

## RAF ACTIVITIES

# THE CANARD PUSHER

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by

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If you are building a RAF design, you must have the following newsletters:

VariViggen (1st Edition), newsletters 1 to 58.  
VariViggen (2nd Edition), newsletter 18 to 58.  
VariEze (1st Edition), newsletters 10 thru 58.  
VariEze (2nd Edition), newsletters 16 thru 58.  
Long-EZ, newsletters 24 through 58.  
Solitaire, newsletters 37 through 58.  
Defiant, newsletters 41 through 58.

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.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY AND FRIDAY FROM 8:00 AM TO 5:00 PM ONLY. If you have parts that you would like us to see and/or would like to drop in, please make it Tuesdays and Fridays if you can. If you need to come other than those days, please call so we will be sure to be here. When you call on Tuesdays and Fridays for builder assistance, please give you name and serial number. It is required before you can be put through to Mike. This is a company policy and we must adhere to it.

When writing to RAF, send along a stamped, self addressed envelope if you have builder's questions to be answered. If you are placing an order, it's best to keep it separate from a request for an answer.

We apologize for the CP being late. The Pond Racer, a twin, piston engine, propeller driven, unlimited racing plane, designed by Burt and being built at Scaled Composites, has been a high priority project that Mike Melvill and some of the others still working in the old RAF building have become involved in. The main gear, elevators and ailerons have been built by this small group and will be integrated into the all carbon-fiber Pond Racer. It is intended that this aircraft will become the fastest piston/prop driven aircraft ever built and Mr. Bob Pond intends to win the Unlimited Class at Reno. A very exciting project and a real challenge to work on. The engines will ultimately develop 1000hp each, and the wing area is about the same as a Long-EZ! Should be quite a kick in the pants to fly!

The Catbird now has a fully functional S-Tec System 50, two axis auto pilot installed, thanks to Dusty Rhodes of Vista Aviation on Whiteman airport in the Los Angeles basin and to S-Tec of Mineral Wells, Texas. It took several iterations to get the auto pilot matched up to the rather zippy control rates of the Catbird ~~but it was worth it. It works so great~~ it has made all of us EZ flyers wish we had one! It is quite expensive but for anyone flying much IFR, it would be extremely helpful. Any Long-EZ or Defiant flyers who are interested in an auto pilot should give Dusty a call at Vista Aviation. He has installed several of the S-Tec System 50 auto pilots in Long-EZ's and other high performance homebuilts and was extremely helpful to us on the Catbird installation.

## FIRST FLIGHTS

Congratulations to Don Wimple who recently made the first flight of his Solitaire, N78DW, at Hemet, CA. Don is the first we know of to use the Solitaire self launch capability to make his first flight.

Congratulations to George Craig on the first flight of his VariViggen, N31GC, at Tracy, CA. George has worked on completing his SP wing version of the Viggen for almost 12 years. Good show, George.

Congratulations to John Steichen who made the first flight of his Defiant, N27EZ. John had it ready to go over 6 months ago but, unfortunately, had an incident during a high speed taxi run when his nose wheel steering diverged and the Defiant left the runway and was damaged in the ensuing ditch crossing. All that is behind him now, all repairs and modifications completed and John says it flies great!

Congratulations to Don Foreman who has finally overcome all of the problems of getting his Defiant, G-OTWO, licensed in England. Don had the English CAA overload his canard, and fail it, in a required static load test. He has had severe nose wheel shimmy, magneto problems, prop problems, his electric pitch trim system failed (he now has an excellent manual system), he had a brake lock up, he had carburetor and induction problems, but, the good news is that finally he has got all these problems sorted out and much to his delight, the CAA test pilot has conducted a very successful flight test evaluation of his Defiant and has pronounced it to be excellent. He has issued Don a permit to fly. Super job, Don. How about bringing it over to Oshkosh 1989?

### DEFIANT REPORT

There are now at least 15 Defiants flying that we know of. All of the builder/pilots who have reported to us are pleased with their Defiants, however one problem in particular has occurred to many of these airplanes. During taxi tests and high speed taxi runs, divergent nose wheel steering has occurred, sometimes getting so bad that the airplane has left the runway. John Steichen had just such a problem which caused him to leave the runway at around 70 KIAS. He ended up in a drainage ditch with a broken prop, broken rhino rudder and a failed nose gear. A devastating situation for someone who has worked so hard to get to this point. Our discussion and suggestions to John are printed here in the hope that they may benefit other Defiant builders approaching this stage.

Burt's Defiant, N78RA, has never had a divergent steering problem but it certainly

did have a few serious shimmy problems early on in the program. These problems were completely cured by rebuilding the nose gear assembly (done by Mooney at Kerrville, TX), and by the addition of an efficient hydraulic shimmy damper (no damper was installed initially). No further nose wheel shimmy or steering problems have occurred in something over 1100 hours of operation with numerous pilots.

This problem has been aggravated by a very confusing drawing put out by Mooney showing the axle centerline AHEAD of the steering pivot!! The dynamics of a trailing link nose wheel (such as the Mooney nose wheel) are such that, if the axle centerline is on or forward of a line extended down through the center of the steering pivot, the nose wheel will be neutrally stable to unstable and may diverge or dart left or right, uncommanded. If the axle centerline is aft of this line, it will be prone to shimmy. Shimmy is similar to flutter and can be instantly destructive. Uncommanded, left or right divergence can be equally destructive by driving you off the runway across a ditch. So what to do? Set the axle centerline aft of the line through the center of the steering pivot by 0.6 to 0.8 inches. Control any tendency to shimmy by installing an hydraulic shimmy damper shown in the plans.

Roger Rupp from Alaska had similar problems to John Steichen's. Rodie Rodewald, also, had divergent steering problems when his nose wheel was adjusted per the Mooney drawing. Some others who have also had varying degrees of this problem: Dr. Yost of Alabama, Don Foreman in England, Dr. George Best in Phoenix, Arizona. Some saw heavy steering divergence at low speed. Scary, but not destructive, probably caused by having the axle centerline too far forward. Some did not see this divergence until traveling much faster, caused almost certainly by the nose wheel swinging forward of the steering pivot line as the canard started lifting the weight off the nose wheel.

