

# Express LINK Newsletter



Vol. 2 No.2

June/July, 1995

## To Test - Or Not to Test

Since EDI has "divorced" the "CT" Express a small group of Express builders led by Larry Olsen at Experimental Aircraft Technology Inc. has been seriously discussing the possibility of forming a group of Express builders, who have opted to complete their project with cruciform tails, to verify and expand the existing knowledge of the aerodynamic characteristics of the cruciform Express through an independent engineering and flight test program. Using a qualified aeronautical engineer who would follow a test program, written cooperatively with members of the "group" and the engineer, the plan would be to produce a full evaluation of the behavior of an unmodified cruciform tail example(s) throughout the full CG range and all flight parameters.

Once existing characteristics are fully understood, the program would proceed to evaluate potential aerodynamic improvements to stability and control harmony, or to produce a reliable set of operating limitations to mitigate any undesirable flight characteristics, or a combination of modifications and operating limitations which seem to be appropriate (if any) to allow the Express to live up to its full potential, if, in fact it is not already there.

It is expected that both IO-360 and IO-540 powered examples would be used in flight testing.

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## Oakhurst Workshop Well Attended

Once again Jerry Sjostrand proved to be a great host and teacher at his shop in Oakhurst, Ca. April 8th and 9th were filled with demonstrations of basic process and finishing techniques combined with an unparalleled opportunity to inspect and photograph Jerry's Express. Among new builders in attendance were Shawn and Nadine Kelly from San Jose Ca. The Kellys are currently in the process of completing their wings and have arranged to take delivery of the balance of the required kit parts from the factory around the middle of June. Also attending were Jeff and Cindi Miller of Fremont, Ca. Jeff is working to get his as yet unclosed wings into a configuration that suits him (including changing fuel tank capacity, reworking and adding some flanged ribs and some fuel line routing).

Jerry's Express is VERY close to completion. Jerry has vowed to press on with his project upon his return from a European vacation (only an excuse to visit Express builders) and will have only painting of major surfaces and some relatively minor work to complete before moving operations to the airport - and we all know what happens there !!

The most significant procedure that Jerry demonstrated that will help CBROS with future construction is the use of aluminum foil to cover foam forms for various components such as induction system parts, fairings, and other small covers and forms for fresh air ducting etc. which need to be made from fiberglass. By lightly spraying the dull side of the foil with Scotch 77 or similar spray adhesive, allowing a short time for the adhesive to "set", then smoothing the foil over the form to be glassed, the finished form can then be covered with fiberglass/resin using an appropriate BID schedule. After curing, the foam can be either ....

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## The Tale of Two Tails ...

..... *an editorial*

There has been a great deal of controversy surrounding the reliability and stability of the Express as originally designed. An interesting facet of the discussion has gone largely unnoticed and it is our opinion that it may just be at the core of the decision that each builder must make to complete his/her Express.

The flight history of the cruciform tail design now includes hundreds of hours of safe, efficient flying with no hint of unusual instability. All owners of flying examples report that their cruciform tail examples behave as well, or better, as many other clean, 200 mph, four place certified aircraft in the 3,000 lb gross weight category **WHEN FLOWN WITH FULL ATTENTION TO COORDINATED FLIGHT - PARTICULARLY AT TRAFFIC PATTERN SPEEDS.**

The so called "tendency for the tail to uncouple in certain combinations of flight modes and control inputs - particularly rudder" does, in fact, exist. This tendency has been purposely demonstrated by Mike McDaniel in 540EX, Ed Bernard in his Express, Jim Warner in his Express and a representative of the Australian counterpart of the FAA in Jim's Express, among others, and accidentally on at least one occasion by David Ullrich in 540EX.

In each case when being test flown to evaluate the condition, the airplane had to be forced, using full or nearly full rudder deflection, into an attitude that allowed the tail to "uncouple". It is important for each builder to carefully test his/her aircraft in all loading and speed combinations to become thoroughly familiar with the full range of its flight characteristics during the first few hours of flight.

