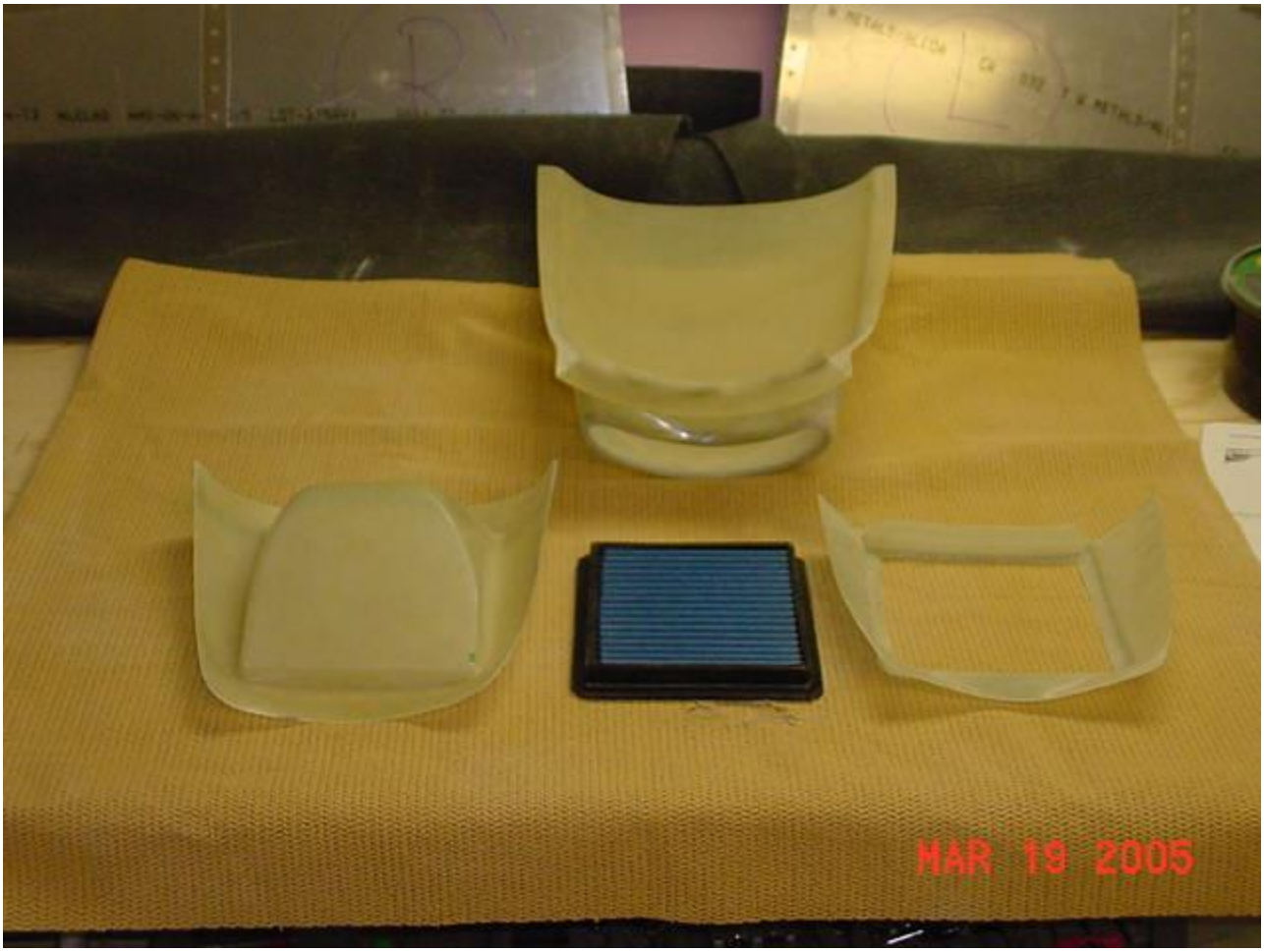
The Air Box and Air Filter Tray

If you plan on putting in Cold Air Induction, you should go ahead and fit the air scoop, but the air box and filter will be quite different, so wait until you have the CAI and your cowl mounted. I don't think there are any plans for that mod. Also, at this time, the stock cowl will have to be cut and lowered along the bottom for the CAI because it needs to hang lower than the stock setup.

