

# THE CANARD PUSHER

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If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 40. If you are building from 2nd Edition plans you must have newsletters 18 through 40. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 40. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 40. If you are building a Long-EZ you must have newsletters from 24 through 40. If you are building a Solitaire, you must have newsletters from 37 through 40.

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's 10th ANNIVERSARY !!!

Canard Pusher #40. This means that RAF is 10 years old. For 10 years RAF has put out a newsletter every 3 months. During the 10 years since Burt founded RAF, he has put out unique aircraft designs for 12 different airplanes. Eleven of these were built and went through flight test programs here at RAF. In addition to these, Burt has designed at least 4 other airplanes that have been built and flown. As everyone knows, Burt has branched out and formed his new company, Scaled Composites. At least two new designs have already come out of this company.

We, the employees of RAF are very proud of our Boss and friend, Burt Rutan. We are proud to work for him and proud of his and RAF's record over the last 10 years. We look forward to many more years of exciting, rewarding and innovative work at the leading edge of aviation technology. We're sure that our customers, whom we consider to be part of the family, feel the same way.

This is a list of the aircraft that were built or tested at RAF:

| Model | Name                      | First Flight |
|-------|---------------------------|--------------|
| 27    | VariViggen - Standard     | 1972         |
| 32    | VariViggen - Special Wing | 1975         |
| 31    | Pre-prototype VariEze     | 1975         |
| 33    | VariEze                   | 1976         |
| 54    | Quickie                   | 1977         |
| 40    | Defiant                   | 1978         |
| 61    | Long-EZ                   | 1979         |
| 72    | Grizzly                   | 1981         |
| 73    | Fairchild NGT - Twin Jet  | 1981         |
| 77    | Solitaire                 | 1982         |
| 76    | Voyager                   | 1984         |

| Other designs that have flown: |                          |      |
|--------------------------------|--------------------------|------|
| 35                             | Scissor Wing AD-1 (NASA) | 1979 |
| 68                             | Amsoil Racer             | 1981 |
| 97                             | MicroLight (Lotus)       | 1983 |
| 115                            | POC Starship (Beech)     | 1983 |

## RAF's SECRET BACK-ROOM PROJECT

The existing absolute unrefueled distance record for aircraft was set over 24 years ago with a B-52 at a distance of about half way around the world. Since the advent of high-performance advanced composite materials, the goal of global non-refueled flight has been within reach. A global non-refueled flight has been called the last remaining major milestone for aviation's history.

In 1981 Burt designed a rather remarkable aircraft with a specific mission. The model 76 Voyager was optimized for long range and intended to shatter (even double) existing distance records.

Dick Rutan and Jeana Yeager then formed Voyager Aircraft Inc. (VAI) and planned to get this aircraft built and to achieve the goals of setting new distance records and to attempt the Round-the-World Flight.

In mid 1982, VAI and RAF agreed to a team plan where RAF and Burt would design, build and flight test the aircraft to prove its structure, flying qualities and performance. VAI would then equip it with special engines and props and the navigation systems required, and conduct the record flights.

Soon, after nearly two years work by a very small team, an awesome aircraft will emerge. Its fabrication has been done by some very hard work by a few dedicated people. RAF contracted Bruce Evans, an early VariEze builder/flyer. He has virtually lived with the project working continuous long hours on everything from tooling to structure and systems. Jeana and Dick have also made a full-time commitment to the building process. Wedged in with the Solitaire development, the Voyager has been a primary task for all the people at RAF. Chuck Richey, a Scaled engineer and VariEze builder/flyer donated detail design work for the landing gear system.

Its prepreg carbon fiber tape/nomex honeycomb sandwich structure required us to build a special, large oven for bagged 250° cure skins. Bruce and Dick traveled to Utah to use Hercules autoclaves to cure the carbon spars for the immense 100 foot plus wing.

The team was assisted by donations of materials and tooling help from Hercules, Aircraft Spruce, Wicks, Brock, Task Research, American Cyanamid and Hexcell. Ken Brooks donation included fabrication of the high-efficiency oleo landing gear assemblies. These units are works of art, they weigh only a couple dozen pounds each but will support an aircraft weighing as much as a large business turboprop aircraft. Bruce Tiffit has donated the interim propellers for the initial flight tests.

The Voyager is an imposing sight. Though designed to fly slow, its fuselage aerodynamically resembles a high speed racing aircraft. Like spacecraft, its structure is highly refined and optimized to support fuel weighing over 10 times the airframe weight.

Watch for announcements and photos in the aviation press, probably before Oshkosh this year. Its unusual design philosophy and details will be a guarded secret until this summer. This is being done to assure that this last-coveted goal in aviation will be owned not just by Americans, but by grass-roots "homebuilders".

## RAF ACTIVITY

RAF has been involved in some work for the Army on an Army Long-EZ. We installed a Texas Instrument T.I.9100 Lorán C, a King HSI and some special-mission sensors in a large external pod. We also converted their standard rudders to the new high performance rudders. This large rudder installation was very thoroughly tested not only by RAF, but by two Army test pilots. All agreed that they were an enormous improvement and no sign of any tendency to depart was observed by any of the three test pilots. We also made other changes and installations that are proprietary. It was a most interesting project to work on. Maybe if it shows up at Oshkosh it can park among the warbirds and get free gas!

Solitaires are being built by quite a few and we hear from them quite regularly. Michael Dilley has been doing an excellent job of supporting Solitaire builders. The prototype Solitaire is flown almost every Saturday and those that fly it still say it is more fun to fly

than any of the other airplanes. Einar Envervoidson, a NASA test pilot wrote an article for Soaring magazine which is in the April '84 issue. The magazine has an excellent cover shot with several color and black and white photos in the article, all taken by photographer, Doug Shane.

#### DEFIANT

Fred Keller is just about done with his part of the Defiant plans and what an outstanding job he has done. Fred was down here at RAF for two weeks to make some of the final decisions on format etc. Fred took over 700 (yes, seven hundred!) black and white photos of his project throughout the construction. A great many of these will be in the plans with captions which will really help interpretation. Defiant plans will not be in the normal RAF format such as the VariEze, Long-EZ or Solitaire plans. These plans will consist of about 80 pages 2 feet x 3 feet, of words, photos and lots and lots of detailed drawings and sketches. The emphasis is more on photos and drawings than on words.

We apologise to those who are patiently waiting for the delays, but we believe that the wait will be well worth it. We should have all of Fred's drawings in our hands within three weeks. Then the paste up begins to get them camera ready for the printers. The printer usually takes about 3 to 4 weeks. It won't be too long now! As Fred says, keep in mind that it is easier to build two airplanes than it is to write one set of plans!!

Burt reports that the prototype Defiant has 800 flight hours and in order to appreciate the fantastic utility of a Defiant you only have to follow one of it's trips.

For example, last week Burt and Rob Shirtzinger (a Scaled engineer) flew non-stop to Aspen Colorado. Average cruise altitude was 15,500 feet. The last portion of the flight was above 17,500 feet to clear the clouds, turbulence and icing conditions (using portable oxygen of course). The descent into the beautiful Aspen area was exhilarating. The performance of the Defiant at this near 8000-foot altitude airport was excellent.

The return trip was relaxing even though done in darkness over some of the roughest, most remote terrain in the United States. Trip times were three plus twenty five to and three plus forty return, not bad for the 650 nautical mile distance. Fuel used was only about 50 gallons each way.

This type of utility is of course, unachievable with any production trim for less than quarter of a million dollars!!

RAF is now accepting orders for the Defiant plans. Your check will be held and not cashed until the plans are ready to ship.

#### Visa/Mastercard Credit Cards

Seeing as RAF builds plastic airplanes we decided that maybe we should take plastic money! RAF is now set up to honor Visa or Mastercard orders for \$10.00 or more. This was done due to popular demand.

#### PATCHES

Ever since RAF ran out of the airplane platform type patches, we have had constant requests for us to do that patch again. You will be pleased to know that the first shipment is due in a few weeks time. RAF will have available the VariEze, Long-EZ, Solitaire and Defiant plan form patches. The aircraft are in white on a blue background with a red border to match the "name" patches. The name patches are available in VariEze, VariViggen, Long-EZ, Defiant and Solitaire.

Aircraft patches are \$3.00  
Name patches are \$1.50  
California residents please add the 6% sales tax.

#### OSHKOSH 1984

RAF will be closed during Oshkosh this year. We will not be available for builder phone calls from Thursday 25 July through Thursday, 9 August. All the RAF personnel will be involved in flying and driving aircraft to Oshkosh.

Don't forget the VariEze Hospitality Club dinner will be held at Butch's Anchor Inn on Monday, 30 July. If you plan on being there you must purchase tickets (\$12.00 each) before Oshkosh. Contact Don and Bernadette Shupe, 2531 College Lane, La Verne, CA 91750

Burt's talks this year are as follows:  
Defiant - 3:45pm - Monday, 30 July  
Long-EZ/Solitaire - 3:45pm - Tuesday, 31 July.

RAF will also be closed over the Memorial Day weekend. We will be headed up to Watsonville, California for the flyin and the delicious strawberries and artichoke hearts!!

#### NEW RUDDERS FOR THE LONG-EZ

The plans for the new rudders for the Long-EZs have been very popular although there has been some confusion. We will try to clear up a few points.