Prudent pilots plan to avoid finding themselves in a flight attitude which requires full deflection of any of the flight controls. At the same time it must be recognized that unusual attitudes, usually from turbulence or gusting wind, do occasionally occur and the pilot must be prepared to handle them by understanding the limitations of the aircraft he/she is flying and deal with the situation within the limitations of the particular aircraft.

As described by Express pilots who have tested this part of the Express flight envelope, the anomaly is one which can, 1) easily be avoided by careful manipulation of the flight controls; 2) be mitigated by careful attention to the CG range, particularly the forward limit and; 3) approach speed management.

CBROS INC. has personally discussed the described anomaly with Mike, Ed, Jim and Hardy Huber and have flight experience in 540EX going to Sun 'n Fun in 1994 (David Bruner PIC) and return from Sun 'n Fun with Ed Bernard and feel safe in saying that, flown properly, within the appropriate CG range, the cruciform Express is not an inherently "dangerous" airplane.

In addition, some of the above mentioned pilots have described numerous, fully controlled landings with cross wind components far exceeding the factory recommended limits.

There seems little doubt that the "Series 90" tail provides some additional positive stability, but it also seems to us that each builder must be honest in his evaluation of his piloting skills and choose the tail option which suits his level of comfort. Whatever your choice of tails, your choice of the Express as a project will reward you with many hours of fast, comfortable, cross country flying.

.... Ed

**Workshop** - Cont'd from pg 1

dug out or dissolved using acetone, or if you are brave enough, gasoline leaving the part hollow where the foam was. CBROS will use the technique to form ducting for the windshield defrost system (See picture of foam form opposite) as well as for major streamlined covers and fairings for the nose and main gear pants. A detailed procedure will be described in a future *Express Link* article.

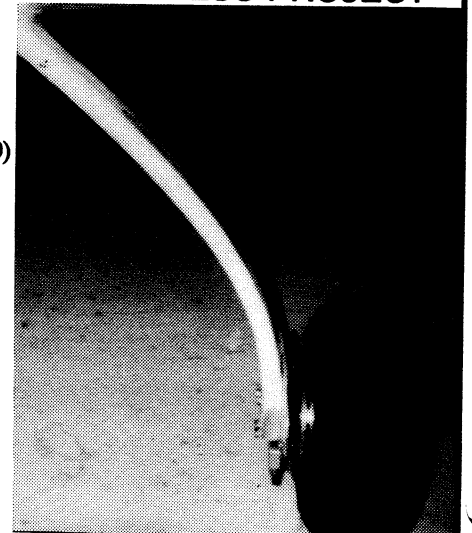
As usual Jerry was most generous in his description of many of the techniques he has used and in particular, technical advice on instrument panel installation, upholstery installation, electrically adjustable pilot and copilot seats and auto pilot installation, to name a few.

Our thanks to Jerry and Pauline for another great workshop and social weekend. Perhaps after Jerry has completed and is flying his Express, we will be able to talk him into holding additional workshops at the CBROS builder support center at LVK. It is proving to be very valuable to be able to communicate with other builders in a technical forum specifically for Express builders, and to build an expanding network of Express builders who are willing to share their expertise for the benefit of others.

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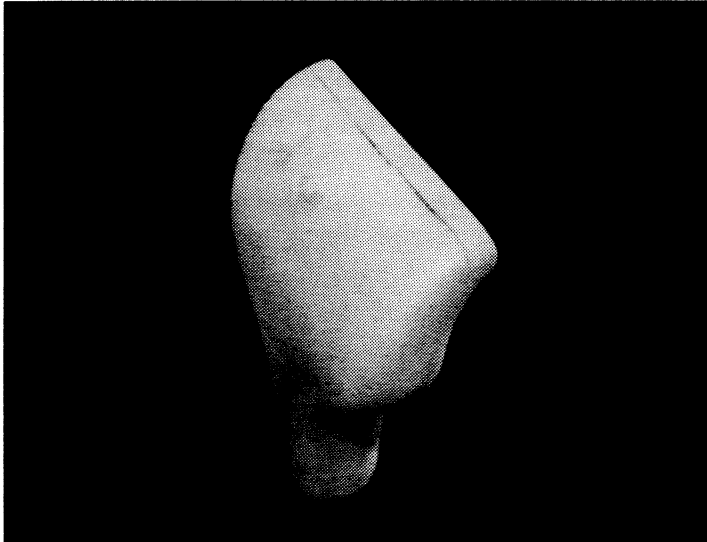
4724 Scenic Drive N.E. Olympia, WA 98506  
Phone (360)491-2599 Fax (360)491-1345

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....While no specific overtures have been made to individual owners, it is believed that finding test vehicles will not be a problem.

