

THE COZY NEWSLETTER, No. 4, January 1, 1984

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It is mandatory for all COZY builders to subscribe to this newsletter, as this is the only formal system we have for communicating plans changes and/or corrections, builder hints and other information of interest to builders and prospective -builders. Issues prior to No. 4 are not necessary, in that they were only reports on the progress of plans, and extra copies are not available. Starting with this Issue the newsletter will contain important builder information. We have tried to keep the subscription price low. so cost wouldn't be a problem.

When writing to Co-Z with questions. please send along a stamped, self-addressed envelope. Please leave space after each question. so we can fill in the answers (without having to rewrite the question) and return on your original.

If you call, please call me at home (612-776-1145) after regular working hours (I'm not retired yet!) or on weekends. We have had quite a few visitors dropping in to see the proof of plans model (in our garage) and the COZY prototype, hangared at Anoka Airport about 20 miles away. So far, we've been

able to handle it. Often the COZY is partly disassembled, with parts here at home for reference. We don't attempt to keep the COZY in flying condition during the winter (about 8 months in MN.) because the weather is so lousy anyway.

In November, we had two sunny days, and as I am writing this, the temperature outside is -20 deg. F where it has been for a solid week now, and we have 48 in. of snow on the ground, and it has just started to snow again! We had to move the new fuselage outside temporarily, so we could get at least one car into our heated, single car garage. Quite frankly, we are getting quite fed up with Minn. winters, and can hardly wait until my earliest retirement date (1985) to move to a more comfortable clime. The only question up until quite recently was where?

Over Thanksgiving, we accepted an Invitation to visit one (two?) of our customers, Ed and Pearlle Moulden, in Mesa, AZ, a suburb of Phoenix. We very much appreciated their wonderful hospitality (airplane builders are such nice people!). and we were impressed with the warm temperatures and clear. blue sky, when the rest of the country was in the deep freeze. and we made the decision that Mesa was where we would like to live. We found a nice. large house. where we could have a shop and an office, on a golf course only 1 mile away from Falcon Field, the site of a lot of homebuilding activity. We attended the local EAA chapter meeting and visited a couple of Long EZ projects in the area. We were particularly impressed with the craftsmanship of Tom McNeilly. in Gilbert, AZ. In addition to his superb workmanship, he had a number of good ideas, which we will describe later.

It is very important, particularly for first time builders, to join local chapters, find out who is building composite airplanes, and visit the projects. It doesn't take long to recognize the difference between good and bad work. Fortunately, there isn't too much really bad work around, but I have seen some. Bad work seems to be typified by gross disregard of plans and instructions, i.e., changes in the airframe and structure, misalignment of hinges, controls, pulleys and cables, use of the wrong hardware (oversize washers, bolts too short. non-locking nuts, wrong type or bolts, even hardware store bolts, heaven forbid! And fiberglass lay-ups which are bumpy. too dry or too wet, etc. Fortunately most aircraft builders set high standards for themselves and others. which is what the EAA is all about. Do make friends with other builders. You will find them the nicest people you ever hope to meet!

PUBLICITY

Articles on the COZY have now appeared in Sport Aviation (Jan 83). Homebuilt Magazine (May 83), Popular Mechanics (July 83), Air Progress (Nov 3), and a few others that we haven't rundown. We are still trying to get our hands on Bud Davisson's negatives (Air Progress). because he got some super pictures and we would like to make them available. Occasionally some things in print need more explanation. Air Progress was our first pilot report. Peter Lert has done much of Burt Rutan's flight testing, so he should know how good airplanes fly, and we were most interested in his opinion. He was very pleased with the COZY and the tone of his article was up-beat. However, he had to find something to be critical of, so he used up quite a bit of ink on how the COZY was so clean it didn't want to come down. There's another side to the story. They were about to close the runway at Oshkosh and there was a problem with the Air Progress Beech, so Peter had to hop in and out and In again over me--not the usual procedure for a passenger. Right after takeoff I turned the controls over to Peter, and he flew the rest of the flight (he's a good Pilot!). We climbed up through the clouds and pulled in tight on the Beech for about 1/2 hr. while Bud got a bunch of good shots. The two

wisecracked incessantly on the radio. Peter said. 'Now do we look?' Bud said. "Some people think you can fly, but I know better" Then Peter said, "Hey Bud, every once in awhile we get a good one!" I particularly enjoyed that comment.