First of all, these plans are strictly for Long-EZ. They absolutely do not apply to the VariEze or any other type aircraft. VariEze builder/flyers should be able to recall a mandatory change in CP 22, Page 8, that reduced the allowable rudder travel from the original plans call out of 3.5" to 2" This was because the rudder authority of a VariEze was powerful enough in some cases to depart the airplane. The VariEze is the last airplane that needs stronger rudders!

If you have not installed your comm antenna(s) in your winglet(s) on your Long-EZ and you would like to have the high performance rudders, do not install any antenna in the winglets until you have the plans for the new rudders in hand. If you are wanting to retrofit the new rudders to a Long-EZ that is already flying, or one that has the antenna already installed per CP 26, you will have to cut through the original antenna and install a new one forward of the new rudder hinge line. This is covered in the new rudder plans. We have made this modification now to 3 Long-EZs and in all 3 cases the old antenna is still under the glass skin, (cut through and disconnected) and the new antenna works very well. We have not been able to perceive any degradation in radio performance. In fact on two of the three, we seem to have improved range both transmitting and receiving!

The new rudders on the Long-EZ give at least twice the yaw authority of the original rudders and allow you to steer while taxiing at speeds as low as 25 to 30 knots without using the brakes. The main advantage of course is in a crosswind take off from a narrow runway. With the new rudders minimal braking is required for steering, so you can accelerate to rotation speed more rapidly. You can rotate at your normal rotation speed of 50 to 60 knots (depending on cg) in any amount of cross wind up to 20 knots at 90° and lift off in essentially the same distance as you would with no cross wind. Quite a few homebuilt Long-EZs have flown into RAF with the new rudders and every one so far has been pleased with them.

#### SAFE-T-POXY II

We have had a lot of requests for information on this material. RAF has been using it in our shop for over a year. We did some direct comparison tests of laminates using regular Safe-T-Poxy and Safe-T-Poxy II. The results of these tests verified the manufacturers claim that the new material was as good or slightly better in every respect from a structural standpoint. In addition to this, this epoxy is thinner (less viscous) and tends to wet out the glass more rapidly with less effort. It should therefore be easier to work with in a cooler environment.

The single biggest advantage is the reported lower likelihood of experiencing an allergic reaction from Safe-T-Poxy II, even compared with the regular Safe-T-Poxy. This is not an easy thing for us to test, since no one who has ever been employed at RAF has had an allergic reaction to any of the epoxies that we have used.

Our experience with the material has shown some advantages and some disadvantages. The opinions of the folk that work at RAF vary, but the general consensus is that it does wet out better, especially if the shop is cool. Safe-T-Poxy II has more tendency to "run out" or "bleed out" of a given layup, especially if that layup is not perfectly horizontal. On a vertical surface or even a sloping surface, run out is more of a problem than it is with regular Safe-T-Poxy. The worst complaint is a considerably shorter pot life, especially in a shop that is heated to the recommended 77°F.

Safe-T-Poxy II in our experience starts to gel and become "stringy" in the cup in about half the time that this occurs with regular Safe-T-Poxy. Once out of the cup and on the part, this is not a problem. If this "stringiness" occurs in the cup, this batch must be thrown away, since it will not wet out the glass once this has happened.

In conclusion, we recommend that you try Safe-T-Poxy II, perhaps a small kit and see how you like it. See if it suits your individual work habits. Both Safe-T-Poxies are excellent structural materials and are suitable for building any of the Rutan composite designs. Both materials are also better than any other epoxy we know of for fuel compatibility.

#### LORAN C UPDATE

Contrary to our thoughts that Jim Wiers super Sport Aviation article on Loran-C installations in composite aircraft would eliminate questions on the subject, it has only created more questions!! Please be aware that RAF is not an avionics shop, our expertise lies in aerodynamics and composite structures. Until recently we had never even flown behind a Loran-C. When we worked on the Army Long-EZ, we installed a T.I. 9100 Loran-C per the manufacturers instructions. This particular Loran is one of the best and most expensive available. It is also specifically designed for use in aircraft.

It worked perfectly parked on the ground, even in the hangar as long as the engine was not running. As soon as we started the engine, it dropped off the line. Apparently the electronic noise that runs around the electrical system in an aircraft that would normally be "damped" out or lost in the metal structure and skin (which is the ground), does not get lost in a composite airplane. The ground in the composite airplane in most cases, is only one piece of wire that runs the length of the aircraft from the negative battery terminal to the firewall.

What can be done about this? Get the ground plane (all the large metal parts) tied together electrically to form as large a ground plane as possible. This means, to attach pieces such as elevator torque tubes to each other and to the negative terminal of the battery. Rudder cables should be electrically bonded to each other and to the negative battery terminal. All of the wiring should run up and down each side of the fuselage inside either aluminum or copper tubes which will act as a shield for the wiring. The tubes should run from the battery negative terminal (or as close as practical, and then electrically bonded with a short piece of wiring) down the length of the fuselage and out through the firewall. On the aft side of the firewall, the tubes should be electrically bonded to the aluminum or stainless steel firewall. A length of automotive braided copper ground strap should go from the bolt that connects these tubes to the firewall to a convenient bolt on the engine accessory case or oil pan. This will give you the largest practical ground plane you can get, short of installing Jim Weir's wires under the wing skin, which can only be done if the wing has not been skinned.

A recent innovation in Loran-C antennas is to buy an automotive windshield type antenna. This consists of a very thin wire centered on a piece of clear tape. This can be installed inside the top of the canopy, starting as far aft as possible and running down B.L. 0, all the way to the forward edge of the plexiglass canopy. The

Loran-C preamp must be mounted on the aft canopy frame, and the antenna wire should be connected directly to the preamp. The preamp will be connected to the Loran with a normal coax cable, RG-58 AU. This antenna is reported to work great and is the brain child of Phil Stotts of Western Avionics of Fresno, CA (209-255-4872). Phil is a clever guy when it comes to Loran-C installations and has quite a lot of experience with VariEzes and Long-EZs. If you are planning a Loran installation, give Phil a call.

VariEze builder/flyer, Wes Gardner is flying with the above antenna installed and reports that his MLX works like a charm. One strange fact is that if this auto windshield antenna is removed from the canopy and lowered into the fuselage, the signal will immediately become intermittent. Could it be that the glass is not as transparent to VLF as it is to VHF?

Of course it goes without saying that a noisy regulator or alternator will give you problems even if you follow the above suggestions to the letter. A good linear regulator such as Bill Bainbridge of B & C Specialty Newton, KS, sells, will effectively eliminate this problem. Contact Bill at B & C Specialty, 518 Sunnyside Court, Newton, KS. 67114

RAF will continue to disseminate information on successful Loran-C installations. Obviously there are probably many ways to make a Loran-C work in an EZ. Those we have suggested are just a few.

On the Loran-C article in CP 39, page 2 we forgot to include Bill Butters address. Our apologies.

Bill Butters  
1478 Urbandale,  
Florissant, MO 63031

#### TO STATIC LOAD OR NOT TO STATIC LOAD

RAF has been receiving more and more requests from builders who would like to static load their newly constructed VariEze or Long-EZ. We are concerned that many of these builders may not fully understand what a static load entails and what the consequences of an incorrectly done static load can be.

Anyone who absolutely insists on doing a static load, can obtain a copy of the load schedule from RAF. We strongly recommend that you have a qualified structural engineer present during the load test. Perfectly good parts can easily be failed by poorly or incorrectly done static load tests. This has occurred to some of the builders from overseas. Unfortunately, for some of the countries, their equivalent to our FAA has a requirement for a static load to be done. We know of two builders who have had their wings (on completed aircraft) destroyed. Do not allow some government official to decide on a load schedule for your airplane. Write to RAF and get a copy of the correct load schedule.

Before you rush off and static load your brand new EZ, consider this. When you purchased your plans from RAF, you paid for the benefit of all of the aerodynamic and structural design capability that Burt and RAF has. RAF does an extremely thorough job of structural analysis, as well as conducting any static load test deemed necessary by Burt. Once the airplane is flying and the flying qualities are to Burt's liking, the airplane is put through an extremely thorough flight test program. Prior to the prototype being built, the amount of testing of the various materials to be used in the aircraft is unsurpassed.

We believe that if you build your aircraft structurally and aerodynamically in accordance with the plans, and you layup the correct number of plies of the appropriate glass, (no less, and certainly no more), in the correct orientation, and you do a reasonable job of wetting out the glass with the appropriate epoxy, you will have an airplane that is more than adequately strong enough.

#### HIGH TIME EZs INFORMATION REQUESTED

A number of VariEzes now have accumulated quite high flight hours, several in fact are over the 1000 hour mark. Some Long-EZs are reaching for the 1000 hour mark. We would like to request from these high time builder/pilots information regarding maintenance type

work that may have been required over the past many hours. We are thinking particularly of possible problems relating to paint finish, tire and brake wear, nose gear retraction, nose wheel fork friction, damping, electrical, baffling, engine problems, etc, etc.

We would like to try to accumulate data and make it available to the rest of the builders, to possibly help them to avoid anything that may be preventable. We know of nothing right now that is of any concern and would simply like to set up a means of keeping track for the benefit of all our builders and flyers.

If you have something along the lines described above, please send a brief description of the problem to RAF.