The nose wheel geometry should be set with ZERO weight on the nose wheel, to 0.6/0.8 inches aft of the steering pivot line using the Mooney spacer washer (SB #20-202-3, 1-1/4

OD x 1.010 ID x .120 thick, 4130 N steel finished in zinc chromate). John Steichen suggests that it may even take two of these washers, at least it did on his 4 donut Mooney nose gear. (see sketch, page 15)

Another factor that may influence the likelihood of shimmy, and/or divergence, is rotation speed. If your Defiant rotates at 60 to 65 KIAS, you may not see any shimmy or steering divergence simply because you have not reached the speed at which either of these phenomenon may have occurred. Some Defiants do not rotate until indicating 80 Kts or more. This may be caused by one or more of the following problems: Forward CG, or too far forward CG. Two large people in the front, nothing in the rear seat, no baggage and minimal fuel will put your CG forward. Fill her up with gas, and the CG will march rearward. Main gear axle centerline too far aft will cause the Defiant to act as though it has a forward CG condition while rolling on the runway but may be normal to aft CG once airborne. Having the main gear too far aft will really extend the take-off roll and will require a higher than normal rotation speed. This is tough to fix. Take great care while ~~building not to end up with this problem.~~ Do not be tempted to move the axle centerline forward either, because this will result in a real problem when loading baggage. The Defiant may tip over on its winglets and could break the prop. Put the main gear axles where the plans call for them to be. Ground attitude. A nose down ground attitude puts the canard and the wings at a negative angle of attack during the take-off roll and can greatly increase the rotation speed causing you to use a lot more runway and putting your nose wheel at risk due to excessive speed. Even a correctly set up nose gear may shimmy if it hits ruts or bad bumps at too high a speed. If your Defiant sits nose low with both engines installed and some fuel, perhaps 1/3 on each side, you have a problem. Burt's prototype, N78RA, with the above conditions sits with the flat bottom (from forward firewall aft 3 feet or so) slightly nose up. Check with a two foot level held bubble level. (see sketch, page 15)

If your plane is not close to this angle, you may have to change the ground attitude. The easiest way to do this is to cut some amount off the main gear strut. You will have to determine how much by calculation after doing the above check. NOTE: You should push the airplane forward on a level ramp at least 100 feet to allow the main gear to relax to its natural position (this is driven by wheel toe-in/toe-out. Your wheels should not toe-out. They should be zero toe-in to a maximum of a total of 1/2° or 1/4° each wheel). If it sits nose low at this point, jack the nose wheel up or shim it with scraps of lumber until you have the required nose up attitude. Now measure the stack of lumber scraps under the nose tire - this is the amount you will have to cut from each main gear strut. The only negative side to cutting the main gear strut is, of course, less rear prop tip clearance. This is not too much of a problem with a Defiant since the rear prop has much more tip clearance than, say, a Long-EZ. The added work of remounting the axles will be well worth the effort. While you are at it, it is best to mount the brake caliper on the forward side of each strut. Better ground clearance with a flat tire and a better brake line run inboard of ~~the strut which gives more flexibility to the~~ brakeline to allow the caliper to move laterally with brake pad wear. One more important point - all Defiants should be using low profile tires, Goodyear 15x600x6. If you use standard 600x6 tires, you will set your axles approximately 1-1/2 too high.

There is one other way you can help lower your rotation speed. It consists of reflexing both ailerons trailing edge up by adjusting the fore/aft aileron pushrods in the wing roots equally to raise the trailing edges of each aileron up to a maximum of 3/16" (measured at the outboard tip of each aileron relative to the wing trailing edge). This should be done with caution and in small increments with careful flight testing after each adjustment. The effect of reflexing the ailerons is a nose up trim change. This will lower rotation speed but, and this is important, it will also allow you to command a higher angle of attack and this may cut down on the stall margin of your main wing. If at any time you see uncommanded wing rock, even if you can null it out with a stab of the aileron, DO NOT

reflex the ailerons any more. Our experience has also shown a small aileron authority increase with reflexed ailerons. This is a test worth trying but we believe you should have some experience in your Defiant first. You should approach this kind of testing in a professional manner, make small changes each time. Flight test each change and document the results. Use good judgement and quit if you see any roll authority degradation or any uncommanded wing rock (caused by asymmetric-flow separation on each wing, probably outboard of the ailerons). A few tufts (3" long pieces of yarn taped on the wing with masking tape) on top of each wing will give you visual warning of impending wing rock before it actually occurs.

### BIRDSTRIKE! BIRDSTRIKE!

"On the Sunday after Thanksgiving, my wife and I departed Inyokern airport (Mojave desert) for a casual Sunday morning flight in our Long-EZ. I climbed out to 5500 feet MSL (approx. 2500 feet AGL), leveled off and throttled back to approximately 150 mph TAS. I looked up just in time to see a bird about 50 feet above my flight path and several hundred feet ahead. I didn't have time to determine its direction of flight or which way I could turn to avoid it. I had probably less than 2 seconds between first sight and impact. Just before impact, the bird winged over and dove down, striking the canopy head on .....instant explosion/implosion? The canopy was shattered and completely missing from my head forward. From my head back, the canopy stayed intact.

The bird and/or plexiglass struck me, knocking my headset off and giving me a fat lip. The bird ended up in the back seat. My glasses were undisturbed.

I immediately throttled back and nosed up slightly to reduce airspeed to keep the debris from flying around and anything else from ripping out. I was in control of the airplane at all times and slowly turned for the airport 8 miles away. I reached for my headset microphone, cupped my hand around it and declared an emergency. I was later able to

put my headset on while my wife took the stick.

We proceeded to motor back to the airport at about 100 mph. The direct wind in the face was no worse than riding a motorcycle at 80 mph. My glasses stayed put with no problem. The plane flew fine and a normal landing was made.

The prop was totaled. There was a chunk missing from each blade (approximately 1" x 1/2" x 1/2") and one blade had a split from the tip toward the center about 10" long. I experienced no noticeable vibration on the flight back or in taxiing. The bird's head was missing and probably went through the prop. The leading edges of the prop were severely chewed up by the canopy fragments. The webfooted bird (Duck??) weighed in at 1-1/2 pounds. My wife was bloodstained but unhurt with a duck in her lap.

My canopy was formed from 1/8" thick plexiglass. The manufacturer increased the thickness for Long-EZ canopies to 3/16" a few years ago.

Prop and canopy: On order!

Gary Spencer"

### EDITOR'S COMMENT

Char and Gary Spencer's experience with a birdstrike that broke the canopy is the first reported EZ incident of its kind. Gary remained cool and FLEW THE AIRPLANE and with no further problems, made a safe landing at his home airport. Congratulations, Gary!

