, due to our work load here at RAF.

Please don't call us on this, as there is nothing we can release at this time. When we are ready, we will publish it in the CP. If you are ready to build your canard, go ahead. If you can delay it for 3 or 4 months by building winglets, wings or whatever, it may be a good idea to do that.

DEFIANT

Johnny Murphy, builder of a Quickie, a VariEze, a Long-EZ, a Mead Adventure and a Glasair is really going to town on his Defiant. Johnny has both wings, both winglets, the centersection spar, the canard and elevators all complete. He is currently building fuselage bulkheads. Charlie Gray builder of two Long-EZs is not far behind. Charlie and a friend are building two Defiants and already have completed 4 wings, 4 winglets, 2 centersection spars and 1 canard! Several other Defiant builders are also making rapid progress.

Fred Keller is working on the engine installation plans, or Section II. These plans will include all the information to install either conical or dynafocal mounted engines, as well as electrical wiring diagrams, pitch trim system, baffling and cowlings.

RAF has asked Ken Brock to make almost all of the Defiant metal parts. We have supplied Ken with a list of these parts in the order that they will be required, provided the builder works in the order that the plans are written. It will of course take some time to tool up and manufacture all of the metal parts to build a Defiant, so don't expect Ken to have them available overnight. Give him time and if you are interested in buying Defiant metal parts, let him know. He is interested to know just how many builders there are out there who would buy the prefab parts.

Task Research has available the main gear and is currently tooling up to produce cowlings and possibly the turtle deck, aft of the canopy back to the rear cowl. Task would really like to hear from the Defiant builders as to the interest in the prefab parts. If you are planning on building a Defiant, please either drop a note to Task or RAF, letting us know if you would be interested in buying the cowlings and the turtle deck prefabricated. This will really help us in determining the tooling.

HELP!

"I was fruitlessly trying to repair my motor glider at Fox Field one Saturday in July this year, when a VariEze builder, I think his name was Hank Aldrich, offered to give my friend and I a ride back to Santa Monica Airport, where my car was. Unfortunately when I got out of his car, I left a small bag containing a transistor and a set of car/house keys. I don't know how to contact him, he does not know me.

Please call - Byron Alexander - 213-398-4093
Thanks"

AN ALASKAN ADVENTURE

Mike and Sally, Bonnie and Bruce Tiff and Fred Keller had planned a trip to Anchorage, Alaska for the period after Oshkosh 1984. On the Sunday after Oshkosh, Fred's Defiant and Mike and Sally's Long set off for Minot, North Dakota where they planned to meet Bruce and Bonnie. Some real serious scud running was required in western Wisconsin and eastern Minnesota but the rendezvous was made on schedule. The next morning the flight of three flew to Edmonton, Alberta, where the tower requested and got a three ship formation flyby. From Edmonton we flew to Fort St. John where we spent the night. Next day we flew along the Alkan highway up to Fort Nelson where the weather was on the ground. A quick 180 and back to Fort St. Johns (nice to have all that range). Later we were able to make it through, although we had to do a little cross country away from the highway plus some fairly good scud running, which required more than a little pucker power on the part of some of the crew. We made it into Watson Lake in glorious sunshine and spent the night. Watson Lake is a really neat place. Early next morning we left for Northway, Alaska. Again we found ourselves doing some serious scud running between Whitehouse and Northway. We cleared customs and had the best home made pie ever. We ran into bad weather at Gulkana, but with Fred's knowledge of the area, we were able to sneak under it and around it and finally found our way to Fred's home base, Merrill Field in down town Anchorage. We stayed with Fred and his wife Sharon-Kay and had the best time ever.

While taking off to fly in an airshow at Merrill Field, Mike had an exciting time, when a valve stuck on his O-235. Our schedule was so hectic, we were unable to look at the engine, but on returning from Valdez, we found a bunch of homebuilders, including a VariEze builder/flyer, Ron Himmelberg and a Long-EZ builder had removed the cowling and had pulled the cylinder! These Alaskans certainly are the most helpful folks. An engine rebuilder was located only 200 yards from our parking place and he had everything ready to go in two days including getting parts from "outside" (the lower 48). Bruce and Mike got the engine all back together and test flew it at 10:30 P.M. that evening, in broad daylight. Big "thank you" to Bruce for all that hard work.

Next day Mike and Sally flew to Fairbanks and back to break in the new overhaul, flying very close to Mount McKinley. It was a crystal clear day and the 20,000 plus foot high mountain was breathtaking. The engine ran well and they felt confident to try the trip home.

Too soon it was time to leave Fred and Sharon's wonderland, so we bid a tearful farewell. We flew non stop to Whitehorse in the Yukon, where we stopped for lunch and customs. After lunch we flew to Fort Nelson where we spent the night. The weather was perfect! Next morning we flew to Williams Lake, a little of the now familiar scud running was required. Flew on to Pentecton, Canada. After landing, Bruce did a brief check of his airplane and found that the main oil seal had broken and was lying in the bottom of the cow! Once again more helpful folks made repairs easy. After spending the night, we jumped across the US/Canada border and cleared customs at Spokane, Washington. We had breakfast and then Bruce and Bonnie departed to visit friends at Grants Pass and Mike and Sally headed for home.

What a fantastic trip. Canada and Alaska are truly magnificent. Have you ever had 100 miles visibility and looked out and seen nothing but majestic mountains, rivers, lakes and fabulous trees? Awesome. What memories - flying along the face of the Columbia glacier in a Grand Champion Widgeon, courtesy of George Pappas, flying a super cub on floats out of little fresh water lakes, looking for mountain sheep in steep glacier cut canyons, watching the salmon making their way up the rivers, dinner at the top of the tallest building in Anchorage. The people in Canada and Alaska honestly enjoyed sharing their wonders with us. Super folks.

If you ever have the opportunity to fly your EZ up to Alaska, don't pass it up. Do learn all you can about the trip. AOPA can be very helpful. Read Don and Julia Downie's book "Alaska Flight Plan" and go for it. It is not to be missed.

Some statistics for the trip on N26MS. Total distance travelled from Mojave to Oshkosh to Anchorage and back to Mojave - 6920 nautical miles (7963 statute)
Total hours on the Hobbs meter - 61.6 hours
(engine running time, include taxiing, side trips, Oshkosh flybys etc).
Total fuel burned for trip - 308 gallons
Average fuel burned per hour - 5.0 gph.
Actual flight time, Mojave to Mojave - 54.7 hours
Average ground speed for trip - 126.5 knots (145.5 mph)

SOME THOUGHTS ON COOLING

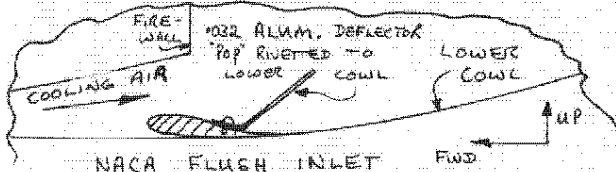
The following observations are based entirely on my own experiences over 900 hours of flying in my Long-EZ, N26MS.

Since first flight in January of 1981, my engine, a Lycoming O-235-L2C, baffled exactly per section IIL of the Long-EZ plans, has run with cylinder head temperatures that were not even, to say the least. Cylinder #4 (forward right side) had always run the hottest. Cylinder #1 (aft left side) had always run the coolest. At normal cruise power in level flight there was normally a disparity of up to 100°F between these two cylinders. Cylinders #2 and #3 ran within 5° of each other at all time (#2 is aft right side and #3 is forward left side). This problem was not entirely as bad as it sounds in that even the hottest cylinder #4 never did exceed or in fact even come close to the red line temperature as called out by Avco Lycoming. (500°F as measured at the bayonette fitting under the cylinder head, not at the base of a spark plug).

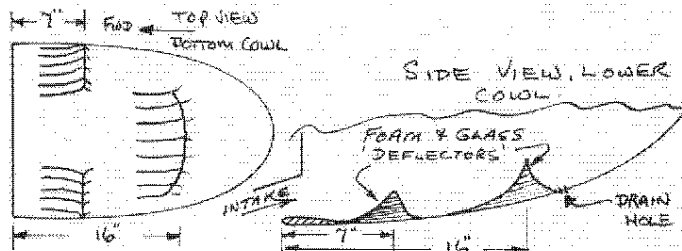
On an average cross country trip, in stabilized level flight, my cylinders would run as follows: #1 - 280°F, #2 - 345°F, #3 - 341°F, #4 - 413°F. We flew the airplane for over 700 hours with this condition. Over this period I tried many small ideas in baffling, tightening the baffles, loosening the baffles, sealing every single little gap in the baffles. None of these changes made a really significant improvement.

~~Sure I picked up 5° and 10° increments from time to time, but I was trying to cure a 100° difference! There is not enough space here to list all the different ideas I tried, but they included removing the intake duct completely, and installing a throttle body fuel injector instead of a carburetor.~~

Finally I tried a small deflector plate, consisting of a piece of .032 aluminum approximately 4" x 5". I bent it so I could rivet it to the inside of the lower cowling lip. I mounted it off center on the right side, under the #4 cylinder, hoping perhaps it might aim the incoming, high velocity cooling air directly at the #4 cylinder. See sketch.



