

# THE CANARD PUSHER

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Long-EZ, newsletters 24 through 79.

Solitaire, newsletters 37 through 79.

Defiant, newsletters 41 through 79.

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**PLEASE NOTE: RUTAN AIRCRAFT IS OPEN TUESDAY ONLY FROM 8:00 TO 4:00.** When you call on Tuesdays, please give your name, serial number, and nature of the problem. If you are not in an emergency situation, we ask that you write to Mike.

When writing to RAF, send along a stamped, self addressed envelope if you have builder's questions to be answered. Please put your name and address on the back of any photos you send.

## 325 MILES NORTH OF THE ARCTIC CIRCLE.

Dick Rutan called me from London, Ontario where he was giving a talk and asked if I would be interested in flying up to Point Barrow, Alaska - Wow! Barrow is almost 72° North Latitude and more than 325 miles north of the Arctic circle. Sally did not want to go nor did Chris, Dick's fiancée. So, what the heck, I arranged to meet Dick the next day on the Friday Harbor airport. Sounded like a great boondogle to me!

I departed Mojave the next morning and flew direct toward Friday Harbor, an island northwest of Seattle, WA. Primary navigation was GPS. My panel-mounted King KLN 90 GPS was backed up by a Flitemate Pro GPS driving Mentor Plus' Flite Star and Flite Map which ran on my 270C MacPowerbook. (The belt and suspenders approach!). The GPS antenna was velcroed to the top of the headrest - worked great!

Unless you have flown with a color moving map that gives you almost unbelievably accurate knowledge of your position, you really can not appreciate how neat this is. This trip proved this system out to me as the navigation system of the future. This, or something very close to this, is what we will all be flying with in the future.

The weather was great from Mojave to Portland, OR but went bad north of Portland. The clouds went from the ground to 17000 feet, so I landed at Ellensburg, WA. To my amazement, when I taxied up to the gas pump, Dick was parked there topping off his fuel tanks! He had tried to get to Friday Harbor just as I had and had landed to check the weather and try to figure out how to join up with me. Just when I was wondering how in the world I could contact him!

We checked the weather and filed an ADCUS flight plan to Nanaimo, Canada where Dick has some friends and where the weather was excellent. We overflew the weather and landed at Nanaimo where we cleared customs. We then flew on to Qualicum, Vancouver Island. We spent a beautiful day fishing for salmon and enjoying the hospitality of Dick's friends, Bob and Cherry Ekoos. They have a beautiful home on the coast of Vancouver Island.

The next morning, we departed for Campbell's River, the nearest place where we could file a flight plan (all flights, VFR and IFR, must have a flight plan filed in Canada). We filed to Juneau, Alaska and flew up the coast in light rain and low ceilings. The coastline is very rugged, lots of islands with rocky coastlines and millions of trees. There were no roads at all and airports are few and far between. There is no VFR-on-top in Canada so we were forced to remain under the solid overcast until we reached Ketchikan, AK where we climbed to on-top and flew on to Juneau.

We overflowed the Mindenhall glacier in the foothills just behind the city of Juneau, then landed at Juneau airport and cleared customs. This cost \$25.00 a piece for each Long-EZ - the US customs was much more of a hassle than the Canadian customs. We had lunch and checked the weather. It was good all the way to Barrow! We filed to Fairbanks and flew up the coast from Juneau to Skagway, then inland over Canada to Whitehorse, then roughly along the Alcan highway to Northway, Alaska, then on to Fairbanks. It was 87°F at Fairbanks and the weather was perfect, however, it was below minimums at Barrow so we spent the night at a beautiful hotel near Fairbanks airport.

The next morning, 4th of July, 1994, we filed to Barrow where the weather was 400' overcast and 6 miles visibility. We ran into rain and low ceilings in the Brookes Range and poked our noses into several passes before finding one that was marginally VFR. We flew through the Anaktuvuk Pass and over a small Eskimo village of the same name where there was a short, gravel runway - not much good for us!

The weather improved a little north of the Brookes Range and we flew toward Barrow over country that was flat and covered with thousands of lakes. There are no trees and no roads, only tundra. This was the North Slope. Gradually, a scattered undercast became solid and, by the time we reached Barrow, we were between layers at 3000 feet. We shot an approach at Barrow and broke out on the centerline of the runway at 400 feet. The GPS-driven moving map depicted this graphically and was very comforting!

The North Slope Search and Rescue took us under their wing and found us a hotel room and

provided us with huge parkas (it was 33°F). Price Brower, a Barrow native and the Chief Pilot for Search and Rescue, treated us like royalty. He flew us to every single point of interest in a Jet Ranger helicopter and later invited us to his home where we had the dubious experience of eating maktak (the skin and blubber of a bowhead whale which had been captured by Price's village). We watched the Eskimo Olympic games which were being held in Barrow and went on around the clock since it did not get dark all night.

At almost 72° north latitude, the ocean was frozen as far as we could see. All of the buildings in Barrow are built on pilings and are 6 feet above the permafrost. The high on July 4th was 33°F! The sun does not set at this time of the year, it simply circles around the sky about 30° above the horizon!

The next morning, we headed down the coast of Alaska toward Prudhoe Bay. We flew very low and followed the coastline looking for polar bear and caribou. We saw hundreds of caribou but no bears. We did fly by two DEW line (early warning radar sites) that are no longer needed but were still manned with skeleton crews. A more remote place you will never see! We flew a low approach to Prudhoe Bay airport (Deadhorse), then turned and followed the gravel service road that parallels the oil pipeline.

We essentially followed the pipeline almost all the way to Fairbanks. We crossed the Brookes Range via the Atigan Pass and were fortunate to clear the highest point in the pass, 6500', due to rain and low ceilings. We decided to bypass Fairbanks and flew directly towards Anchorage. The weather really deteriorated and we flew through the broad pass from Nenana through Talkeetna to Anchorage with driving rain and less than 1 mile visibility. This was our longest leg, from Barrow to Anchorage, just over 6 hours, much of it flown in heavy rain. We landed at Merrill Field in downtown Anchorage where we were met by Fred Keller and his wife, Judy.