#### Canopy Opening in Flight in an EZ

Ralph Gaither, an experienced naval pilot with over 26 years of experience in airplanes and a VariEze pilot/owner called the other day to let us know of a canopy opening that he had. First of all his canopy warning system was out of order, a micro switch had failed. (Don't laugh, this can happen to you!) Secondly it was a hot day in Arizona. The canopy was kept open while taxiing out to the runway. The canopy was locked, then the wind shifted necessitating a long taxi to another runway. The canopy was opened for better ventilation (you can see it coming, right?) To make a long story short, he had to quickly fit in between traffic for take off, his safety catch had somehow gotten bent and did not catch, so the canopy opened fully at between 200/300 feet AGL during the climb out. Ralph kept his cool, he flew the airplane, maintaining the climb, left the throttle full up, reached with his left hand and grabbed the canopy rail. He pulled the canopy down and closed it on his wrist (not fully closed). He climbed out in this configuration until at 1000 feet AGL. He trimmed the airplane as best he could, and throttled back to fly level at a reasonably slow speed (100 to 110 knots would be best).

Then he took his right hand off the stick and calmly locked the canopy and continued on his way. Ralph's canopy does not have the throw over stay that was shown in CP 30, page 8. Rather he has a simple retaining cable. He expressed the concern to us that he felt that the over-center type throw over stay may have made it much more difficult to close the canopy in flight. We have given this some thought and we agree. It would be more difficult to close the canopy, but certainly not impossible. Anyone who flies an EZ with this type of stay, will know that it takes both hands for about a second to flick it over center and close it.

It is food for thought and we wanted to give the builders and flyers the benefit of Ralph's experience. We believe the throw over stays advantages outweigh its disadvantages. It is very light, it will hold your canopy open in a wind without allowing it to crash closed or open against the fuel tank. It does not impose the tremendous torsional loads through the canopy frame that the gas spring type canopy retainers do.

Consider also that there has to be literally a triple failure before this would become a factor in flight.

1. The canopy warning system must have failed.
2. The safety catch has to fail.
3. The pilot must have a brain failure, or fails to comply with his or her checklist.

All three of the above have to occur before the throw over stay becomes a factor. We at RAF have elected to keep our throw over stays but we feel that each individual builder should make his or her own decision.

Incidentally, Ralph reported that the airplane was not at all difficult to fly, he easily maintained heading and continued his climb. The biggest thing to remember is to FLY THE AIRPLANE.

#### CAUTION - Unauthorized Prefab Parts for the Long-EZ

It has recently come to our attention that there are some prefabricated nose cones for Long-EZs, as well as other parts, such as fuel/baggage strakes, that are being misrepresented as being approved by RAF. The only RAF approved prefab Long-EZ parts, are manufactured by Task Research of Santa Paula, California. These parts are sold through Wicks, Aircraft Spruce and Task Research.

The prefab nose cone in particular is manufactured from non approved glass and polyester resin. It is not a sandwich construction is heavy and would be difficult to incorporate safely into a Long-EZ. The nose section of a Long has to be able to support the loads taken by the nose gear. In order to do this safely, we believe the plans should be followed as closely as possible. The Long-EZ nose is not simply a fairing, it is a structural sandwich, composite design that should not be compromised.

#### LETTERS FROM THE BUILDERS

"Dear RAF,  
After almost 500 hours in our Continental O-200 powered VariEze, N13WN. We decided to give her a new heart. She made her first Lycoming O-235 powered flight on the 16th March, 1984. So far we are very pleased.

We were featured in an episode of "Blue Thunder", the TV series in February '84. N13WN and her identical twin N13MW played the part of the nasty drones.

After almost a year of frustration trying to make our MLX Loran-C work, and almost ready to give up on it, we read in CP 39, Page 2 of Ray and Nova Cullen's success with their MLX, and decided to follow their advice. We contacted Phil Stotts of Western Avionics in Fresno (209)255-4872. He is definitely a whiz. With just a simple installation application of an auto windshield type antenna, our Loran-C works like a dream.

Sincerely,  
Wes and Millie Gardner"

"Dear RAF,  
The weather here in the northwest has been terrible, so I have not been flying much. The aircraft is a super flying machine and a compliment to Burt's designing and engineering skills. The only incident to report is an engine failure. Airplane fault? NO. Pilot stupidity? YES. I was flying up the Columbia river gorge towards the Dalles at about 3000 feet when I suddenly heard the ominous sound of nothing but air, and sudden deceleration. You always think the worst in these kinds of situations, but since there were no loud noises, I figured that fuel starvation must be the problem. I checked the boost pump, it was on. Mixture was rich, throttle was full open. All the time I was looking for a spot on the freeway below, thinking, 6 o'clock news, here I come. (I really did not want to break into show business in this manner) I then reached for the fuel valve (had to loosen my shoulder harness first) and switched tanks. As I was reaching for the starter, the engine roared into life. Music to my ears!! I added full power and climbed to 5000 feet so that if it dare happen again, I would have a shot at the airport. All of this happened in a matter of seconds but, with absolute fear coursing through every cell of my body, it seemed like an eternity.

On the ground I checked the drain on the suspect tank and only a few drops dribbled out. Before take off I had assumed I had about 3 gallons in that tank. I had 5 gallons added to it. I took off on this tank and flew for about an hour at high power settings when the failure occurred.

Evidently there was little more than the 5 gallons when I took off. I am only thankful that it occurred with enough altitude to handle the situation, and that it ended up a learning experience and not a tragic one. Additionally thank goodness for the other tank!

Sincerely,  
Dave Petrosino"

Editors note: If you do hear the sudden silence, always assume it is fuel related and switch tanks immediately. Check mixture rich, throttle open. The prop will continue to windmill if you were cruising along, so you do not need a starter. It will windmill down to 65 knots in fact.

#### ACCIDENTS AND INCIDENTS

A southern California VariEze was seriously damaged during a forced landing caused by the catastrophic failure of a home made kevlar prop. The pilot suffered a serious foot injury.

This propeller was reportedly designed and built by the pilot. The laminate consisted of multiple plies of kevlar layed up with room temperature cure epoxy, similar to that used to build the VariEze. The prop had a total running time of approximately 3 minutes when during the first take off, one blade failed completely near the hub.

Composite props may eventually be built that will be safe for us to use on our homebuilt airplanes, but we must caution builders that composite props require careful design and very, very thorough testing under controlled conditions. Propellers especially on a pusher, operate in a very stressful environment, the average homebuilder simply does not have the facilities at his or her disposal, necessary to tackle such a project.

#### EZ CLUBS

EZ Builders of Florida - A very active group of builders put out an excellent newsletter that is published on a flexible bi-monthly basis. The main purpose is to aid in the construction and assimilation of information on all Rutan designed aircraft, as well as other aircraft using the same type materials. A fee of \$6.00 annually is requested to help cover mailing and printing costs. Anyone is welcome to subscribe, whether or not you are building an airplane. For more information, contact:

Contact: Jim Carlin,  
7282 Skyline Drive,  
Delray Beach, FL 33446  
(305)498-8006 - nights  
(305)585-1756 - days

Long-EZ Squadron I - Chino, California. This is an active Long-EZ builders only club. They put out a bi-monthly newsletter and have meetings once a month usually with a guest speaker. The purpose is to help each other during the building stages and to encourage as many as possible to complete their airplanes. They have a respectable record so far. Club membership is limited to 100. To qualify for membership you must have a set of Long-EZ plans and have a RAF issued serial number.

Contact: Robert Maetzold  
2814 Associated Road #7  
Fullerton, CA 92631

Long-EZ Squadron II - Santa Monica, California. This club is an offshoot of the Squadron I and has generally the same goals and requirements. Mike and Sally were the guests at last months meeting and thoroughly enjoyed the camaradie of a group so dedicated to producing safe, high quality Long-EZs. In a hangar on the field, there are two flying Long-EZs, while upstairs in the attic there are four more under construction. One of these is very nearly done, and should be an outstanding example. This group of four are called the "hole in the wall gang" and with good reason. They will have to cut a hole in the wall to remove their airplanes from this second story workshop!

Contact: David Orr,  
2523 S Bundy Drive,  
Los Angeles, CA 90064

D.U.C.K.(S) - (Dayton United Canard Klub!) This club now has 43 members and are continuing to grow. They are presently assembling a photo roster to include a photo of each member and his or her project. This will be updated each six months. This club is not exclusive to a particular type, rather it caters to all canard, composite types.

Contact: Michael Zimmerman,  
7313 Dabel Court  
Dayton, OH 4549  
(513)435-0882 - home  
(513)434-6800 - work

#### SOLITAIRE CLUB

If you are building a Solitaire and are interested in forming a club, Bob Matheny from San Diego would like to hear from you. Bob is probably as far along as any Solitaire builder and would like to exchange information and share ideas.

Contact: Bob Matheny,  
4452 Brindisi Street,  
San Diego, CA 92107  
(619)223-3745

#### FLY INS

Sun 'n Fun 1984. Due to other commitments, RAF was unable to make it to the flyin this year. Charlie Gray, Johnny Murphy and Herb Sanders filled in for us. Thanks a million guys, RAF is mighty lucky to have builder/flyers such as you to pinch hit for us and we appreciate it.

The following is a report from Charlie: "The weather for Sun 'n Fun was as good as 1983 was bad. Sunday to Sunday was almost all sun with only one afternoon and evening shower. The first day we had 5 or 6 EZs fly in. Each day we had a few more come in until about 20 Longs and Ezs showed by the end of the week.