We have had several reports of birdstrikes on the canopy, as well as other parts of the airframe, but none resulting in a broken canopy. Now we hear from a Texas Long-EZ builder/flyer who inadvertently took off without latching his canopy. His safety catch had been bent so it did not catch as it should have and the canopy opened rapidly, and with enough force to fail the "throw over" canopy stay bracket on the canopy frame. This allowed the canopy to open beyond its normal position and smash into the right fuel strake, breaking the plexiglass canopy into small

pieces. This occurred right after lift off and, to make matters worse, it was raining! Well, our intrepid pilot remembered to FLY THE AIRPLANE. He ignored the canopy problem, slowed down to cut down some of the stinging effect of the rain and flew a normal pattern back to a safe landing on the same runway he had so recently departed from. Apart from the stinging raindrops, he suffered more from hurt pride than anything else. His canopy frame was in perfect shape, all the plexiglass was gone, but incredibly, there was no damage to his prop! Presumably, the pieces departed toward the right winglet with enough velocity to completely miss the prop. He reports that the Long-EZ flew OK, he had no trouble maintaining control or in making a normal landing. Now he is faced with the unenviable job of replacing the plexiglass canopy.

All of this goes to show that as long as you continue to think and continue to FLY THE AIRPLANE, you can fly away from even this kind of a serious emergency problem. Replacing the plexiglass is tedious, hard work but it can be done, and it's a lot easier than trying to repair a badly damaged airplane - or worse.

- 1) NEVER fly with your canopy warning system inoperative - NEVER EVER.
- 2) CHECK YOUR SAFETY CATCH FOR CORRECT FUNCTION BEFORE EVERY FLIGHT, it could save your canopy or even your life. - NEVER FORGET that there have been several fatal accidents because the canopy opened on take-off or in flight.
- 3) IF you are unfortunate enough to have an emergency situation such as an open canopy in flight, if you do nothing else, FLY THE AIRPLANE, then, and only when you have the airplane under reasonable control, you might consider what else you could do.
- 4) When pilots are faced with an emergency, frequently their first problem is realizing (or admitting) that it is an EMERGENCY. That is the first switch that must be thrown. After the pilot accepts that he or she has an emergency, and is FLYING THE AIRPLANE, and has reasonable control, obviously the flight may have become non-standard to some degree or other, depending on conditions, careful evaluation of the situation must then determine the extent of deviation from normal

procedures. You must get back on the ground as quickly and as safely as possible, but NEVER exceed your own capabilities. If necessary, declare an emergency, but get an immediate clearance for any runway (if at an airport). You may have to land downwind, or crosswind, whatever. Keep your cool, watch your speed and make as normal a landing as possible, depending on the circumstances.

PREVENTING CARB ICE using a Teflon coated throttle plate, shaft and screws plus a gasoline icing inhibitor.

Long-EZ builder/flyer Ken Clunis sent us a copy of *Mechanical Engineering Report LR-536* from the National Research Council of Canada titled "Aircraft Carburetor Icing Studies" by L. Gardner and G. Moon. This report is quite extensive and obviously very carefully researched. The summary of the test results states: "A study has been made of the effects of gasoline icing inhibitors on aircraft carburetor icing. An engine test was developed and used to evaluate various types of icing inhibitors. The results obtained showed that aircraft carburetor icing can be prevented by the inclusion of additives in the gasoline."

The use of a Teflon-coated throttle plate to prevent ice adhesion was studied and found to virtually eliminate any ice formation on the plate. The use of ethylene glycol monomethyl ether (EMGE) at 0.10 to 0.15% by volume in the gasoline and the Teflon-coated plate was shown to prevent both carburetor and fuel system icing".

Ken has followed up on this report and has had his shaft, screws and throttle plate Teflon-coated. He is currently running his Long-EZ with these parts installed and is using Prist "Hy-Flow" (not "Lo-Flow" which is alcohol based and may be hard on your epoxy in the fuel tanks), which he says is the best source of EMGE. He has installed a carburetor temperature gauge and is very pleased with his results so far.

Ken says that he had his carburetor shaft, screws and throttle plate Teflon-coated (black) at: Durable Release Coaters, Ltd.  
4 Finley Road

Bramalea, Ont., L6T 1A9  
Canada  
416-457-2000

His contact there was Dave Lund, himself a well informed expert on carb icing. There is a \$75.00 minimum charge. If enough people wanted to get it done, the price would run about \$15.00 for shaft, screws and plate in quantities of 10. We sure appreciate the effort Ken put out to obtain this information. It sounds like an excellent preventive measure that EZ/Defiant pilots may wish to try.

#### FUEL SELECTOR VALVE UPDATE

In CP-57, we discussed the sticking fuel valve problem which is not a problem to be taken lightly. At least one VariEze has crashed due to a stuck valve and the FAA has contacted us asking us to do something about this problem. The Whitey stainless (or brass) valve is a good valve, uses Teflon seals against a ball, and it turns nice and smoothly. The major disadvantage is the configuration. It is not a bolt in direct replacement. It requires a new mounting bracket and the intake is located on the bottom of the valve, making it more difficult to install.

Yesterday, we saw the best fuel valve we have ever seen. It is a direct, bolt-in replacement for your existing weatherhead valve. It uses the same elbows and nipple in the same orientation but, best of all, it turns smoothly and freely with a very positive spring-loaded ball detent system which lets you feel that you are in the left, the right, or the off position. The handle cannot be installed incorrectly and it is not a tapered plug design which can be prone to sticking. It has a parallel shaped valve body that uses replaceable "o" rings. The whole valve comes apart with two snap rings for easy maintenance. It is made of hard, anodized aluminum and is very light. OK, so what's the catch? The perfect valve, right? Yes, but - Wicks Aircraft will need at least 50 firm orders before they will be able to stock them. They will sell to the homebuilder for \$118.65! A lot of money, but then again, what is your life worth? And maybe the life of a loved one or friend? A stuck valve can ruin your day. For \$118.65, this problem which has been

ongoing for several years now, will be gone forever. If you would like to have one, write or call Wicks and place an order. When Bud Myers has 50 orders, he will get them in stock and this fine fuel valve will, hopefully, eliminate this "sticky" problem once and for all.

#### FUEL BOOST PUMP UPDATE

CP 57's fuel pump alert caused many letters and phone calls and there still appears to be much confusion.