Next comes the air box and filter tray. The plans are pretty straight forward for shaping these parts. I put the scoop under the cowl and held it in place and traced the air hole with a sharpie onto the scoop. Then I put each the filter tray and air box on the scoop and traced the outline I drew. My handy air saw was used to cut these parts down, then my Permagrit and sponge sanding blocks did the rest. Unfortunately, I had cut the spinner area of the cowl a little short, and so it was marked short. Ergo I cut the filter parts short at the front. Not enough to worry about, but it made a bigger gap up front, and air is going to try to bypass the filter if I don't close the gap.



Later on, you are supposed to reline the edges of the parts and then RTV a gasket on them. I'm sure the discrepancy would be taken care of one way or the other, but I didn't want to leave the gap to chance. So I mixed up some West epoxy. First I put two strips of 2 inch tape behind where I ground the shit out of the spinner area on the bottom cowl. It kind of filled up the back of the spinner ring. I hope it doesn't hit the timing ring. There was some epoxy left over so I mixed some flox in there and spread it onto the cowl where the air gap is going to be located. It may not completely solve the problem, but at least it will get it closer. Perhaps close enough that I won't have to have a huge globe of RTV unsupported in that area.

Time to kick back and relax for a while. I'm burnt out working with all this fiberglass. I'm going to take a break until tomorrow (after 8 hours today) and let the epoxy cure. Next I'll try to assemble the air box parts and try to have them ready to install with the scoop onto the lower cowl.

The air box parts don't really fit any better than the air scoop. Lots of slop built in there, evidently. Either that, or I'm just missing something. At any rate, the air filter tray has to be mated to the air filter box. The box is actually a lid to the tray and it will be made to be removable, with some hinge material to hold down the air filter. I set the tray in the scoop and put the box over the top of it. I got everything in it's best position (far as I could tell). I took the tray and box out and taped them together in that relationship and put them back in the scoop to check the fit. So far so good. I measured for the screws and nutplates per plans. You don't have much choice here. There's just no place for the nutplates without getting into the scoop body, and you can't get a screwdriver to the flanges on the tray/box assy due to it's shape. So stick to the plans on this part, then go from there.

I marked and drilled the 4 holes through the box into the tray flanges with a #40 and clekoed each hole as I went. Then I went around with a #30 and clekoed a nutplate under that as I went. Then I aligned the nutplates to give as little interference as possible, and drilled them #40, and clekoed 1 hole in each nutplate. I countersunk the fiberglass on the tray for a NAS soft rivet and then removed the copper cleko. I squeezed each of the nutplates one at a time. Next drill up to #18 for a #8 screw and off I go!

The nutplates contact the air scoop body. It was necessary to grind down the nutplates. I went ahead and inserted the #8 screws and ground them down, too. You know, I probably should have used #6 screws. It would have all fit better. The #6 nutplate threaded barrel is about the same length as the ground down #8's. Oh well, if I was more industrious and wanted a smaller footprint on the head of the screw, I'd go back and change them. It wouldn't be hard. As it is, I think I like having the larger screw. Maybe I should have used a TEN instead?!

Air Filter Brackets

The plans recommend brackets in the air box to hold down the filter. I decided I really didn't like the prospect of trying to construct brackets that way, so I cobbled something different. Keep in mind that this is my own idea, and it may not be a good one. The bad side of this idea is that there are removable parts (SCREWS) after the filter that could come loose and lodge in the intake. To prevent that, I am going to put steel screen between the cone and the air box that is small enough to trap a #6 screw. Other than that, I think this is a much easier way to hold down the air filter. I could even lessen the chance of screws coming loose and getting through the intake by riveting down the bracket on one side and screwing down the other. 2 fewer screws to come loose (although rivets have been known to come loose, too!).

First, I had to make the filter fit the tray. I used an Exacto type knife and trimmed the front end and the rear end. I oriented the mesh in the filter to go side to side. I don't think it matters much, but that just made sense to me. I also rounded the corners a bit more. The rubber is pretty soft, but I was able to smooth out my cuts with my Permagrit sanding block.

Once the filter sat fairly passively, I made some measurements. The filter is 7x7 inches. I made my brackets just short of that, but could have easily made them 7 inches. I used a double bend on my brackets. What I did was hold the filter down and scribed the highest level of the filter onto the tray. Then I measured down to the

gasket of the filter, then across, then up.