We stayed with Fred and Judy for two nights and Fred very kindly repaired my rain-damaged prop (Dick's is a B&T with the urethane leading edge and was essentially undamaged). They lent us a

car and we visited the local points of interest. It was a neat time and we needed the rest.

We departed from Anchorage and flew south over the Portage Glacier to Valdez, then on down the coast which was much friendlier here with beautiful beaches and quite a few airports. We landed at Yakutat for lunch of fresh caught halibut. This is the place for fishermen. They catch several varieties of salmon and it is fairly routine to catch 400 lb. halibut here!

After lunch, we flew on down the coast and then inland to Glacier Bay. What a spectacular sight! We continued over Gustavus where the Glacier Bay Lodge is, on down the central islands to Sitka, AK. We spent two days at Sitka which is really a beautiful place and the site of the original Russian capital of Alaska. We saw all the historical sites (Dick is a fanatic about such things!), met some really fine people, and I can tell you this: I intend to return to Sitka, sometime, with Sally.

We departed Sitka on a rainy, cloudy day and flew low along the coast all the way to Arlington, WA where Dick landed to give a couple of talks at the Arlington Fly-in. I continued on to Madras, Oregon where I filled the tanks with 100 low lead and headed south across Nevada and down the Owens Valley to Mojave. 10.2 hours of flying with one stop - Sitka, AK to Mojave, CA - 1514nm, 1741sm.

We had flown more than 6000 miles in 8 days. I used 281 gallons of fuel and N26MS performed perfectly for almost 40 hours. We both made it to the most northern point in the USA where the Eskimos showed us great hospitality. A marvelous trip in the company of a good friend. All take-offs and landings were flown in close formation, as was the approach into Barrow. We flew more than the distance from Mojave, CA to London, England in only 8 days and this trip brought back, once again, what magical flying carpets the Long-EZs are! For a trip like this, GPS is not a luxury and should be considered mandatory. The moving map was fabulous and it was very reassuring to always know exactly where we were.

Plan long trips, and go for it!

## PROP EXTENSION FAILURE

At Oshkosh this year, we were shown photographs of a prop extension that had failed, catastrophically, resulting in the loss of the prop and a forced landing that seriously damaged the E-Racer which, while not an RAF design, is a similar pusher. The pilot and passenger were not hurt.

The engine was a Lycoming O-360, 180hp. The prop was a B&T prop and it was driven by a Brock prop extension 6" long with a 7" diameter flange at the prop end. The fracture started right in the radius between the barrel and the aft flange and propagated across the extension. This fracture has been characterized by experts as being a high cycle, fatigue failure. The total time on this prop extension (and on the aircraft) was 72 hours. What caused this failure? Is it something we should be worried about?

A little history may be helpful here. Several years ago, a good friend who was an excellent engineer and VariEze builder, Bob Beard, experienced a large vibration while in flight, shut it down and glided to a safe landing. He discovered that his 8" long prop extension had an enormous crack in it. (See photo). He analyzed the prop extension and found that it was machined from 6061-T6 aluminum instead of the required 2024-T351 aluminum. This happened on his original design aircraft, the Two-EZ, a large four-place similar to a Long-EZ. He had a Lycoming O-360, 180hp engine and a wood prop.

About the same time, Danny Meyer was flight testing his Velocity, also a pusher, when he had almost exactly the same experience Bob Beard had. It turned out that both prop extensions had come from the same source. Both were made from 6061-T6, both were 8" long and both were using Lycoming O-360s.

The difference in strength between 6061-T6 and 2024-T351 is only 18-20% so although the wrong material may have been the cause of this problem, at least on an 8" long prop extension, 18-20% is not much margin of safety.

Bob Beard designed a prop extension that had a 4.5" diameter in the middle as compared to a 3.25" diameter on his previous extension. He

sent this editor a letter and a drawing of his new design and said that this 8" long extension would be just as stiff as a standard Brock 4" long extension and that its natural frequency should occur above 4000 rpm.

We purchased a billet of aluminum (2024-T351) and machined a 9" long modified Beard design which has a 5" diameter in the middle and which has been tested, in flight, to show that peak stress occurs at an rpm that is out of the normal operating range of the engine. The problem with this design is that it does not lend itself to economic manufacture.

We have borrowed a torsional order analyzer. This is a magic box that has a built-in x-y plotter and receives a signal from a magnetic pickup which is mounted close to the teeth on the starter ring gear. Basically, this machine measures the speed of each tooth passing by the magnetic sensor. As the engine drives the prop, it speeds up and slows down with each firing stroke and each compression stroke, this causes the crankshaft, prop extension and prop assembly to twist like a spring. This "spring" winds up and unwinds many times per second as the engine drives the prop. Now, obviously, the magnitude of this windup/unwind action is very small. In fact, this machine measures the rotational displacement in milidegrees, that is to say, thousandths of degrees. One of the uses of this machine is to determine if an engine/prop combination should have a "yellow arc" on the tach. A Grumman Tiger, for example, has a "yellow arc" from 1500 - 1800rpm. This means that the pilot should not operate within this yellow arc. He may pass through it in either direction but must not fly within the yellow arc.

We are concerned that there may be a yellow arc on some of our RAF designs and we have spent many hours flying several airplanes and a bunch of different engine/prop extension combinations. We have talked to experts in this field and the consensus is that a light weight, low inertia, wood prop simply cannot damage a Lycoming aircraft engine - good news! Introduce a prop extension, particularly an aluminum, spool-type, prop extension, and maybe you can have a problem! It turns out that a spool-type, aluminum extension is relatively soft, torsionally. It also turns out that a crankshaft, prop extension, prop assembly

is what is called a first mode shape. This means there is only one node (a node is a point where there is no action or movement - if you grab a spring with one hand at each end of the spring and twist it, someplace in the spring, there is no movement - this is the node). It further turns out that the node in this assembly usually occurs between the crankshaft flange and the propeller. That is to say, most, if not all, of the twisting we are measuring takes place within the prop extension.

With all of the above in mind, we set out to run in-flight tests on Long-EZs with Lycoming engines, 6" long prop extensions and wood props. An 0-235 powered Long-EZ categorically does not have any measurable problem with a 6" aluminum spool-type prop extension. The same is true of a pusher, such as a Defiant, with an 0-320 and a 6" prop extension. It may not, however, be true that an 0-360 with a 6" aluminum spool-type extension on a pusher is as free of problems. (A Long-EZ with any engine larger than a Lycoming 0-235 is not approved by RAF).

