

# THE CANARD PUSHER

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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 flyings. 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 kept quite busy supporting VariEze, Long-EZ and Solitaire builders. In addition work continues on Voyager project. Although this airplane is being built in RAF's skunk works, information on it is very limited as the program is proprietary to Dick and Jeana. We have also developed, installed and flight tested, larger more powerful rudders on the prototype Long-EZ, N79RA as well as on Mike's N26MS.

## DEFIANT

Fred Keller is working like a little Alaskan demon on the plans. He has brought them down to RAF so we can spend several weeks to verify them and get them ready for the printer. We are still shooting for March for plans availability.

## NEW RUDDERS FOR LONG-EZ

For almost two years we have worked hard on nosewheel steering for the Long-EZ. The reason we did was the Long-EZ's one weakness, a take-off on a narrow or icy runway with a strong cross wind. Due to the requirement to brake for steering on the ground, the take-off roll with a stiff cross wind is extended. We wanted to eliminate this problem, and some form of nose wheel

steering seemed like the logical way to do it. We spent many frustrating hours, and actually installed several different types of nosewheel steering mechanisms. None of them proved to be effective enough and it soon became clear that the only way to achieve this was to completely redesign the nose gear. This got away from our goal of a simple, retrofittable system.

Some time ago Charlie Gray of Lantana, Florida had asked our advice on larger rudders for his modified Long-EZ. We saw his airplane at Oshkosh with Mike and Dick both having the opportunity to fly it. Both were quite impressed with the effectiveness of the larger rudders, particularly the way they "steered" on the ground, even down to quite low airspeeds. Dick installed his own version of the larger rudders on his and Jeana's Long and Mike had the opportunity to evaluate their effectiveness in a 20 knot plus cross wind, on a narrow runway.

Now all we had to do was convince Burt to let us try it on N79RA. He gave us his blessing and the two Michaels and Sally cut out the old rudders, foamed and glassed the winglets, cut out the new ones, glassed them, hinged them and had them ready to fly (minus finish paint) in only 3 days. (These were not 8 hour days!!). They also photo documented the whole procedure.

Mike put on the trusty parachute and climbed to 12,000 feet where he put old 79RA through a vigorous test program to determine departure susceptibility similar to the one that Phil Brown of NASA did several years ago. The result was very satisfying. The prototype N79RA, even at the aft limit of the cg envelope (103") will not depart or do anything unusual, even using aggravated control inputs at all attitudes and airspeeds from full aft stick (52 KIAS) to the maneuvering speed (120 KIAS) including full pro-spin controls in both directions. Mike has demonstrated crosswind take offs and landings in direct crosswinds of over 20 knots. We are very pleased with the performance of the new rudders and feel that they are a very real and desirable improvement to the Long-EZ. We do not intend to make their installation a mandatory one. However we believe that the original rudders, while not super, are adequate, and any Long-EZ flyer who is satisfied with his or her yaw control does not need to install the new rudders.

For those builders wishing to have more yaw authority, better crosswind take off and landing capability and less braking required for steering on the ground (at least while taxiing into the wind!). We have a set of plans available for \$18.50. These plans consist of 4 pages 18" x 24" with a detailed description as well as many cross section drawings and sketches. Two of the pages have a total of 28 photos of a step by step sequence of how to retrofit these rudders to your already completed Long. The plans also cover installation on a new construction Long-EZ. The plans are available off the shelf as of now.

We sincerely hope that the builders and flyers out there in the field appreciate the amount of time, effort and not a little risk that RAF puts out for continued support and improvement where possible for the RAF airplanes. You can demonstrate your support by paying for one set of plans for each airplane you build. Those builders out there that are building more than one airplane from one set of plans, are not just cheating RAF, they are actually cheating themselves and may eventually end up cheating all of our builders. RAF has the finest builder support program in the industry and we are very proud of that. We intend to continue with the same quality program for the foreseeable future. However, we do need your support to do so. A very high percentage of our builders do support us and have rigidly stuck to the license agreement of one plane per set of plans. We sincerely appreciate your honesty and your support. Those who have not supported us, stop for a moment and consider what a small percentage of your airplane's total cost your plans are. Consider also what you get for that cost. Not only an excellent flying machine, but the designing, structural testing, flight testing and development of that flying machine. Add to that the fact that we are here 6 days a week, ready to help you on the phone or by mail, any time you don't understand something, or have got yourself into a jam. Actually the plans are quite a bargain if you think about it. Enough said!

## EZ FLYINS

Shirl Dickey of Salt Lake, Utah once again is organizing the Jackpot Flyin. The dates will be 6, 7 and 8 July 1984. The race will be held again this year but with different class categories, with \$800 in prize money so far. There will be a banquet Saturday night, with spot landing and ribbon cutting etc. during the day. More news to come in the next CP. Contact Shirl at 1646 Allegheny, Murray, UT 84107

## NEW DEVELOPMENTS

Since January 1982, RAF has been working on a new canard airfoil for the Long-EZ. The design goal was higher performance, lower take-off speed, lower landing speed, and no rain trim change. Quite an order. John Roncz, (designer of the Solitaire airfoils) said he could do it, so we asked him to have a shot at it.

The canard was built and test flown in early 1982, and even flown in the CAFE 400. It had some problems and needed more refinement. We have been working on it and flying it on and off since then, with mixed results. Some aspects are excellent, others are not good. We are actively pursuing this test and if we get it to where it meets our requirements, we will publish the results and put out plans for the canard as an optional performance change.

Please do not call us for information on this canard. We cannot release any data on it until it meets the standards we require. The only reason we are reporting on it at this time, is that so many builders have seen it on the Long-EZ here at RAF, that rumors are flying around. RAF's policy is that we will not put out any information on any design modifications until we are completely satisfied with the results of flight testing. At this point, we are not satisfied, but are continuing with flight tests. Stay tuned.

## 1/5 SCALE LONG-EZ R/C MODEL

In December, 1983 RAF granted St. Croix of Park Falls, Ltd. the exclusive rights to develop and market a radio controlled scale model of the Long-EZ. On December 13, Jim Schmidt, Manager of St. Croix's Model Aircraft Division, flew prototype demonstration flights at the Mojave airport for Mike Melvill who agreed that the model looks and performs much like the real thing.

The kit, which will build up to a 1/5 scale replica of Mike and Sally's Long-EZ will be available in the spring and should retail for under \$100.

To receive information about this product as it becomes available, you may contact Jim at the following address:

Jim Schmidt,  
St. Croix of Park Falls Ltd.  
P.O. Box 279E,  
Park Falls, WI 54552

The 1/5 stand off scale model Long-EZ was painted to look exactly like N79RA and when it was in the air, it looked for all the world like the real thing. It flew very well, Jim really knows how to fly R/C models. Mike had not flown an R/C model in two years but Jim allowed him a few minutes of "stick time" and Mike said it was a 'blast'!! It flew just like the real one, right down to the full aft stick, no stall condition, it even rolls much like a real Long. To watch it come in and land was quite a treat. Mike was able to take Jim for a ride in his Long-EZ and although Jim had never flown a light plane before, he was quite at home in it and commented that it was just a big model!!

As soon as St. Croix has the kits available, RAF plans to keep some in stock.

## NEW EZ FUEL GAUGE

Paul Prout has been working for almost a year on a fuel gauge for VariEze/Long-EZ. He brought a demonstration model up to show us last week. It is retrofittable, and consists of a white plastic background, with a clear plastic sight gauge bonded to the background. The clear part is triangular in shape. A small hole at the top

and bottom allows fuel to flow into the sight gauge. Almost all of the sloshing associated with turbulence is thus eliminated. The fuel is clearly visible through the clear plastic, (crystal clear in fact!). Then Paul added the icing to the cake. He installed a small red light bulb at the bottom of the gauge, which illuminates the white background and clearly illuminates the fuel, particularly the surface or meniscus of the fuel. This will allow good night visibility of fuel level. On top of all this, Paul has installed a photo electric cell (or some such gadget!), at the level that approximates 30 minutes of fuel at 75% power. When the fuel level drops below this level, a red light is illuminated on the instrument panel. The electronics is self testing and the whole works weighs almost nothing. The secret to the success of this remarkable fuel management system is the type of plastic used and the method of bonding the parts together. Paul demonstrated his sight gauge by striking it a terrible blow with a hammer! The result, absolutely no damage. The type of plastic and the bonding method Paul is keep proprietary to himself.

Paul sells a kit consisting of two gauges, electronics, two red lights and an excellent set of instructions on how to install them. RAF is pleased to recommend Paul's fuel gauges. They have all the desirable features: very light weight, simple, fuel is clearly visible day or night (what you see is what you got, absolutely the best system) and they warn you when you get to 30 minutes of fuel each side, a total of 1 hour.

Contact: Paul Prout,  
4039 Olive Point Place,  
Claremont, CA 91711  
(714)621-0060

## LORAN-C - (Once Again!)

Jim Weir of Radio Systems Technology (the designer of the EZ Nav and Comm antennas) has recently written what is probably the definitive article on Loran-C antennas for plastic airplanes. His article will be published soon in Sport Aviation. This is a much needed article and will go an awful long way toward answering the many questions our builders have on the subject.