Such a program will cost a significant amount of money and the information developed could be readily copied by non participating builders, but the project would seem to be within reach if a reasonable number of builders are interested enough to financially contribute to the project. No specific estimates of project costs have been developed pending an indication of interest from enough builders to justify proceeding to that stage.

If you would be interested in participating in such a project, call Larry Olsen at (360)491-2599 or FAX at (360)491-1345 at your earliest convenience.



Above: Form for windshield defrost duct uses common, blue insulating foam covered with aluminum foil.

## Builder Techniques:

### Milled Fiber Fillets / A use for PLAY DOUGH

From the Shop of Joe Chisolm:

1) When a procedure calls for a milled fiber fillet, or cleaning up a wing/tail squish, first form the fillet with your finger, then put on a layer of peel ply and form again working as much resin as possible into the peel ply. The cured result will be a neat, ready for BID application, fillet. (ed note: adding a small amount of Cabosil to the milled fiber mixture will make things much easier. Also, pay particular attention to "feathering" the edges of the fillet. If there is a way to get to the peel ply with a small brush, consider using a small amount of acetone - from your brush cleaning can - to dilute the edges while they are being worked).

2) PLAY-DOUGH works great for checking rib clearances before a squish (wing/stab/elevator etc.). Here's how it works:

- A) Put a layer of masking tape on top of the rib, sticky side on the rib.
- B) Put a small bead of PLAY-DOUGH on top of the masking tape. The

PLAY-DOUGH will ....adhere to the non-sticky side of the masking tape, even on vertical surfaces (such as tail shear webs etc.).

C) Cover the PLAY-DOUGH with a layer of masking tape, sticky side on the PLAY-DOUGH.

D) Position the skin, etc.

When the skin is removed a clean, masking tape/PLAY-DOUGH/masking tape "sandwich" that shows the clearance between the rib and skin is left in place. For cleanup, simply pull the masking tape "sandwich" off the rib.

The PLAY-DOUGH is reusable by pulling the top layer of masking tape off the PLAY-DOUGH, scrape the PLAY-DOUGH off the lower masking tape layer and then removing the lower masking tape layer.

THANKS JOE !

Joe Chisolm can be reached at:  
2235 West Potter Drive  
Phoenix, AZ 85027  
Voice: 602.582.9515  
FAX: 602.582.1138



## Truly Independent Brakes

As furnished with your *Express* kits from the factory you will find that the brake system does not truly operate independently from both the pilot and co-pilot positions. Using the master cylinders supplied, *as soon as either position applies even the smallest amount of brake pedal action, the other position is cut off and cannot apply pressure to the system.*

While the factory system as documented works, CBROS has opted to change the system to provide fully independent operation where the person with "the biggest foot wins".

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### *".... the biggest foot wins"*