We have not fully analyzed all of the data and we plan on generating a finite element model to help with this analysis. At this time, we are unable to say (as we can with the 0-235 and the 0-320) that a Lycoming 0-360 with a 6" or longer prop extension on a pusher-type aircraft is completely safe. Some facts: If you are in the market to buy a Lycoming 0-360 (for your new Defiant), we strongly advise that you purchase one that is equipped with a 6th order damped crankshaft.

We have designed, and are testing, a couple of prop extensions that show promise to eliminate this problem, however, there has been only one failure of a Brock prop extension with many hundreds out there in the field accumulating hundreds and, in some cases, thousands of hours. We will continue to test and evaluate and keep the builders and flyers informed.

The prop extension that did fail had three strikes against it. First of all, the radius between the flange and the barrel of the spool-type prop extension was too small. Other prop extensions we have examined, including several other Brock extensions, have 1/4" radii. The failed extension had only a 3/32" radius (less than half the normal radius). Also, in this radius, there were

machine marks, tool "chatter" marks, in fact. Expert opinion says that chatter marks in a highly stressed part are bad news. These chatter tool marks are longitudinal "ridges" and are torsional stress risers. Also, the forward face of the prop flange was in the same plane as a change of inside diameter and this area had a sharp radius.

None of these features are good news - all of them in one prop extension are probably bad news. Add to that the possibility of a slightly out of balance prop and then throw in the possibility that the engine/prop extension/prop may have been running in resonance causing maximum stress in the aluminum prop extension.

The torsional order analyzer shows the rpm at which peak stress occurs, if there is such a point. We tested a long-service Brock 6" long prop extension on a Lycoming O-360-A4A, 180hp engine (with no 6th order dampers) and measured a peak torsional displacement (windup) of 20 milidegrees at 2770rpm, yet at 2500rpm, the peak displacement was only 3 milidegrees. Running continuously at 2770rpm in this pusher aircraft would probably fail this prop extension. This same test was done using all the same parts, but with a Lycoming O-360 with 6th order dampers installed, and the peak displacement was only 3-1/2 milidegrees!

With our modified Beard prop extension, these numbers changed significantly even with no 6th order dampers. Peak displacement is only 12.5 milidegrees at 2870rpm! (At 2770rpm, maximum displacement is only 6 milidegrees). This data is all the more impressive when you consider that this prop extension is 50% longer than the 6" Brock extension.

We have designed, and are having made, a 6" long prop extension that we believe will eliminate any problem associated with the O-360 Lycoming. It has not been tested yet and is not available at this time. We will report on its performance in the next CP.

We would like to state that a correctly designed prop extension should run virtually indefinitely because peak stress would be below the maximum allowable stress. This is the key to the whole

problem - the maximum allowable continuous stress must not be exceeded.

We have had the cooperation, not only of Ken Brock Mfg. in this endeavor, but also of Woofter Manufacturing (formally Woofter Custom Metal Fabrication) of Pembroke Pines, FL. We would like to thank Judith Saber of Woofter Mfg. for all of her help. She has machined and sent to us for testing five different prop extensions and she is currently machining a proprietary design which we hope to test soon. If you have not seen a Woofter prop extension, you are in for a treat! Judith runs the CNC lathe and machines all of the various prop extensions sold by Woofter Mfg.- and all of them correct the problems mentioned in this article. The radii are at least 1/4", there are absolutely no machine marks of any kind, and the I.D. has a really clever "S" curve transition from the smallest diameter to the diameter that fits your crankshaft. The workmanship is absolutely first-class and we are very happy to report that just as we were going to press with this CP, Ken Brock Mfg. has decided to order prop extension from Woofter Manufacturing. Stay tuned!

**WOOD PROP FAILURES** Reprinted from: *CLEAR PROP*, the newsletter of EAA Chapter 49, Lancaster, CA.

Recent calls from Texas informed us of two Warnke wood props, installed on 180hp RVs, which cracked in flight. There was no perceptible vibration and the damage was not realized until the airplane was back on the ground. Both props were "high aspect ratio" models. Both cracked chord-wise, across the laminations, about 12" from the spinner, right where the urethane leading edge protection is routed into the wood. One prop had been in service 70 hours, the other 130.

Just as we were going to press, we learned of another failure involving a Warnke propeller. We contacted Mr. Warnke and, after some research, he found that this prop was a prototype and no others of the type were in service. (In this case, the blade failed completely on a 160hp RV-4 after 40 minutes of service and no operation above 2400 rpm. About 2/3's of the blade broke off and struck the right elevator, damaging it severely. The lower cowl was also badly damaged as the unbalanced engine thrashed around, but

the pilot, in an excellent piece of flying, was able to maintain control and glide to a safe landing at an airport.

We don't know and can't speculate why these failures occurred, but since there seems to be a pattern forming, we felt that all users of the Warnke "narrow blade" prop should be aware that they have happened. We talked with Mr. Warnke and he assured us that he will be doing everything possible to find the cause. Meanwhile, he suggests extra care on both pre- and post-flight inspections. He also noted that, for other reasons, the "high aspect ratio" prop is no longer in production. There are hundreds of these props in use, some with over 500 hours.

### DOT 5 SILICONE BRAKE FLUID

We recently received our second letter regarding a problem with the silicone brake fluid, this time in a Defiant. John Rippengal, who built and flies his Defiant in Cyprus, found that after 4 years of use, he had a leak at the caliper on one brake. He dismantled the calipers and found that the 'O' rings were sticky and showed signs of roughness.

Some time ago, we received a letter from a Long-EZ builder with similar complaints. At that time, we recommended a complete tear down of the brake system, including master cylinders, and a complete and careful cleaning of all parts before installing new 'O' rings and new DOT 5 brake fluid.

DOT 5 brake fluid is 100% silicone. Silicone is an inert material and should not react with any other material, however, maybe, when mixed with red aircraft brake fluid, it does slowly attack the 'O' rings.