I test flew it, with little enthusiasm and was amazed to say the least. #4 was now the coldest cylinder. Unfortunately #2 was not too hot, however I now knew I was on to something. To make a long story short, I tried 6 different iterations of various width and height of deflectors in several positions on the lower cowling. Currently I have 3 deflectors, one on the left side, one on the right side, and one on the centerline, aft of the carburetor. See sketch.



These deflectors are made of foam and glass (1 ply of BID over pour-in-place). My results at this time, with 150 hours of flight time on the above, maximum power climb to 12,000 feet, #3 cylinder is the hottest at 435°F, #4 is the coolest at 395°F. In level flight at 8500 feet, at an economy cruise power setting (approximately 60%) of 17" manifold pressure, 2500 RPM, indicating 121 knots for a true airspeed of 136 kt/157 mph (OAT +1°C), fuel flow was 4.4 gph. Cylinder #1 - 345°F, #2 - 31°F, #3 - 338°F, #4 - 343°F.

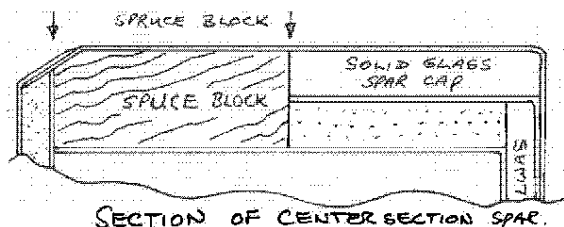
On another trip at 8500 feet at maximum available power (approximately 75%) 21.4" manifold pressure, 2850 RPM, indicating 146 knots for a true airspeed of 163 knots (OAT +4°C) fuel flow was 6.4 gph. Cylinder #1 - 363°F, #2 - 361°F, #3 - 364°F, #4 - 363°F.

So it can be seen that with a little trial and error, the cooling air deflectors can be made to work rather well. I don't claim that they will work for everyone, but I believe that if you are having similar cylinder head temperature disparities, it may be worth a try. I must emphasize that this test was done on a Long-EZ with a flush NACA cooling inlet and a Lycoming O-235 engine. Whether or not this idea would work on an airplane with a standard ram inlet, I can't say, but again, it may be worth a try. Remember that I have all four cylinders instrumented with CHT as well as EGT with a calibrated digital gauge, so I knew at all times what was happening with each change.

BUILDER HINTS

Bondo for jiggling - When you position your winglet onto the tip of your wing, be careful to sand the wing and the winglet locally where you apply the bondo that will jig it into position for the structural layup. If you do not sand the glass, the bondo may not hold, and it is possible that the bondo will fail in the middle of the cure cycle of the structural glass layup. This can cause the winglet to be misaligned incidence wise. This has happened before and it can happen to you. Sand the glass wherever you intend to apply bondo for accurate jiggling purposes.

Spruce blocks in the Long-EZ centersection spar. These four wood blocks are microed into the foam core such that they touch the forward edge of the spar caps and extend forward 3". They are there to absorb the crush forces when the two bolts that attach the engine mount extrusions to the centersection are tightened. It is important that these bolts go through the spruce blocks. See sketch.



CAUTION

When mixing epoxy and micro balloons, wear a dust mask and keep your face away from the balloons that may float up into the air. Although these glass balloons are inert, they can lodge in your eyes or in your lungs and can cause problems. Handle with care.

LONG TERM MAINTENANCE ITEMS ON EZs

Quite a few EZs, both VariEze and Long-EZs have now accumulated over 1000 hours of flight time. We have requested feed back from the builder/pilots of these aircraft regarding maintenance.

Problem - Paint flaking off, particularly at the dry micro to featherfill juncture and especially in humid climates.

Solution - Sand glass and dry micro filled areas thoroughly with 40 grit. Use Morton's Eliminator or Sterling primer filler instead of featherfill. Use primers and finish coat by the same brand name manufacturer, ie. Dupont primer 1315 and Imron or Ditzler primer Preet 33 and Ditzler Durethane polyurethane enamel system.

Problem - Nose wheel friction damper seems to loosen after one or two flights.

Solution - Remove fork and pull phenolic friction button. Ream the hole the phenolic button slips into, to allow a little clearance. The problem seems to be caused by the phenolic button being driven into the hole, against the spring, by a hard landing and then becoming stuck. Get it to work in and out freely, adjust the spring to give 2 to 4 lbs of side force measured at the trailing edge of the nose tire with a fishing scale, and you should have solved the problem.

Problem - Long-EZ exhaust system support bracket cracking. Either the brace or the tab welded onto the exhaust pipe will fall.

Solution - Remove the braces completely and allow the exhaust pipes to float free. They will only be attached at the engine exhaust flange. Experience has shown this to be the best method, no bracing is required.

Problem - A few builders report that nosewheels are turning, not on the tapered bearing, but on the 1/4" bolt at the spacer/bushing. Apparently no combination of torque on the bolt will cure it once this occurs.

Solution - Machine a spacer to install between the aluminum bushings so that when the 1/4" axle bolt is torqued up, it can be tightened up solid on the two existing bushings and the new spacer. The trick is to machine the spacer to exactly the proper length to ensure that the two taper roller bearings in the wheel are just right, not too tight and not too loose.

Problem - Nose gear downlock bouncing out of over center locked position, putting all loads onto wormgear teeth. Of course this strips off about half the teeth on the wormgear.

Solution - Rotate wormgear 180° and you are back in business. Worm and wormgear should never see the loads (other than retraction and extension). The mechanism must go over center. To ensure it stays in the over center position, some form of friction must be maintained at the gear handle pivot in the instrument panel. Try shimming the oval shaped green plastic bearing block to misalign it and put the handle shaft "in a bind" so to speak. You just need enough friction so the gear retract mechanism will stay in the down and over center locked position, as well as in the up position.

Problem - VariEze main gear attach tabs. The 1/4" diameter holes in the aluminum extrusions elongate and become loose on the AN4 (1/4") bolts. Check for this by lifting the airplane so that the main wheels are clear of the ground. Grab the gear strut close to the tire and attempt to move the wheel fore and aft. Any movement at all would indicate the above condition.

Solution - Remove the main gear attach bolts and ream the 1/4" holes in the extrusions up to 5/16" diameter. Replace the AN4 bolts with AN5 bolts and torque them to approximately 125 in/lbs.

Long-EZ Operations - Carburetor ice can be a real hazard. Do not omit the installation of a good carb heat system. When the temperature and humidity are just right and you are flying at a relatively low power setting, you can get carburetor ice, even in a Lycoming. The classic evidence of ice is an unexplained drop in RPM. Should this occur, go to full power immediately and apply full carb heat. This condition is not nearly as common in the Lycoming installation as in the Continental installation, but given the right conditions it can occur. Do not assume it will never happen to you.

Brakes sticking on - A few builder/flyers have experienced the peculiar phenomenon of brakes that remain on after being applied. The causes of this have not been easy to find, but it does occur. Look for the following possibilities: 1) Automotive brake fluid instead of aircraft grade. This can damage the 'O' rings and seals and cause the brake master cylinders to stick. 2) Check the 1/8" size plugs in the top of the reservoirs to be certain that they have vent holes drilled in them. This should be a 1/16" diameter hole. Without this vent, it is possible to have the brake master cylinders stick. 3) Be certain that your brake linings have not worn down to the point that the pistons in the brake calipers (at the wheel) can be forced out of the caliper far enough, that the piston can become cocked and bind so that it can not retract into the caliper. 4) If these conditions persist, you will have to dismantle the brake master cylinders and overhaul them.

Summary

We have 3 Long-EZs and 1 VariEze here at Mojave, all of which are 4 years old or more. The total hours on these four EZs exceeds 3,300 hours. We have never had a problem related to the composite structure. We have not had a composite structural problem reported to us from the more than 600 EZs that are now flying world wide in all different climates and conditions. We are very pleased with the structural performance of these airplanes and we encourage all builders to continue to send in reports of any maintenance items that you may encounter so that we can look for any trend that may develop and report on it in the Newsletter to help all of the EZ builder/flyers out in the field.

LATEST PROP INFORMATION

The following information (in alphabetical order) was supplied by the respective prop manufacturers at RAF's request and is current information as of October 19, 1984.

B & T Propellers (209)742-6743
Bruce Tiffit,
3850 Sherrod Road,
Mariposa, CA 95338

Bruce says that his best all around props are the following:

Continental O-200 VariEze - 58 x 70
Lycoming O-235 VariEze - 58 x 72

Lycoming O-235 Long-EZ - 62 x 66
Lycoming O-235 High compression Long-EZ - 62 x 68

Bruce was the first of the homebuilt prop builders to provide urethane leading edge protection on his props and it is the best rain erosion protection available. Bruce is now full time in the business of carving props and has built and flown a VariEze and is currently flying his new modified Long-EZ.