Meanwhile we continue to hear from builders and flyers who have tried to install Loran-C, some successful, others not so. Among them, VariEze flyer, Long-EZ builder, Bill Butters of St. Louis, MO. Bill is an EE and runs an RF lab for McDonnell Douglas, has had good success with a II Morro Apollo Loran-C in his VariEze. Bill has offered to help any builder who would care to write (don't forget to include a SASE).

Ray and Nova Cullen, owners of a beautiful VariEze "Rapid Rabbit", N22809, have a SRD labs MLX Loran-C. They could not get it to operate satisfactorily until they ran into Phil Stotts, who operates Western Avionics of Fresno (4995 East Anderson, Fresno, CA 93727, (209)255-4872). Phil is a Loran whiz and is very interested in Loran installations in Ezs. Ray and Nova recommend Phil to anyone having problems with an MLX. Thanks, Ray, Nova and Bill.

Herb Sanders and Ray Cole (Ray is an avionics wizard and works in the avionics division of Federal Express) have been flying a Micrologic ML5000A Loran C Navigator in Herb's Long-EZ for about 7 months now and feel they have identified most of the major problems associated with the installation of Loran in the Long-EZ. Their installation is performing very well and has been used from the Loran "waste land" of west Texas to the northeast including the navigation required for the Dulles efficiency race. Signal to noise ratio and accuracy have been consistently very good. Ground speed readouts have been within one knot of the ATC report.

The ground buss is very important to the installation. In the composite airplane, the metal components connected to this buss will be the only counterpoise (ground plane) the receiving element will see. They insured the Loran Navigator was properly grounded to this point.

They can provide additional information about the Micrologic Loran C Navigator, (they are dealers) and are also willing to share their experience with Loran installation. Contact: Herb Sanders,  
3500 S. Mendenhall,  
Memphis, TN 38118  
(901)365-7606

## WEIGHT AND BALANCE

Recently here at RAF we have been conducting several weighings of the two Long-EZs. For test flight purposes, we needed actual center of gravity information for a certain condition. During these exercises, we were sharply reminded just how careful you have to be. Remember, accurate weight and balance data on a new airplane is critical to flight safety.

We have a calibrated certified balance beam scale. We decided it would be easier if we used 3 scales, so we borrowed two balance beam type scales. We assumed these scales were accurate and we conducted a whole series of weighings in order to establish actual pilot position (with parachute), actual fuel load position, and actual position of required ballast. It took the best part of a working day to get all of this information logged for two airplanes and then to drop reactions and measure the actual location of wheel centerlines, canard leading edges etc, etc.

At the end of all of this very careful, painstaking work, we reduced all of the data and came up with some pretty significant errors! The errors were small regarding the actual aircraft cg, but quite large when we tried to pin point the pilot's position or the position of required ballast or fuel. After much head scratching and figuring, we found that two things had "bitten" us. 1. One of the borrowed scales was inaccurate to the tune of about 15 lbs. in 400 lbs. 2. The nose gear shock spring when loaded with pilot parachute and ballast collapsed slightly, allowing the nose wheel centerline to move aft on the scale. If this is not noticed and taken into account, your results can be very misleading.

The lesson to learn here, is that we have conducted dozens of weight and balances over the years, and should know better. We ended up with some erroneous figures that could have conceivably resulted in someone getting hurt. Do not take your scale accuracy for granted. Check it with a known weight close to the weight you expect to weigh. Be sure that the axle center line fuselage stations, as measured on the floor by dropping reactions using a level or plumb bob, are the same when the airplane is up on the scales and loaded as required.

## SOLITAIRE NEWS

The prototype continues to fly very well and is much enjoyed by all who have flown it. Fourteen pilots of varying experience levels are in the log book so far. The airplane has over 135 hours total time and almost 200 flights.

Einar Enveroldson, a NASA test pilot, has turned in his article to Soaring magazine and it is slated to appear in the March issue (with a cover shot!). Einar is an extremely experienced sailplane pilot and is sure to write an unbiased article that will be very interesting to anyone interested in the Solitaire.

A lot of photography was done for the article. Oil flows were conducted and photographed. This consists of painting dirty oil (not really, but almost!) all over the wing, then flying the airplane and observing what the airflow does to the oil. This is a most interesting exercise and clearly shows laminar flow, boundary layer transition and turbulent flow.

Mike was involved in some close formation flying with a J-3 cub for photos, with the engine up and running, and with it folded away. This flight was conducted with Soledad mountain in the background and some of the shots are exceptionally fine (thanks millions Doug!). These photo flights are lots of fun, especially trying for "head on" shots!

Solitaire is flown almost every Saturday during our normal Saturday demos and of all the different airplanes we have available to fly here at RAF, we all agree that none of them compare to the Solitaire for just plain fun! Really is a ball!!

Task Research has delivered about 13 kits so far and quite a number of builders are making rapid progress judging from the letters we receive.

Now, a request. Please send us photos of your projects. We have not received any so far. We would love to publish some Solitaire project photos. How about it? Of course we also welcome progress reports, and last but not least, if you have any builder hints, or suggestions that might help other builders, send them in.

The Solitaire Owners Manual is now at the printers and will be available for \$8.00 off the shelf by the time you read this. The Owners Manual contains all the information that a pilot wants to know, and as such is almost a better choice than the information package if you are wanting to know more about the airplanes capability and operating procedures.

The Solitaire prototype is on display in our hangar 6 days a week and is usually demonstrated every Saturday. If you are in the area don't hesitate to drop in and visit.

The KFM107E engine is running like a Swiss watch. So far it has required a couple of plug changes, but otherwise all we do is fill it up with gas (plus oil!) and fire it up and go flying. The electro-hydraulic engine retract mechanism has been flawless and has been absolutely maintenance free.

Don't forget to look for the March '84 issue of "Soaring".

## Ken Brock Solitaire Parts

Ken Brock Mfg. has been working steadily on the Solitaire prefabricated parts and at this time has 2/3 of them ready to go. The rest should not be far behind. If you are building a Solitaire, contact Ken, to see which parts are available.

## SOLITAIRE PROP

We recently tested a super little prop on the Solitaire. It was made by the Prince Aircraft Co. This prop is very light, and has what Mr. Prince calls "p" tips, little bent over tips which makes the Solitaire noticeably quieter. Rate of climb is slightly better and RAF recommends this prop to all Solitaire builders. ~~It comes drilled and balanced to bolt right on the KFM 107E engine.~~ Contact Prince Aircraft for prices.  
P.O.Box 147, Waterville, OH 43566

## EZ CLUBS

Gianni Zulani, via Procaccini 68, 20154 Milano, Italy, would like to make contact with more European EZ pilots and builders. Gianni reports that his beautiful Long-EZ now has over 60 hours on it. Besides his Long-EZ, he knows of two Italian VariEzes flying and three more nearing completion.

An EZ-Association has been formed by the French VariEze and Long-EZ builders. Over 40 members, including 20 Long-EZ builders have joined already. All EZ builders in France as well as other European countries are invited to join. Contact: Jean Louis Beret, 2 rue d'Anjou, 57157 Marly, France.

The Long-EZ squadron I and Squadron II, from the Los Angeles basin area, are planning a joint fly out/drive to RAF in Mojave. This is planned for May, probably Saturday the 19th. We at RAF welcome this idea and encourage other groups to do it. Let us know a few weeks in advance and it should make for an interesting day for all.

## Change of address for B & T Propellers

As of March 1, 1984, B & T Propellers operations, (along with all our personal worldly goods and possessions) will be relocating to our new home and shop in central California. Our new address and telephone number will be:

3850 Sherrrod Road,  
Mariposa, CA 95338.  
(209)742-6743

Until March 1, we can still be reached at 8746 Ventura Ave, Ventura, CA 93001 (805)649-2721

Since January 1, we have been in the prop business full time, and after the move north are looking forward to lots more time for faster delivery, research and testing, and lots and lots of EZ flyins with travels around the country visiting EZ people in our new "Vari Long" - "The Beez II". Bruce and Bonnie Tiff.

**LETTERS FROM BUILDERS AND FLYERS**

"Dear Mr. Rutan,  
Well what do you know, on July 16, 1983, six years after I obtained my prints and serial number #690, N999TT came to life and flew off into the blue just like it was meant to be. Six years seems to be quite a span of time to build a plane, but maybe not too bad considering the wife's position when she made the statement, "A home is the most important thing in our life and you had better get your priorities in order". This cost me two years of time out of the six. Now we are both happy. I have my VariEze and she has her home. See pictures.

So much has changed in aviation and aircraft design since I worked on Ford Tri Motors for TWA back in the early 30s. Now 74 years of my life have come and gone. Of those years I have enjoyed 53 years as a pilot. When I'm not flying, often I find myself wondering if that little O-200 isn't thinking, "Here I came out of a 150 Cessa, used to chugging along at 110 mph and now I'm climbing at 2000 fpm, cruising at near 200 mph and running backwards at the same time. Sakes a live, whats happening?"

I was on my way to Albuquerque, NM to attend the National Balloon races, stopped at Addison to pick up my son. About a mile ahead of me in the pattern, I saw what I thought was a VariEze. I thought, "great, a buddy VariEze". I taxied to the Beech complex and was I surprised when up taxied the Beech Starship. What a beautiful creation. Keep on surprising us Burt, with your marvelous creations.