In spite of these problems, we still believe that DOT 5 silicone is safer because it is not flammable. Normal aircraft brake fluid is highly flammable. There have been several brake fluid fires reported in Ezs and one in a Defiant. So far, we don't know of anyone having lost his or her airplane, but it has been close a couple of times. Since silicone can not burn, we feel that even if it requires a complete cleaning and 'O' ring replacement every 3 or 4 years, it is worth it. Mike Melvill has been using DOT 5 silicone brake fluid for almost 10 years. About four years ago,

he did a complete tear down and replaced all 'O' rings, including master cylinders. At that time, he did notice what appeared to be rust in the master cylinders. It was very thin and cleaned up easily using 3M Scotch Bright. He has had no brake problems before or since. We know of several antique-ers who fly J-3 Cubs, etc. who have used only DOT 5 silicone, for more than 15 years with no problems.

If anyone experiences a problem with silicone brake fluid, please let us know so that we can share it with others. Also, if anyone out there knows of a different 'O' ring material that perhaps should be used, please drop us a line.

### COOLING PROBLEMS (SOLUTIONS?)

Oil and cylinder head cooling are probably the single largest source of letters to this editor. Several builders have resorted to installing two oil coolers in series which we are told definitely fixed the problem.

Mike obtained a much larger than normal oil cooler about 4 years ago and has been running it ever since. It is a Stewart Warner, part #10634R. It has 13 segments and is almost square in the top view. It is the same thickness as the standard 7 segment oil coolers. Contact Stewart Warner, Southwind Division, in Indianapolis, IN for your nearest dealer. This is an expensive oil cooler but it absolutely has cured the problem. It is mounted on the bottom cowling as called out in the plans.

Mike recently increased the radius of the lip of his NACA cooling inlet from about 1/4" radius to a 1/2" radius which actually reduced the size of the inlet but it dramatically improved the cylinder head cooling. A sharp radius on the intake is a no-no.

### LONG-EZ FUEL TANK VENTS AND CAPS

A little history is needed here. The plans show only one vent in each fuel tank. Mike and Sally built N26MS according to the plans and soon discovered that one vent in such a large, flat tank is not enough! When parked out in the sun, nose down, the air above the fuel is heated by the sun and expands, forcing the fuel up and out of the vents. This fuel then spills into the cockpits! I

am sure more than a few of you have experienced this problem!

The answer was published in CP27, page 9 and consists of a second vent line that is located in the inboard, aft corner at the top of each fuel tank. There should be four 1/4" aluminum fuel tank vents protruding out of the top of your fuselage just forward of the cowling. Do not run all or some of these separate vents together. For redundancy, they must be separate. This will fix the leaking-vent-in-the-hot-sun syndrome.

At the time, Mike was ready to do his first flight so he solved the problem by drilling a small hole in the fuel caps. While this fixed the leaking vent, it ruined a pair of very expensive fuel caps and, also, made it impossible to park nose down with full fuel tanks. It also made it possible for rain to leak into the fuel tanks resulting in small quantities of water in the fuel tanks after the airplane had been parked outside in the rain.

Recently, this problem was solved by installing the second vents in each tank and by removing the drilled fuel caps and installing Newton Aero fuel caps. These are sold by Aircraft Spruce and are made in England by Robin Voice. These are truly works of art! They have been in production for more than 10 years and can be found on a wide range of Ducati motorcycles as well as such supercars as the Ferrari F40 and the Jaguar XJ220. It is also common on many European racing cars and motorcycles.

It is a solid aluminum cap in an aluminum ring that is bolted into the tank with a ring of stainless allen bolts. The cap and receptacle are anodized and buffed to a bright finish and they look really fine mounted flush with the skin. The recessed tab is pulled up and rotated 90°. The cap is then lifted out. Mike added a safety chain which is mandatory and he is absolutely delighted with these completely fuel-tight fuel caps. Take a look at them next time you see Mike and Sally at a fly-in.

These caps sell for about \$85.00 each and can be found in the Aircraft Spruce catalog under "fuel caps" They are the Newton Fuel Caps. They are also available with key locks installed to prevent losing fuel to thieves. (See photo).

## LETTERS

"RAF,

During a recent annual inspection, I found the rubber valve portions of my ACS carb heat box to be deteriorated to the point of separation. As you can see by the enclosed sample, it is obvious that a portion of the rubber is about to separate and could have been ingested into the engine causing a possible engine failure.

I purchased the carb heat box for my 0-235-L2C-powered Long-EZ from ASC in 1986 and my first flight was June of 1991. I had logged 450 hours on the airframe when the problem was discovered. I have since replaced the torn rubber with red silicone baffle material and it works fine.

I am writing you about this dangerous and potentially fatal situation so that you might follow-up and inform other ASC customers who may have bought this unit about the obvious flaw.

Sincerely,

Frank Nowak"

## ACCIDENTS AND INCIDENTS

A VariEze got away from its owner recently while hand propping. A friend, a non-pilot, was asked to monitor the throttle while the owner propped it. It started, unfortunately the throttle was full forward, and the non-pilot did not retard it but did hang on for the ride of his life as it scooted across the ramp on its nose. It finally struck a steel fence post which cut a 3" wide slice from just left of the pitot tube in the nose, all the way aft to the shearweb/spar cap of the canard! An expensive lesson. Fortunately, no one was hurt but the damage was extensive.

Always have a pilot who understands the EZ throttle and mag switches monitor your controls while you prop it - or better yet, get a B&C light weight starter!

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Charlie Mottier sent this letter to RAF regarding his ditching in the ocean off the Berry Islands in the Bahamas. Unfortunately, the airplane was a total loss but the good news is that Charlie and his wife, Phyl, survived with only minor cuts and

bruises. His letter is printed in its entirety in the hope that this information may help someone someday.

"Following Sun-N-Fun '94, nineteen canard-type aircraft flew to Great Harbor Cay in the Berry Islands (67nm south of Freeport, Grand Bahamas) for some well deserved R&R.

On the flight home our Long-EZ experienced a loss in engine power about 15 minutes into the flight and we subsequently ditched the plane in Big Sturup Bay off the Berry Islands.

When the problem developed, we immediately advised our flying partner and then changed frequency to call in a Mayday which was acknowledged by Customs at the airport. We advised that we were attempting to return to the airstrip and requested landing priority. That frequency, all inbound and departing aircraft were advised of the emergency.