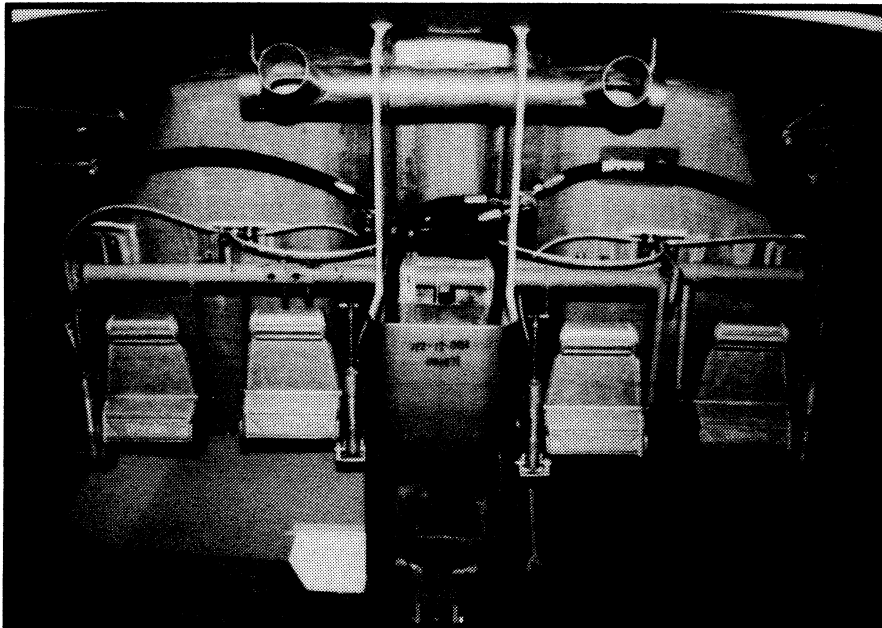
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This has been accomplished by acquiring two shuttle valves, which are actually used for the same purpose in some certified aircraft, and installing them in the brake line(s) which run from the bottom of the master cylinders to the brake cylinders at the wheels. In the picture below the two shuttle valves are shown installed in the sides of the nose gear support, and are plumbed, in and out, with flexible hoses (AeroQuip 303, not nylon tubing as shown and supplied by the factory). As can also be seen in the picture, the flex lines to the wheel cylinders are routed to the floor inside

the nose gear support and are extended aft, using 1/4 inch aluminum tubing, along the floor, through the forward shear tie and the spar carry through to a 90 degree elbow located in the flap torque tube "box" and finally to a 45 degree bulkhead fitting attached to the inner fuselage skin just in front of the flap torque tube exit hole. From the bulkhead fitting, another flex hose runs through the hole in the rib carrying the inboard landing gear bracket and along the landing gear leg to just short of exiting the lower wing skin. A hard line is planned from the end of the flex hose to the wheel cylinder to make fairing easier and to eliminate noted problems with heat from braking causing the nylon lines to eventually begin to seep. If you are interested in duplicating this procedure the shuttle valves, which are Piper part No. 492-037 (Valve Assy., Brake Shuttle), can be purchased from: AZ-PAC @ (800) 228-1836 for \$56.75 each or, if you are diligent, you may be able to find a pair at your local aircraft salvage yard for a lot less.

Brake line lengths came out as follows:

- \* Outbd master cyl(lower) to shuttle valve = 28"(flex)
- \* Inbd master cyl(lower) to shuttle valve = 18.5(flex)
- \* Out of shuttle valve to exit N.G.support = 24"(flex)
- \* N.G. supt. to el at flap torque tube C/L= 61.5"(hard)
- \* El to 45 deg bulkhd fitting to fuse exit = 18"(hard)
- \* Bulkhead fitting to L.G. exit = 31"(flex)



Above: View from aft side of nose gear support. Shuttle valves can be seen just below the heater/defrost distribution tubes, on either side of N.G.S..

## NOTICE!

Effective 1 October, 1995, Experimental Aircraft Technology will discontinue to stock its line of *EXPRESS* related firewall forward components. Current levels of demand and little indication that demand will increase in the future, has made it impractical for Experimental Aircraft Technology to invest in inventory. We will continue to accept orders for items listed in our '95 catalog, but low production rates will cause a price increase of 25% to 50%. Items ordered prior to October 1, 1995 will be sold at the price indicated in the 1995 catalog.

## LANDING LIGHTS

### Visibility is Important Too !

Using the Factory furnished Landing light kit as a starting point, CBROS has installed "landing lights" in both wings. Landing lights is in quotes because in actual practice the lights will be pulsed and used more for visibility than night landings.