Great American Propeller Co. (805)481-9054
1180 Pike Lane #5
Oceano, CA 93445

red. Gr. ith. repor. t. their props are now cu com

laminations of Canadian maple, glued together with phenolic based glue and are very hard and tough.

With one of these props, the prop bolts can be torqued to 20 to 22 foot lbs (240 to 264 inch lbs) and experience has shown that this amount of torque does not crush the prop hub, with the torque remaining consistent over 25 to 50 hours of flying. In addition, these props have a covering of Kevlar on the outer 70% of each blade. While the Kevlar provides excellent splitting protection, you should throttle back to 2500 rpm or less in rain. Great American includes a flyer on prop installation and care with each prop shipped out. Be sure and read this information. Fred informs us that they now have in stock and available, loaner props for most EZ/engine combos.

Best all around props are:

Continental O-200 VariEze - 56 x 68
Lycoming O-235 VariEze - 58 x 65
Lycoming O-235 Long-EZ - 62-62
Lyc O-235 high compression Long-EZ - 62 x 64

Teds Custom Props (206)568-6792
9917 Airport Way,
Snohomish, WA 98290

Ted Hendrickson was the first supplier of props for VariEzes back in 1976. He has consistently supplied high quality props for all types of engine/EZ combinations. All of Teds props are supplied with his version of the urethane "rain" leading edge. Ted reports about a 90 day delivery time, but that he will work with you in an emergency.

Teds best all around props are:

Continental O-200 VariEze - 56 x 70
Lycoming O-235 VariEze - 58 x 74
Lycoming O-235 Long-EZ - 62 x 66
Lyc O-235 High compression Long-EZ - 62 x 68

CAUTION

Do not neglect to check your prop for the correct torque. We have had this caution in the CP before, but we continue to hear of EZ flyers who have had props come loose or even losing a prop.

As an example, we had not flown the prototype VariEze N4EZ for almost 9 months. It was stored in a hangar on the Mojave airport. The desert dry air caused the prop to shrink and when we checked it prior to flying it, there was essentially no measurable torque on any of the bolts. Mike checked the prop bolts on his VariViggen, N27MS after it sat in the hangar for almost as long. The torque was less than 50% of what was normally required. A homebuilder checked the torque, went flying and lost the prop, all six bolts had broken. All six bolts were bottomed out on the threads and were not tight on the prop! This is a real gotcha! Be sure the bolts are not too long. Add a washer or two if they are. Do not ignore this problem. If you do, it will definitely bite you.

We at RAF normally check a brand new prop after the first flight, then after 10 hours and then at 25 hours. Thereafter we check them every 25 hours. Now, after a prop has 100 to 200 hours on it, it is usually compressed and stabilized and in fact, we seldom find any discrepancy in the torque on airplanes that are flown often. However, we still check them, and we strongly recommend you do the same. This is very important and could save you and your airplane from a serious problem, that can be avoided with a few minutes of preventive maintenance.

ACCIDENTS AND INCIDENTS

A South African Long-EZ crashed off the end of a 1700 foot rough field when the pilot attempted to take off with a quartering tailwind. The airplane accelerated slowly on the very rough strip and failed to lift off before running off the end of the strip into a marsh. The nose gear collapsed, the nose dug in and the airplane flipped. The pilot and passenger were both injured and the airplane badly damaged.

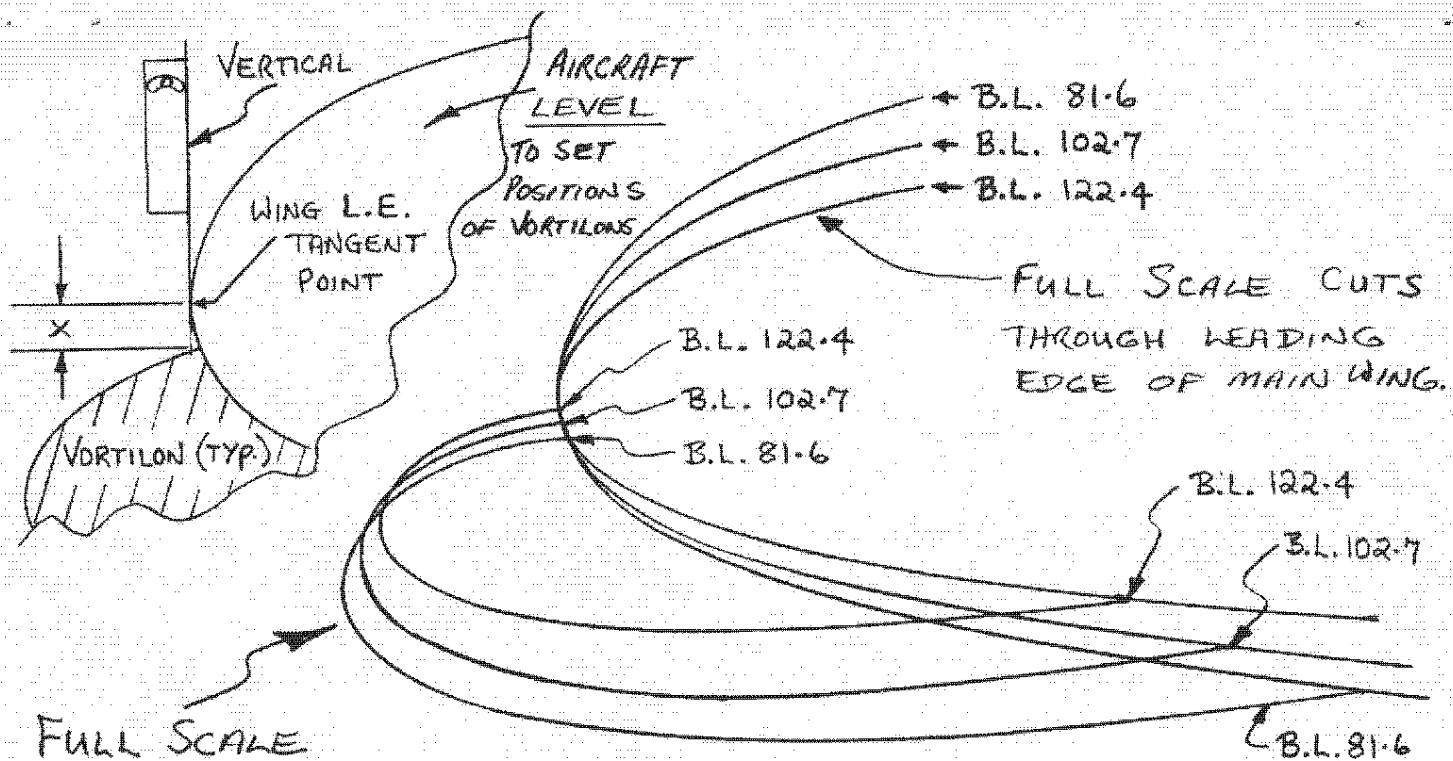
This accident was one that need not have occurred. The Long-EZ is not suitable for short rough fields. You can land a Long-EZ on a rough strip that you may not be able to fly out of. Remember, with a canard pusher configuration, such as the Long-EZ, you have no prop blast over the elevator, and therefore you can not force the airplane to rotate early and start the wings carrying the load. You have to accelerate to flying speed, 60 to 65 knots depending on the CG and a rough grass field with long grass (anything over 2" long) will greatly add to the rolling drag and slow down your ability to accelerate to the point that you may need more runway than you have available. As long as you fly your Long-EZ from a hard surface or a smooth grass field at least 2500 feet long, you should have no problems. All aircraft are compromises, you cannot have a Lear jet and a J-3 cut in one aircraft. The Long-EZ is no exception. It does what it was designed to do very well. High speed, economical transportation is the Long-EZs forte.

VORTILONS FOR VARIEZES

These little wing leading edge fences, or more properly, vortilons, have been seen by many builders on Mike and Sally's Long-EZ, N25MS. Since Oshkosh '84, we have been testing them on several airplanes including the prototype Long-EZ, N79RA. We also received expert assistance from Chuck Richey who installed and tested them on his VariEze, and from Gary Hertzler who did essentially the same thing on his VariEze and from Bruce Evans who installed them on his VariEze and test flew it to Oshkosh.