When it became apparent that we would not make the field, the decision was made to ditch rather than to put the plane in the trees on the adjacent island as I felt there would be less chance of fire in a water landing. Our landing speed into the wind and with calm seas was about as low as possible to keep the sink rate to a minimum. The main gear hit first and pitched the plane forward. The canard was sliced off cleanly at the fuselage on both sides. The plane dove under water and the canopy was lifted right out of its frame. We came to rest dead in the water and perfectly level. With the canopy gone, I simply stood up and turned to check up on my wife who was in the back seat. Boats to help arrived within 3 minutes and, after sending Phyl to the local dispensary, we towed the plane to the shore.

I suffered no injuries other than some minor cuts and bruises and required no medical attention. Phyl suffered some sore ribs on her left side and some minor cuts, but on complete examination in Ft. Lauderdale, was pronounced fit and was released from Browder Memorial hospital.

There are at least two important points for EZ drivers from this experience: 1) A water landing is survivable although it is hard on the plane. My plane floated, it was heavily loaded and it floated entirely level. We walked on the wings as did others and it was very stable. In attempting to

stretch the glide to reach the airport, the nose gear was not extended. If I had to do it over again, I would put the nose gear down. That might help soften the forward pitch when the main gear digs into the water. (Also, the landing brake should be deployed - ED.). 2) Most of our problems have developed from dealing with our own FAA. They advised immediately and strongly that we were in violation of the law by being in Bahamas air space without receiving prior written approval from the Bahamas government. That restriction is shown on the back of your pink Experimental Airworthiness Certificate. It is item D and among other things, restricts experimental aircraft from flying over any foreign country without the special permission of that country. That means "in writing and in advance".

In summary, we do not know what happened to our factory-new, 250-hour, Lycoming O-320, 150hp engine. The plane took all of the licks and we elected to total it. The passengers suffered almost not at all. Not a pretty story but we think one with a happy ending.

We want to thank our Canard friends who agonized with us as we splashed down and for their continued support through phone calls and cards.

Charlie and Phyl Mottier"

#### STATIC FUEL FLOW CHARACTERISTICS

We often receive inquiries as to what the acceptable static fuel flow is on an EZ or Defiant. While draining all of the fuel prior to installing new fuel caps into his Long-EZ recently, Mike took the opportunity to carefully measure the fuel flow. Here are the results: The fuel line was removed at the carburetor and run into a container. The fuel was allowed to flow for 6 minutes, exactly, then the container was weighed and the fuel flow was calculated. This was done with the in-line boost pump off, and with the boost pump on.

With 12 gallons in one of the tanks, the free flow with the in-line boost pump turned off, was 7.1gph. With the pump turned on, this increased to 21.1gph. With only 2 gallons of fuel in a fuel



tank, the free flow, boost pump off, was 5.3gph, with the boost pump on, it increased to 19.8gph.

This airplane has a Lycoming O-360 engine and the fuel supply to this engine has been very adequate over the past 1400 hours without the boost pump running, and at altitudes from sea level to 27000 feet. If your fuel flows are at least this good, you have nothing to worry about.

This test should be carried out by anyone who is preparing to fly a new airplane. Check the flow with 10 to 12 gallons in either fuel tank, boost pump on and off. Then repeat the test with a minimum fuel, such as 2 to 3 gallons. If you do not have flows similar to the above, you probably have a blockage in the fuel lines somewhere and this should be corrected before you attempt your first flight.

Mike ballasted the airplane so it was level on all 3 gear (not parked nose down). His fuel valve is between the pilot's legs, exactly per the plans. His boost pump is in line (all the fuel must go through the Facet fuel pump) per the plans. The only addition is the presence of a flow-scan fuel flow transducer between the engine-driven, mechanical fuel pump and the carburetor. This transducer was left in place for this test.

#### WHAT CAN I DO TO COMBAT THE HAZARDS OF 100LL FUEL IN MY 80 OCTANE CONTINENTAL O-200 OR LYCOMING O-235?

We have been asked this question a number of times and, over the years, we have accumulated a few answers for those whose engines simply were not designed to live on low lead fuel.

Use TCP as recommended on the can. Pure TCP can possibly harm glass/epoxy fuel tanks but we used TCP on the RAF Long-EZ prototype, N79RA, all of its life with no measurable problems and the TCP will definitely help your engine digest the modern low lead fuel.

Lean your mixture, even while taxiing. Richen it for take-off and then lean in flight using a good quality EGT gauge. A good rule of thumb is that you can lean aggressively above 8000 feet (below

75% power) or if you have a manifold pressure gauge, when you are below 22"MAP.

The bad news is that, in spite of these precautions, you should expect to have to remove your valves and ream the carbon build-up out of the guides every 300 to 400 hours. If you don't, you will experience sticking valves. If you can get 80 octane avgas, by all means, use it. Your engine was designed to run on leaded fuel and that is why you may be having these problems.

#### LIGHTNING STRIKE!

Long-EZ builder/flyer, Dan Worley, sent in a couple of photos and a report of a lightning strike. His Long-EZ, N63EZ, was parked, nose down, at his local airport within 50 feet of other airplanes and a metal hangar during a storm. As you can see from the photograph, the lightning vaporized the copper tape comm antenna under the skin of the left winglet and, in doing so, melted the blue foam core fully 2" wide and through to the outboard skin. The pressure of expanding gasses literally blew the inboard skin off the foam core and split the skin for almost 30". The rudder itself was undamaged and the structural attachment of the winglet to the wing was intact.

In addition to the above damage, his nav/comm was burned out, a handheld wired into the airplane was destroyed, the voltage regulator, intercom and strobe power supply were burned up, a digital CHT monitor, a digital fuel flow meter and bus voltmeter were destroyed. One co-ax antenna cable was burned. No other wiring was damaged. The lightning entered at the NG-3/NG-4 nose gear brackets, burning a 2" hole in the nose gear fairing, then ran around burning out the various electronic items and, finally, traveling outboard along the antenna co-ax and exiting from the tip of the left winglet. This is what we are told probably happened. Andy Plumber is a lightning expert and Burt has talked to him about this incident.