The first decision to make is whether or not to use the factory light kit option. While somewhat expensive, the kit will readily solve the problem of having the correct lights and compatible pulse units, as well as furnishing mounting hardware, aluminum reflector, and plexiglass lens (which, by the way, would be a lot easier to use if it was 1/8 inch thick instead of 1/16th) . Similar units without the mounting stuff are available separately from your local automotive supply store as "driving" lights. We have heard it speculated that the newest Honda

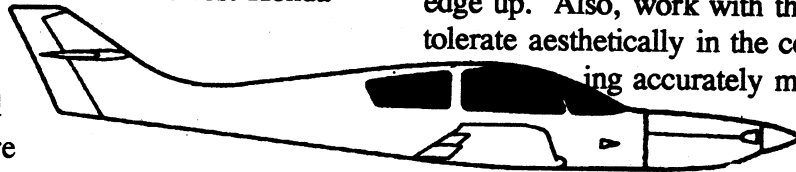
headlights are very small and powerful, but we haven't looked at one naked as yet. Next, decide where

it/they will be located. The most obvious place is in the leading edge of the wing, outboard of Rib G. The factory kit fits easily in this space. Russ Porterfield has decided to install his "automotive" system in his wingtips. This will require special molded lenses. More details on this procedure when Russ and Joyce have successfully completed theirs.

If you decide to mount them in the "most obvious" place, the next decision is what direction the cutout in the leading edge will take. The cutout can be aligned perpendicular to the leading edge, perpendicular to the main spar, or angled toward the center line of the airplane at a point 200 to 300 feet out in front of the airplane. Once this decision is made, a pattern for the portion of the leading edge to be removed can be made, keeping in mind that the part to be removed will be at least 1/2 inch **smaller**(all around) than the ultimate size of the lens, and the width will at least equal the width of the back of the reflector/mounting bracket. Take care to determine the depth of the section to be removed as it relates to where the light is to be focused.

More is not necessarily better as we have seen some lenses on certified aircraft with a significant part of the lens painted over. If you are using the factory kit, pay no attention to the rib shape drawn on the outside of the reflector sides, and do not cut the sides until later. First, the pattern is not likely to fit your wing within reasonable tolerances but, more importantly, the light will be set so far back in the wing that the use of the light will be severely restricted. An additional consideration when making the pattern for the cutout is to keep the sides and back of the cut parallel top and bottom to the greatest extent possible.

When the pattern is to your liking, mark the outline of the pattern and, using a sabre saw, make a hole that looks like a cutout for a landing light. (\$50.00 TIP: this process is a whole lot easier to do with the wing in a vertical position - leading edge up. Also, work with the largest radii you can tolerate aesthetically in the corners - it makes sawing accurately much easier).



Next, decide what the width of the flange for the lens will be and mark the width **outside** the cut you have already made. **CAREFULLY CUT THE OUTER SKIN ONLY, LEAVING AS MUCH OF THE FOAM AS POSSIBLE.** (We used a Dremel) There will be a portion of the flange which you just exposed where there is no foam. Decide what thickness of lens to be used, add 0.025 (the equivalent of two layers of glass) inches and remove that much foam from the flange area. Where there is no foam, sand the leading edge layups or add foam strips as required (they will bend to fit the curve of the leading edge) to complete a flange surface to be glassed with two layers to bring it back to the required depth. Remember to sand the edges of any foam put in so that it can be glassed on the inside.

Next, seal all exposed foam with Q-cell slurry and glass the flats of the flange. Next, do the edges.