Monday I held the RAF forum for Mike and Burt. We had all seats filled and most of the talk was about Long-EZ. Herb Sanders gave a very interesting talk about his results with Loran-C and how to install antennas in the winglets. Johnny Murphy gave a talk on the coming Defiant. Lots of questions and answers. But 45 minutes is just not enough for me to get started talking about the Long-EZ.

Don Riley and I held bull sessions on the flight line on Sunday and Friday. These were enjoyed by all with lots of talk and information given and taken from the builders and flyers.

The annual EZ builders of Florida banquet had 65 members and friends on hand. Bob Dunham had made a cake for Ron and his wife for their 2nd Anniversary. The message was "Marriage with you is VariEze and full of Quickies and Long-EZ with nary a Defiant Word" !!

All in all Sun n' Fun was much better this year. We all missed the RAF bunch, but hope all that time was spent getting the drawings for Defiant plans ready.

O.K. get to work, build fast, fly safe and see you next year.

Charlie.

Flash! Just heard we have a new EZ member, congratulation to Jim and Susan Carlin on the birth of their daughter. OK, Jim, now get back to work on your Long-EZ. C"

2nd Annual IVHC Flyin - Concord, New Hampshire, Saturday, June 23, 1984. This flyin is held in conjunction with the Concord Air Day and last year 10 EZs and 20 builders were on hand. Come on up and join the fun, lets see if we can double the EZ attendance. Two Long-EZs will perform a fly by routine. A Hyperbipe and a Christen Eagle II will go at it and Bob Hoover will fly his P51 and Shrike.

Free coffee and donuts, a drawing for a ride in a warbird, aircraft judging, bomb drops and spot landings will round out a day to remember.

Contact: Paul Adrien,  
100 Franklin Street,  
Lawrence, MA 01840  
(617)682-5656 - days  
(617)635-3061 - evenings

Third Annual Flyin/Drive in - For RAF design builders in the Mid west will be held on May 19 from 10am to 4pm at Brookeridge Airpark (private). We have put it a month later this year hoping for better weather this year. Like last year, the hosts (Talbot, Gutch, Steichen) will provide Brats and Soda for \$1.50 per person, and people are requested to bring a salad or dessert if they can fit it in their EZ. Also bring anything of interest (parts, kids, games, video tapes, parts or supplies you don't want etc).

Brookeridge Airpark is 21 DME outbound on the Joliet VOR 050 radial on the Chicago sectional. 9-27 runway 2800 feet monitor 122.9. Driving location is south of Downers Grove 1/4 mile north of Lemont road exit off I-55. (960 86th Street). The event/picnic will be held off the west end of 9-27 on private property. RSVP 312-985-6671

Jackpot Fly In and EZ Race - Come to the extreme N.E. corner of Nevada, for a really special flyin over July 6, 7 and 8, 1984 weekend. The Jackpot airport has a new 6000 feet asphalt runway at an elevation of 5217 feet. Excellent camping facilities on grass, only 100 feet

from tiedowns. Tennis courts, swimming pool, golf course, billiards, gambling and live entertainment. Cactus Petes's Resort Casino is close by and offers lodging (advance booking required).

Shirl Dickey has conceived of a race "The Jackpot 120", which was very popular last year and even features prize money put up by Cactus Pete's Casino. Ribbon cutting, spot landing contests and an awards banquet will make this years event a memorable one.

Contact: Shirl Dickey  
1646 Allegheny Drive  
Murray, UT 84123  
(801)974-7526 - days  
(801)268-3360 - evenings

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

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

VariEze - There have been no reported plans changes.

LONG-EZ PLANS CHANGES

LPC #117 Section III, Page 10. The Lycoming #STD 619 washer should be replaced with an AN970-6 washer. The Lycoming washer has too large a hole allowing it to slip over the 1.84" long spacer. This allows the rubber bushings to be crushed more than they should be.

SOLITAIRE PLANS CHANGES

- SPC-38 CP 39, Page 6, Solitaire plans change #33 called out a change in the hole diameter of the SRH-4 and SRH-8. Delete this plans change and change the center hole diameter from 1/4" to a #12 drill on the SRH-1 and SRH-9 as shown on Page 7-4 and 7-5. This change has been accomplished on the Brock part.
- SPC-39 Section I, Page 2-2. Under washers, 8 each 18-2-9, change to 8 each 18-2-6. These are nicopress sleeves.
- SPC-40 Section I, Page 10-1, Step III calls out the spoiler drive tubes as 5/8 x .058 2024T3. Change this to 3/4 x .035 2024T3. Also change 24" 5/8 O.D. x .058 wall 2024T3

tubing to 24" 3/4 O.D. x .035 wall 2024T3 tubing on Page 2-2 materials call out under Spruce and Wicks. Change the call out on Page 10-2 Figure 11-3. Changing this tube diameter will require the drive tube to be set in the spoiler slightly aft of where the 5/8 O.D. tube would sit. This is however acceptable because the rods that screw into the SSF-6 can be adjusted slightly longer.

SPC-41 Section I, Page 10-2, Figure 11-6 and Page 10-3, Figure 11-7 calls out a 5/8 O.D. x .058 wall tube. Change this to 3/4 O.D. x .058 2024T3 as shown on Page A-23 detail B.

SPC-42 Section I, Page 9-4, first paragraph. Before the layup for the trailing edge foam core is layed up, it is necessary to install the SCS-111 in the aft face of the wing core. The position of this is shown on Page A-23. Round the top and bottom edge of the part to allow it to follow the contour of the foam after it is inset. Be certain the hole layout fits the holes in the SCS-110 brackets. Install K-1000-3 nut plates on the back side, apply some silicone to the back of the nut plates to keep the micro out, sand both sides for bond and inset the part flush into the foam as shown on Page A-23 with micro. NOTE: The round over and nut plates will be on opposite sides to make a right and left hand part. Then procede with the trailing edge foam layup.

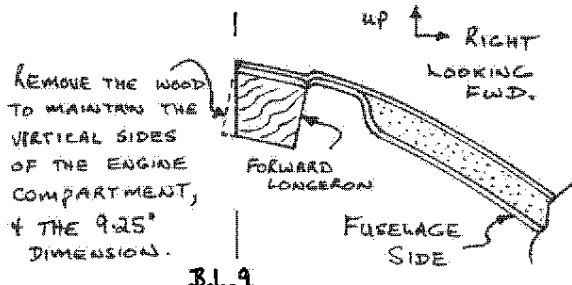
SPC-43 Section I, Page 10-1, Step IV calls out to install the Avex pop rivets into the control tube. However the rivets will interfere with the SSF-9 as shown on Page A-21, detail D. So do not install the rivets now. Make a note on Page 14-3 spoiler actuation, paragraph 3, to install the Avex pop rivets at this point.

The same problem exists on the aileron drive tubes as called out on Page 10-3, Step IX. Do not install these Avex pop rivets now, rather make a note on Page 14-2, paragraph 8 on the left column to install these after the SCS-212 insets are installed in the aileron drive tubes.

SPC-44 Section I, Page 10-1, Step II. Spoiler bottom skin calls for 2 plies UND at +30° and 2 plies UND -30° to the T.E. Change this to 1 ply -30° and 1 ply +30° UND to the T.E.

SPC-45 Section I, Page A-24, View C-C and Page 14-1. Pitch and roll system. When installing the SCS-2, SP-1 and SP-2 assembly, this must be shifted to the right on View C-C for the SCS-208 to miss the LWP-R legwell side bulkhead. The SCS-208 must have a clear path from the SCS-2 to the SCS-102 walking beam. Check this before permanently installing the SP-1 and SP-2 control stick supports.

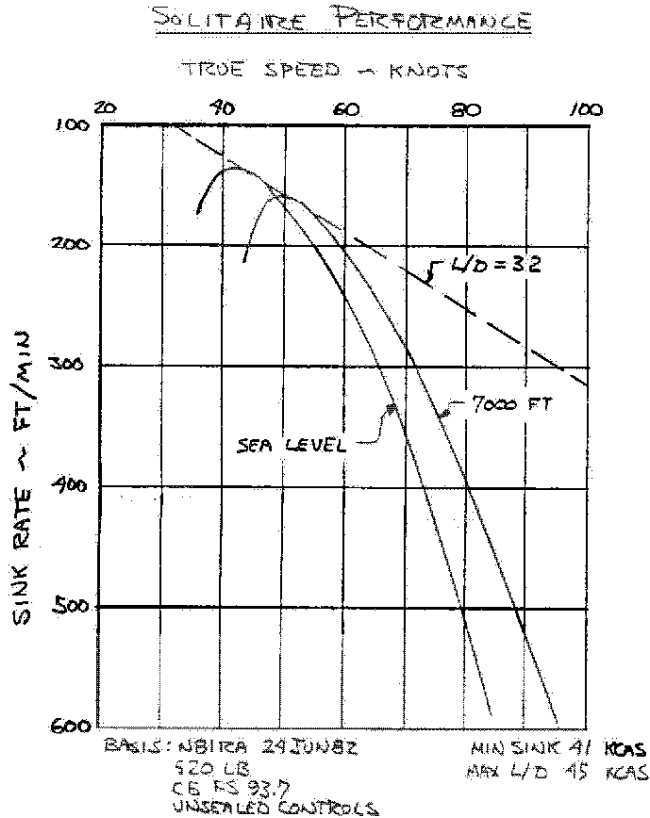
SPC-46 Section I, Page 6-1, Step IV. Installing the forward longerons. After the first sentence add "trim the longeron so that when it is clamped in place the 9.25 dimension is not compromised as shown".