The measurements for my hold down brackets ended up being: 6.75 inches long by 45 mm wide. The bends work out to 20 mm x 10 mm x 15 mm. You could easily just go with a single bend bracket and use 35 mm wide with a 20 mm side and a 10 mm contact footprint on the filter. BTW, 3/8 x 3/4 inches would work just as well on the bend measurements. The filer tray tapers down quite a bit at the forward end, so you have to taper the bracket where it rests in that area. I started the taper 1.5 inches back and it worked out pretty close.

You can put two nutplates on either side to hold down the brackets. I used #6 screw nutplates, but could have used #8's to match the air box. The only thing you have to be concerned with is the tray interference with the air box (not so much the air scoop body) when you locate these screws and nutplates. The head of a #8 might contact the box, but I don't see a problem with the #6. So far.

The screw holes center on the bracket. The holes go 2 and 5 inches or so from the very aft edge of the outside of the filter tray. I drilled the holes in the tray first, the back drilled the brackets. I think it's easy to go either way. 2 and 5 inches was a guess, but it locates on the bracket fairly well. When I drilled my original holes, I went midway between my scribe line and the filter, which was 10 mm down. Then I just tried to find convenient locations for the holes and nutplate. And it worked out the first time.

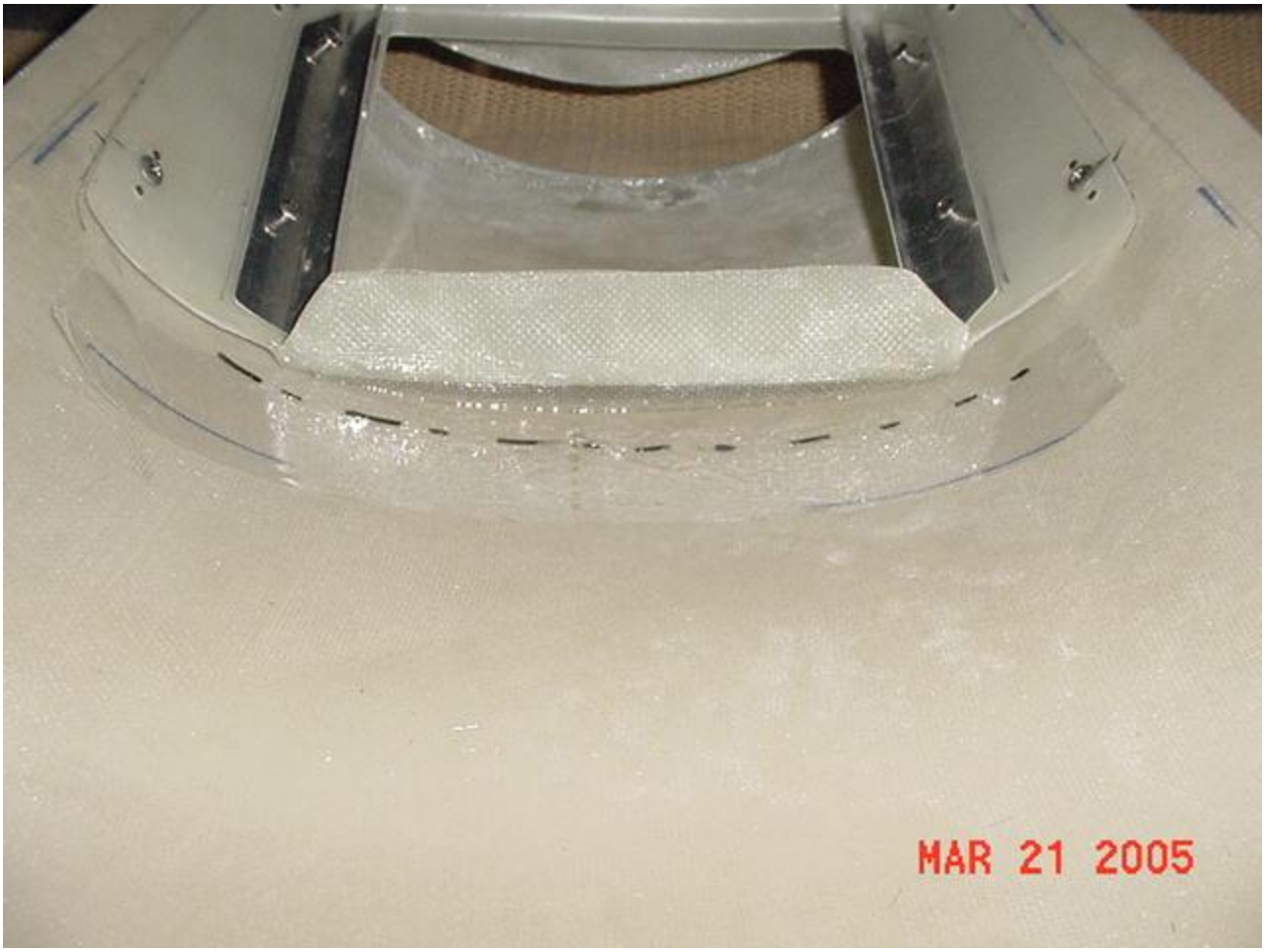
Another method that I had considered was to put 4 nutplates in and put in some screws, then use safety wire and lace over the filter from screw to screw, and twist tie one single piece. You could even permanently bond the screws into the nut pates. You could even just lay some cloth along the side, making a long tab or cleat of sorts and run safety wire from that over the filter to hold it down. I just didn't like the idea of trying to make a bracket and guessing how it would attach to hold down under the fairly irregularly shaped air box. My bracket technique is very straight forward and gave me predictable results.