RAF recommends, as a first choice, a Facet boost pump with 37° x 3/8 flare fittings and with a nylon foot valve on the inlet side and a nylon plunger valve on the outlet side. The Facet part numbers for this pump are:

40108 - 12v 6 psi max. 4.5 psi min. 37° flare

40154 - 24v 6 psi max. 4.5 psi min. 37° flare

If you do not want to install the aircraft style 37° x 3/8 flared fitting type pump, due to plumbing requirements or space or whatever, the next best choice would be to use a pump with 1/8 - 27 national pipe thread internal or female threads, requiring elbows such as AN822-6 to go to 37° x 3/8 flared fittings.

40106 - 12v 6 psi/4.5 psi, 1/8-27 NPT internal threads.

40082 or 40164 - 24v 6 psi/4.5 psi, 1/8 -27 internal threads.

Facet does not manufacture a 3/8 - 18 internally threaded pump that meets the 6/4.5 psi fuel pressure requirement with nylon valves. For this reason, RAF is not recommending the larger internal thread style pumps. Anyone who is using one of these pumps should be very aware of the fact that while the outlet plunger valve may be nylon, the intake valve is Buna or rubber and is a check valve, not a foot valve. A check valve will maintain full fuel pressure on your fuel system down stream of the fuel pump and against your needle and seat float valve in the carb. This is not necessary nor is it desirable in any RAF design. If you are using one of these pumps, a careful inspection of the

intake valve at least once a year is strongly recommended.

Ian Wilde from Olney, England, a Long-EZ builder/flyer, sent this information in and we have included it here to help those builder/flyers of RAF designs in England. "Facet fuel pump, #40108 is not easily obtainable here in England, however, I am told by the Facet agents that #40105 is the replacement for 480615 and that this pump has all nylon parts. (40105 has a maximum fuel pressure of 4.5 psi which should be OK - all the pumps RAF is now recommending have a 6 psi maximum). Price in the UK is 30.00 Sterling. Better still, the plunger assembly of #480615 can be replaced with an all nylon assembly as per #40105 at a cost, including labor, of 10.93 Sterling, including tax and postage. I have had mine modified and I am very happy with it. Anyone interested should contact the Facet agent:

FSE Fuel System Enterprises)  
180 Hersham Road  
Hersham  
Walton-on-Thames  
Surrey, KT12 5QE  
Phone: 0932 231973  
Telex: 925109 Fuelit

My contact was Mr. Peter Huxley"

### FUEL FLOW CHECKS

As called out in CP 53 have caused a number of builders some confusion. We even re-checked our numbers to be sure we had not made a mistake! Mike and Sally's Long-EZ and Burt's Defiant are both relatively old (8 years and 11 years) and the electric fuel boost pumps were also this old at the time of the tests, as were the mechanical fuel pumps.

Since we have installed new Facet electric boost pumps on both of the above aircraft, we also cannot get the fuel flows called out in CP 53. We believe that the foot valve springs in the new pumps must be creating enough restriction to fuel flowing by gravity, that it is impossible to obtain the flow rates called out in CP 53. Of course, the "fuel pump on" tests are still relevant and nothing has

changed in this test. We believe, now, that the gravity flow check must be conducted by removing the gascolator bowl or breaking the fuel line at the gascolator. You should be able to achieve the flows shown in CP 53 using this method for the gravity flow check. You should re-connect the fuel line at the gascolator for the "fuel pump on" test and break the fuel line at the carburetor. Again, you should be able to achieve the flows shown in CP 53. If you cannot get at least the correct flows shown, you may have a restriction in the fuel lines or fuel valve. This restriction must be cleared before flight.

### LONG-EZ AILERON BELHORN FAILURE

RAF has recently received two separate reports of failures of one of the CS132L weldments, the belhorn, which drives the aileron out in the wing roots. One of these belhorns has had lightening holes bored through the .050 steel belhorn and it cracked through one of these holes. However, the second one was as received from Brock and it cracked across at the edge of the weld around the tube. Prior to the failure of the belhorn this builder pilot had had to replace the rod end that bolts to this belhorn, at least twice over the past 350 flight hours, due to the rod end being "pounded out" until it was dangerously loose.

The belhorn failure occurred in flight and caused a few moments of concern, but in both cases the Long-EZ was easily controlled. A disconnected aileron will float trailing edge up. To keep the wings level, the pilot has to raise the trailing edge of the operable aileron which, of course, will give a nose up pitching moment requiring forward stick to fly level. The one operable aileron will provide reasonable roll control and, of course, the rudders will roll the airplane by themselves. The greatest hazard would be if the disconnected aileron pushrod, being loose in the cowling/root of the wing area, ever managed to get itself jammed. Depending how much lateral input there was at the time, you may or may not be able to correct the roll with rudder.

A primary control system failure is cause for strong concern so we at RAF have designed,

built and flight tested a new aileron belhorn. Drawings for this new part have been sent to Ken Brock Mfg. and Ken will have these parts available as soon as possible. We will provide a drawing of the new belhorn in this CP for those people who would like to make these parts themselves. (see sketch, page 15)

Why would this belhorn fail on two relatively low time Long-EZs when we have literally dozens of Long-EZs with 1000-plus hours and some with 1500-plus hours with no failures and zero wear on the rod ends? Bill Freeman, Long-EZ builder/flyer and a man whose specialty is working with vibration problems and who has a Master's degree in Mechanical Engineering, has a theory with which we concur. The original control system with aluminum push rod tubes apparently was OK. The natural frequency of this collection of parts was not the same as the normal cruise excitation frequency of the engine/prop. Changing the aluminum tubes to steel as called out in the CP may have moved the control system into the excitation frequency of the engine/prop combination. Bill says that this strongly suggests to him a spanwise vibration of the CS132L belhorn and CS129L pushrod at, or near, its natural frequency, inducing a high-cycle fatigue failure in the CS132L belhorn. The fact that the rod end bearings were beaten out is strongly suggestive of a resonant vibration of the CS132L and CS129L pushrod. This vibration would have the bottom end of CS132L and the aft end of CS129L moving spanwise, bending CS132L in the weak direction with high enough stress levels to initiate a fatigue failure in CS132L.

The new part, part number CS132L-R, has two arms instead of one which will more than quadruple the stiffness of the system and will also provide redundant links in the aileron system as well as providing positive retention of the rod end in the event of a ball slipping out.