SPC-47

Section I, Page A-6, Legwell side bulkheads. Cut a hole through the LWP-L and LWP-R bulkheads both right and left at W.L.20 and F.S.51.25. This is 6" back along the W.L.20 line. Cut a 5" diameter hole with the center at this point. Also make two round covers from .020 2024T3 aluminum, 6" diameter as covers for these holes. These will be installed later with RTV silicone. The holes should not overlap the rudder pedals so there is no chance to catch the rudder peddles or cables on the edge of the hole. These holes will allow easier installation of the rudder pedals.

Oops! We forgot to include the following performance chart in the Solitaire's Owners Manual. Clip this (or photo copy it) and glue it into the manual permanently. Page 41, under "notes" would be a good place.



SOLITAIRE BUILDER HINTS

#8. Section I, Page A-5 shows a scale drawing of the Solitaire canard and elevators. There are numbers in circles with lines to various layups. These are the order in which the layups are done with #5 (not shown) being the elevator end ribs and the end ribs in the T.E. of the canard at 8.L. 75.

#9. When building the canard templates, match each one to the drawing on Page A-5. We have found that the template H on Page A-11 varies from Page A-5. After cutting the template H out, lay it on the drawing on Page A-5 and remark the hinge line and rear shear web. All dimensions on the canard and elevator should match Page A-5 except the spar caps are exaggerated for clarity.

#10. Section I, Page 5-1. When installing the static port in the fuselage side, we found it simpler to cut a slot through the inside skin, remove the core at this point. You will be able to tell where this hole is on the outside by gently pressing on the outside skin. Mark the center of this slot on the outside skin. Bend the tube and seal the end as called out in the plans. Pot the tube in place with micro and cover with one ply of 810 lapping 1" onto the inside skin.

#11. Casey at Task Research suggested the following idea for installing the longerons. This is different from the plans, but reportedly worked well. Instead of using a one piece, solid longeron, Casey laminated 3 pieces 1/4" x 3/4" spruce together using epoxy to join them. They were clamped into position in the fuselage and allowed to cure. Use grey tape on the inside of the fuselage as a release. After cure, remove the now curved longeron, trim and bevel the ends as required, then flex them in place per the plans.

BUILDER HINTS

VariEze and Long-EZ - If you ever experience what appears to be a brake failure, that is to say you hit the brake and it goes all the way down, don't just sit there!! Hit it again and if necessary several times and it will almost certainly be as good as ever. This has been a fairly common problem, and can be caused by several things. The first place to check is the clearance between the brake caliper and the wheel pant and/or the main gear strut. If the strut or wheel pant touches the caliper, this will cause the piston in the caliper to back away from the brake disc, and this will then necessitate several quick pumps on the brake to bring the piston back. Similarly, a disc that does run true can do the same thing. Do not just assume that your master cylinder is shot, do check it for signs of hydraulic fluid leaks, also check the elbow and fitting in the caliper for leaks. Don't forget to check fluid level in the master reservoir. Do not fly if you suspect a bad brake.

Another potential place to keep an eye on is the hole in the firewall where the rudder/brake cable goes through and connects to the CS15 bellcrank. Check and be sure that it is not possible for the nicopress sleeve on this cable to go into the hole and jam. If necessary enlarge these holes a little, or adjust the brake cable length to limit the travel so the nicopress sleeve does not get into the firewall.

Dick Kreidel has been using a new brake lining, a Cleveland part # 66-56, which is a semi metallic material with good success. He reports equal brake effectiveness, but about three times the brake lining life. RAF is currently testing these linings and so far have not managed to wear them out, so cannot comment on the brake life.

VariEze and Long-EZ - Cooling vent door, installs easily in the little NACA scoop in the canopy frame. It is so simple and works so well, it is amazing. Designed by Gene Zabler, himself a VariEze builder/flyer, this little door can be installed in 10 minutes. You control it with one finger from completely shut to full open or anywhere in between. It eliminates the need for a foam plug and you can keep your hankie in your pocket when it rains. Gene will sell you one for \$6.00 plus .50¢ for packaging and postage. Contact: Gene Zabler, 48 Robin Hill Drive, Racine, WI 53406

Long-EZ - Fuel/baggage strakes. If you are installing the Task Research prefabricated strakes, it is a good idea to delay cutting out the baggage holes in the fuselage sides, until you have the strakes in hand and fitted. Mark around them, measure inside this mark the thickness of the sandwich strake and cut along this new line. Do not attempt to install the fuel/baggage strakes unless the appropriate wing is bolted in place. It is nearly impossible to position the strake so it fits nicely with the wing if you don't. You can do this one wing at a time if you are pressed for space.

Fitting the ribs/bulkheads to the inside of the top of the strake on prefab as well as homebuilt strakes. Install the ribs and bulkheads per the plans. Trial fit the top and sand the ribs and bulkhead down until the top of the strake fits well to the fuselage, centersection, wing root and leading edge of the bottom strake. There is no need to strive for a perfect fit on top of the ribs and bulkheads (this is difficult to do). Now stick a strip of grey tape inside the top of the strake to correspond with every rib and bulkhead in the fuel tank/baggage area.

**SHOPPING**

Pile flox on top of each rib and bulkhead generously, then set the top in place, cleco or clamp or grey tape it in its proper position and allow the flox to cure. Pop the top off, remove the grey tape release and sand the appropriate areas for bonding. Trim the flow overspill on each side of each rib and bulkhead, sand the top of the flox (which is now a perfect match to your strake top). Smear a thin, wet flox coat on the top of each bulkhead and rib, don't forget the leading edge and along the fuselage, then put the top on for the final time. Clamp, cleco and or grey tape it in position for a full cure.

This method gives you a perfect fit between the ribs/bulkheads and fuel tank top. This gives better support for when people sit on your strake while climbing in and out of the airplane and of course it is much stronger.

Do yourself a favour and paint a generous, wet, full coat of Safe-T-Poxy every where inside the fuel tank, paying particular attention to the fuselage sides and the forward face of the centersection spar before you close the tank. This will eliminate the frustration of fuel tank leaks.

**NEW EZ FIRST FLIGHTS**

We have not reported first flight name and times since CP 35. The following list are those that we know of who have made a first flight in their EZ since CP 35. If you know of anyone who should be on our list, please send us his or her name, address and date of first flight.

Irene "Mom" Rutan as most of you know, has kept a historic record of all known Rutan type aircraft. She would very much appreciate receiving a card and if possible a photo of your aircraft if you are flying. She has a really interesting photo album dating back to Burt's first flight of the VariViggen. She has names, addresses, first flight dates and photos of virtually every Rutan type aircraft that has flown. She would like to keep this record as accurate and as up to date as possible. So, please send in the information on your aircraft and be included in Mom's photo album.

Mrs. Irene Rutan,  
8526 Calmada,  
Whittier, CA 90605

**VARIEZES**

|              |        |               |        |
|--------------|--------|---------------|--------|
| D. ADAMS     | N650V  | R. MOSS       | N262UB |
| V. ATKINSON  | N3LZ   | R. MUCHA      | N50ME  |
| J. CARROLL   | N?     | G. NICHOLAS   | N15GN  |
| J. COX       | O660C  | M. PUPPI      | I-PINA |
| H. DAVIS     | N3262D | H. ROBBINS    | N83HR  |
| L. GLASER    | N999TT | R. ROYSE      | N8508H |
| L. GODSEY    | N57LG  | W. SCHWEBER   | N8517X |
| R. JOHNSON   | N84EZ  | G. STILLWAGON | N798EZ |
| S. KELLY     | N529SK | M. TILLIA     | N3248T |
| A.S. KNOWLES | G-81MX | A. TOWNSEND   | N40TS  |
| E. LAUGHLIN  | N4ZE   | E. WALLWORK   | C-GSPR |
| P. MILLET    | N930L  | G. ZABLER     | N3793X |
| D. MOSKWA    | N60HZ  |               |        |

**LONG-EZS**

|                 |        |                |        |
|-----------------|--------|----------------|--------|
| AERO-TECH       | N36MX  | J. BACH        | N82TJ  |
| C. BAKER        | N3223P | G. BEST        | N?     |
| B. BOLTON       | C-GFBB | J. BRAMDT      | N103JB |
| K. BRODRESKIFT  | LN-HPB | K. CHRISTENSEN | OY-CMT |
| R. CORLEY       | N82CD  | P. CORNELIUS   | N139PC |
| A. DIERKSEN     | N?     | D. DOMEIER     | N26JD  |
| D. ESH          | N98CU  | T. EVANS       | N?     |
| FERRIS/JOHNSON  | N34JR  | C. GRAY (#2)   | N211LE |
| W. GUSTAFSON    | N329W  | S. HALE        | N353M  |
| K. HANSEN       | N31AK  | W. HARE        | N262E  |
| W. HINCKLEY     | N55L2  | M. HINSON      | N16DEZ |
| J. HOPELAIN     | N9JB   | R. HULTEN      | N82KL  |
| J. HUSA         | N143EZ | N. JOHNSON     | N613NC |
| G. KELLEY       | N3260K | D. KREIDEL     | N888EZ |
| H. McCLANAHAN   | N3260T | A. MCCUMBER    | N407MN |
| S. OLESEN       | N460LZ | D. PETROSINO   | N1391W |
| J. PIERCE       | N67JD  | R. POYNER      | N89PC  |
| R. PUGH         | N38EZ  | W. PULLEN      | N30WP  |
| M. REILLY       | N280EZ | D. RIEHM       | N983JU |
| D. ROGERS       | N245R  | O. RONNEBERG   | N5150R |
| G. WJ. SABO     | N20GJ  | G. SCOTT       | N4680S |
| L. SCOTT        | N6NG   | R. ST. CLAIR   | N234SC |
| S. STIBER       | N954LE | J. STITT       | N82ST  |
| P. SUPAN        | N83PJ  | B. TITFT       | N115EZ |
| R. VAN BALDEREN | N51EV  | R. WHITE       | N38AR  |
| T. WILLIAMS     | N8EZ   | B. WOLD        | N58BW  |
| J. YASECKO      | N303Y  |                |        |