Loren Glaser,  
Swanton, OH"

"While many of you were enjoying the end of Oshkosh, my father and I were having our own sort of excitement. On August 4, 1983, N206J received its airworthiness certificate and on August 5, 1983, it made its first flight.

It seemed like a long time from the start of my dream to the moment of lift off. Now, with the prospect of many hours of flight in front of me, I have already begun to forget all of the anxious moments when I thought we would never finish the project.

I suppose by some people's standards, nine months to build a Long-EZ, with no previous building experience, wasn't so bad; after all, we didn't start on the Long until November 1982. Although, it seems like the year previous to starting construction was probably as taxing as the actual process of building the plane. Spending hour after hour wondering, should I buy the kit or not? Am I really capable of completing a project of this magnitude? It was during one of those "think" sessions when the answer came to me ... "Dad"

My father, Joe Sabo, had just retired and since he had a large, empty garage attached to his house, (well, empty after I parked his cars in the street), I thought, what better way for him to enjoy retirement than to build his son a Long-EZ. Sound sort of crazy? Well, he bought it and off to Mojave he went for the Saturday morning demonstration, he even got a ride in 79RA. He was impressed and decided that building a Long would be fun, and EZ.

Now, he says all it takes to build a Long are three things: Patience; interpretation and perseverance. Also, he now knows why they say homebuilding is a learning experience. He learned not to let me talk him into these things.

The help we received from our designee, Kevin Morris, with his hours of work and guidance, and other veteran builders, like Jim Schultzman, who openly shared with us his knowledge of homebuilding, made the successful completion of N206J all the more possible.

I want to thank Mike and everyone at RAF for answering all our questions along the way. I think it would be helpful to offer some words of encouragement to hesitant future builders, its EZ, especially if your father just retired and it helps to have a pocket full of money.

Thanks to all,  
Gus Sabo,  
Las Vegas, NV"

"Dear Mike,

Just a quick note to tell you that Gene Scott and I have finally finished Long-EZ, serial #180 and to enclose a couple of pictures. It took three years of weekends and about 500 gallons of Gene's character building coffee and many times it seemed like we were making no progress, but last week it was time to see if we had a airplane or just a conversation piece.

We were concerned because we were heavier than you folks would like (starter, generator, full IFR and less than perfect attention to weight in our layouts) but we could put it off no longer. Last Sunday I had the privilege to take the initial flight. We had been doing high speed taxi tests for a couple of weeks and were both proficient in holding the nose off the runway, and I felt reasonably comfortable in attempting to lift it a couple of feet off the runway and then plunk it right back down (we had an 8000 feet runway). What I was unprepared for was the feeling of the Long when it left the ground .... it turned into a solid, stable, easily controlled, great flying machine. The next trip down the runway, it was impossible not to point the nose up and get it into its real element. From that point on (as you are well aware) it was a great experience that can't be properly described.

I do have to report one note of embarrassment, however. We decided to fly with a few "minor" details left undone. One of these was the nose gear warning system. As a result, on one flight I did not get the gear completely down into the "over-center" position and it collapsed during landing, stripping the gear mechanism and folding the gear completely into the wheel well, allowing me to skid to an inglorious halt in front of the tower. Fortunately, (and I highly recommend this to other builders) we had installed a 1/4" stainless steel plate under the nose "bumper", and this saved us from any real structural damage. The runway merely sanded the paint and fiberglass directly in front of the gear. Had the plate been just a little thicker, even the paint would not have been scuffed. Moral: Every little detail IS important!

By the way, thanks to the Ken Brock organization for getting new gears to us within two days.

Like so many letters that we have read in the CP, this one is to thank you for a really great flying experience. We now have about twenty hours on N6NG and are looking forward to getting the initial time flown off so we can take it back to our home base at Gillespie field. I guarantee you it won't spend much time on the ground.

Jerry Hansen,  
Las Mesa, CA"

"Dear Mike, Irish and all the rest of you who gave us so much support.

On January 6, 1981, my son Gregg and I began the building project of our Long-EZ. We completed the fuselage, wings, winglets, canard and first canopy (we broke that one) in about 10 months. Gregg left to return to school so I was by myself to build the second canopy and do many of the other "small" jobs. In April of this year I was joined by the very able Lan Mace. Together, we mounted the engine and did the finishing.

We hauled the plane via a large flatbed trailer to Santa Rosa. There we had it painted at the Truck Works with Imron paint. We worked on assembling and getting it ready for quite a few days. The first excitement was the first engine start. It started almost immediately, and ran perfectly. Everything seemed to work so I did some low speed taxiing. The low speed taxi went well and the next day I got up enough nerve to raise the nose wheel. That went well too, so it seemed to be about time to test fly. I was surprised to see how long the canard flew once it was off the ground, even with the power pulled back. Don Prestin, did a very thorough going over of everything once again. I must admit that I was getting impatient even though I knew what was being done was very important. Finally, about 4 pm Don was ready to try it out. With our ground radio on we proceeded out to the runway to watch and listen. It was an indescribable feeling to watch. In just a few seconds the canard was flying and almost immediately she was off the ground. I stood there with tears in my eyes and a lump in my throat with Evelyn tightly gripping my arm. It was a beautiful evening which added to the gracefulness of the airplane.

Don flew to 3000 feet and did the usual first flight checks. Then he came on the radio to the tower and said "This is the first flight for this plane and it flies absolutely beautifully". I was filled with joy and relief. We watched and listened for about 30 minutes and Don returned for landing. Again the excitement, does he have the gear down, will it handle ok on touchdown, were but a few of my concerns. N3IAK settled perfectly onto the runway and with a huge smile Don peered out of the cockpit and reported that we had done a very good job of building, that he was even slightly envious.

I would like to thank Burt and Mike for the development of plans even an amateur can follow and thank you Mike for our always more than adequate phone support. Thank you too, Irish, for being helpful and friendly on the phone. Building this airplane and seeing it fly has to be one of the most exciting and gratifying things I have ever done. Now, I'm looking forward to learning all about the airplane from the front seat.

Warm regards,  
Ken Hansen,  
Mendocino, CA"

#### ACCIDENTS AND INCIDENTS

The Canard Pusher newsletter reports on accidents, discusses their conditions and causes in order to disseminate any information to operators of similar aircraft. This information is published here purely in the hope that possibly someone in the future may be saved from the same situation. It should be recognized in discussions of accident conditions or causes that generally this information is preliminary since it is being published before the availability of the FAA or NTSB accident reports.

A modified Long-EZ crashed on the Southern California coast. (This accident was mentioned briefly in CP37). We have actively been trying to determine a possible cause on this one but so far have been frustrated. Although there were a few eye-witnesses, their information is sketchy and contradictory. Several witnesses reported seeing the aircraft flying low along the beach and pulling up into steeply banked turns. No one we have talked to saw the actual impact. We have carefully examined the wreckage and it appears that the airplane struck the beach with very little forward speed in a flat attitude. There was no evidence of rotation. This aircraft has a non standard fuel system. A header tank containing 5 gallons was built into the space over the centersection spar, aft of the passengers head. This tank was kept full with a fuel pump at all times, and the engine was gravity fed from this header tank.

The aft cg, and the vertical cg of this fuel possibly contributed to an unacceptably aft cg condition for the airplane, particularly at higher deck angles, when the vertical cg would cause a worse aft cg condition. We have been quite frustrated in our attempts to obtain accurate weight and balance data, but our best efforts indicate a probable out of limits aft cg condition. We know this aircraft made its first flight with 30 lbs of ballast in the nose. There was no evidence of any ballast in the wreckage.

NOTE: We would like to reiterate what we said in CP 37. Due to individual builder tolerance build-ups, and contour variances, you cannot assume that your airplane will behave exactly like the original prototype, N79RA. Because of possible variances, we are now making the aft cg limit of F.S. 103 (recommended in CP 37), a mandatory permanent change.

An Australian VariEze struck a power transmission line. The airplane crashed into a reservoir. The pilot and the passenger were fatally injured. The weather was reportedly a factor, for in order to stay in VMC conditions they were flying at low altitude.

A Southern California VariEze crashed while attempting to land. The pilot was fatally injured. The weather was clear with unrestricted visibility. The wind was directly down the runway at 5 knots. The pilot made two attempts to land. Making a second go around, the airplane climbed steeply, turned left, the bank angle increased to 90°, hesitated for one or two seconds, then rolled inverted and crashed nose down in a wings level,

inverted attitude. No control systems or engine problems were found. This pilot had recently bought the airplane. He had entered VariEze time in his log book. However, evidence suggested he was on his first flight and had improperly logged time for insurance purposes. He was a low time pilot with very little recent time. The probable cause of this accident was lack of experience and low proficiency.

A VariEze crashed in Arizona in front of several eye witnesses. The pilot was fatally injured. The aircraft made several high speed low passes in the vicinity of the witnesses, then on the last pass, pulled up steeply and initiated a roll. The roll maneuver was not quite completed and the aircraft struck the ground. This pilot was observed a few days earlier doing "aggressive aerobatics" in his VariEze. The aircraft had only 14 hours total time since new.