It is Andy's opinion that this was a very tiny lightning strike! He also informed us that had this strike occurred in flight that damage most probably would have been less, not more! He is absolutely adamant that no unprotected composite

aircraft should fly within 50 miles of a thunderstorm!

We have a friend who works on a fleet of 4 C-130 aircraft and he tells us that at least one of these airplanes experiences a lightning strike on an average of once a month! Damage is usually small but occasionally results in an antenna being blown off the aircraft! There is even a report circulating that the recent loss of a similar C-130 (not one of his) was caused by a lightning strike which hit a fuel tank blowing the wing in half!

Lightning is not to be taken lightly, but for those who can afford it, there is a full, anti-lightning treatment available as written up in *Sport Aviation* on a Glassair III. A metal mesh was bonded to every square inch of the airplane then it was struck by an artificial lightning bolt. There was some damage but mostly cosmetic. I cannot find the article right now but it is an expensive procedure and not something the average homebuilder would normally opt for.

This article is reproduced here simply to let all composite flyers know that flying close to thunderstorms could, quite literally, ruin your day! Stay clear of them, fly well around them, heck, that's the advantage of our canard pushers, we can fly around this kind of hazard with the excellent range we have. Fly safe and report any incidents to RAF so we can keep everyone informed.

### CAUTION

Dick Rutan reported a failure of his starter solenoid recently. The problem was that the failure caused the starter to be permanently engaged! The solenoid welded itself in the on position so there was no way to shut the starter off! Fortunately, this occurred during normal maintenance with the cowling off. Dick saw the problem and shut down the engine. He has installed a "hung starter" amber light on his panel similar to what some general aviation aircraft have, and he highly recommends this precaution to anyone with an electric starter. Had this occurred during a start-up prior to a normal flight, he would not have known of the problem and the results could have been serious damage to the starter and ring gear and may have resulted in a fire!

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### PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION

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#### LONG-EZ PLANS CHANGE

**1/2" X.028" WALL STEEL TUBING NO LONGER AVAILABLE.**

Ken Brock Mfg. has informed us that the 1/2"x.028" steel tubing called out for use in place of the original aluminum aileron control push rods is no longer available. They will supply 1/2"x.035" wall 4130 steel tubing from now on.

This means that the CS-50 steel inserts originally called out won't fit. Brock has changed the sizes of the CS-50 to ensure that these inserts do fit the 1/2"x.035" steel push rods. These inserts have a 10-32 thread machined into them to accept the dash 3 rod ends.

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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.

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#### ALL RAF DESIGNS

**MANDATORY INSPECTION BEFORE NEXT FLIGHT.**

If you use a 6" long or longer prop extension remove the cowling and spinner and carefully inspect the prop extension using a strong light. Look for machine tool marks (chatter marks) in the two radii or a radius smaller than 1/4" or hairline cracking in the anodized finish in the radii. This is particularly critical if you have a Lycoming O-360 engine. Discovery of any of these flaws is a ground-the-airplane problem. Contact RAF with a detailed description of your problem.

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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

FeatherLite  
PO Box 781  
Boonville, CA 95415  
707-895-2718

Brock Mfg.  
11852 Western Ave.  
Stanton, CA 90680  
714-898-4366

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

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RAF recommends the following prop manufacturers:

Bruce Tifft  
B&T Props  
75872 Mosby Creek Rd.  
Cottage Grove, OR 97424  
503-942-7068

Ted Hendrickson  
PO Box 824  
Concrete, WA  
98237  
206-853-8947

SHOPPING

FLUSH, INTERNALLY MOUNTED ANTENNAS

A complete line of antennas, specifically designed for, and flight tested on, composite aircraft. The antennas are tuned for maximum performance and, in general those who have used them so far, report reception is doubled over standard external antennas.

VariEze builder/flyer, Bill Butters, has started a company to develop a full range of buried antennas. These are normally supplied with a BNC connector built into the actual antenna, but can be supplied without connectors to include enough length of co-ax cable to facilitate easy installation with minimum weight and bulk.  
Contact: Bill Butters  
Advanced Aircraft Electronics  
PO Box 4111  
Florissant, MO 63032  
1-800-758-8632

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LONG-EZ PARTS PRICE LIST FROM FEATHER LITE

Main gear strut	\$ 349.00
Nose gear strut	58.00
Engine cowls, pr. (glass)	329.00

Engine cowls, pr. (Kevlar)	480.00
Cowl inlet	48.00
Wheel pants (3.5x5)	150.00
Wheel pants (500x5)	180.00
Above item in Kevlar	215.00
NG 30 cover	21.00
Pre-cut canard cores	160.00
Pre-cut wing & winglets	1199.00
Leading edge fuel strakes w/bulkheads	524.00
Strut cover SC	19.50
Nose wheel cover NB	19.50
Sump blister	19.50
NACA inlet	47.00
3" extended nose gear	70.00

Feather Lite, Inc. is proud to announce another product to re-introduce to EZ builders: The original Space Saver Panel by the late Rusty Foster. This is a bare fiberglass panel with a molded recess for builder installation of an aluminum flat stock electrical panel. \$40.00  
Contact Michael Dilley or Larry Lombard (both ex-RAF employees and EZ builders and flyers) at:  
Feather Lite, Inc.  
PO Box 781  
Boonville, CA 95415  
707-895-2718

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RAF "GOODIES" AVAILABLE

Charms-Long-EZ/VariEze (gold or silver)	6.50
Name patch	1.50
Silhouette patch (no Defiant or Long-EZ)	3.50
3-ship poster (17"x22")	3.75
2 Long-EZs in trail (11"x17")	3.00
Defiant on water (11"x17")	8.00
RAF Chronological poster	15.00
Long-EZ lithograph	10.00
Color photos (EZs, Solitaire, Defiant)	1.25
Night photo by Jim Sugar	5.00
Videos - Building the Rutan Composite	25.00
Go-A-Long-EZ	25.00

FOR SALE

F-16 DEEP STALL INCIDENT VIDEO  
Gives a pilot's-eye view of a deep stall which almost doesn't recover. Includes a letter describing what the important learning points are from the video, especially as they apply to EZ pilots who are unfamiliar with deep stall, as well as a transcript of the audio portion (for clarity).  
Price - \$13.00.