We broke off and Peter put the COZY through its paces. He tried slow flight at full aft stick and then tried to stall. Nothing happened. He described it as a 'non-event'. He wanted to try some acrobatics until he remembered his loose photographic gear in the back seat.

Returning to Oshkosh, Peter made a straight in approach to runway 27 at 800 ft. I would have gone around, but he tried to make the COZY behave like a Cessna (which it isn't) and come straight down. Anyway, I had to hold the landing brake down (it wasn't intended to be a dive brake) and he had to hold both rudders fully deployed. We landed on the second half of the runway, hit the brakes hard, and were able to turn off at the next taxiway. Not what I would call a typical approach and landing! I agree that approaches like that would require stronger springs in the landing brake and perhaps renaming it a dive brake.

THE RUTAN REVOLUTION

When the first Varieze appeared at Oshkosh, there were many skeptics who questioned whether the canard configuration and composite construction would catch on. Subsequent years saw the numbers swell to surpass all other designs, and variations such as the Long EZ. Quickees (who said that?), Defiant and COZY appeared. The ultralights got into the act with the Eagle and Goldwing and there were even rumors of a 6-place called the ONAC, which weren't taken too seriously at the time. But what about the aviation establishment? Were they watching and what did they think of all this nonsense? Well, Beech stunned the establishment this fall at the NBAA show by introducing the all-Rutan Starship I, a biz-jet carrying 10 people and bears an amazing resemblance to the Long EZ. It is efficient, fast and has outstanding range. You guessed it, all-composite construction with a canard which sweeps back in flight.

As if that weren't enough, the Gates Learjet/Piaggio GP-180 had sprouted a small canard on the nose, and Canadair's Challenger 600 and 601 have sprouted winglets. Most of the others were built out of composites, and guess where they are putting the engines--in the back! Looks like Father Burt started something after all! It will be interesting to see what the Heavies look like 10 years from now!

PROGRESS ON PLANS

We finally did it! Section I of the plans has issued, is copyrighted, we are current on filling orders, and even have extra copies in stock. Tell your friends!

We know of three projects which are already pretty far along; one in Burkburnett, TX, one in Cheraw, SC., and one in England. It will be quite a challenge for us to keep ahead of these eager builders on the several chapters which remain.

The turtleback was quite a challenge! When we built the prototype, we tried to form it from PVC foam. That was a disaster, and we ended up carving it from urethane foam. which was tedious, took a lot of eye-balling, and not what I would want to recommend to others. So we started out making

accurate templates from the prototype and building a female form (of the turtleback, that is). We experimented with 1/4 in. low density Clark foam, and on the second try everything turned out perfectly. We have the procedure well documented and it was very satisfying to have finally figured this one out.

With this behind us, we laid out the canopy dimensions and got them off to the Airplane Factory. They suggested shortening it two inches, so they can get two canopies from one sheet of acrylic. and keep the price down. We had allowed for some trim, but will probably lengthen the turtleback one Inch just to make sure. We have authorized permanent tooling. Because of their backlog, they can't promise the first one until the end of Feb, so we will have to wait until then to wrap up the Canopy chapter. Incidentally, we think that clear and smoked are the two best colors, and will give people a choice. We also made molds for the side windows and shipped them off. They are compound curves, and most people wouldn't want to bother trying to make their own.

In the meantime, we will be working on the control system. There are a lot of parts to be pre-fabbed, so this will also take some time. Those of you in a hurry can make your own, if you wish (we will supply advance copies of the drawings if you have everything else done).

PLANS CORRECTIONS/CLARIFICATION

- Guess what? We have already discovered some errors in the plans. We're embarrassed! Mark up your plans now!

-Chap.2, p.2, Interferences shown mean you have to glue in a scrap of foam to complete the part. Saves money!

-Chap.4, p. 1, Fig. 1: Change 28.3 to 28.7"

-Chap.4, p. 2, Fig. 13 Change 13 to 14.5, and 3 to 3.5

-Chap.4, p. 3, 4th line: Change 1 in. x 2 in. to 1 in. x 1/4 in.