A Long-EZ ran off the end of the runway during an attempt to take off in the threat of a rapidly approaching thunder storm. The pilot broke both ankles and passenger suffered some heavy bruising when the aircraft overturned and was seriously damaged. A thunderstorm was closing in from the north. The wind was only about 5 knots when the pilot began to taxi out. He elected to take off downwind. According to eye witnesses the wind rapidly built up to an estimated 45 knots on the tail during the aircrafts take off roll. In the pilot's words " the accident was caused by pilot judgement, not by the plane".

A California VariEze, travelling through Arizona was destroyed in a weather related accident. The pilot and passenger were both fatally injured. The weather was reported as 500 foot ceiling, poor visibility in sleet and freezing rain.

The aircraft totally disintegrated in the air. Very little damage was due to the impact with the ground. We spent a lot of time looking for possible causes, and we carefully examined all of the pieces which were found. The wreckage was spread down wind for over 2 miles. The damage showed signs of extreme high speed flutter, rather than overload due to excessive g. This accident was probably caused by the pilot pushing on into bad weather, or possibly trying to climb over bad weather. He may have become disoriented or overcome by hypoxia, the aircraft probably ended up straight down at very high speed. Finally it reached a speed beyond anything intended for this design, when it literally experienced flutter over the entire airframe.

The important point to note is that there was no evidence of a massive 'g' overload, such as would be expected if the pilot tried to pull out of a high speed dive, was found. All of the evidence points to total catastrophic failure due to high frequency, divergent flutter. The damage could only have resulted from an extreme overspeed condition possibly in the region of 400 knots plus.

#### 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.

NEO Minor error or omission.

VARIEZE PLANS CHANGES

There are no Varieze plans changes this issue.

LONG-EZ PLANS CHANGES

NOTE: Plans change LPC #116, CP 37, this is a mandatory change.

CAUTION: A number of builders have not installed the metal shields in the wing root areas as called out in Section I, Page 23-3 of Long-EZ plans. It is possible that exhaust system radiated heat can damage the foam in the root of the wing. The metal shield eliminates this problem.

SOLITAIRE PLANS CHANGES

SPC #24 - Section I, Page 8-4. Top paragraph, right column, call out of 6" x 6" x .025 aluminum should be one 6" x 6" x .032 2024T3 and two 5" x 6" x .032 2024T3 aluminum. Note, the outboard one is 6" from the end of the elevator.

SPC #25 - Section I, Page 2-2. Spruce and Wicks parts list. Change 134" 1/2" dia. steel to 136".

SPC #26 Section I, Page 5-1, Step III. Bulkhead placement. Bulkheads 22.5, 45 and 72 are located aft of the scribe line. Bulkhead 112.5 is located in front of the scribe line at 112.75 and bulkhead 132.2 is located forward of the scribe line at F.S. 132.3.

SPC #27 Section I, Page 8-6. Rivets. 13 lines up from the bottom left hand column calls out MS20426-3-4 change to MSC-32, Page 6-1, Step I, line 18 calls out AW426-3-7-4A change to MSC-32 pop rivets. Page 6-1, Step II last sentence calls out BSC-44 pop rivets change to Avex 1604-0412.

SPC #28 Section I, Page 7-5, Detail A. Change the bolt call out from an AN3-10A to an AN3-11A. these are the rudder pivot bolts.

SPC #29 Section I, Page 5-1, Step II. Second sentence above figure 5-4 says to coil up 4 inches of tubing and tape it to the fuselage side. This should be 4 feet.

SPC #30 Section I, Chapter 5. The overview calls for the right fuselage half to go down into the fixtures which are setup on the floor. But the rest of the chapter calls out the left half. Although either half would work, it is probably simpler to put the right half in the fixtures because this is the half with the double joggle and cleanup of excess micro would be simpler. In order to put the right half in the fixture, figure 5-1 would need to be reversed as shown.

SPC #31 Section I, Page 703, Step IX. After the sentence which reads "wet this out only to 1" and the tape will stick", add the sentence "apply a second ply UND at -45° overlapping 1" onto the vertical. Lap this at the top and tape down as you did the first ply, wetting only 1". The first ply was installed at +45°.

SPC #32 Section I, Page 11-2. At the end of the page, add: the interior layup, slurry the foam inside the nose cone and lay up one ply of BID overlapping as necessary. This ply laps across the shear web of the canard. Layup a second ply of BID 2.5" wide from the lip inboard as shown in Figures 11-4 and 11-6 all around the attach area. Lap 1" as necessary. Peel ply the edges and knife trim when ready.

SPC #33 Section I, Page 7-5. The hole for the rudder hinge pin in the SRH-4 and SRH-8 are called out as .312 diameter. Change this to a #12 drill to fit an AN3-11A bolt.

SPC #34 Section I, Page 9-2. The third drawing from the top of the page shows the dimension from B.L. 11.5 to B.L. 179.5 as 238.5, change this to 168.0" as shown on the drawing above on Page 9-2.

SPC #35 Section I, Page 9-1. Overview states the layout is for a right wing, change this to a left wing. All other drawings in this chapter show a left wing.

SPC #36 Section I, Page 6-1, Step I. Calls out to have K3000-3 nutplates installed onto the SRH-10, change these to MK2000-3. Change the call out on Figure 7-4 and in the bill of materials on page 2-2.

SPC #37 Section I, Page 2-2. Spruce and Wicks parts list of hardware reads 86" - 5/16" diameter steel rod (any steel). Change to 172" - 5/16" diameter steel rod (any steel). NOTE: These and the 1/2" diameter steel rod in the next line on the parts list are counter balance weights. These can be installed in several short pieces. The prototype was done with 3 foot sections.

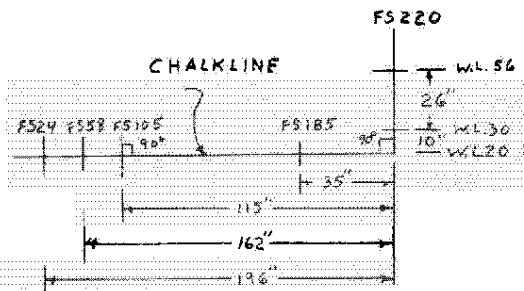
SOLITAIRE BUILDER HINTS

BH #4 Section I, Page 8-6, Step X, 12th line down. See Page 10-3 for a better explanation and pictures of how the hinge line system is installed.

BH #5 Section I, Page 7-1, Step I. The trailing edge of templates A and B go on the end of the foam block with taper cut on it as shown in Figure 7-2. There has also been some confusion as to the fact that core A-B is cut from the same block as core C-D. After cutting the core C-D, remove the core and trim the block as shown in Figure 7-2. Then cut core A-B. Hold both cores in position before glassing to verify that the leading edge of the vertical stabilizer lines up with the leading edge of core A-B and that with the block in this position the trailing edge of core A-B and the rudder trailing edge, core C-D are also in alignment.

BH #6 Bulkheads taped in place with one ply of BID each side wherever you can reach.

BH #7 Section I, Page 9-2, Step III. When joining the spars to the wing core it is a good idea to round the corner on the foam wing cores where the glass skins will lap onto the spar before microing the spar in place, rather than afterwards as called out in the plans. A drawing showing the 0.2" radius is shown on Page 9-3.



REVISED FIGURE 5-1

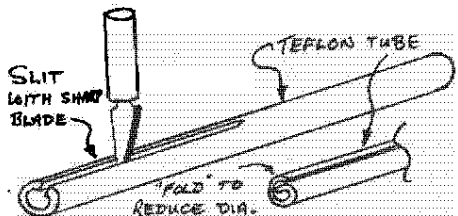
CP39 Pg 6

## BUILDER HINTS

**Long-EZ** - Long-EZ builder Fox Smith, sent this one in and although we have not tried it, it sounds great. He used a Morse # TA10-5/8" high speed hole saw bit, called "The Real McCoy". Reportedly, it simply "walked" through the aluminum/glass wing attach pads, when mounting the wings to the centersection spar.

**VariEze and Long-EZ** - Aileron hinge pin wear. This problem still has not gone away, even with the "bent" hinge pins. Rodie Rodewald originally suggested a modification, and Dick Kreidel has had it installed for 125 hours with "zero slop". It consists of a piece of thin-walled teflon tubing inserted through the hinge, with a piece of stainless steel welding rod  $\frac{1}{16}$ " dia. for a hinge pin. The teflon tube makes an excellent tight fitting 'liner' for the hinge pin hat does not allow any rattling or looseness, yet allows smooth pivoting action.

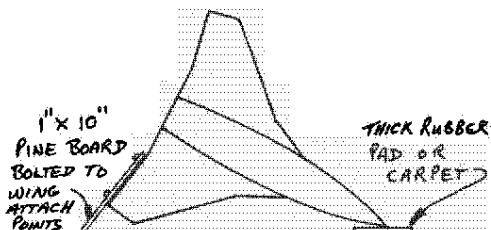
The only drawback is that it is tricky to install. You will need a piece of teflon tube a little more than twice the length of each hinge, for each hinge. Use an Xacto knife to slit the tube for half its length.