Contact: Charlie Precourt  
7015 Little Redwood Dr.  
Pasadena, TX 77505-4433

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**NOSE GEAR RATCHET**

Dr. Curtis Smith's nose gear crank ratchet is still available at \$38.00 which includes postage and packaging. No need to call, just send check or money order. This little device should be considered a "must" by all Long-EZ and VariEze builder/flyers. Once you have flown with it you will wonder how you ever did without it.

Contact: Curtis Smith  
1846 Sextant Dr.  
Worden, IL 62097  
618-656-5120

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**SIGHT GAUGES**

New, improved fuel sight gauges. Use with auto fuel or Avgas. Clear bubble with white background. Retrofit for Long-EZ and VariEze. \$35.00 per set.

Contact: Vance Atkinson  
3604 Willomet Court  
Bedford, TX 76021-2431  
817-354-8064

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**FOUR STACK STAINLESS EXHAUSTS**

Further update on the all stainless steel 4-stack exhaust pipes. They are now available with springs and slip tubes at the flange or with ball joints, builder's choice, each still has the original slip tube support on each side to keep the pipes totally independent of each other. They have 1/4" type 321 stainless steel flanges and type 321 .035" stainless steel tubes. The tubes are "degreased" inside and out before they are purged or back-gassed with argon while being welded (others don't do these two very important steps). They fit Lyc. engines for any pusher aircraft, EZ's and Cozys, etc. - Cost - \$500.00 plus \$15.00 shipping and handling.

Also, if anyone would like to have ball joints fit and welded on their existing pipes, the cost is \$150.00.

The RAM AIRBOX is still available at \$325.00. Reusable foam air filter - \$20.00 plus \$11.95 shipping and handling.

The increase of performance of both 4-stack exhaust pipes and airbox combination is very impressive, about 200 rpm on the average Long-EZ installation. Builders can call or send SASE for a flyer. Both items come with an installation sheet.

Contact: Hal Hunt  
6249 Longridge Ave.  
Van Nuys, CA 91401-2528  
818-989-5534

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**NOSE WHEEL SHIMMY DAMPER**

Bob Davenport tells us that he can still supply this excellent damper. Unfortunately he gets very few orders nowadays but can sell them even if he gets only one order. Including the set up charge, the cost is \$236.00 delivered in the USA.

Contact: Bob Davenport  
PO Box 650581  
Vero Beach FL 32965-0581  
407-567-1844

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**NEW STARTER FOR 0-200 CONTINENTALS**

B&C Specialty introduced a beautifully made, 12 volt starter specifically designed to be installed into the accessory housing on a Continental 0-200 engine, or on an 0-240. This starter has been thoroughly tested at Teledyne Continental (more than 5000 start cycles without a single problem!).

Bill Bainbridge has these starters available for immediate delivery and they can be had STC'd or for homebuilts.

Contact: B&C Specialty Products, Inc.  
123 East 4th Street  
Newton, KS 67114  
316-283-8662

PS If you did not see this jewel at Oshkosh 1994, you should try to see one soon. They are really objects 'd art! ED.

0-235-C1 w/accessory case. Slick mags, starter, alt., fuel pump, vac. pump, carb AD'd, no prop strike, 1800 TT logs. Light rust found in cylinders. Needs TOH. \$2200.00

62x66 B&T prop (60 hrs.).

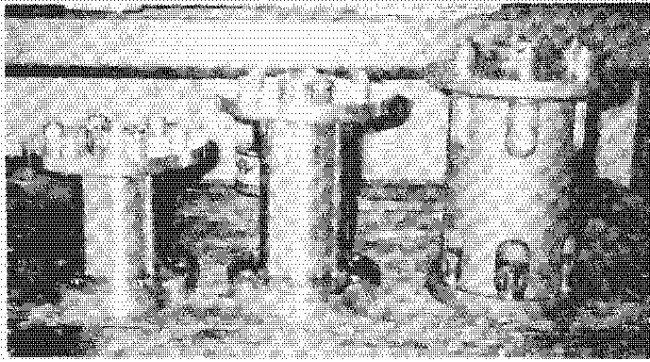
3" extension.

Brock exhaust.

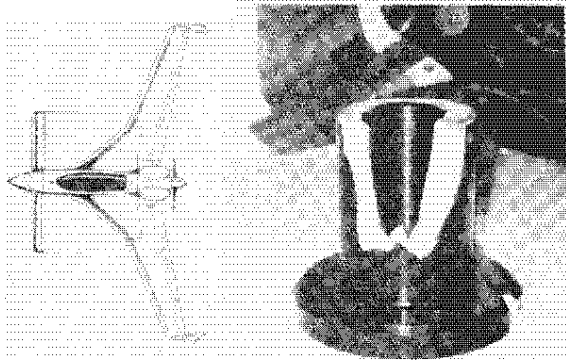
Air valve and intake elbow.

Call for prices on above items.

Contact: Francois Choquette  
187 W Plumtree Ln. #61  
Midvale, UT 84047  
801-566-6102 (H)  
801-565-4674 (W)



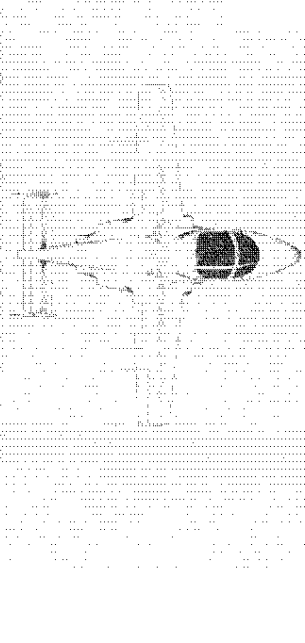
Left to right: Woofter Mfg. prop extensions; 6" long, 8" long, both with 7" dia. prop flanges in bare aluminum. Normally these extensions are black anodized. 9" long Bob Beard/Mike Melvill design has 7" dia. prop flange but the dia. in the middle is 5" as compared to 3-1/2"



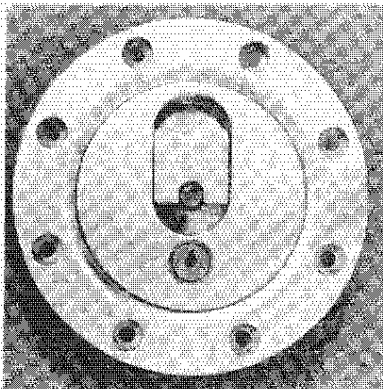
This is the failed prop extension. Failure occurred at the radius where the 7" dia. prop flange intersects with the 3-1/2" dia. barrel.