-Chap.4, A-3, F-28 bulkhead: Doubler should have been shown in phantom. Cut out for top longeron only.

-Chap.4, A-5, Seat back trim template: Notch for upper longeron isn't deep enough. Add 3/8 in. at top of template. And remove 3/8 in. from center of template.

-Chap.5, p. 1, Fig. 1 & 2: Install doubler after F-28 in Chap.6.

-Chap.5, p. 3, Fig.4: Change FJC to FJE (2 places), FJE to FJB, and FJB to FJC.

-Chap.5, p. 3, Fig.7: Sections A-A & D-D, change 1/2 to 3/8 in.

-Chap.5, p. 3, 3rd par: Change 2 1/2 in. to 2 in. wide strip.

-Chap.5, p. 5, LWZ top view, change 1.0 in. to 0.7 in.

-Chap.5, p. 5, Fig.17: Dimensions shown should be measured along lower longeron instead of horizontal. Also, angle pads and brackets slightly as shown on A-12.

-Chap.6, p. 1, 3rd par: Five screws may not be enough to hold bulkhead against stringer, You can bend flange by heating to about 150 deg, with hair dryer.

-Chap.6, p. 2, Fig.5: 1 x 4 in. may not be tall enough. If not, substitute 1 x 6 in.

-Chap.7, p. 1, 4th par: Change 2 1/2 in. to 2 in. width.

-Chap.7, p. 1, 3rd par: The template shown on A-5 is a little too large. Remove material from the top, from 1/4 in. on the left to 1/8 in. on the right.

-Chap.9, p. 6, 3rd par: Change piano hinge from a P-5 to a P-6.

-Chap.9, p. 6, 4th par: Change 1/2 in. square to 5/8 in. square.

-Chap.9, p. 6, 6th par: Instructions difficult to follow. Better method, put dab of 5-min. epoxy on LB-19 and set brake in place on top of it. Then remove assembly and cut through foam around LB-19, using it as a template. Then rip LB-19 loose and remove foam under it.

-Chap.9, p. 7, 3rd par: The centerline of the brake actuating arm slot can be located easily, by drilling a 1/8 in. hole through the bottom of the fuselage from the inside out at a point 6 in. aft of the seat back and 5/8 in. to the right of the right side of the seat back brace. Then follow the remaining Instructions.

-Chap.10, p. 6, 3rd par: Delete "and shim as necessary" (both occurrences). Add, "If not okay. Determine cause and correct". Explanation: If the bottom surface of the canard is straight, but the top is not, shimming will not correct the problem. Likely cause is an incorrectly cut airfoil. Filling low areas is preferable to sanding down high areas, because canard airfoil shape is critical.

-Chap.10, p. 7, 2nd par: Top contour on canard is critical. Don't let spar cap layup get too thick and cause a bump! Start by sanding shear web in bottom of trough to remove any bumps or joggles, Squeegee cap layup well from center out. Protect bare foam with masking tape. You can cover completed layup with peel ply, and heat with hair dryer while squeegeeing or cover with wax paper and weight down. A slight amount of sanding after cure is permissible to remove any bumps to maintain contour before applying top skin.

PROPELLORS

-Our prototype has a B & T prop., which has a urethane leading edge, looks good, and performs well. It may not be best, however. The following is reprinted from the Canard Pusher:

Since last newsletter, we have flight tested 7 different props from four different manufacturers. Most of these props work well, keeping in mind that on an airplane as clean as a Long-EZ, any prop is a compromise. After all, we stall at 51 knots and we can indicate 165 knots at sea level. That is a very large speed range for a fixed pitch prop to handle. So, in order to get acceptable take off and climb performance, we have recommended that a minimum of 2400 rpm static should be available. This is done on a gravel free patch of taxiway, brakes locked, full throttle and mixture leaned to best power (max. rpm). Our experience has shown that if you don't have at least 2250 rpm static, your take off run will be excessive, particularly at gross weights and even more so at high density airports.