Now fold it up to reduce its diameter, and push it through the hinge. When you have it all the way through, (the unslit half is not into the hinge yet) now insert your welding rod hinge pin into the unslit half of the teflon tube, then pull the whole works through the hinge until your new hinge pin and teflon liner are properly aligned in the hinge. Trim off the "slit" portion of teflon tube and discard. The teflon tube can be obtained from McMaster Carr, part #5335K17 McMaster-Carr Co. P.O.Box 54960, Los Angeles, CA 90054 (213)945-2811

**Long-EZ** - Bill Smullin, Long-EZ builder has available an excellent spherical bearing that can easily be installed in the wing root instead of the phenolic block that inevitably rattles and allows play in the aileron torque tube and thus play in your roll control system. These spherical bearings are easy to install, just drill the phenolic block out to fit (a hole saw works well) and flex the bearing into the phenolic block. A couple of plies of BID over the bearing, just lapping onto the edge of the bearing guarantees it will not come out. The ID of the bearing is an excellent fit on the steel tube (CS152) in the aileron torque tube (CS151). Bill can supply these spherical bearings to builders for \$12.00 a pair. Contact: Bill Smullins, 1000 North San Gabriel, Azusa, CA 91702 (213)-969-3979 or (213) 963-4706

**Long-EZ** - Richard Marr suggests this method to roll your Long-EZ over after you have your fuel strakes and centersection installed. Bolt a 1" x 10" pine board to your 3 wing attach points on one side. Make the board long enough to protrude about 15" beyond the outboard tip of the centersection spar as shown. Now if you set the nose on a piece of carpet or similar pad, it is possible (though not without some strain) for one person to roll it over. The pine board keeps the centersection strake off the ground. Two people can do the job very easily.



**VariEze** - Comm antenna. This looks like a good one. Bob Beard sent this in. He installed a standard RST copper foil antenna up the aft face of his front seat bulkhead. The upper element runs up the aft face of the roll over structure. The bottom tip of the lower element runs down into the bottom right hand corner. Each element is 20 1/4" long. The elements can be as close as 1/8" in the middle, but must not touch each other.

**VariEze and Long-EZ** - Transponder antenna. Bob Beard installed his antenna forward of his right rudder pedal on the floor. An aluminum ground plane at least 5" in diameter (larger is better) is siliconed to the floor. The antenna is bolted to the ground plane so it sticks out through the bottom about 1". This antenna really works great.

**VariEze, Long-EZ and Solitaire** - Epoxy brushes may be used several times over, without washing them out, if you wipe most of the epoxy out of the bristles with a paper towel, then place it in a freezer. The low temperature slows the cure cycle dramatically. The next day, you can take it out of the freezer, stir it around in a fresh cup of "ready to use" epoxy and within a few seconds, the brush will soften until it is like new. We have reused a single brush many times using this technique. The only problem will be if you don't need the brush for a couple of weeks. Then it will have cured. The freezer slows down the cure. It does not stop it! As long as you are busy doing layups every day or every two or three days, this trick works.

## FOR SALE

Brand new Lycoming O-235-L2C, removed from C-152s.  
Low time - \$4200, high time - \$3200  
Contact: Heimo Trathnigg  
P.O.Box 2122  
Farmington, NM 87499

Lycoming O-235-L2C, 1310 hours total time, removed from a Tomhawk. With all accessories, flange ok. \$3200  
Contact: Trev Zander  
(314)296-4157

Lycoming O-235-L2C, 1945 hours total time.  
Contact: John Cova  
(503)-862-2492

Lycoming O-235-C2C, 1400 hours total time. Removed from Grumman TR2. Includes carb and Slick mags.  
Contact: Bruce Evans  
(805)824-2645

Accessories for a Continental O-200A, exhaust system, starter, 60 amp alternator S4LN-21 mags.  
Contact: Bill Morgan  
6295 White Mill Road  
Fairburn, GA 30213  
(404)-964-9408

Flight Research Mufflers for VariEze, stainless steel with integral heat muff for Continental O-200. \$250, (cost \$325 new).  
Contact: Phil Wimberly  
1926 Pinehurst  
Los Angeles, CA 90068  
(213)876-2129

Mule Ferguson has his "Oshkosh '83" video tape, with lots of EZs for sale. Running time is 2 hours in VHS or Beta, \$39.95 plus shipping.  
Contact: Video Service,  
Rt 1 Box 654,  
Boomer, NC 28606  
(919)921-3019

B & C Specialty Products new Linear Regulator will be available in February. The regulator will work with their 35 amp alternator or your standard aircraft alternator. Also included are the following features:  
1. Will work with standard aircraft alternators, or automotive type 14 or 28 volts.  
2. Over-voltage protection with built-in logic to prevent nuisance tripping from inductive loads.  
3. Flashing high-low voltage warning lights with 100% press-to-test of associated circuitry.  
4. Uses linear type regulation to reduce RFI.



5. Ideal for use in composite aircraft with Loran C or ADF.
6. Regulator output is short circuit protected.

B & C is also selling the Apollo I Loran C for \$1,590, which includes the preamp and radio tray. The Loran C is only 2" high, 6 1/4" wide and 11" deep.

If you want to save a lot of time when you are cutting your fiberglass cloth, try a heavy duty rotary cutter (similar to a pizza cutter). B & C has a special price of \$11 for one knife with one extra blade. Additional blades are available for \$2.50 each.

The Lightweight 12 amp gear driven alternator that B & C has been making for the Continental O-200 is still available.

If you would like more information on any of these products please send your aircraft and engine type along with a long SASE to:

B & C Speciality  
518 Sunnyside Court  
Newton, KS 67114

#### WANTED

Bill needs a Marvel Shebler MA3PA or MA35PA carb for his Lycoming O-235.

Contact: Bill Allen,  
Lilleybrook Lodge,  
Cirencester Rd, Charlton Kings  
Cheltenham, Gloucestershire,  
England.

Lycoming O-360 A1A or A1D. Ok if it needs an overhaul, but no damage.

Contact: Rodie Rodewald,  
68-361 Crozier Dr,  
Waiialua, HI 96791  
(808)637-5515

Hangar to share at Brackett Field, La Verne, CA. Room for Long-EZ, VariEze or smaller.

Contact: Max Overholtzer  
(818)966-2060 home  
(818)357-6061 work

Original VariEze fuel strakes.

Contact: Frank Nickel  
210 Patrick Dr,  
Pacheco, CA 94533  
(415)934-6050

#### VARIVIGGEN NEWS

The big news is that we have a new VariViggen flying. Congratulations Frank Stites!! Frank has completed and flown his VariViggen, N99VV. Frank reports that he was conducting high speed taxi tests with zero reflex set, when to his surprise he found himself 20 feet in the air. Frank had previously been out to Mojave and had had a back seat check out in N27MS. But even so, he reports being behind the airplane, and had some difficulty getting it back on the ground. The problem arose from not being prepared to fly. Now hear this: If you decide to do a high speed taxi run down a runway, you had better be ready to fly, because unless you are quite proficient at high speed taxi tests, you almost certainly will find yourself off the ground. The trick is to be prepared, both mentally as well as physically. That is, have the airplane completely preflighted and prepared for flight.

Frank later went on to an uneventful 30 minute "second" flight. He finds the airplane very quick on the controls, compared to what he is used to, but is very pleased to have finally achieved the goal of flight.

We are happy to report that Arthur Schwartz has got his Viggen flying once again. Arthur has 246 hours on his "Birdie". He had the misfortune about 5 months ago of having the right main gear shock strut fail at the rod end bearing (not per plans). This allowed the trailing link suspension to swing back and lock the tire. This caused the airplane to skid off the runway into a field of alfalfa. Striking a two foot high embankment, the

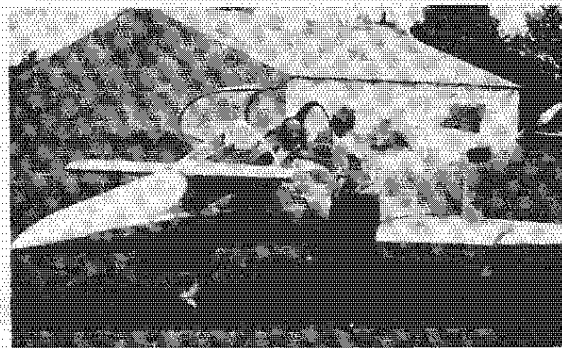
nose gear was torn out by the roots, causing lots of damage. The mains also folded causing more damage. Fortunately the aircraft did not flip over, and there was no fire. Arthur got out with a few bruises. It speaks well for his tenacity and enthusiasm, for little more than 4 months later he had repaired all the damage and was flying again. Good for you Arthur, perhaps you will be at Oshkosh this year?

Wayne Wilkins reports that he is hanging his Lycoming O-320 and has changed his MG-4s per the CP change for 4130 MG-4s.