There's a big gap at the back of the tray when the air box closes over it. You will seal that when you bond down the air box to the air scoop.

This gap would act as an airflow bypass around the filter. So again, you have to do some glass work to seal off this gap. You are to glass the tray into the air scoop permanently anyway, so this extra bit of work isn't that big a deal. I'm trying to hold off finishing all this stuff until I have my engine core hung, but it would be easy to add a strip of cloth to get it close now, then seal it with the flox around the perimeter upon final installation.

I could have just made a HUGE dam of flox to close this gap. However, I decided to put some cloth back there to support the flox and tie into the tray. It was a fun little exercise. I roughened up that pristine glass tab on the back of the tray and wet it with epoxy. I wet the tape thoroughly and brushed it into position. The tape seemed to want to fold under. I was originally going to lap it aft, but decided instead to fold it under the tab and lean it forward. In retrospect, this could be a good thing. I could even flox the forward side of this fold and "ramp" the airflow to the filter. I'll decide that when I get the part glassed permanently down to the scoop.

I have a huge amount of the 3 inch roll of tape left over, so rather than cut from the bolt, I used a piece of tape scrap. I put some dental plastic down on the scoop "floor" to keep the glass from bonding. I measured the aft flange on the air box at 1.5 inches, and marked it on the plastic so I'd be sure and not interfere with the box. Well, that wasn't an really an issue. I'm glassing to the flange that laps over the filter to help keep it in position. I trimmed the piece of tape to mimic the shape of the tab, then rounded off the opposing corners to release some tension when the tape is put into place.