Now at the other end of the scale, if we have our 2400 rpm static, obviously, with a fixed pitch prop, we will be able to over rev the engine at high speed, particularly at low altitude. Our criterion here has been to accept a full throttle, best power mixture at 7500 feet (MSL) in level flight with 2900 rpm as our optimum goal. This is 100 rpm over the engine manufacturers red line, but we use a very lightweight prop, and our static thrust is half what these same engines see in the factory airplanes they are installed in. We have been running these engines at high rpm and low manifold pressure for a long time with no problems. So, the optimum prop would be one that turned 2400 rpm static and 2900 rpm at full throttle at 8000 feet. This is a difficult design goal for the prop maker and each one is different. Also each individual Long-EZ is different and a prop that may work perfectly on Mike's Long-EZ may not be as good on your own Long-EZ.

With all of this in mind, and with no intention to try to recommend one manufacturer's prop over another, we present a summary of the results of the tests of these different props. All tests were done on N26MS. Choose a prop for your airplane based on your expected flying conditions. If you are based at a short field, or high density airport, you would not choose the same prop as a person who was based at an 9000 feet long runway at sea level who would fly mostly high speed cross country to similar airports. Probably the best bet is to have two props!

Manufacturer

Size

Static RPM

RPM at max power at 7500' MSL

Hendrickson

62"x66"

2360

2900

B&T

63"x67"

2300

2920

Sensenich

64"x72"

2150

2860

Great American

62"x62"

2530

2925

There is only a 3 mph true airspeed difference in these four props at the top end. The fastest props turn the highest rpm generally, the best take off performance comes from the prop turning the highest static rpm. All of these props are of excellent quality, but vary considerably in blade design and

method of measuring pitch. Leading edges also vary, some have solid polyurethane leading edges which withstand rain erosion very well, others have epoxy leading edges, while others have a wrap of kevlar. All will hold up quite well in rain, IF you throttle back to 2400 rpm or so to keep the tip speed down.

Ted's Propellers B & T Propellers
9917 Airport Way 8746 Ventura Ave.
Snohomish, WA 98290 Ventura, CA 93001
(206) 568-6792 (805) 649-2721

Great American Props John Benjamin Propellers
1180 Pike Lane #5. P.O.Box 216
Oceano, CA 93445 East Petersburg, PA 17520
(805) 481-9054 (717) 569-2687
(Made by Sensenich)

From this data it looks like the Great American prop would give better take off and climb performance with no sacrifice at the top end, although we have not tried one yet.

ENGINES

- We continue to be asked about O-320's. I am aware that a lot of Long EZ builders are installing them, so I called RAF to get the latest word. The emphatic response from RAF was that they are not approved. Reasons were: 1) the mounting system was not designed for O-320's, 2) it makes the aircraft heavier. It Increases the probability of an aft C.G., 4) it increases the landing speed, 5) It reduces the crash survivability, and 6) RAF has not flight tested it. All of these reasons apply to the COZY. We are NOT putting an O-320 in the proof-of-plans model, and can't recommend it to others. As a matter of fact, we do not even recommend putting a starter on the O-235, or even using the standard alternator. We removed the starter ring gear and used a 6 lb. 35 amp automotive alternator and a light weight spinner. We have always preferred to get our performance by keeping our airplanes light and clean. Our 85 hp. Varieze was faster than most 100 hp. Variezes. Adding horsepower to make up for poor workmanship is usually self-defeating. Good O-235's are available at reasonable prices, if you are willing to take a little time looking, and are patient. We have a lead on several which might be available from a single source. We will see if we can make a successful bid on the entire lot, and if so, will let you know. Another angle is to get acquainted with a number of insurance claim adjusters and put in bids on wind damaged airplanes. Often you can make out quite well buying a damaged airplane, removing everything you can use, and then selling the rest of the parts. Sometimes you can even bid jointly with a salvage dealer. You might even work a deal with a flight service. They can't run an engine beyond the stipulated overhaul period, but you can, and often such an engine has many good hours left in it. A used engine, besides being cheaper, is preferable to a new one, because ground running, such as you have to do to check out and test a new homebuilt, is bad on a new engine and not the proper way to break it in.