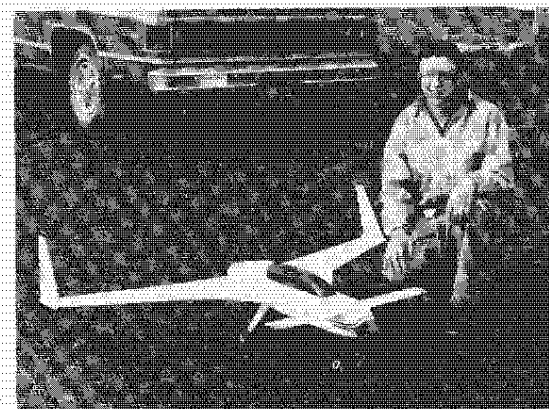
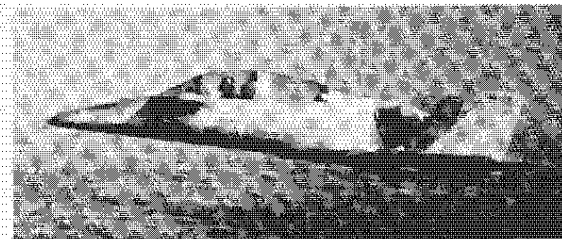
Orv Winfield reports that his Viggen is now covered and ready for finishing. SP wings are complete and installed. Engine is hung and partially hooked up. His photo looks promising. Keep it up Orv, not too far to go now!

Emerald Ullman reports that after logging over 3600 man hours he estimates that his Viggen is 80% complete. Viggens don't come easy.

Joe Rayne of Clinton, Michigan is flying a real mind blower! Joe used a set of Viggen plans for a baseline and redesigned it into an all aluminum (except for cowlings and nose cone) version, see photos. Quite a unique bird, and quite a unique achievement. Congratulations Joe, hopefully we will see this one at Oshkosh?

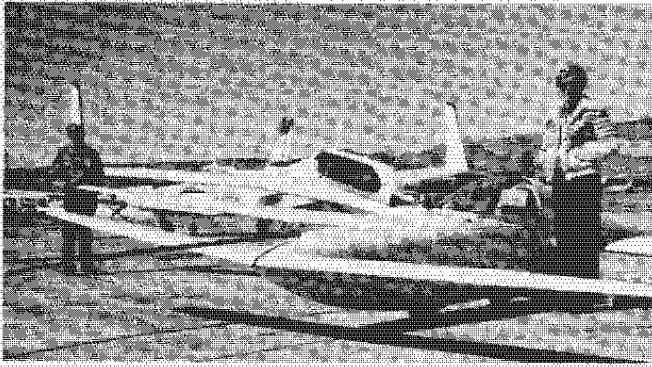


Joe Rayne after first flight, Congratulations! Joe in flight. High deck angle is because this photo was taken from a friend's 'Stampe' biplane at 80 mph.

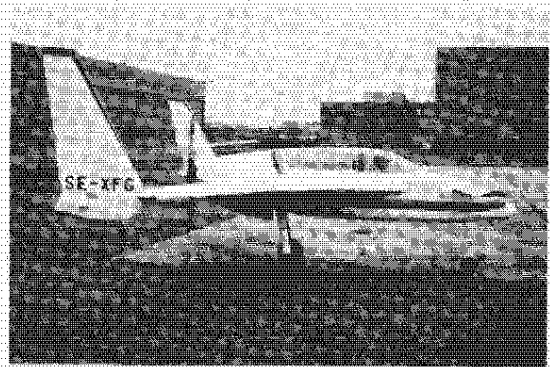


Jim Schmidt of St. Croix of Park Falls, WI with the proof of concept prototype 1/5 scale Long-EZ model. This stand off scale model will soon be available as a kit. It not only looks like a "Long", it flies like a "Long".

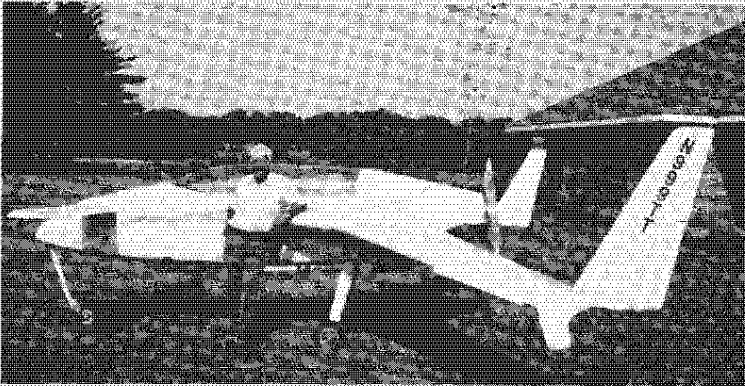




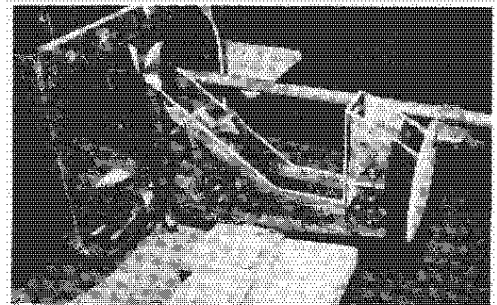
Sally with Solitaire on the Mojave ramp. Note the pitot static boom mounted for airspeed calibration for Einar Eneboldson's "Soaring" article.



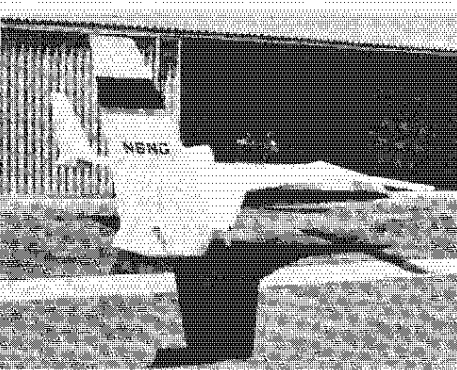
Sun Nilsson taxiing out for his first flight in his Long-EZ. There are two Long-EZ builder/flyers in Sweden named Sune Nilsson!!



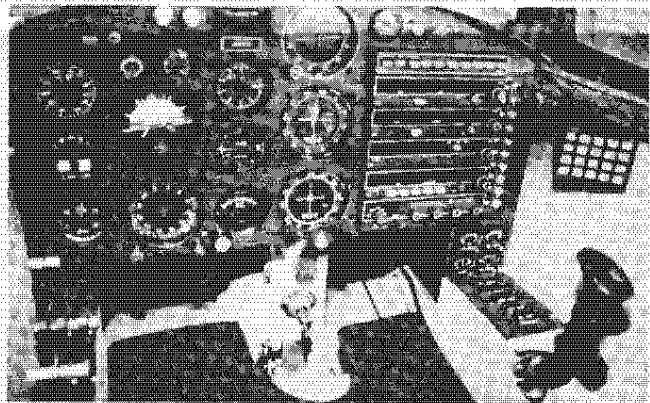
Loren Glaser with his beautiful VariEze AND brick home that he built. Loren is a very young 74 years of age, 53 years of which he has been a pilot.



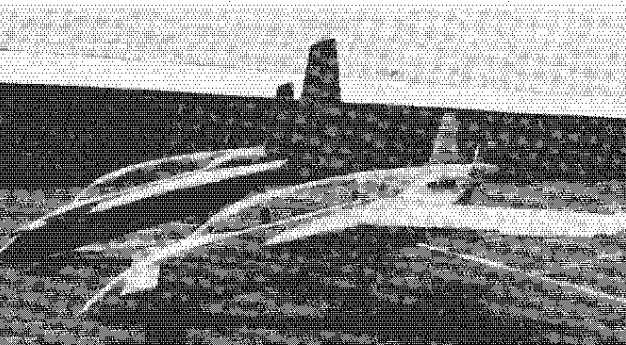
A typical Long-EZ "nose gear area" installation. Note the furniture clamp holding the NG-30 assembly to the F2 2 bulkhead.



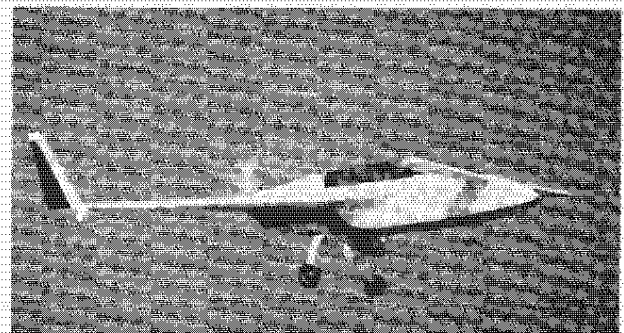
Gene Scott and Jerry Hansen's immaculate Long-EZ. This one is a real beauty.



This is Gene and Jerry's instrument panel! Wow, everything fits and it really does not look crowded.



Bill rice has over 300 hours on his VariEze N103B and now he has flown his Long-EZ N99B, which he built with friend Jim Hopelain.



Its amazing! VariEzes continue to hatch with regularity. How about this paint job? Red on white, very striking. Congratulations, Raymond Mucha.