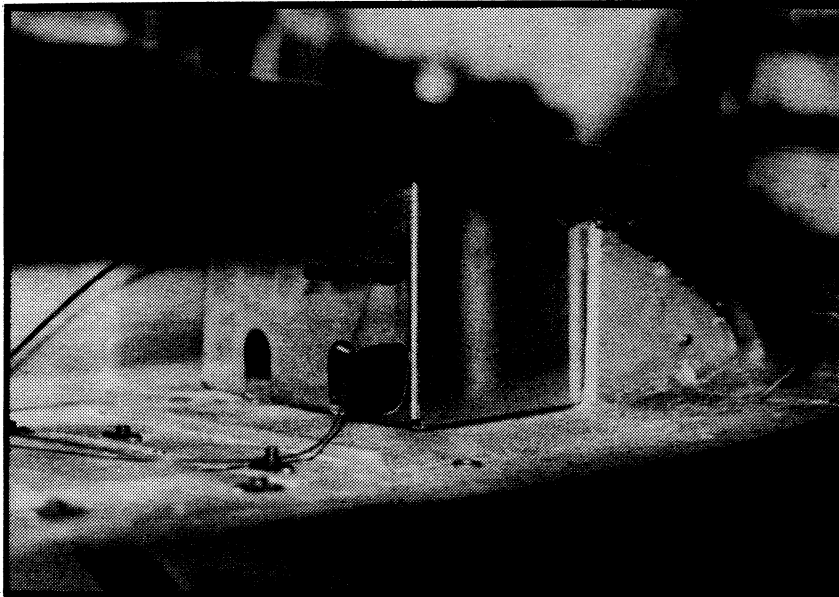
After the glass on the flange has fully cured, using 40lb foam make a false rib approximately 4 inches long for each side of the opening, see

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photo below, and mill fiber in place allowing room for two layers of glass on the full inside face of both false ribs to bring the completed ribs flush with the inside of the flange.

Put two layers of glass on the inside face of each false rib, and 1 layer, 1 1/2 in. wide on the outside of the joints.



Above: View of starboard light installation showing false rib in place and reflector/mounting bracket trimmed to fit snugly between the upper and lower wing skins.

Using stiff paper, make an accurate template of the outside edge of the flange. This will be the pattern used to cut the plexiglass lens. Once satisfied with the pattern, transfer it to the best fit location **on the inside of a lens**, (remember, right and left sides will not be the same) cut it out and trim to exact fit.

Having achieved a satisfactory fit, tape the lens tightly in place.

Next, determine your preferred spacing for the 8-32 flush mounting screws, flush head we assume, and drill plexiglass and flange at the same time - keeping the drill as perpendicular to the surface as possible. Start with the holes nearest the leading edge and alternate left to right, top to bottom keeping the lens tightly in place. Cleco as you proceed.

When all holes are drilled, remove the lens and set aside to be relieved for the flush head screws later. Drill all holes in the flange to 1/4

inch, still paying particular attention to keeping the drill as perpendicular to the surface as possible.

Using a 1 1/2 in piece of hinge pin, bend a 90 degree "hook" 1/8th inch from one end. Insert the "hook" in an electric drill and, working through the 1/4 inch holes in the flange, rout out as much foam as the 1/8 "hook" will easily reach.

Protect the side of the plexiglass which will be against the flange with clear packaging tape. Using pan head screws, attach brass threaded inserts in either the upper **OR** lower most forward holes in the plexiglass with a thin washer for spacing. Mix a small amount of milled fiber/cabosil and fill the corresponding holes in the flange with the mixture, using tape or your finger to prevent mixture leaking out. Make certain that the entire hole out to the edge of the foam that was removed is filled. Position lens with threaded inserts into the mixture, tape the lens firmly in place, allow to cure. Repeat for the opposite two forward screw locations. After second set has cured, the remaining top **OR** bottom

inserts can be done at the same time. The balance of the inserts can then be done and the lens removed and countersunk for finish screws. You may find that some of the threaded inserts will bottom on the false ribs. If so, drill the same diameter as the insert slightly into the rib to allow the surface of the insert to be flush with the surface of the flange.

With the lens removed, extend pencil lines flush with the inside face of the false ribs aft to a station where the dimension, perpendicular to the bottom wing skin, is equal to the height of the reflector. In the case of the factory unit the station worked out to be approximately 11 inches aft of the forward edge of the flange. At the appropriate station draw a pencil line parallel with the main spar centerline. Using these dimensions, make a stiff paper template emulating the reflector sides. Once satisfied, mark the sides of the reflector and trim to fit.

Our installation uses one 8/32 washer head  
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screw in a threaded insert near the front of each false rib, and a single, flush head 10/32 screw through the bottom wing skin to secure the light in place.