BUILDER HINTS

- According to Burt, our prototype should have been 15 mph slower than the Long EZ but it is not. Some reasons are:

- 1) We faired in the cowlings and gas sump blisters to eliminate abrupt cross section changes.
- 2) We eliminated the external ram scoop and designed in the flush NACA scoop for engine cooling.
- 3) We tightly baffled the engine. to use less cooling air which reduces cooling drag.
- 4) The main gear legs are faired to a sharp trailing edge as are also the airfoils.
- 5) The canopy was made more sleek, to avoid abrupt contour changes.
- 6) We selected exhaust headers which exit aft, to take advantage of the thrust.
- 7) Attention was paid to all joints, keeping them tight with no joggles.

Tom McNeilly of Gilbert, AZ is doing some of the nicest work we have ever seen. Before cutting his wing sections, he glued the styrofoam blocks together with pour foam, while clamped together to get very thin joints. Even though the glue joints don't melt, they were so thin the hot wire passed through them without catching. The result was some beautifully cut foam airfoils, perfectly true.

He also developed a vacuum-bagging technique to get super light layups. He would get the layup down in a hurry, cover it with perforated poly, cover that with soft carpet underlayment foam, and cover that with regular poly. He tapes down all the edges and pulls a vacuum with a vacuum cleaner hose between the layers. Excess epoxy gets squeezed out of the layup, through the perforations into the soft foam. After cure, he strips all the coverings off, including the excess epoxy. I didn't see this in operation, but his parts sure looked nice and he claimed he saved 6 lbs. per wing, and that he is using this technique on all of his layups. He ought to have a super light airplane'

Cutting BID Tapes

Try rolling the BID cloth into a 1" diameter roll at 45 degrees to the selvage edge, having previously carefully straightened the fibers. Now use a large sharp pair of shears to cut off 2" wide rolls. Presto! Your 2" wide tapes are ready to use and even rolled up for you.

Corner Tapes

Installation of BID corner tapes, such as in corners between fuselage sides and bulkheads can be a time consuming job. Try this: spread out a piece of aluminum foil (such as Reynolds). Layup the BID cloth, usually two plies, large enough to cut all the tapes you are going to need, onto the foil. Squeegee this layup out to a good layup. Now cut your 2' wide tapes out of this layup, cut through the glass and aluminum foil. Sand and paint a coat of epoxy onto the area to be layed up over, then with your fingers, bend the aluminum foil to form the 'tape' into an angle to fit into the corner. Carefully position it and lightly squeegee or stipple it into place. Peel the aluminum foil off, stipple to eliminate any small air bubbles, peel ply the edges and presto, a perfect tape. Really works well.

Wing Fitting Ventilation

The outboard main wing attach fitting recesses in the wings should be ventilated to avoid an accumulation of condensation. Drill a #30 hole in the bottom cover. Remove the top cover and drill a hole in the lowest point of the recess such that it will break into the recess underneath the wing. This hole should allow a soda straw to slip through. Work a little micro into this hole and slip a soda straw

through. Allow to cure. Now carefully cut the soda straw flush with the bottom of the recess. Silicone the top cover back on. This will allow the two covered areas to 'breathe' and eliminate condensation, which could corrode the wing bolts.

Engine Alignment

The engine should be mounted with the crankshaft center line right on B.L. 0 looking down at a plan view. There is no side to side offset. Looking at a side view, the engine is mounted with down thrust. That is to say, the prop flange is higher than the magneto end of the engine. Ideally this is a 2 degree angle. Plus or minus 1 degree will be okay. When you install your engine mount, do not assume that the four forward tubes are square and true. Clamp the mount to the aluminum extrusions and measure from the firewall back to the flanges (conical mount) or to the donuts (dynafocal) and do not drill in the mount until you have it positioned correctly.

Prop Bolts

If you are using a standard Brock prop extension with threaded drive lugs and crush plate, and a prop that is approximately 3 3/4" thick at the hub, (Ted's, B&T, etc.) you will need 6 prop bolts. AN6H-51A will work fine and are much cheaper than the AN76 prop bolts.

Worm Gear in Nose Gear Mechanism

If you buy the worm gear from Boston Gear, it will not be a solid gear, but will have holes in the hub area. This can still be used, but must have the holes filled first. We simply used flox. See sketch.

If you would prefer a solid gear as shown in the plans, the only source we are aware of is from Ken Brock Mfg.. Brock also sells this gear for VariViggen builders, for the main gear retract mechanism.