If you absolutely insist on flying before the new belhorn is replaced, a careful examination of your CS132L belhorns are mandatory. Use a bright light and a magnifying glass. Examine the area shown in the sketch while gently flexing the CS132L

left and right. Any sign of a crack starting requires immediate grounding of the aircraft until the new CS132L-R is installed. Examine the rod ends bolted to the CS132L. Look for a loose ball, or play in the rod end in the fore/aft plane. A worn rod end must be replaced before flight and you should realize from the above discussion that a worn rod end almost certainly indicates that a belhorn failure is imminent. If you have steel tube push rods (CS132L), your belhorns are definitely more suspect. If you have worn rod ends, do not fly until you replace the belhorns and rod ends. Even if everything looks OK, replace belhorns within the next 25 hours of flight. The CAD plated CS132L belhorns should not be painted since the paint may hide a crack.

This is a serious matter and should not be ignored. A primary control system failure could result in a serious accident.

Please report any cracked or broken belhorns to RAF along with the number of hours on the airplane, whether you have aluminum or steel push rod tubes and if you have experienced rod end wear or failure.

#### AILERON VIBRATION

Below is an excerpt of a letter received at RAF recently.

"Thanks for all the good newsletters. Just to clarify, I have had aileron flutter (see Ed. note). At 10 hours, I noted a lot of aluminum dust behind the aileron hinges. In flight, I visually could see the tip of both ailerons as a 1/4" blur. I added leading edge weight and installed the Teflon hinge pin setup. At this point, I had no visible vibration at 2000 ft at 120 mph, but still had vibration at 8000 ft., 160 mph. It remained this way for many hours of "hauling rides" but less than 5 cross country hours. Note: I never was able to detect any vibration on the stick.

I recently put more weight on the right aileron which was still vibrating slightly at altitude. This extra weight was along the outboard end where I had previously not had any. This



finally cured the problem. Now the ailerons hang with the top surface level. Note: The problem occurred when the ailerons balanced bottom surface level as per plans. Note: Both ailerons had this problem. The left aileron is very accurate dimensionally, the right's trailing edge rises 1/4" in the outboard 8" from a straight line. Also, I have a good surface finish, laminar flow, as evidenced by wing drop before the vortilons.

It is very hard to see the trailing edge of the aileron and difficult to decide if it is indeed vibrating 1/4" or if your eye is just not that sharp, but having fixed it, I can verify that it was not an optical illusion.

I feel that many Long-EZ's probably have this problem and their pilots are not aware of it. Again, there is no indication of stick vibration.

Larry Bush"

#### EDITOR'S COMMENT

We have published Larry's letter as he wrote it because we believe he experienced the same phenomena described above: Engine/prop excited "forced vibration" driving his aileron at the same frequency as the engine/prop. "Flutter" is an aerodynamic condition and is normally divergent, i.e., expands to destruction. "Forced vibration" can continue as long as the source (engine/prop) is maintained near the same frequency as the natural frequency of the aileron. By over-balancing his ailerons to the top limit as called out in the plans, he has (1) changed the mass of his ailerons thereby lowering the natural frequency of the ailerons and, (2) repositioned the CG of the aileron relative to the hinge, thus reducing the "forced vibration" input.

If your ailerons are vibrating at the trailing edge as Larry's were, you must add more leading edge weight. Note: We checked several Long-EZs here at Mojave and none of them exhibited any visible vibration at the trailing edge, however, all of them show some signs of aileron hinge wear (black aluminum dust on the aileron, particularly after flying through moisture).

Keep in mind that it may be difficult to spot. Have a passenger in the rear seat look at the aileron trailing edges very, very carefully. Spend at least 30 seconds staring at the ailerons in level flight, in a climb, in a descent, and in left and right turns. If any vibration is seen, re-balance the ailerons.

The easiest way is to get some lead ribbon from a golf pro shop and stick it to the top of the aileron leading edges, full span, until it balances top skin level. Lay up one ply of BID to permanently secure the lead to the aileron leading edge. (see sketch, page 15)

We would like to thank Larry Bush for the excellent feedback on this situation. This is the kind of information we all need to know about in order to keep the large fleet of EZs flying safely and consistently.

#### 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.

<u>Category</u>	<u>Definition</u>
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<u>MAN-GRD</u>	Mandatory - ground the aircraft. Do not fly until the change has been accomplished.
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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 affect flight safety.

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MAN-GRD: Long-EZ and VariEze - see section on belhorn failure. Replace aileron belhorns within the next 25 hours of flight. If ailerons are vibrating, you must re-balance.

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help. Please submit any significant plans changes that you may come across as you go through the building process.

## SHOPPING

### WICKS AIRCRAFT SUPPLY

Wicks has Neoprene and fiberglass baffle material in stock, Part #CCM36. This is an excellent material to seal the gap between the aluminum baffles and cowling.

"The best fuel valve we have ever seen", will be in stock at Wicks soon. Part #6S122. It is a direct, bolt in replacement for your VariEze, Long-EZ or Defiant, and it is all "O" ring seals (replaceable) with a very positive spring and ball detent system. Place your order with:

Wicks Aircraft Supply  
410 Pine Street  
Highland, IL 62249  
818-654-2191

DIGITAL TACHOMETER. In the past, we at RAF have not been too impressed with digital tach's, however, the current lack of a really accurate analog tach has prompted us to look at this situation again. The Braal Tach 1 is tiny, (1.2 x 2.17 x 2.67 deep) but easy to read. A digital tach which is accurate to plus or minus 2 rpm! It only weighs 8 ounces and uses an infrared sensor (optical reflective switch). This must be cleaned once a year. It is easy to install. It comes with sample rates of 1/2 second, 1 second, and 2 seconds which allows you to choose a tach to suit your needs. Probably the 1 second would be best for use in an aircraft such as an EZ. Very accurate leaning can be achieved with a tach as accurate as this, but if super economy is your bag, the 1/2 second tach might be the best choice.

For Lycoming installations, the installation kit includes bracketry to mount the optical sensor. For Continental powered EZs, you will have to build your own simple mounting bracket. The manufacturer recommends an internally lighted tach if you intend to mount it down low or horizontally on a console. We recommend you mount it as a "head's up" display as high as possible in your panel. For this, you can get away with a non lighted tach. Prices range from \$165.00, non-lighted, to \$190.00 for the internally lighted model. Both models have a one year warranty on parts and labor. For more information contact:

Braal Micro Instruments, Inc.  
160 Eastman Lane  
Petaluma, CA 94952  
707-763-9377

### AEROGRAPHICS

Number 1 in aircraft lettering. We agree! The service is great, next day or overnight delivery is available on lettering or "N" numbers in 50 different styles in sizes from 1/4" to 24" tall in every color imaginable.