**DEFIANTS FLYING!!**

|            |       |             |        |
|------------|-------|-------------|--------|
| BURT RUTAN | N78RA | FRED KELLER | N39199 |
|------------|-------|-------------|--------|

Radio Systems Technology has recently put out their 10th Anniversary issue of their kit avionics catalog. This is a very worthwhile catalog and has many items of interest to EZ builders. Most of you will be familiar with Jim Weir, founder of RST. He is the designer of all of the buried antennas that we use with such success on our EZs. He has also written several excellent articles on the subject, that have been published in Sport Aviation. RST is located on the Grass Valley airport, Grass Valley, California. For more information or to receive the new catalog,

Contact: Radio Systems Technology,  
13281 Grass Valley Ave,  
Grass Valley, CA 95945  
(916)272-2203

**A variometer in your EZ.** This is not as silly as it may sound. Especially if your live or fly in or around mountains, or high density altitude airports. Sailplane pilots are very aware of the benefits that are derived from a variometer. EZ flyers can get very helpful information from a vario. In simple terms, a vario is a very sensitive rate of climb. We have been testing a couple of Ball variometers, one in the Solitaire and one in the Long-EZ and have found them to be excellent. Ball makes a large variety of varios, some of them incredibly complex and sensitive. The one we tested is the simplest ones Ball makes. A 2 1/4" Ball model 601 which has a range of zero to 1000 feet and the other a 3 1/8" Ball model 501 with a zero to 1500 feet range. The rather low range gives greater sensitivity in the low rate of climb area, when you most need it while climbing in the vicinity of a mountain range. You will get positive information as to whether you will make it over the ridge or whether you should circle to climb. With practice you will find you can really take advantage of thermal lift or even wave lift. You can save gas by throttling back in strong lift and still maintain your ground speed. Try it, you will be pleasantly surprised.

Contact: Ball Variometers Inc.  
5735 Arapahoe Ave,  
Boulder, CO 80303  
(303)449-2135

**GREAT AMERICAN PROPELLER CO.**

Mike and Sally flew over to San Luis Obispo on the west coast where they met with the guys from the Great American Company. Mike tested two of their props on his Long-EZ, N26MS. Mike's Long-EZ has the high compression pistons installed (9.75:1) so it is a 125 hp Lycoming O-235 now and Fred Griffith of Great American had designed and built a prop specifically for this engine/airframe combination. Although both props were good, one was the best Mike had flown. This prop, a 62x 64 was carved from a Canadian hard rock maple blank. This blank is glued up using about 30 thin plies of wood, bonded under high pressure using Resorcinol glue. The prop looks very attractive with all the thin laminations joined with the dark resorcinol glue. After the prop is carved to shape and balanced, it has 70% of its blades wrapped in Kevlar. This is a time consuming process and each prop takes 11 days to go from start to finish.

The Great American Propeller Company was started in 1977 mainly building decorative clock propellers. Later they got into building props for homebuilts. In July 1983, the owner sold the company to three of his employees, Fred Griffiths, Kevin Ruediger and Bert Ruediger. These guys have worked hard to come up with a really excellent product and are justifiably proud of their product. Attention to detail is the watch word, the props are checked and rechecked for balance. The bolt holes are reamed a few thousandths oversize so that you can slide the prop bolts through easily with your hand.

Great American is concerned about the care that is given to wooden props. They believe, and RAF agrees with them, that it pays dividends to preserve and protect your prop. If it gets damaged by gravel or a rock, repair it and seal the wood. A properly cared for wood prop should provide many years of safe flying. For this reason Great American has a repair and refinishing service. They will refinish a wood prop and balance it for \$49.50. They will do a complete rebuild, strip to bare wood, repair minor damage, refinish and balance (provided the basic prop is sound) and issue a new warranty on any of their props for \$99.50. In addition to this Great American keeps a loaner Long-EZ prop, 62 x 62. They will ship it to anyone who needs a prop to get them home, provided the recipient pays the shipping both ways. This is a great service and could really be a boon to someone unfortunate enough to break a prop away from home. For more information, contact:

Great American Propellers,  
11180 Pike Lane, #5,  
Oceanside, CA 92045 (805)481-9054

CP40 Pg 8



PAUL PRUOT'S NEW EZ FUEL GAUGE

Mike and Sally recently installed a pair of these gauges in their Long-EZ, N26MS. The installation was straight forward and the instructions supplied were easy to follow. The installation took two days mainly due to cure times on the epoxy. They look neat and best of all, work great. The fuel is clearly visible. Thanks to a soft red light in the base of the gauge, the fuel is visible at night. Mike says that the most desirable thing about these fuel gauges is the fact that when you get down to approximately 30 minutes of fuel on either side, you get a low level warning light on the panel. No more inadvertently running out of fuel on one side. Now the light comes on and you have the choice of switching tanks or going to an airport. Best of all, you can still clearly see how much fuel you have, even with the low level light on. This feature makes these gauges highly desirable and greatly enhances the safety of your EZ. For more information contact:

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

The following is from Byron McKean, a VariEze builder/flyer from Texas and the person primarily responsible for adapting the automative compucruise fuel flow computers to our EZs in the form of the Compuflight. Byron has done a superb job of preparing, marketing and servicing these very useful instruments for all of us, but now, unfortunately he finds himself unable to continue with this important program. If anyone is interested in getting involved in a program like this, please get in touch with Byron.

\*McKean Systems Inc.  
Rt 1, Box 429 B  
McQueeney, TX 78123  
(512)557-6575

The Compuflight computer system that I have supplied to homebuilders for the past fourteen months has been very popular and I feel should continue to be available. However, I am unable to continue to furnish the system. What started out as a hobby, quickly grew into a small business that requires more time than I have available, so I am looking for someone who is interested in taking it over.

The Compuflight very accurately measures fuel flow and increases the accuracy and consistency of mixture leaning. In addition it contains a quartz clock, alarm, elapsed time, battery voltage, inside and outside temperature in both Celsius and Fahrenheit, plus when you enter your calculated ground speed, all time, distance, and fuel requirements are available to you continually. All this for a very reasonable price.

Anyone interested in operating their own business, increasing their income, and being able to deduct as a business expense much of your shop, office, and flying expenses, please contact me.

Until someone takes over, there are no more Compuflight units available as I am completely sold out. I will continue to service those I have sold and answer questions. I will also keep a list of those interested in purchasing an individual unit and pass along those names to the new supplier.  
Thanks,  
Byron"

FOR SALE

Lycoming O-235-C2C, 2000 hours total time, zero since major. Complete with logs, carb, mags, starter, alternator, fuel pump and vacuum pump.

Contact: Doug Shane  
(805)824-4860 Evenings.

Lycoming O-235-L2C, 798 hours total time, complete with logs. Best offer. After 6:00 pm, no collect calls.

Contact: Paul Sticker  
703 E Sunrise  
Roswell, NM 88201  
(505)623-5769

Continental O-200B (for pushers), factory brandnew, with logs, generator and starter.

Contact: John Ring,  
63 Main Street, Box 188,  
Easthampton, MA 01027  
(413)527-5835

Continental O-200A, 2927 total time, 1839 since major, \$2000

Contact: Jim Carraway  
P.O. Box 4163  
San Rafael, CA 94903  
(415)479-3668

24 volt starter and alternator for O-235-L2C. 200 hours total time on each. Both for \$250.00 or \$150.00 each.

Contact: Tim Crawford  
(205)767-3493

Original VariEze main gear strut and nose gear strut. \$170.00 for both.

Contact: James F Jansa,  
2 Rue de le Roi,  
Ft Walton Beach, FL, 32548  
(904)862-6806

Original VariEze main and nose gear struts and some other VariEze parts.

Contact: G. Brotherson,  
2224 N Demirit  
Mesa, AZ 85205  
(602)986-3241

Sensenich prop for VariEze - 58 x 69

Contact: Klaus Zavier  
P.O. Box 115  
Rhododendron, OR 97049  
(503)622-4011

Electric gyro instruments, TSO'd, factory new and warranted. 3 1/8" case, 14 V or 28 V, lighted.

3400 attitude indicator - \$645.00  
4305 Directional gyro - \$645.00

Contact: Shirl Dickey  
1646 Allegheny Drive  
Salt Lake City, UT 84123  
(801)268-3360 - evenings.