Since we have decided to bond our wingtips permanently in place, we needed to install an access cover in the bottom wing skin, outboard of rib G. We made this cover large enough to allow maintenance of the light units, the strobe power units which mount on the forward side of the main spar in the same bay and the aileron counter weight.

**About this issue:****EXPANDED COVERAGE:**

In an effort to bring together as many Express builders as possible in a shared building experience, this issue is being mailed to approximately 150 builders who are thought to be actively proceeding with Express construction. Nearly half of that number are already subscribers. It is with the other "half" that we would like to share our experience as well as their experience. For those of you who would like to become part of the friendliest group of people you could meet, welcome. You will find subscription information on the back cover.

**SPECIAL INSERT:**

We have developed a special working relationship with Ashlar Inc. who produce and distribute an excellent CAD program called **Ashlar-Vellum3D** which, as you can see by the information in the insert, is endorsed by Burt Rutan. We figured that some of you may have more than a passing interest in such a program, so we thought we would pass the info along. CBROS does not represent ASHLAR and has not been paid to insert the brochure in this issue. If you have any interest in looking at the program, call the sales rep

**Strings too short to save....**

.... Russ and Joyce Porterfield are keeping pace with CBROS in the construction of their Lycoming IO-360 powered Express. As might be expected of homebuilders, they have chosen several different modifications of systems such as wing tip installation (which we will describe in the next issue), and instrument panel configuration to name just two. Porterfields are planning to PIC from the right seat, similar to Hardy Huber, and will mount a throttle/prop/mixture quadrant between the front seats - a la their Beech Skipper.

.... Larry Olsen is planning to have an LPE, inverted V8, engine on a Lancair IV (wash your mouth out) mount at Oshkosh. He and Hardy Huber will also be displaying their folding motorcycle, which is now available in street ready form. Larry has also completed, test run and shipped a Lycoming IO-540 **TURBO** package for Doug McMillan who is building his Express in San Martin, Ca. More on this package, including pictures, in the next issue.

.... Dave Smith/Dick Clayton from Palo Alto, CA are seriously considering the "tail dragger" configuration (Dave is an active partner in a Pitts). It seems they would like to make the mains retractable. Any suggestions out there?

.... Jerry Sjostrand just completed a month long trip to Europe (to recover from the workshop?) and visited several builders there. None of the European versions are close to being completed at this time.

.... Have been in touch with Petar Novakovick from Australia, who reports good progress. Anyone have any idea how to convert Australian dollars to U.S.?

.... **NOTICE:** in the next issue of the **EXPRESS LINK** we have decided to publish a list of people who regularly receive copies of our news letter. If you believe you are on our mailing list and do not wish to have your name included, please notify CBROS at your earliest convenience. The purpose of publishing the list of builders is to increase the flow of information between Express builders everywhere.



**Subscription Information:** Subscription to the *Express LINK* will be based on a 6 issue volume for the subscription price of \$36.00. Subscriptions entered during each volume will entitle the subscriber to all back issues of the current volume. There are 8 issues in Vol. 1, dating back to July '92. Back issues from the earlier volume may be obtained upon request for \$3.00 each which includes shipping and handling.

**Documentation:** CBROS, Inc has retained an extensive file of patterns and templates for all procedures through flap and aileron construction. We will be happy to share them with any builder for the cost of copying them. If you have a particular need, give us a call at (510) 455-1036.

**Materials/supplies available:** CBROS, Inc. can furnish vacuum bag material, 7781 fiberglass cloth, self stick window covering, precast flanges, and precast cable tunnel for use on your *EXPRESS*. If you are interested in any of the above, call John or Bill at CBROS, Inc. for prices.

**Component construction:** CBROS, Inc is prepared to assist other builders with their projects. It is not our intention to build complete airplanes, but to assist with component construction of parts such as wings, lower fuselage/firewall, empennage, and control surfaces. Our plan is to parallel the Factory "quick build" program, but on a more customer controlled basis. As each project is unique, if you are interested in speeding up your *EXPRESS* project, call CBROS, Inc. to discuss costs and scheduling.

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