Call, toll free, to place an order or if you just have questions. We used Aerographics on Catbird and Scaled Composites' new mini business jet. The "N" numbers look beautiful

and are easy to install and are as thin as paint. Call:

1-800-336-9633.

#### LONGER POT LIFE FOR STERLING PRIMER FILLER.

Nat Puffer, VariEze builder and COZY designer/builder, reported to us that Wicks Aircraft will be stocking a new catalyst for U1761 Sterling Primer. Sterling makes an excellent urethane primer but in the past, it has been a material that many builders have found develops pinholes! By the hundreds! Pinholes! Also, the pot life has been very short, making it difficult to spray and clean you gun out in time. Well, Nat assures us that using the new catalyst U-1000C, the pot life is almost 6 hours and virtually eliminates pinholes. U-1000C is available in quarts as well as gallons. Thanks, Nat.

#### VOYAGER - THE WORLD FLIGHT

*The Official Log, Flight Analysis and Narrative Explanation* by Jack Norris. Comes three ways, Regular copy, \$12.95 (exactly as on file in the official records and archives). Autographed copy, \$15.00 (personally signed by Dick and Jeana). Personalized gift copy, \$20.00 with your name written, a thanks and autographs by Dick and Jeana.

This log contains every detail of "how and why" the Voyager flew around the world on one tank of fuel, written by the technical director in Voyager Mission Control. Contact: Jack Norris.

PO Box 7663  
Northridge, CA 91327  
818-360-1105

#### CANARD PUSHER INDEX

"Response to Canard Pusher Index that was discussed in CP57 was much greater than I had expected! All orders have now been shipped and I have a good number of Digest copies ready for immediate delivery.

After a long period of deliberation, I've decided to publish quarterly updates to the

Canard Pusher Digest. Compiling the Digest set me nearly a year and a half behind on my own Long-EZ project, and I was initially hesitant in taking on the task of compiling updates - a task which will no doubt put me even further behind. However, nearly all of you who ordered the Digest expressed a desire for the updates, so I feel somewhat obligated to make them available. Updates will be compiled so that the new information can be inserted at the front of each affected Digest chapter.

Effective 15 February, all new orders for the Canard Pusher Digest will include Update number 57. Update 57 contains information from CP57 necessary to update the basic Digest package. Also effective 15 February, the cost of the Digest will be \$53.00, plus \$4.00 shipping. This cost increase is necessary to cover the additional cost of the update.

Yearly subscriptions for the Digest Updates will be \$30.00. Updates will be mailed to subscribers 4 times per year, each within a month of receipt of the respective CP newsletter. I apologize for the high cost, but ~~copy costs these days are unbelievably high,~~ and I'm unable to get volume discounts due to the relatively low number of copies required. In addition, there usually will be many more pages in the update than the CP from which the information was obtained. This is because many CP articles affect more than one Digest chapter and have to be duplicated for each chapter affected. As an example, Update 57 contains 44 pages, more than double that of CP57.

Stet Elliott  
Building 12-1-2  
Governors Island, NY 10004  
212-825-0011"

#### EDITOR'S COMMENT

If you have not seen the Canard Pusher Index, you are missing a bet. It is great. We use ours almost every day and we have heard from a number of builders who feel the same way. Give Stet a call.

### DEFIANT INFORMATION

An excellent source of Defiant information from builder hints to pilot reports. Contact:

Charles Sims  
1918 Atlanta  
Deer Park, Texas 77536  
713-476-5406 (H)  
713-930-1133 (W)

The Texas Defiant Newsletter is a steal at \$10.00 per year and Charlie has all of the back issues available for \$60.00. As Charlie Sims says, "This newsletter is about builders helping builders. It is not a profitable newsletter but is intended as an exchange of information by communication".

### MAGNETO COVER SCREWS

Ever tried to remove the mag covers on an EZ? 90° screwdrivers, skinned knuckles, one or two hours of cussing and, finally, you get 'em off. Right? If you have been there, you will love these Allen screws - direct replacements - uses an Allen wrench - remove all six screws in one minute. Send \$1.00 and SASE for 6 screws to:

Mike Melvill  
Bldg. 13 - Airport  
Mojave, CA 93501

### FOR SALE

Lycoming 0-235-L2C. 600 SMOH in my Long-EZ, 125 hp, "F" pistons, exhaust system, prop extension, prop, spinner, oil cooler, baffling, vacuum pump, B&C 35 amp alternator. \$5900.00 Contact:

Gus Sabo  
2842 Brockington Dr.  
Las Vegas, NV 89120  
720-454-0078

Lycoming 0-235 Zero SMOH. Set up for Long-EZ \$4600.00. Many other Long-EZ parts. Contact:

Contact: Edwin F. Goad  
CCNP PO Box 786  
Pinehurst, NC 28374  
919-692-3813

62 x 62 Great American Prop for Lycoming 0-235/115 hp. For Long-EZ. Leading edge protection, SAE 1 flange, like new - used only 25 hours. \$450.00 plus shipping. Contact:

Mike Stolle  
9505 Candle Lane, NE  
Albuquerque, NM 87111  
505-821-3778 (H)  
505-844-0321 (W)

Exhaust system by Sport Flight for Lycoming/Long-EZ Contact:

John Hayes  
2505 Liston Lane  
Eules, TX 76039  
817-294-0975 (H)  
817-267-2771 (W)

Whelan Power Supply, Par #A413A HDA DF, 14 volt. Factory tagged 1-89. \$140.00

12 volt, DC, Quartz cabin Heater. \$60.00

Contact:  
Steve Franseen  
10196 W. Keene Ave.  
Denver, CO 80235  
303-534-8181

Accessory housing - Lycoming 0-235-L2C, PN GW16011. Cleaned - machined for fuel pump and checked. Tagged 7-2-88. \$255.00

Contact:  
Ray Ratzlaff  
Hangar 13  
Mojave, CA 93501  
805-824-4976

Accessory case for Lycoming 0-235 machined for fuel pump - \$75.00

Oil cooler adapter - \$25.00.

Oil pump housing and gears - \$15.00.