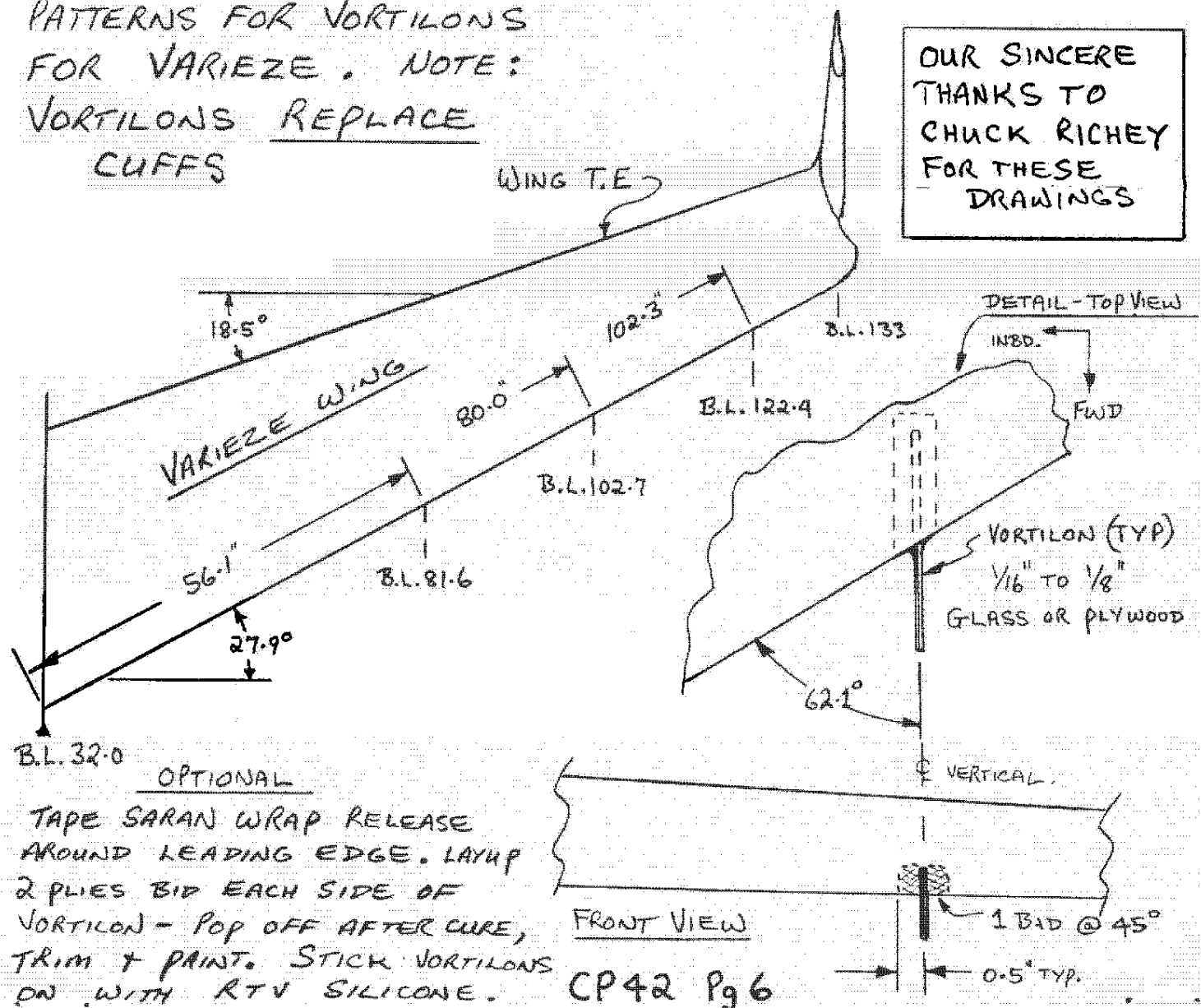
We are pleased to be able to report that the vortilons, as shown here (full sized patterns) are approved for installation on VariEzes as called out. They replace the leading edge cuff, which should be removed if using the vortilons. There is little or no speed penalty caused by the vortilons, but there is a very noticeable improvement in takeoff and climb performance. Visibility over the nose during rotation for lift off as well as in the flare for landing is greatly improved. Stall characteristics are also improved at all weights to gross and at all c of g conditions from 97" to 102.2".

The installation information given is for VariEzes. The vortilons on the Long-EZ are not as effective as on the VariEze due to the higher sweep angle of the VariEze wing and the different airfoils used on the two airplanes. Vortilons only work on swept wings and will do nothing on straight wings. After considerable testing on 3 different Long-EZs we do not feel there is enough to be gained, to warrant the trouble to install them on the Long-EZ.



FULL SCALE PATTERNS FOR VORTILONS FOR VARIEZE. NOTE: VORTILONS REPLACE CUFFS

OUR SINCERE THANKS TO CHUCK RICHEY FOR THESE DRAWINGS



OPTIONAL
 TAPE SARAN WRAP RELEASE AROUND LEADING EDGE. LAYUP 2 PLYS BID EACH SIDE OF VORTILON - POP OFF AFTER CURE, TRIM + PAINT. STICK VORTILONS ON WITH RTV SILICONE.

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.

No VariEze Plans Changes.

No Long-EZ Plans Changes.

DEFIANT

- DPC #1 Page A-3, Recommended order of construction, MEO paragraph 4, reads, "refer to page B-4" - should read "B-5".
- DPC #2 Page B-1 under TOOLS. #3 list should include a MEO LIETZ mod 11 or Sears Dumpy Level.
- DPC #3 Page C-2, Photo #47 reads 8" - should read 8 MEO feet or 96".
- DPC #4 Page C-3 Photo #100 reads "Heel Saw" - should MEO read "Hacksaw".
- DPC #5 Page C-3 caption is for Photo #104. Discard MEO caption on Photo #104 and insert #103 caption. Caption for #103 should be "Peel ply spar caps as shown".
- DPC #6 Page C-4 Photo #153 - Reads "Binding", should MEO read "Bending".
- DPC #7 Page C-5, Photo #190 Reads 1.8", should read MEO 1/8".
- DPC #8 Page C-6, Photo #216, reads "B.L. 100" should MEO read "B.L. 180".
- DPC #9 Page C-6, Photo #237 - Reads "to 80 to 100", MEO should read "8 to 10".
- DPC #10 Page C-6, Photo #241, reads "Backsaw", should MEO read "Hacksaw".
- DPC #11 Page C-6, Photo #242, reads 1.8" should read MEO 1/8".
- DPC #12 Page C-9, Photo #351, reads " nose gear MEO finished", should read " nose gear to finish forming box".
- DPC #13 Page C10, Photo #395, should read "allow epoxy MEO to tack for - -".

- DPC #14 Page C-10 Photo #414, reads "1/16" stainless" MEO should read ".016 stainless".
- DPC #15 Page D-26 reads, "1/16" 301 stainless", should MEO read ".016 301 stainless".
- DPC #16 Page D-42 - Note at the bottom of the center of MEO this page, reads "drawing of C-28" should read "drawing of C-29".
- DPC #17 Page D-29 "B" pattern - insert dimensions MEO 3"x3".
- DPC #18 Page D-47 - HM-3 Rod end, should read "HF-3 rod MEO end".
- DPC #19 Page A-3. Part # RUD-7 calls for .080 aluminum. MEO Should be .063 aluminum (see Page D-42).
- DPC #20 Page D-28. Wing jig are shown at 78°. Should MEO be shown at 102°.
- DPC #21 Bill of Materials. The following parts need to MEO be added to your bill of materials.
Stainless firewall material should be 36" x 80" (not 36" x 60") and can be shipped as two pieces 36" x 40".
3" x 6" .190" 2024T3 aluminum
4 pcs. 2030 x 4 flared tubes
3/4" dia x 6" 4130 steel rod
1 AN960-916 washer
5 AN665-21R fork ends, 5 AN315-3R nuts
5 AN393-11 clevis pins, 5 AN380-2-2 cotter pins
12 wood screws #10 x 1 1/2"
3/8" O.D. x .035 wall x 30" 2024T3 aluminum tubing.
2 HF-5 (MW5 rod ends)
1 F5000-3 (MS21059L3) nut plate

SOLITAIRE PLANS CHANGES

- SPC #50 Section I, page 2-2, Bill of Materials. Bolts AN3-4 calls for 4, this should be 8.
- SPC #51 Section I, Page 12-1, Wing Attach, Step III. Sentence 4 calls the water lines of the spar cutout at 17.1 to 22.75. The fuselage shells have indents for the spar cutouts and these are correct.
- SPC #52 Section I, Page A-2, Part #SP-5 is not called out. The SP-5 bulkhead is installed behind the F.S.112.5 bulkhead as shown on Page A-25. Cut a 2 1/2" diameter hole in the center of the SP-5, sand it to fit and install with micro and 1 ply of BID lapping 1" all around. Do not tape the under side of the bulkhead.

DEFIANT GENERAL

When you layup your 1/4" thick solid glass hard points, such as WA-1 and WA-2, it should take 21 plies of BID. One ply of BID is approximately .012" thick, therefore .012 x 21 plies = .252". Some builders have found that it takes more plies or less plies to make a 1/4" thick glass pad. The 1/4" dimension is important and must be held, therefore you should add however many plies it takes to bring the pad up to the correct thickness, or you should layup less plies as required. Caution. If you find that it takes one or two plies less or even three, that's ok. However if you find that your layup has only half the required plies to make up 1/4" pad, you are doing something wrong! Your glass pad will be used for bearing support at the wing attach fittings, and the number of plies is proportional to the bearing strength. A layup that is half glass and half epoxy is not as strong as this application as a layup with the correct percentage of glass. Check your workmanship.