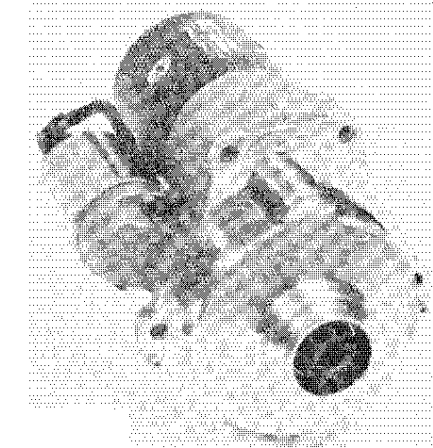
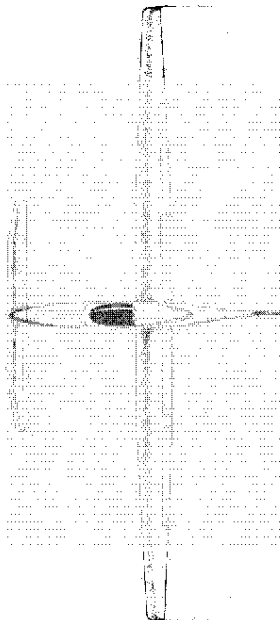
Dan Worley's Long-EZ winglet after suffering a lightning strike while parked nose down on the ramp during a storm.



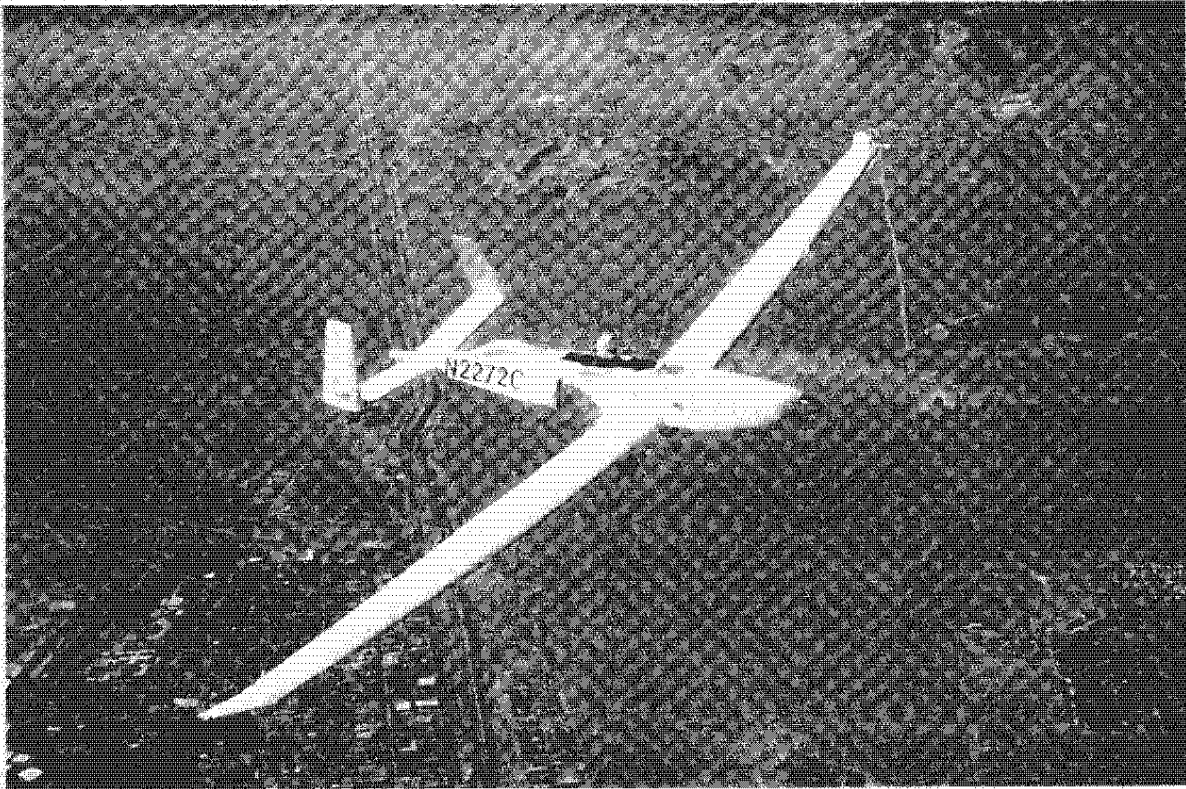
Bob Beard's original 8" long prop extension made from 6061-T6 aluminum.



The Newton fuel cap. Solid aluminum anodized and polished - available with or without the locking feature - absolutely seals against fuel leaks with 'O' ring seals

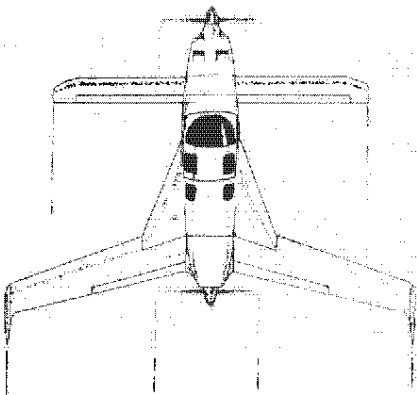


Bill Bainbridge's new Continental 0-200 and 0-240 electric starter. Another beautifully engineered product from B&C Specialty Products.



RAPTOR D-2. Second in the series of RPV aircraft by Scaled Composites. Compare this photo to the cover of CP78 and note the obvious difference of the pilot's seating position. First flight 8-23-94

**RUTAN AIRCRAFT FACTORY**  
**1654 Flight Line**  
**Mojave, CA 93501**



**OCT.: 94**

The line which appears above your name lets you know through which *Cunard Pusher* you are paid. If your label says **LAST ISSUE CP79**, then this is your last issue, and you need to renew.

**CP 79**