Contact:  
Marc Borom  
2171 Foxhill Dr.  
Schenectady, NY 12309  
518-370-2662

## WANTED

Small wheel pants suitable for Long-EZ with Lamb tires - maybe you have changed to 500 x 5 tires and have a surplus set? Contact:

Glen Fleming  
105 Van Dyk Court  
Lafayette, LA 70503  
318-984-8871

## RAF RECOMMENDED SUPPLIERS

Aircraft Spruce PO Box 424 Fullerton, CA 92632 714-870-7551	Wicks Aircraft 410 Pine Street Highland, IL 62249 618-654-7447
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FeatherLite PO Box 781 Boonville, CA 95415 707-895-2718	Brock Mfg. 11852 Western Ave. Stanton, CA 90680 714-898-4366
--	---

The Airplane Factory  
8300 Dayton Road  
Fairborn, Ohio 45324  
513-864-5607

The above suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

## ACCIDENTS AND INCIDENTS

A California VariEze suffered an engine failure over the airport and crash landed short of the runway in two to three feet of water. The airplane flipped over and the pilot did not survive. The FAA has stated that their initial findings are that carb ice was probably the cause.

This was carefully looked into by people much more expert in these matters than we here at RAF, and their report to us was that, yes, they would have to agree with the FAA. The weather was conducive to induction icing with light rain, fog and high humidity. This pilot was in the process of fine-tuning his EZ with the intention of entering it in the CAFE 400 efficiency race. With this in mind, he was after fuel efficiency at medium power setting. He made a number of improvements to his Continental 0-200 engine but one of these

changes was probably very significant in light of the accident. He altered the intake manifold to include an expansion chamber, or plenum, downstream of the carburetor or, in this case, a throttle body. While throttle body types, in general, are highly resistant to carb ice, it is strongly suspected that the induction ice in this case probably formed in the plenum downstream of the throttle body. Tests have shown that allowing the fuel/air mixture to rapidly expand after it comes out of a venturi, or throttle body, can cause immediate and severe induction icing in the plenum and intake tubes, yet not form any ice in the carburetor or throttle body.

In view of the situation, this is very likely what happened. The builder/pilot had been experiencing power related problems since installing the new plenum -type intake manifold and had, in fact, been working on a carb heat system. He arrived over head the destination airport and reported having lost power. Visibility was poor, but he was seen on short final, gliding toward the runway threshold. Tragically, he was about 50 yards short and touched down in 2 to 3 feet of water on the extended runway centerline. The EZ pitched nose down and flipped on its back where it remained until rescuers lifted it out of the water. The plexiglass canopy was broken, the canopy frame was undamaged as were the latches and hinges. The canard failed aft on both sides, leaving a short center section of the canard still attached to the fuselage. Left and right pieces of the canard from the fuselage sides out were torn off. The fuselage was damaged below and aft of the canard. The wings and winglets were not damaged. After drying out the engine, it started and ran OK although a magneto was replaced due to waterlogging.

What can we learn from this tragedy? The pilot was unable to exit the airplane, either because it was inverted with its nose and canopy imbedded in the mud on the bottom of the shallow bay, or because he may have been incapacitated by the impact, or both. Obviously, this situation was very bad and the chances of surviving a crash landing in shallow water are very slim. Since this accident, RAF has received a number of calls and letters wanting to know how to ditch an

EZ. We honestly do not know of a safe way to ditch any fixed gear airplane. The possibility of nosing over is very high with fixed gear since the gear dragging in the water produces a powerful nose down pitching moment.

If we were faced with an unavoidable water landing, we would put the nose gear and landing brake down and we would fly into the water as slowly as possible while still maintaining control. We would not unlock the canopy because when the nose dives under water, a 60 mph jet of water entering under the canopy and striking the pilot in the face, would almost certainly be incapacitating. We would recommend carrying a canopy breaking tool such as a heavy, short bladed knife, kept where the pilot could easily reach it. After the airplane has come to rest, be it upright or inverted, if the canopy was intact, the canopy breaking tool should be used to break the plexiglass, making a large enough hole to exit through. Since an EZ will almost certainly float, particularly if it remains mostly intact, the surface would not be far away.

Prior to touch down, declare an emergency and, if possible, give an accurate position report. (A Loran would sure be handy here, since you could broadcast your latitude and longitude position.) Tighten your seat belt and shoulder harness as tight as you can bear it and brace yourself as best you can. Try for the slowest controlled touch down, no fancy stalling maneuvers, these will usually only compound the problem. Since the EZ-types will almost certainly nose over, be prepared for this. Remain calm, release your seatbelt, break out and swim to the surface.

Better yet, since a successful water landing is so uncertain, perhaps we should all seriously consider remaining within gliding distance of land at all times. EZ's were never designed with landing in water as one of the goals, and they are almost certainly not at all suited for this activity.

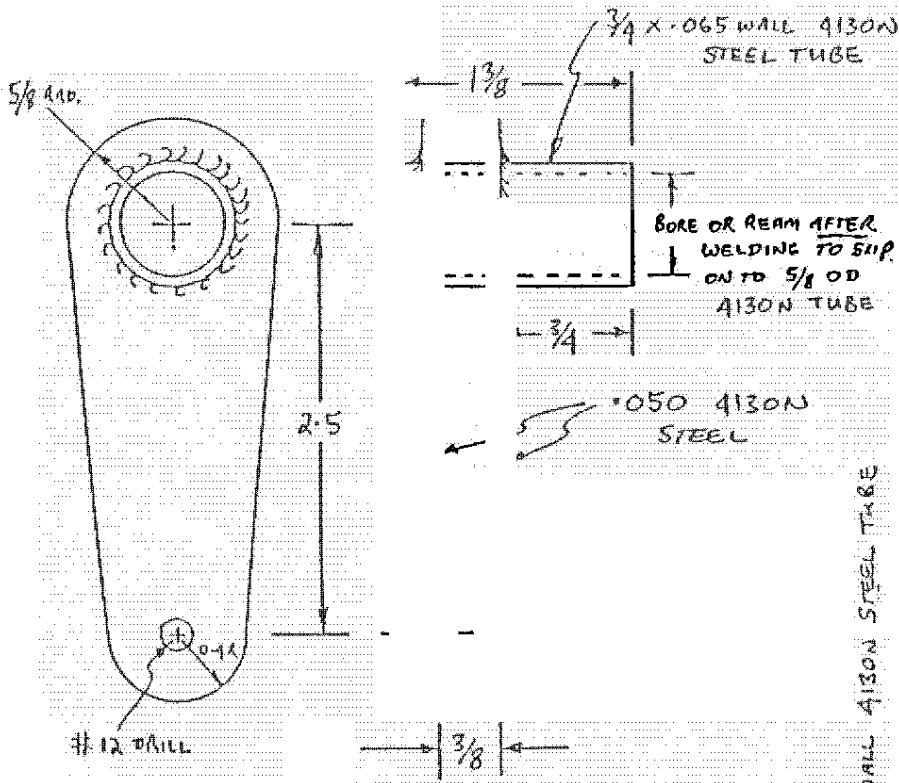
One other VariEze crash landed in water. The cockpit area broke up and the pilot found himself swimming. He made it to the beach but had a fractured back and wound up in a body cast for two months. His EZ was severely damaged and he never did rebuild it.