# DEFIANT

## HOMEBUILT FOUR-PLACE TWIN

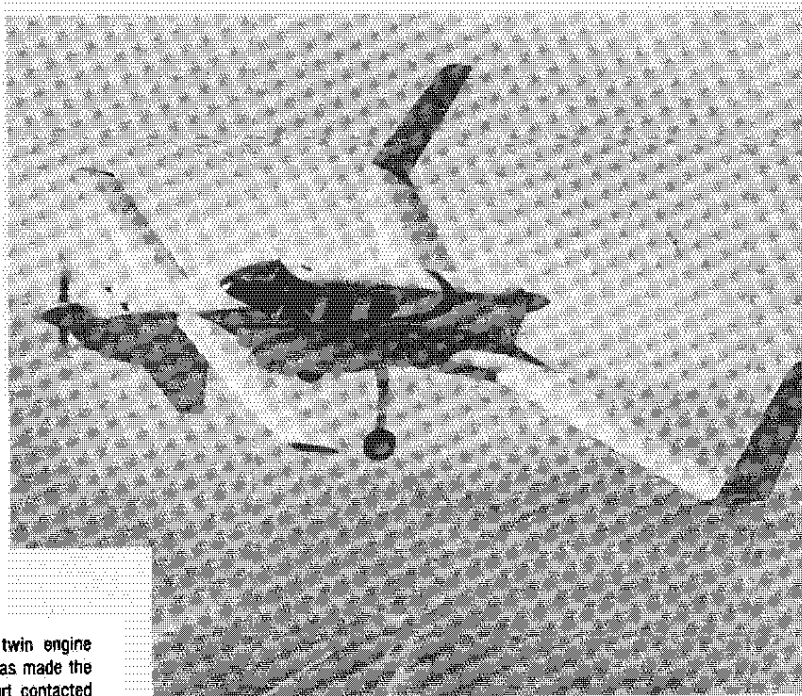


Photo by Don Downie

### 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 tap 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-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.

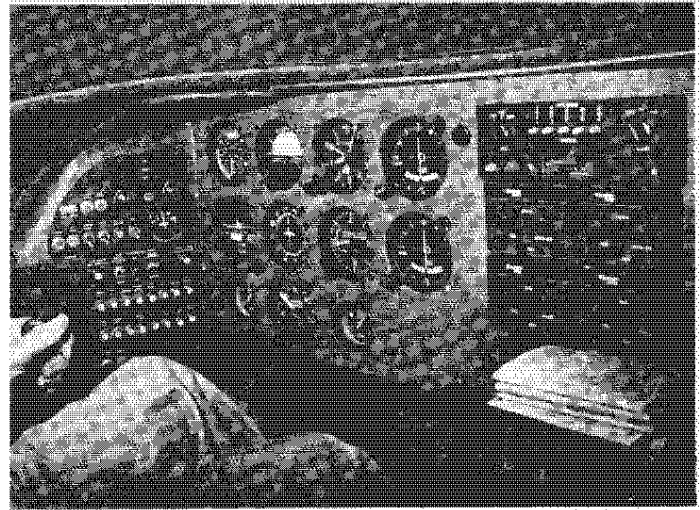
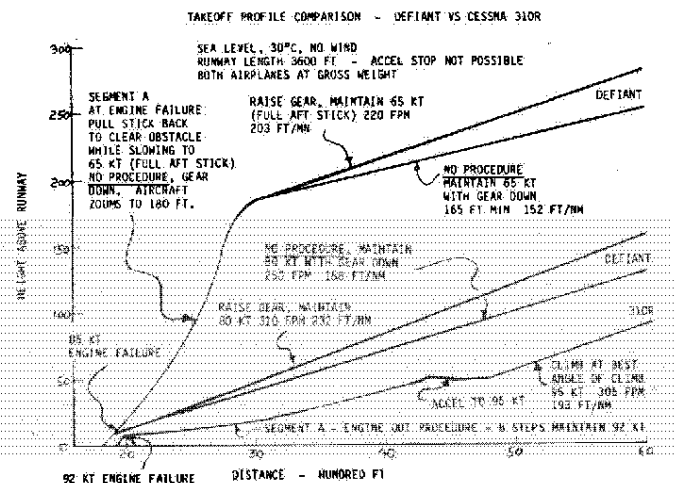


Photo by Don Downie

## SPECIFICATIONS AND PERFORMANCE

(with 160 BHP engines, fixed props)

Engines (2)	Lycoming O-320
Seats	4
Basic Empty Weight	1600 lb.
Equipped Empty Weight	1680 lb.
Equipped Useful Load	1270 lb.
Gross Weight	2950 lb.
Fuel Capacity	115 gallons
Span	31.4 feet
Wing Area	133 ft.
Wing Loading	22.2 lb <sup>2</sup> /ft <sup>2</sup>
Power Loading	9.2 lbs/hp
Payload with full fuel	660 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 lb)	310 fpm
Single Engine service ceiling (2950 lb)	6500 ft.
Single Engine climb (2200 lb)	550 fpm
Stall Speed (2950 lb)	64 knots
Stall Speed (2200 lb)	58 knots
Baggage Area Seat Up	16.5 cu. in.
Seat Down	41 cu. in.

## 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	



# 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

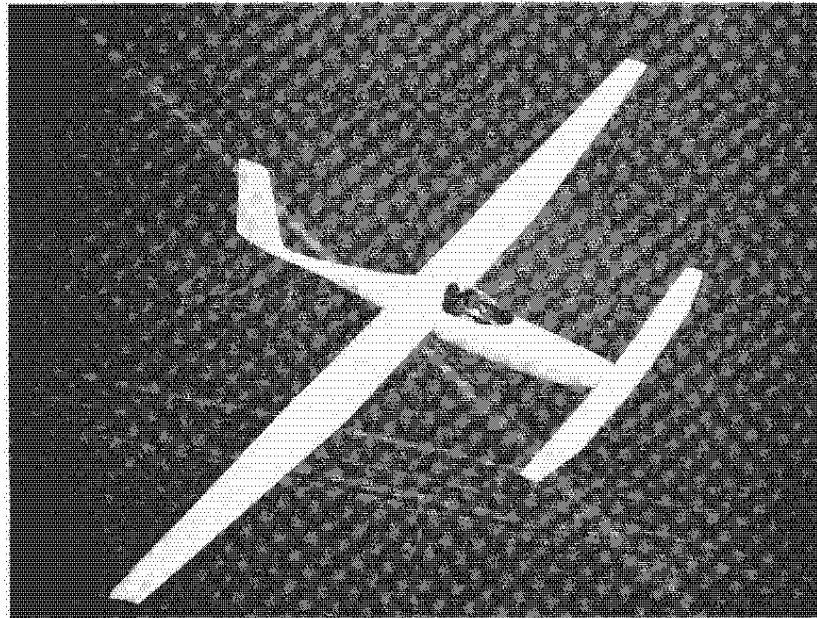
The SOLITAIRE is a single-place self-launching sailplane that is fitted with an engine package that folds into the nose of the aircraft after it pulls the SOLITAIRE to soaring altitude. With the engine folded, it has a L/D of 32 to 1 giving it true soaring capability. The engine can be deployed and restarted in flight using its electric starter. The canard concept results in high resistance to inadvertent stalls and spins. Its 'spoiflap' 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.

**KEN BROCK MANUFACTURING**  
11852 Western Ave., Stanton, CA 90680  
(714) 898-4366  
Catalog \$3

#### PREFAB FUSELAGE, CANOPY, TURTLE DECK, WING SPARS, SEAT PAN.

**TASK RESEARCH**  
848 East Santa Maria, Santa Paula, CA 93060  
(805) 525-4545

### 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. <sup>2</sup>	Min. Sink	150 ft./mn @ 40 knots (approx.)
Span	41.75 ft.	Descent Control	Spoiflaps usable to V <sub>NE</sub>
Wing Loading	6.05 lbs./ft. <sup>2</sup>	Min. Flying Speed	32 knots
Engine	KFM 107E	V <sub>NE</sub>	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

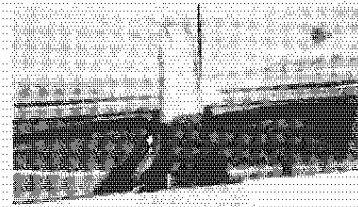
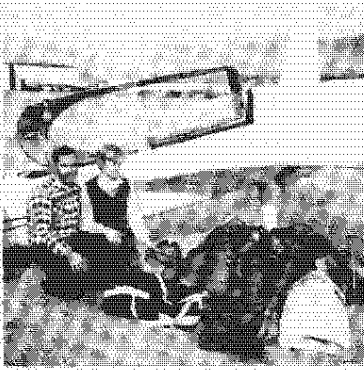
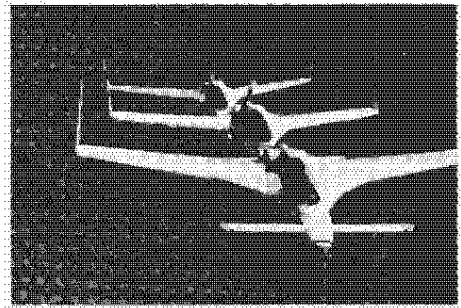
This is the complete education and construction manual for building the entire SOLITAIRE except for the engine installation. This manual consists of a spiral bound book 11" x 17" together with a set of 23" x 33" drawings, which include all necessary full-size templates, jigs and cross sections.