Note: Wherever aluminum material is called out such as 2024T3, you may substitute with 2024T4 or 2024T351. This is true anywhere in a Defiant, Long-EZ or VariEze.

Note: Aluminum tubing called out as 1200 versatube is the same as 3003-0.

Note: Wherever Nylon sheet is called out, phenolic sheet or Delrin sheet can be used with no problem.

Note: The Defiant material list calls out bolts and screws in the older AN format. Wicks and Spruce has changed the AN part numbers wherever it is applicable to the latest MS numbering system. You still get the same part, but in some cases this can lead to confusion. If you are not sure of what you have, give Wicks or Spruce a call. Don't call RAF, as we do not have any means of cross referencing.

IMPORTANT - When Ken Brock has Defiant metal parts available ready for sale, in order to eliminate confusion, he has requested that Defiant builders add a D in front of any part number from the plans, ie. throttle quadrant handle part number TQ-6 becomes a D-TQ-6.

SHOPPING

RAF has available white polo shirts with pocket with the Long-EZ design and Rutan Aircraft printed underneath. The shirts are \$14.00 which includes postage.

Beautiful desk top scale models of the Long-EZ. Ready in mid-November in time for Christmas. \$145.00

Contact: Future Wing Models
624 North 5th Street,
MonteBello, CA 90640

Aircraft Spruce is now carrying an excellent new canopy seal, as seen on Mike's Long-EZ, N26MS. V-canopy seal sells for .40¢ per foot. 20 feet required per canopy.

Contact: Aircraft Spruce,
714-870-7551

Excellent hotwire power supply for \$12.50

Contact: Mike Quinn Electronics,
Bldg 727 Langley Street,
Oakland airport,
Oakland, CA 94614
415-569-1539 (ask for Vinnie)

The lightest, simplest canopy air vent door available.
\$6.00 each.

Contact: Gene Zabler,
48 Robin Hill Drive,
Racine, WI 53406

For Defiant builders, the Aerorecord Log Book gives you an excellent place to record your progress, includes space for photos of important structure, space to record materials used, engines, props etc. A section on weight and balance, specifically as this relates to your Defiant. A section on AD notes, literally a builders log that will greatly simplify FAA final inspection and years from building will let you look back and see what you in fact actually used, such as paint type and color. This builders log is designed by a former FAA aviation safety inspector and meets all current FAA requirements. We recommend this vinyl bound, loose leaf builders log.

Contact: Gerald R Redman
2778 Waverly Ave,
Camarillo, CA 93010
805-482-8081

Defiant Log - \$27.50
Long-EZ Log - 20.00

Rusty Fosters Space Saver panel has been refined even more! Rusty has done a truly superb job with this prefab fiber glass panel and he sells it as a kit with an excellent set of instructions for the do it yourself builder or he sells it completely prewired, ready to install. Rusty recently moved from the Santa Paula area to northern California. For more information contact:

Rusty Foster,
P.O.Box 1569
Portola, CA 96122
916-832-5993

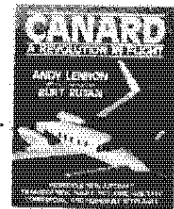
1/5th Scale Long-EZ model kits manufactured by St. Croix Models, of Park Falls Wisconsin. These are now available at RAF. 20% Discount to Long-EZ builders! These are beautiful models and fly just like the real thing. For more information contact:

St. Croix Models,
P.O.Box 279,
Park Falls, WI 54552
715-762-3226 - talk to Jim Schmidt.

At last, for the composite fanatic, a high tension hot wire cutter! Seriously, while the standard plans built hot wire cutter is an adequate tool, which with care will produce very nice foam cores, this high tension hot wire tool essentially eliminates wire lag. A Long-EZ builder, Tom Berkley, designed, built and tested this hot wire tool. Now that he has perfected it, he has

put out a well done set of plans and is offering them to homebuilders. A hot wire tool of this caliber is probably not for everyone, but for the persnickerty builder who likes perfection, why not get him or her a set of plans for Christmas?

Contact: Tom Berkley,
P.O.Box 6184
Tehachapi, CA 93561
805-822-5065



New Book News

"Canard - A Revolution in Flight"
by Andy Lennon, Foreword by Burt Rutan.
A complete history of canards, tandem wings and "tail first" airplanes. \$17.95. Order from RAF or
Aviation Publishers,
P.O.Box 234,
Hummelstown, PA 17036
717-566-0468

FOR SALE

Please Note: RAF cannot advertise parts that are normally supplied by our distributors.

Continental C-85, zero time with VariEze engine mount.
I need an O-290.

Contact: Peter Spanovic,
1870 Ben Franklin Drive,
Reno, NV 89509
702-876-7525

Continental O-200 suitable for VariEze, 2927 total time, 1839 since major. Running good. With logs, manual and new Lord mounts. \$1500.00

Contact: Jim Carraway
415-479-3668

Lycoming O-235-C. 800 hours since major includes all accessories. \$2500.00

Contact: Don Jackson
213-373-5717

Lycoming O-235-C, 166 since major. New chrome choke, bore cylinders, new 100 octane valve guides. Cylinders are currently not installed on the engine. \$1500.00

Contact: Brian
818-705-4314

Lycoming O-235-L2C, 500 hours total time, all logs and accessories. \$4250.00

Contact: Jim Rodrian
Grafton, WI 414-375-1755

Attention Defiant Builders!!

Lycoming O-320 H2AD, 875 hours since major, all logs and accessories \$2900.00

Lycoming O-320-A3B, 3221 hours total time, 1108 since major - all logs and accessories. \$2500.00

1 set 600 x 6 Cleveland wheels and brakes #199-46.
\$430.00

30 Grimes post lights \$10.00 each

3 lighted compasses C-2300 DL4 \$40.00

1 Oil screen assembly for Lycoming O-235 - \$20.00

Contact: Steve Franseen
1245 South Tennyson,
Denver, CO 80219
-922-6081
-399-8793

Collins 253 VHF radio, 6 preset frequencies, new - retail \$2600.00, sell for \$1750.00

Contact: Bob Brown,
421 West Brookdale Place
Fullerton, CA
714-525-8032
714-546-3551

Brand new prewired Long-EZ space saver panel. I won it in the Voyager raffle. Will trade for bits for my Defiant project or make offer.

Contact: John Loofbourrow,
815 Standish Ave,
Westfield, NJ 07090
212-466-1717 (days)

New "Kurth" stainless steel tuned exhaust system for Continental O-200 in a VariEze. Includes muffler. Paid \$500.00, best offer.

Contact: Bob Gentry,
1902 30th Street, CT NE.
Sumner, WA 98390
206-863-7339

New Dynafocal engine mount - \$150.00
VariEze wing fittings - \$100.00

Contact: Robert Bannach
715-344-6970

VariEze nose gear strut and strut cover. Rosehan wheels brakes and cylinders.

Contact: Edward Hanley,
205 W Gum Street,
Marion, KY 42064
502-965-5129

VariEze main and nose gear struts, wing fittings, canopy and many other VariEze parts.

Contact: Dennis Costello,
Rt 1,
Lockport, IL 60441
815-838-2057

Task Research strake sale !!

First come, first served.
50 sets at \$884.00

Contact: Task Research,
805-525-4545

Wanted:

VariEze prefab fuel tanks.

Contact: Larry Anderson,
501-855-1281

Torrance Airport Noise Abatement

Mike and Sally recently flew their Long-EZ, N26MS into the Torrance Airport in southern California. This airport has a full time noise measurement system installed and they measure the noise level of every airplane that departs from the runway. Since they simultaneously record the tower transmissions, they know which airplane is making the noise.

They record the loudest one second period during the take off, the maximum allowed is 82 decibels, 83 is a violation. N26MS recorded at 66 decibels. They also factor the noise level over the entire take off period. This is called a senel Scale and the maximum allowed is 88 decibels. N26MS recorded 75 decibels on the Senel scale. This makes the Long-EZ a relatively quiet airplane and certainly well within the limits set by the city of Torrance. This Long-EZ was loaded with two people and about 1/2 fuel and 20 pounds of baggage at the time.

If you fly into Torrance and would like to know what your noise level is at take off, contact David Roelen at the Noise Abatement Center, west of the tower on the Torrance airport. The Noise Abatement Center is run by the City of Torrance and they are always interested in measuring noise levels in different types, particularly homebuilts. Dave Roelen is a very helpful and interested individual, give him a call at: (213)325-0505.

SOLITAIRE

Doug Shane, a test pilot for Burt at Scaled Composites (he only works three days a week) had some fun flying Solitaire and wrote the following article for us.