Stainless muffler/exhaust system by Flight Research for O-200 VariEze. Integral heat muff, never used, cost \$325, sell for \$195.00

Contact: Phil Wimberly,  
1926 Pinehurst,  
Los Angeles, CA 90068

Accessory case for Lycoming O-235-L2C, machined to accept a mechanical fuel pump.

Contact: Pete Simmons,  
(203)535-2040

Continental O-200, zero time, disassembled, includes mags, VariEze Sanders exhaust system, oil separator system, engine mount, etc.

Contact: Wes Gardner,  
1310 Garden Street,  
Redlands, CA 92373  
(714)792-1565

Wes also sells oil separators for Continental O-200 as well as Lycoming O-235, lifetime foam air filters, fuel sight gauges and fuel caps.

WANTED

1 pair of original VariEze fuel strakes.

Contact: John Nelson  
(801)571-0184 - evenings  
(801)566-4655 - work

VARIVIGGEN NEWS

Since the last newsletter we have heard from only two builders. We have not heard from any Vigen flyers. Dennis Jacobs, serial number 486, wrote a most interesting progress report on his project and mailed to the members of the VariViggen Club. This is the way to keep up your enthusiasm for your project and we encourage each member to write up a report.

George Craig stopped by at RAF recently and he reports good progress on his Vigen. George is working on the canopy now.

Mike and Sally's Vigen N27MS has been flying a little more than usual recently, proficiency, annual inspection, etc. and it is performing as good as ever.

A poem by Debbie Pearsall.

Those awesome boxes all came in on 18 wheels that day.  
I hardly knew just what to think or just how long they'd stay.  
As each revealed it's contents of epoxy, foam and all,  
it seemed the lot was endless - - - it soon was wall to wall.

The task at hand was hardly known, yet he was surely ready.  
At that time it was hard to grasp, he'd still be working steady.  
The endless hours of reading prints and diagrams that blur were long and sometimes longer 'cause he knew he must be sure.

And I stepped in to help sometimes, when 2 hands weren't enough.  
The hot wire cutter moved with ease, though sometimes it was rough.  
I stirred and mixed epoxy and helped with fiberglass. I even helped to flip the plane,  
out front amidst the grass.

The living rooms not art nouveau, right now its art 'de

plane". At this time, gracing one full wall, not one, but 2 wings span.  
Our Heather's beds been covered, since that first shipment came. And Eric's too, from time to time,  
has looked about the same.

Now free times always taken up; he's always working steady.  
First the canard and then one wing and finally 2 are ready.  
Each finished step draws closer still that ever reaching goal.  
And that is usually all it takes to keep him on a roll.

I stand inside the doorway and look out past the piles.  
I think about how far we've come, first inches, then in miles.  
I realize that love is not just saying "I love you".  
Its letting someone that you love do what they want to do.

He soon will see the end of what he's striving for each day.  
And sometimes I will back him up and sometimes I will pray.  
That when that first day comes and he goes reaching for the clouds.  
He'll soar among the eagles and feel extremely proud.

VOYAGER

Around the World, Non-stop, Non-refueled.

The VOYAGER is in its final stage of construction and with some last minute systems work, it will be ready to take to the air this summer.  
As this 100 foot plus wing flying machine takes shape on the hangar floor, it is indeed a sight to behold.  
We are honored to know that the Smithsonian's National Air and Space Museum (NASM) has requested the aircraft be added to their prestigious collection along with the Wright Brothers, Lindbergh, Wiley Post, Amelia Earhart and so many others.

We have had a lot of help from people, who like us, have been caught up with the concept of world flight on "one tank of gas", and who have so generously contributed their time, effort, materials, hardware and moral support to the project.

We have also had many requests from individuals to be a

part of the VOYAGER project. I wish we could put all of you to work sanding on the aircraft (its big!!!), but we can't. So far, we have kept the project somewhat on the grass-roots level.  
To allow a wider participation in the VOYAGER project, we are considering establishing a V.I.P. Club (VOYAGER'S Impressive People). Contribution levels would range from placing your name in the VOYAGER log books (which will be enshrined in NASM), to invitations to attend special events, to autographing the aircraft itself.  
If you would be interested in helping through this type of membership, let us know. If the response is encouraging, we will proceed. Strong V.I.P. participation may allow the grass-roots effort to complete the entire VOYAGER project.

This is the last great milestone in the history of atmospheric flight. We would very much like to share this flying adventure with you.

Your VOYAGER Pilots  
Dick Rutan and Jeana Yeager.

\_\_\_\_\_ YES. I would like to contribute to the VOYAGER IMPRESSIVE PEOPLE (V.I.P.) Club.

\_\_\_\_\_ NO. I would not be interested in contributing in this manner.

Name \_\_\_\_\_

Street \_\_\_\_\_

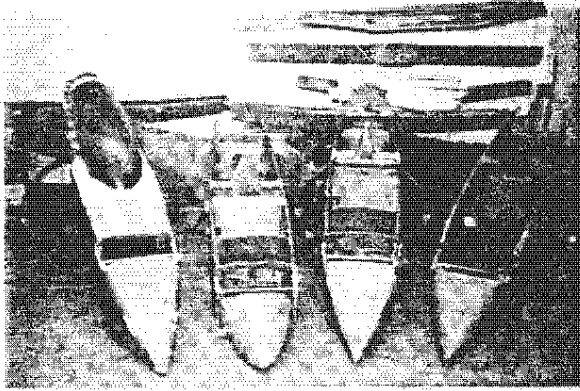
City/State \_\_\_\_\_

Zip/Phone \_\_\_\_\_

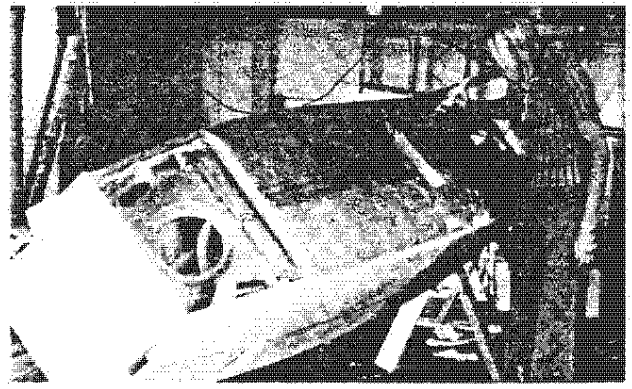
Comments \_\_\_\_\_

MAIL TO:

VOYAGER AIRCRAFT INC.  
Hangar 77, Airport,  
Mojave, CA 93501  
(805)824-4790



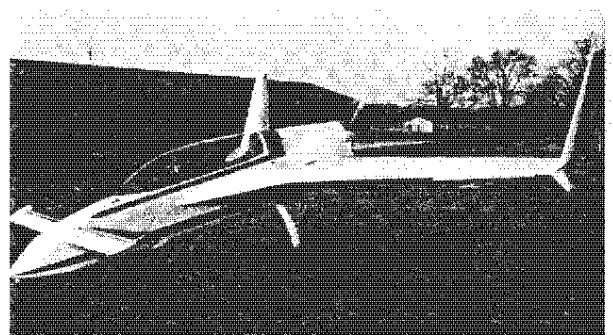
They call themselves "the hole in wall gang". Reason is the shop is in an attic and there will be a "hole in wall".



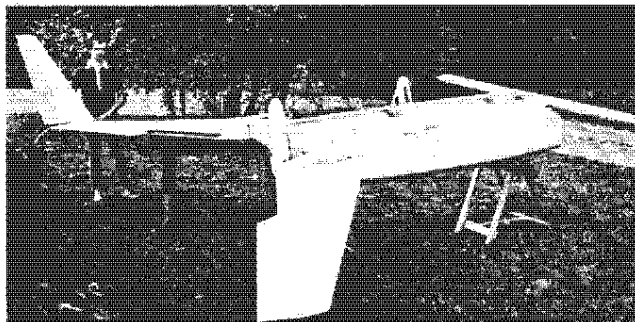
Pat Krause stipling away at her Long. Pat is also putting together the RST radios.



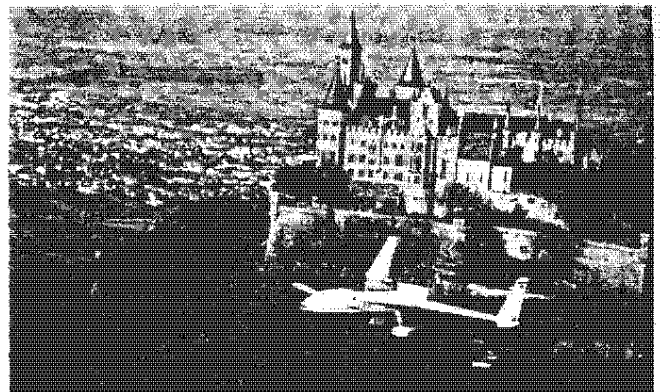
Randy Pflanzler's project coming along. What amazes us, is how super clean your shop is Randy.