**Rutan  
Aircraft  
Factory, Inc.**

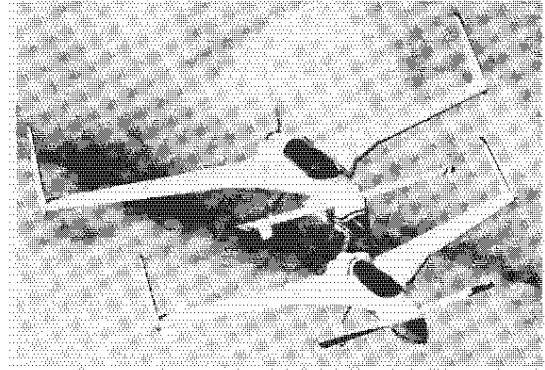
BUILDING 13, MOJAVE AIRPORT  
MOJAVE, CALIFORNIA 93501  
TELEPHONE (805) 824-2645

Brief Long-EZ specifications/performance.  
 Engine — Lycoming O-235 108 hp.

Span	26.1 ft.	Takeoff solo/gross	600/950 ft
Area	94.8 sq. ft.	Climb solo/gross	1750/1250 fpm
Empty Basic	750 lb.	Cruise 75% 8000 ft.	186 mph
Empty Equipped	800 lb.	Cruise 40% 12000 ft.	146 mph
Solo Weight	1000 lb.	Top Speed — Sea Level	193 mph
Gross Weight	1425 lb.	Max range* 75% (solo/2 place)	1380/1150 mi
Max. Fuel	52 gal.	Max range* 40% (solo/2 place)	2070/1690 mi
Cabin L/W/H	100/23/37"	Ceiling (solo/gross)	27000/22000 ft
		Landing distance (solo/gross)	450/680 ft
		*40 minute reserve	



This amount of baggage fits nicely in the Long-EZ baggage area. Baggage is accessible in-flight.



## LONG-EZ DOCUMENTATION

**SECTION I — MANUFACTURING MANUAL** — This is the complete education manual for composite materials and methods, also, the complete plans and construction manual for the entire Long-EZ except engine installation and landing-brake. The manual consists of a 180-page, bound 11" x 17" book plus 14 larger full size drawings. It includes many photos, over 800 drawings and illustrations, and over 65,000 words. The builder is led step-by-step through the entire construction of the airplane, including electrical system, fuel system and finishing procedures. The manual identifies sources for all materials and all prefabricated components. A video tape is available covering all aspects of building the moldless fiberglass/foam sandwich construction. The tape covers the latest methods used to obtain the optimum weight, strongest fiberglass layups. This presentation will help both the first-time and experienced builder attain quality aircraft workmanship.

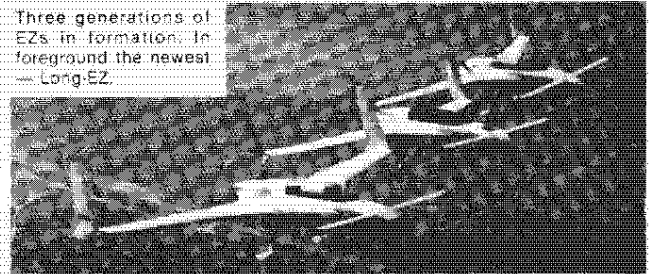
**SECTION II — ENGINE INSTALLATION** — This is a set of drawings and construction for the complete engine installation, including mount, baffles, instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.

**OWNERS MANUAL** — This is the required operations handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, and pilot checkout, etc.

A video tape is also available which covers the weight and balance procedures, taxiing tests and first flight.

**LANDING BRAKE** — Complete full size drawings for the landing brake device. This is the large drag plate that extends from the bottom of the fuselage for landing approach.

Three generations of EZs in formation. In foreground, the newest — Long-EZ.



The following are RAF-authorized distributors of Long-EZ materials and components. Contact the distributors at the addresses below for their catalogue and description of items.

### ALL RAW MATERIALS AND PREFAB FIBERGLASS PARTS

Near Los Angeles  
**AIRCRAFT SPRUCE**  
 201 W. Truslow, Box 424  
 Fullerton, CA 92632  
 (714) 870-7551  
 Catalog \$4

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

Prefab machine parts such as, control system parts and welded parts, fuel caps, engine mount, rudder pedals and exhaust systems.

### KEN BROCK MANUFACTURING

11852 Western Avenue  
 Stanton, CA 90680  
 (714) 898-4366  
 Catalog \$3

Main and nose gear, fuel strakes, fuselage bulkheads.

**TASK RESEARCH INC.**  
 848 East Santa Maria  
 Santa Paula, CA 93060  
 (805) 525-4545

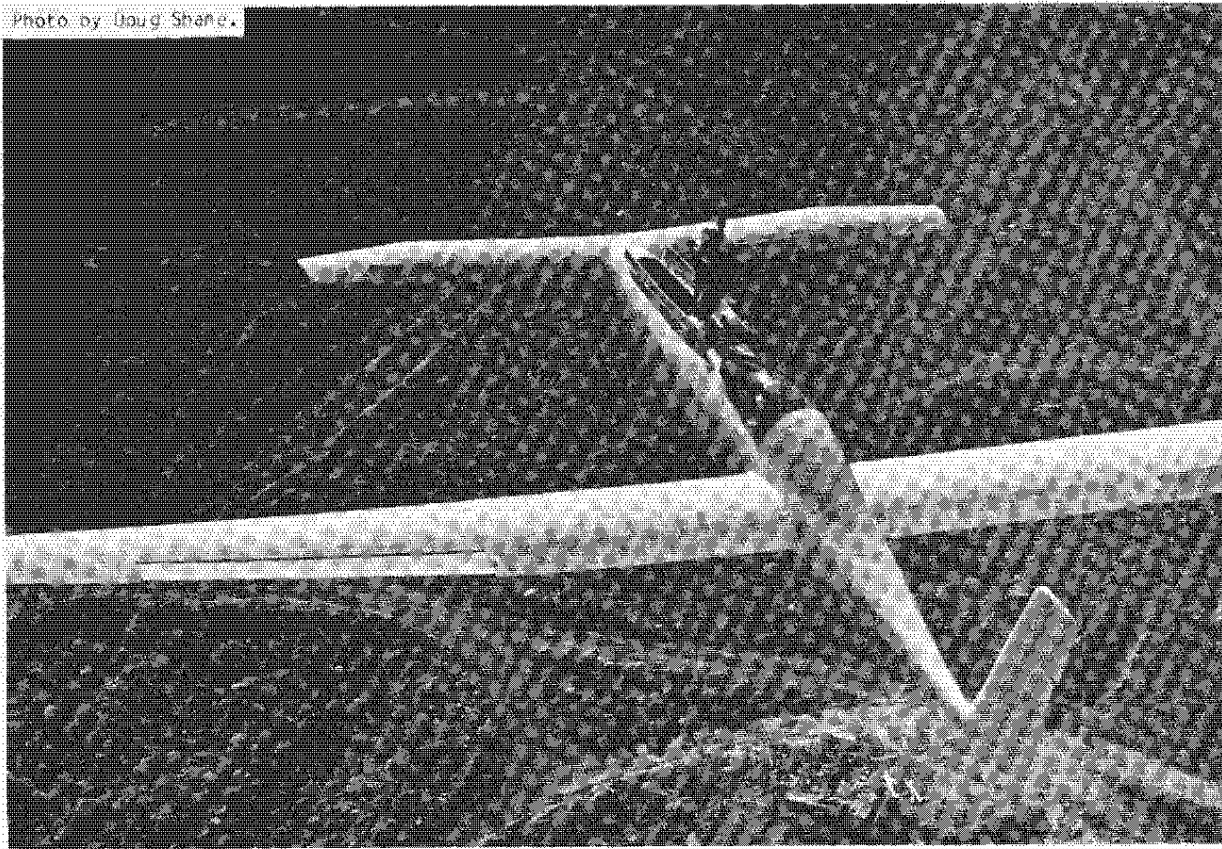
Canopies are available from **RUTAN AIRCRAFT**.

**Rutan**  
**Aircraft**  
**Factory**

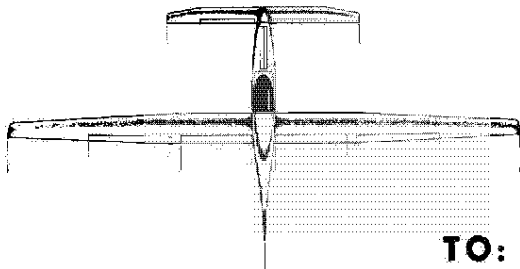
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 MOJAVE, CALIFORNIA 93501  
 TELEPHONE (805) 824-2645

Check items desired.	Price, includes first class mail to U.S. & Canada	Overseas Airmail — U.S. Funds
<input type="checkbox"/> Rutan Aircraft Information Package — complete data and photos of all Rutan designs.	\$ 10.00	\$ 11.00
<input type="checkbox"/> "Canard Pusher" newsletter Published quarterly. One year subscription. Approx. 10,000 words per issue.	6.75	8.75
<input type="checkbox"/> Long-EZ plans. Section I	198.50	212.50
<input type="checkbox"/> Section III, Lycoming	21.50	23.50
<input type="checkbox"/> Long-EZ Owners Manual	9.00	10.50
<input type="checkbox"/> Long-EZ Landing Brake	10.00	11.00
<input type="checkbox"/> 6% Sales Tax, if Calif. order. Newsletter not taxable.		

Photo by Doug Shane.



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



**TO:**

**first class mail**

**January '84**

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**CP 39**