"When you are as crazy about flying airplanes as I am, if you are lucky enough to be offered a new type to fly, have the seat belts fastened as fast as possible. The one who was so generous to offer, may suddenly regain consciousness.

And so it was early in the month of September. Mike Melvill offered the Solitaire prototype for a morning of flying. And even though I had flown (in front of) a KFM 107 engine before, I rather hastily accepted.

After a cockpit check and briefing, I started up the engine and did a little ground handling evaluation. At any speed above a crawl, the ailerons are effective enough to raise the low wing and allow taxiing on only the bicycle mains. Nosewheel steering is positive, with light forces (although a fairly large turn radius). The hand operated disc brake is effective enough for taxi use, and visibility is good for ground operations.

The pre-takeoff check consisted of closing and latching the canopy, checking switch positions, and running up the engine to assure adequate static RPM (5700) was available. The takeoff itself was an anticlimax; rotation with full aft stick was at about 35 knots and the airplane flew off almost immediately thereafter.

With only 23 advertised horsepower available, the climb rate was not sufficient to induce eardrum problems, but by remaining in good gliding position during the climb, no severe anxiety occurred. I climbed to about 3500 AGL and spent a little time getting familiar with the flying qualities, stalls, etc. This included shutting the engine down and folding it away a couple of times to get the hang of it it works very well.

Much has been written about the soaring performance and handling characteristics by someone infinitely more knowledgeable than I, so I'll just try to relate how much downright FUN the Solitaire is to fly. I shut the engine down over Tehachapi at 7500 feet and climbed to just under 11000 feet. While that high, I did big lazy wingovers, stalls, thermalling turns and evaluated the spoilerflaps. Then Mike, who was alongside (sort of) in his Long-EZ suggested that I open the canopy (definitely not recommended in the usual Canard Pusher). Wow! Not only is that fun, but is it ever cold at 11000 feet!

I came down more due to a storm moving into Mojave than due to the airplane's wanting to, but on the way down I was able to evaluate the rain trim change characteristics. Simply, it has none. My first landing was with the engine folded away, as it had been since over 1.5 hours ago, in gusty winds and light rain. Absolutely no problem with crosswind handling or pattern work at all.

The Solitaire really offers a kind of flying that many of us don't understand without some exposure to it. To be able to go out and fly without power, in an atmosphere where you're essentially free to learn at your own pace, in your own way, for viturally no hourly operating expense, is a very wonderful feeling. It's one that I hope others can learn with Solitaire."

VIGGEN NEWS

Once again at Oshkosh '84 we had three Viggens on the field! Arthur Schwartz finally made it to Oshkosh. He has tried for the previous three years and each time had problems that caused him to miss. It was good to see "Birdie" on the line. Ken Winter flew his Viggen up from Tulsa, Oklahoma. This was Ken's third Oshkosh. Bernard Duneman made his second year. Bernard has an interesting forward sliding front canopy.

Mike and Sally's Viggen was dusted off and flown to the Brown Field flyin, San Diego, California and to the Copperstate flyin in Eloy, Arizona. A former RAF employee, now working at Scaled Composites, Doug Shane flew the Viggen to both flyins and really enjoyed the "fighter like" flying qualities of the Viggen. He also flew many flybys and amply demonstrated the unique characteristics of the Viggen. To our surprise and pleasure, there was a second Viggen on the flight line at Eloy. Len "Dobbie" Dobson flew his Viggen in. Dobbie was unable to make it to Oshkosh this year, but hoped to for '85.

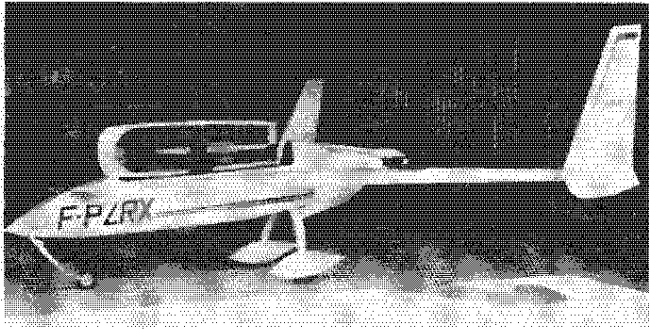
Wayne Wilkins is ready to take it to the airport. Empty weight is 1165 3/4 lbs, cg has been calculated and Wayne is ready. By the time you read this Wayne will be flying. He is trying to organize a Viggen builders get together for Oshkosh '85, perhaps in the evening.

That would be great and would allow the Viggen builders a chance to swap information and ideas. Wayne recently flew in the back seat of Peter Lawrence's Viggen (Peter rebuilt Wally Warner's) and says it flies great. Lots of luck Wayne.

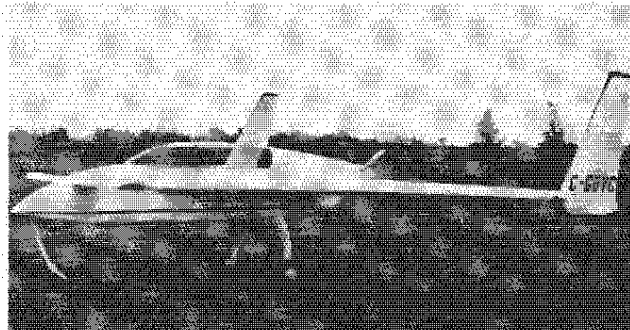
Arthur Schwartz reports that he had an uneventful trip home from Oshkosh and that he now has 310 hours on his Viggen. Frank Stites has flown off his restrictions and has been flying in to a few local flyins.

* Viggen project for Sale. Asking \$3500.00

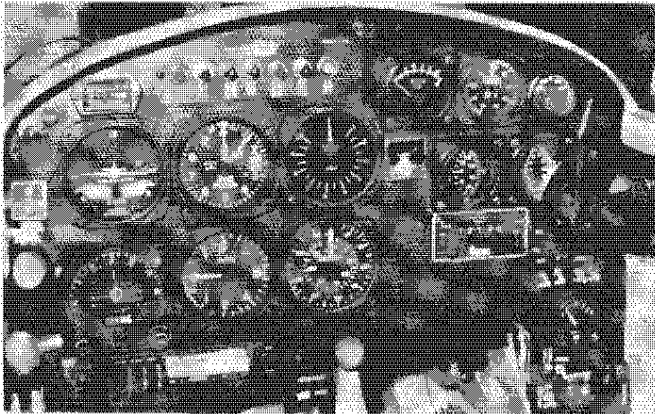
Contact: Greg Kesel
194 Squiredale Lane,
Rochester, NY 14612.
716-225-6461



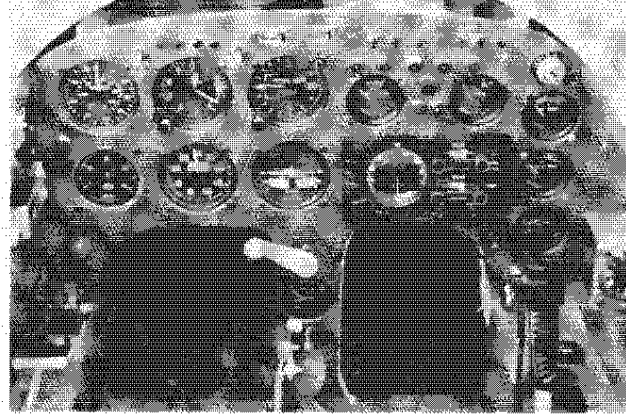
Jacques Causse' beautiful new Long-EZ. Jacques is from Toulouse, France.



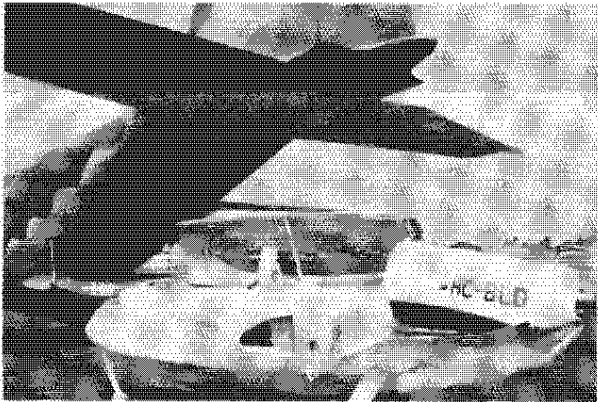
Bernard Verdon's newly completed Long-EZ was the second Long-EZ to fly in Canada



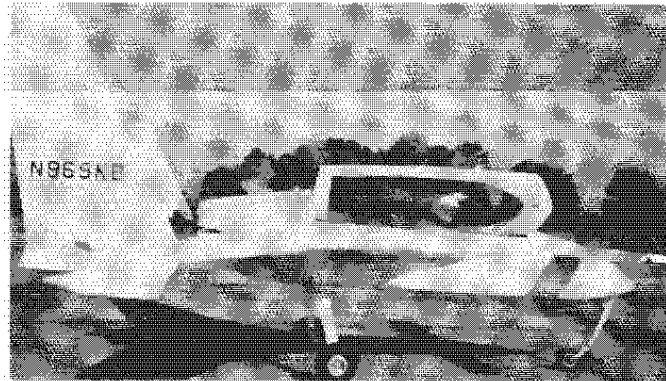
Rob Cook's VariEze instrument panel. Rob is coming right along and will fly soon.