Surprisingly, or perhaps not surprisingly, one of the phone calls we got suggested we, or someone, should conduct a test by deliberately crash landing an EZ, preferably by remote control, in water!

#### CAN YOU HELP?

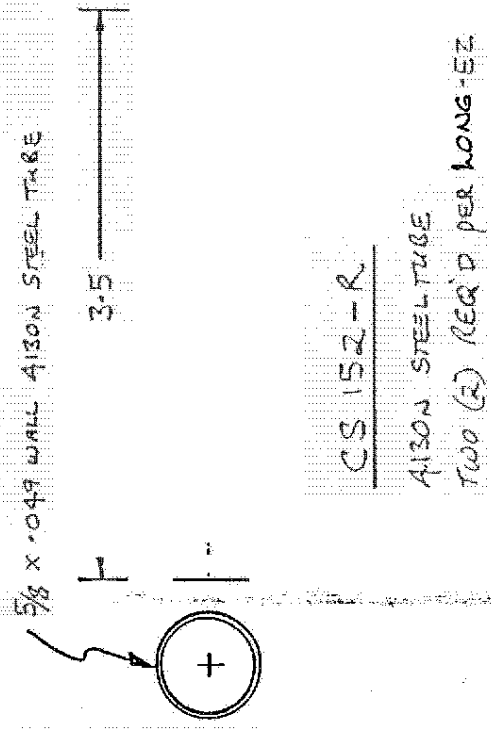
A Kansas City pilot traveled to the Grand Rapids area of Michigan where he purchased a VariEze. With no check out or weather briefing, he took off and headed for home. He landed at Peoria, Illinois for fuel. An attempt was made to repair a small gas leak in one of his fuel sight gauges before departing for Kansas City. The pilot then took off into what eye witnesses have called "marginal VFR conditions" with heavy rain, thunderstorms with tops to 41000 feet, turbulence and icing conditions reported up to 6000 feet. His last known position was 20 miles southwest of the Peoria airport. The pilot did not arrive at his destination, nor has anyone see or heard from him. His wife has been working very hard with FAA and CAP and the CAP conducted an intense search of the area for almost three weeks. Initially, the search was conducted with no snow on the ground and with good visibility, but with no sign of the VariEze.

This pilot's wife is determined to try to find her husband and has asked Burt to help in any way he can. We would ask any of you who may be in this general area, that is on a line from Peoria to Kansas City, to assist in the search. Keep in mind that a VariEze is tiny. If an EZ crashed into a wooded or brush covered area, it may not even look like a VariEze any longer. If you are flying over this area, look for anything white, not necessarily the shape of a VariEze, and please report anything to the CAP in Kansas City (phone 618-256-4815) or, if anyone knows of this VariEze, N234EZ, having landed somewhere else, please contact Mrs. Jo Ann Wilson, phone 913-888-5023.

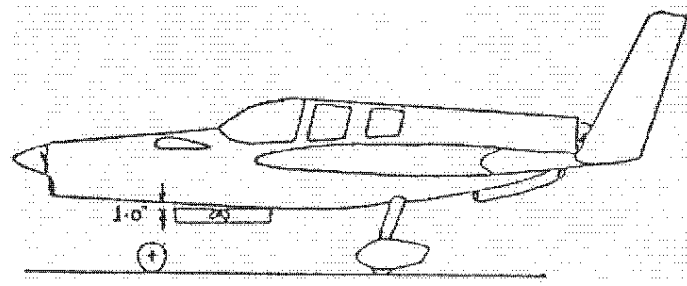
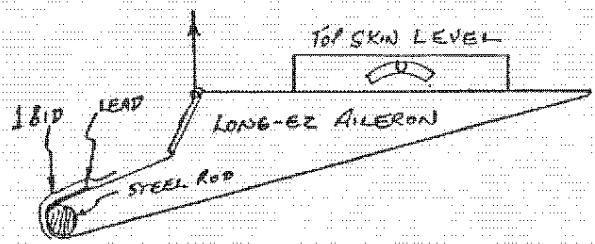


CS132L-R

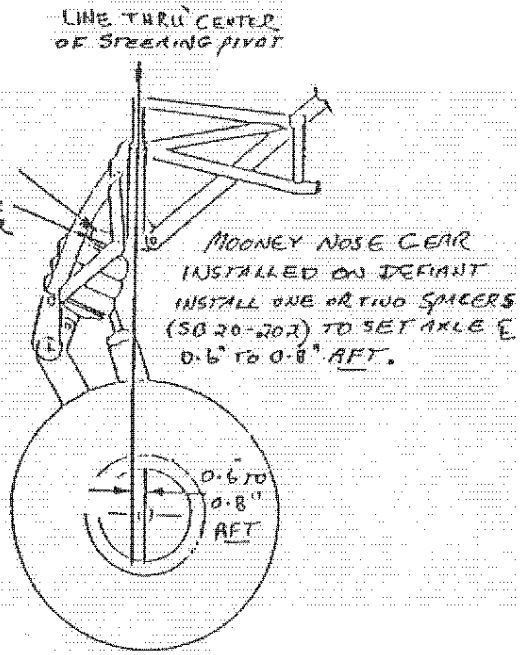
4130N STEEL WELDMENT (NORMALIZED)  
TWO (2) REQ'D PER LONG-EZ



CS152-R  
4130N STEEL TUBE  
TWO (2) REQ'D PER LONG-EZ



NOTE: NOSE UP STATIC

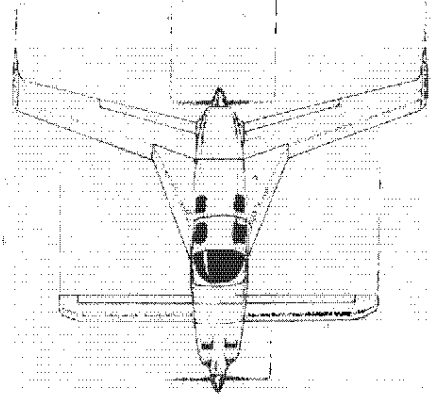


**CP 58**

**January '89**

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