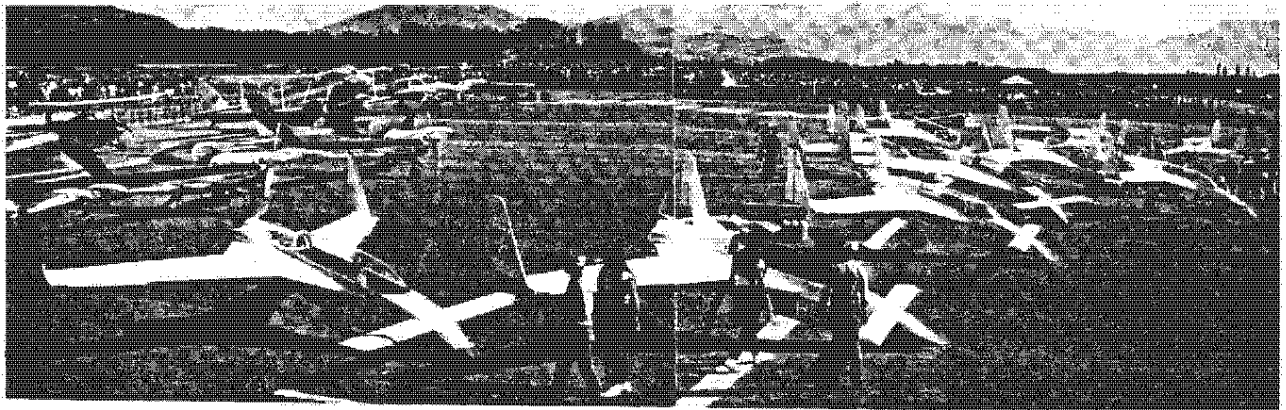
Michael Zimmermans' super VariEze



Mr. Vigaire's project in France. We have quite a few builder/flyers in Europe.



The first Long-EZ to fly in Germany belongs to Roland Heier. What beautiful countryside to fly over.



What a neat sight! 9 VariEzes and 1 Long-EZ at a flyin at Annemasse, France.

# DEFIANT

## HOMEBUILT- FOUR-PLACE TWIN

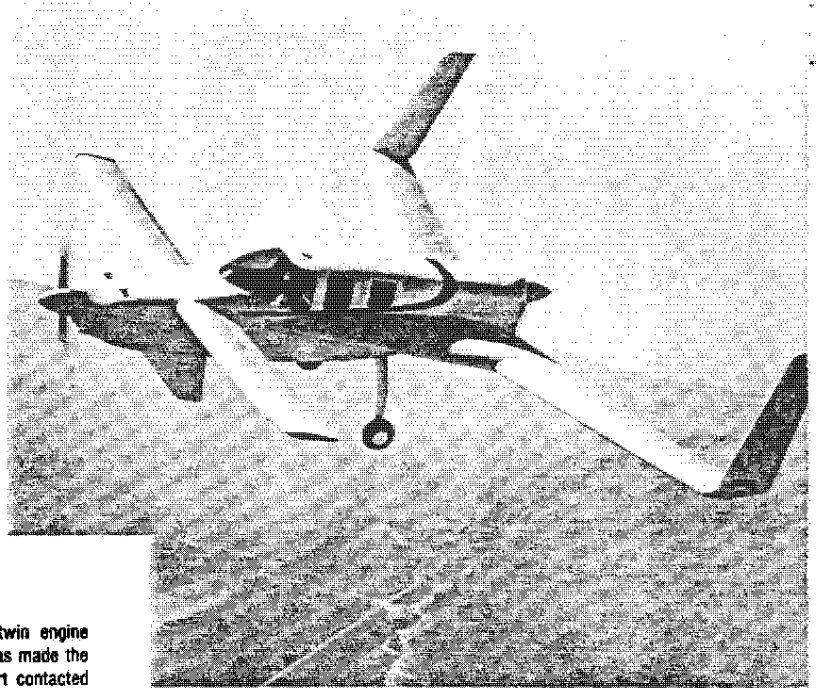


Photo by Don Downie

### 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-aft-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.

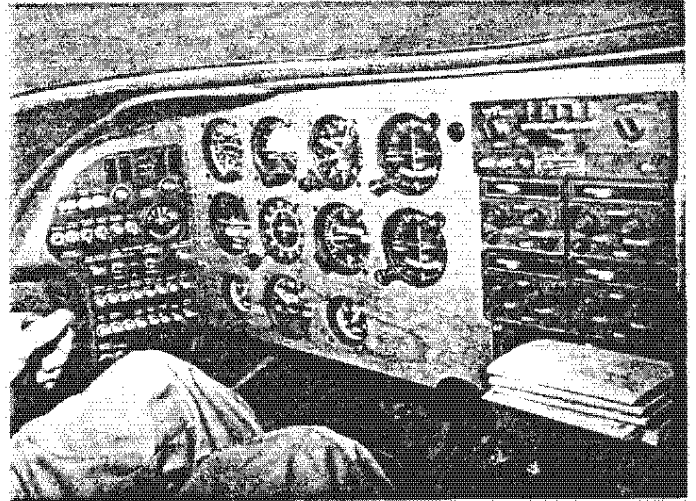
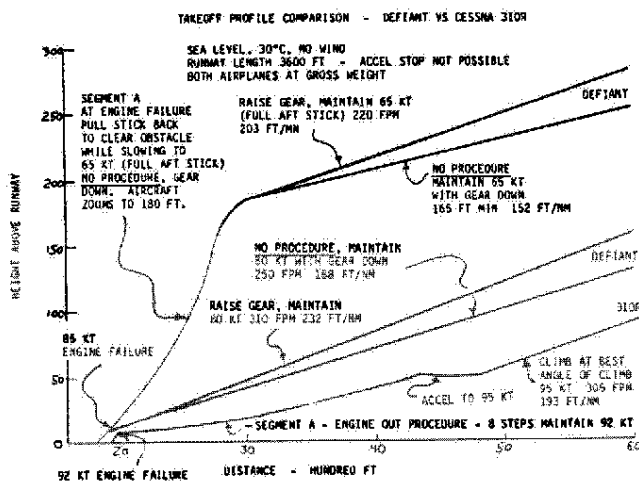


Photo by Don Downie

## 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. ft.                          |
| Seat Down                                | 41 cu. ft.                            |

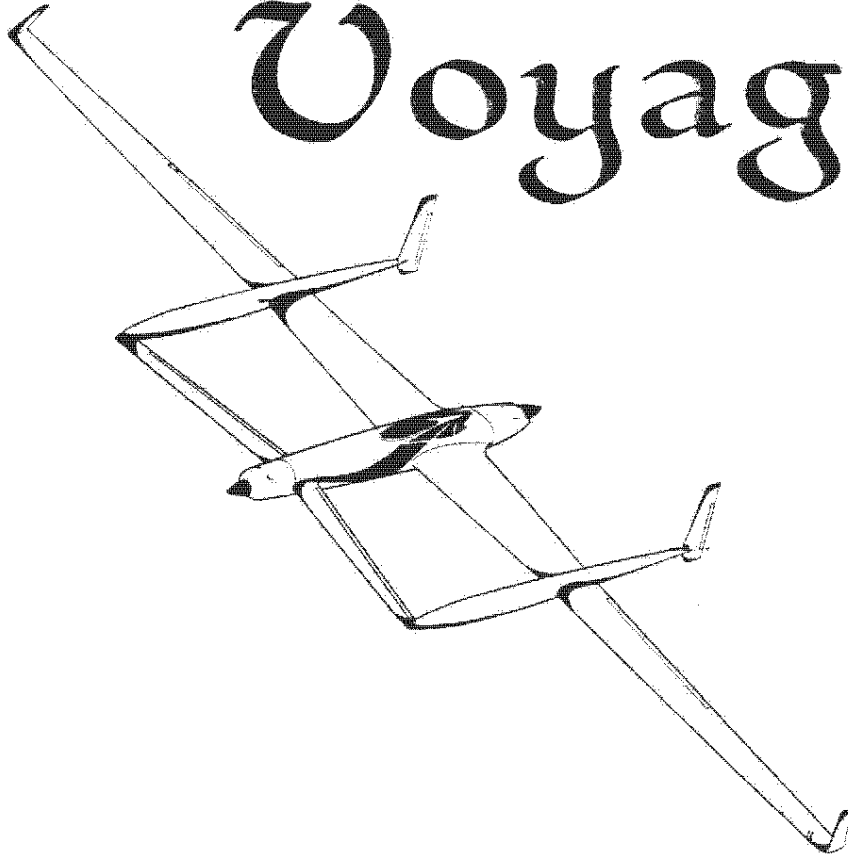
## COST AND TIME TO BUILD THE DEFIAINT

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-Ez's", 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.

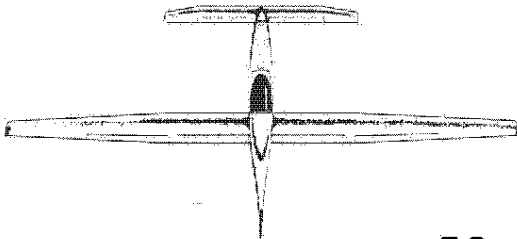
Time to build the Defiant, again will be "two Long-Ez's" as it is the same type of construction, just more. A competent builder can build a Defiant in as little as 2000 man hours. Until the plans are completed, it is difficult to say how many of the parts will be available prefabricated and this would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

# Voyager



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



**TO:**

**first class mail**

**April '84**

The line which appears above your name lets you know through which Canard Pusher you are paid. If your label says **LAST ISSUE CP 40**, then this is your last issue, and you need to renew.

**CP 40**