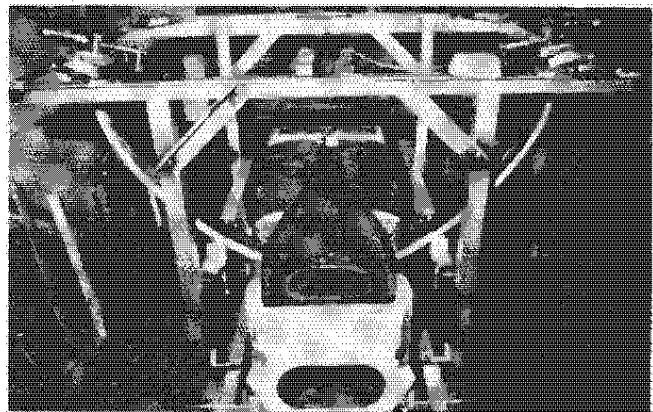
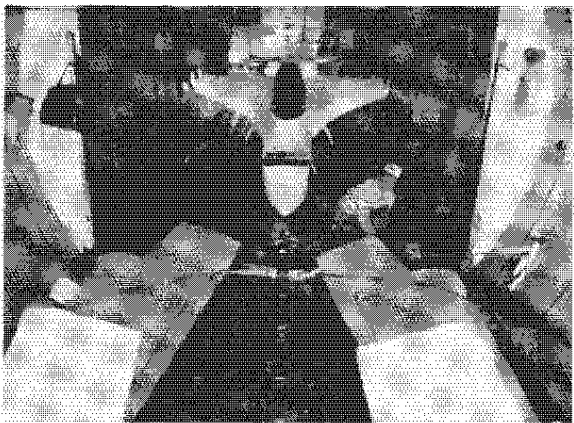
Bernard Verdon's Long-EZ instrument panel. Very nice! Uncluttered, simple and functional!



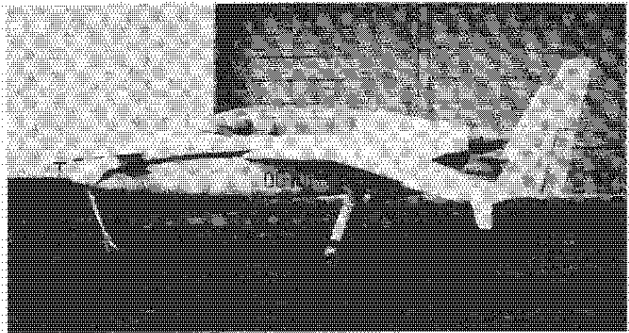
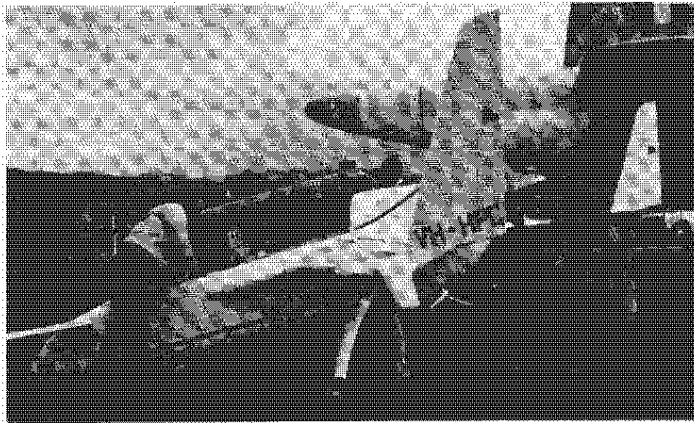
Anthony Gittes has his Long-EZ flying in Equador! He had to move it in a C-130 Hercules due to extremely high density altitude. Most of us have adventures getting to the airport, but this takes the cake!!



L.K. Bradley of Palm Harbor, Florida. Long-EZ first flight, August 1984.

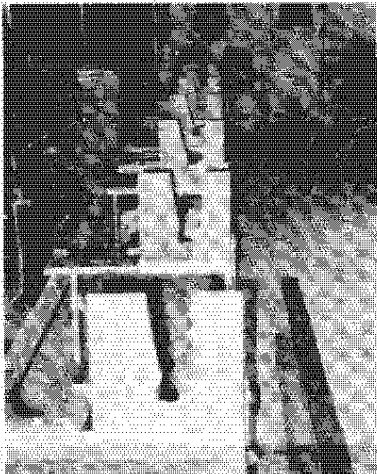


From time to time we receive suggestions and photos of "easier and better" ways to install Long-EZ main gear struts. This one is from Bob Davenport, (305-567-1844) and is probably the ultimate extreme that a builder could go to! Anyone interested in Bob's method is welcome to call him. Our feeling here at RAF is that the plans method is still the simplest and quickest. But that is what being an "experimenter" is all about!

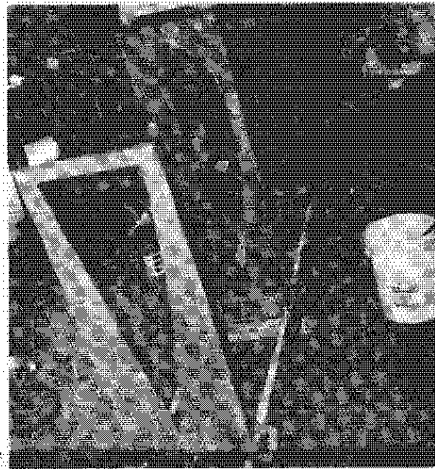


Serial Number 00-101, the first VariEze to fly in Belgium, was built by Jean d'Otreppe of Borlez-Faines, Belgium.

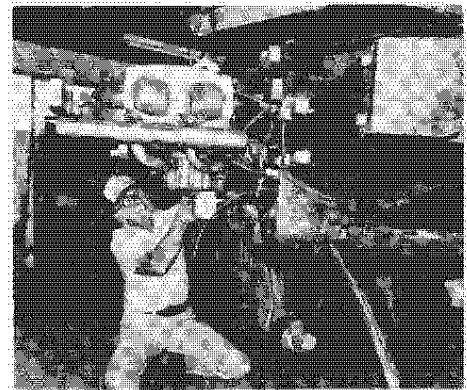
Philip Hefferman, of Melbourne, Australia is flying and has been issued a certificate of Airworthiness by the Australian Department of Aviation.



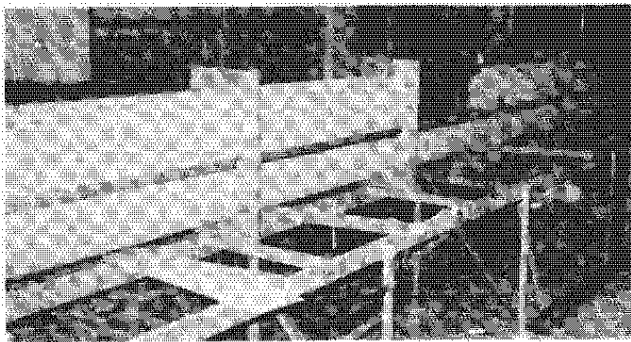
Charlie Gray's Defiant canard jigs set up and ready.



Charlie Gray's Defiant wing jigs, looks like an overgrown Long-EZ.



Bill Durland, working on his engine installation on his Long-EZ at Sedona, AZ.

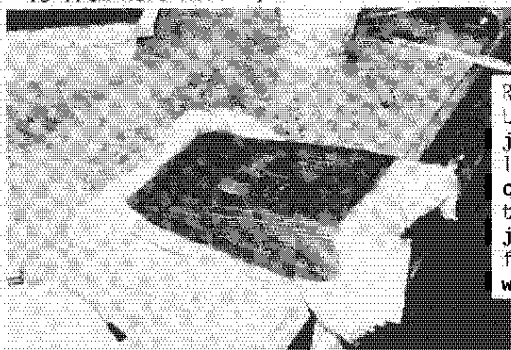


Charlie's "Big Easy" canard in the jig, with shearweb completed.

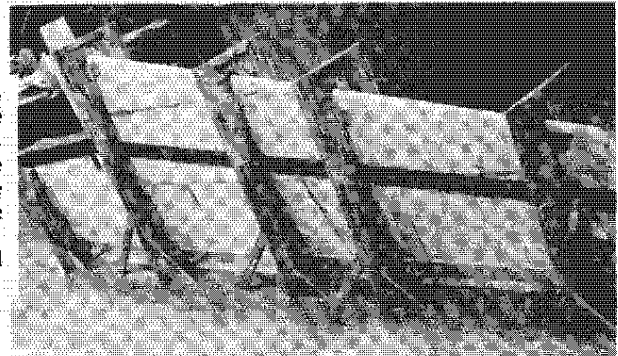
Yes Sir! Some builders out there really do the bookend practice layup. This one is from Herb Abrams, Solitaire builder.



Johnny Murphy's Defiant wing in the jig with shearweb layout complete.



R. Van Cleve's Long-EZ wing in the jig, shearweb is layed up and once cured, the whole thing will be jigged horizontal for spar caps and wing skins.



DEFIANT

HOMEBUILT FOUR-PLACE TWIN

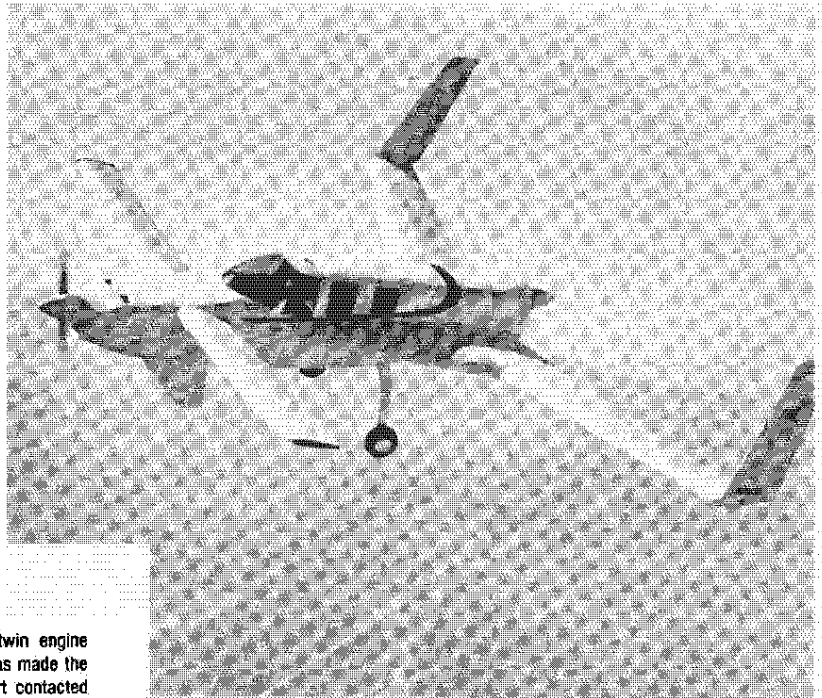


Photo by Don Downie

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 flies "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 12000 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-ailt-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.

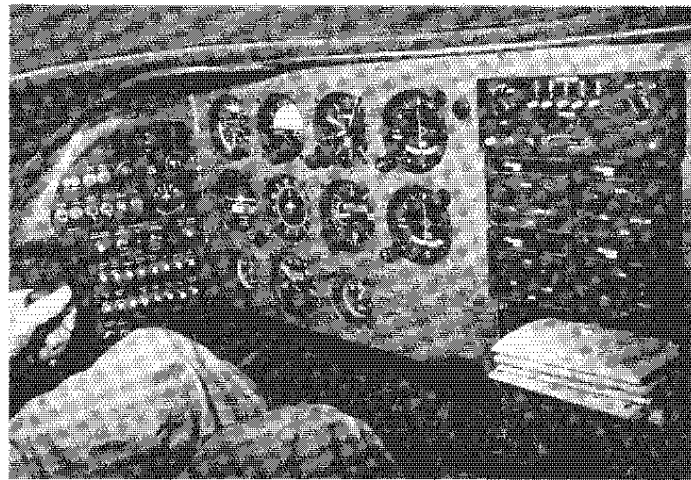


Photo by Dan Downie

SPECIFICATIONS AND PERFORMANCE

(with 160 BHP engines, fixed props)

Engines (2)	Lycoming O-320
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/ft ²
Canard Span	24 ft.
Power Loading	9.2 lbs./hp
Payload with full fuel	680 lbs.
Max Cruise (70%)	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.)	1500 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. in.
Seat Down	41 cu. in.
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.

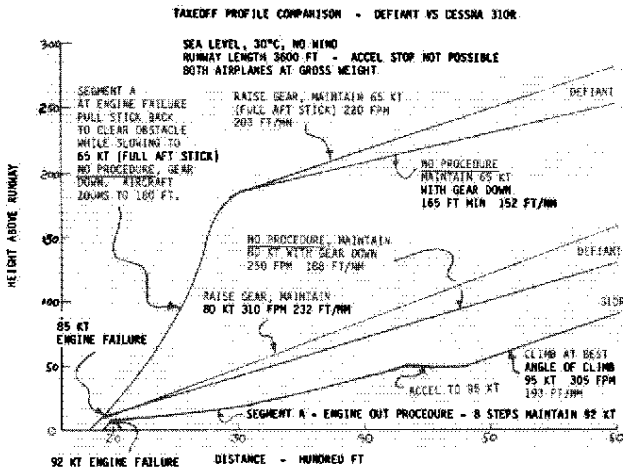
COST AND TIME TO BUILD THE DEFIANT

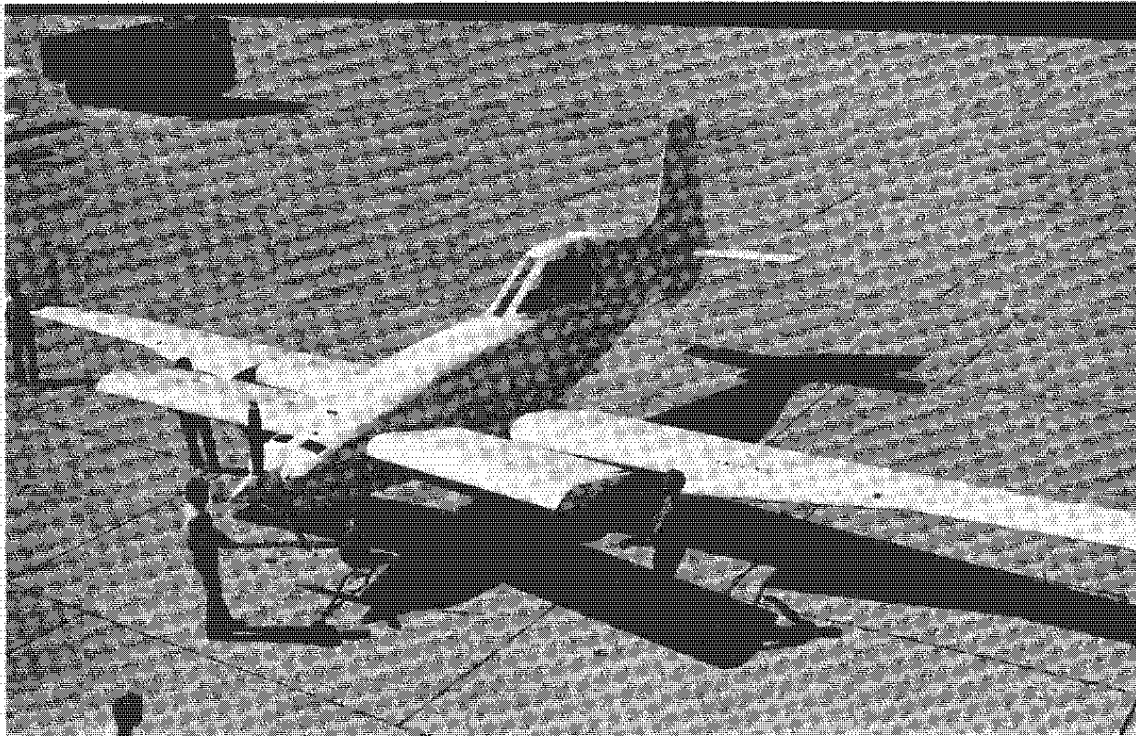
The cost of the materials list has not been completed at this time, but we estimate the cost of building the Defiant will be approximately "two Long-Ezs", between \$20,000 and \$30,000. Remember that avionics can cost you as little as \$1,000 or as much as you wish to pay.

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.

	U.S.A.	Overseas
Canard Pusher Newsletter	\$ 6.75	\$ 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	

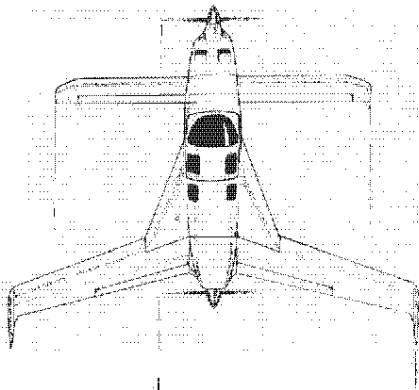
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Predator - an ag plane designed by Burt and built at Scaled Composites. Mike Melvill did the first flight on the aircraft. The Predator has been designed and built for David Record. Photo by Pat Storch.

**Rutan Aircraft Factory
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Mojave, CA 93501**



TO:

first class mail

October '84

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