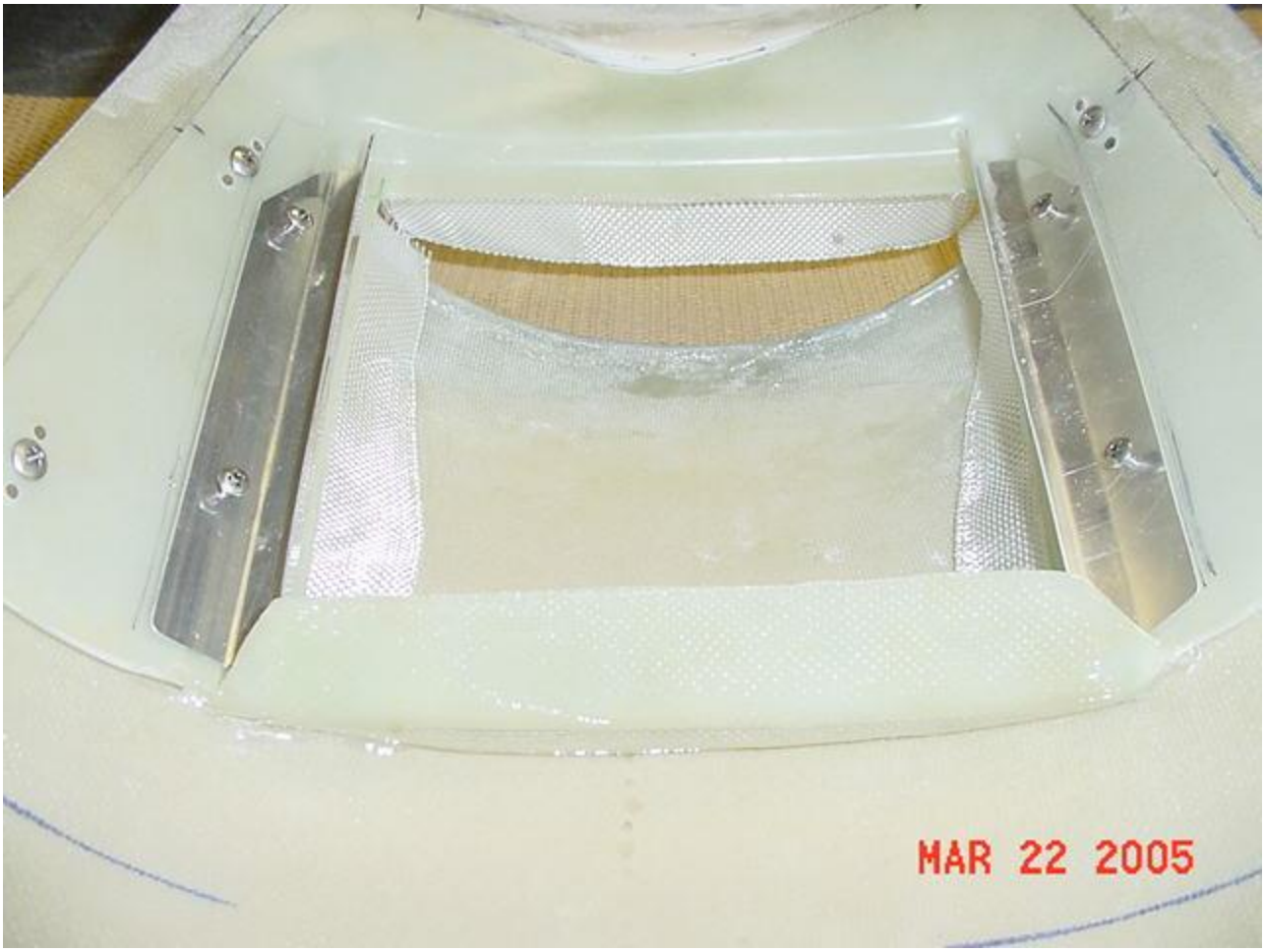


The reflection in the photo makes it a little hard to see the roll of glass under the flange. You can see it's not a huge area, but now the gap will be very small and easy to seal.

Airflow into the Scoop

The plans say you are supposed to use A-B flotation foam and build up the inside of the scoop under the tray and around the inlet to smooth out the airflow into the filter. That stuff is $90 and I need about 10% of the containers. Probably less. So I decided to go it on my own again. The seal I made by glassing in at the back of the tray gave me an idea... and glassing in the back of the tray to the floor of the scoop is part of this technique. The plan is to epoxy side and front skirts from the tray to the rear skirt that I already glassed, and to the surface of the air scoop. This blocks nooks and crannies and perhaps better guides the airflow more directly to the filter.

I cut some lengths of 3 inch tape. 2 of them are about 8 inches long and one is 7 inches. I flipped the filter tray upside down and readied the rim under the tray for epoxy and the tapes. What I did was wet ONLY the 1/2 inch rim under the tray floor to attach the fiberglass tapes to the tray frame. I let that cure overnight. That will make handling the "skirts" a lot easier when working through the filter hole and the mouth of the skirt. Better to have one side of the tapes attached to the tray already than try to glass down both sides of three pieces at once in a tight turn and close spaces.



The idea here is to make these "skirts" fold into the throat of the air scoop and cover the open nooks and crannies. Admittedly, the 1/2 inch footprint on the tray frame is pretty small, but there is going to be 1 to 2 inches contacting the "floor" (or "body") of the scoop. What I'll be doing is wetting the "skirts" and then tucking them in when I glass down the tray to the scoop. After that sets, I can glass in a second layer and fill in any nooks, corners, irregularities, whatever, with flox, micro, or more cloth. Cheaper and faster than getting flotation foam. And it should be more than adequate to improve the airflow. Perhaps not the highest performance improvement, but simple and quick. I'm actually doing it to give bugs and birds less territory to set up house in. I should be able to look in the mouth and see the entire throat of the air scoop. As big an open space as this is, that's probably a good idea. I'm tempted to put large gauge stainless mesh behind the lips of the mouth to keep out intruders, too. I think I'll save that for another day.

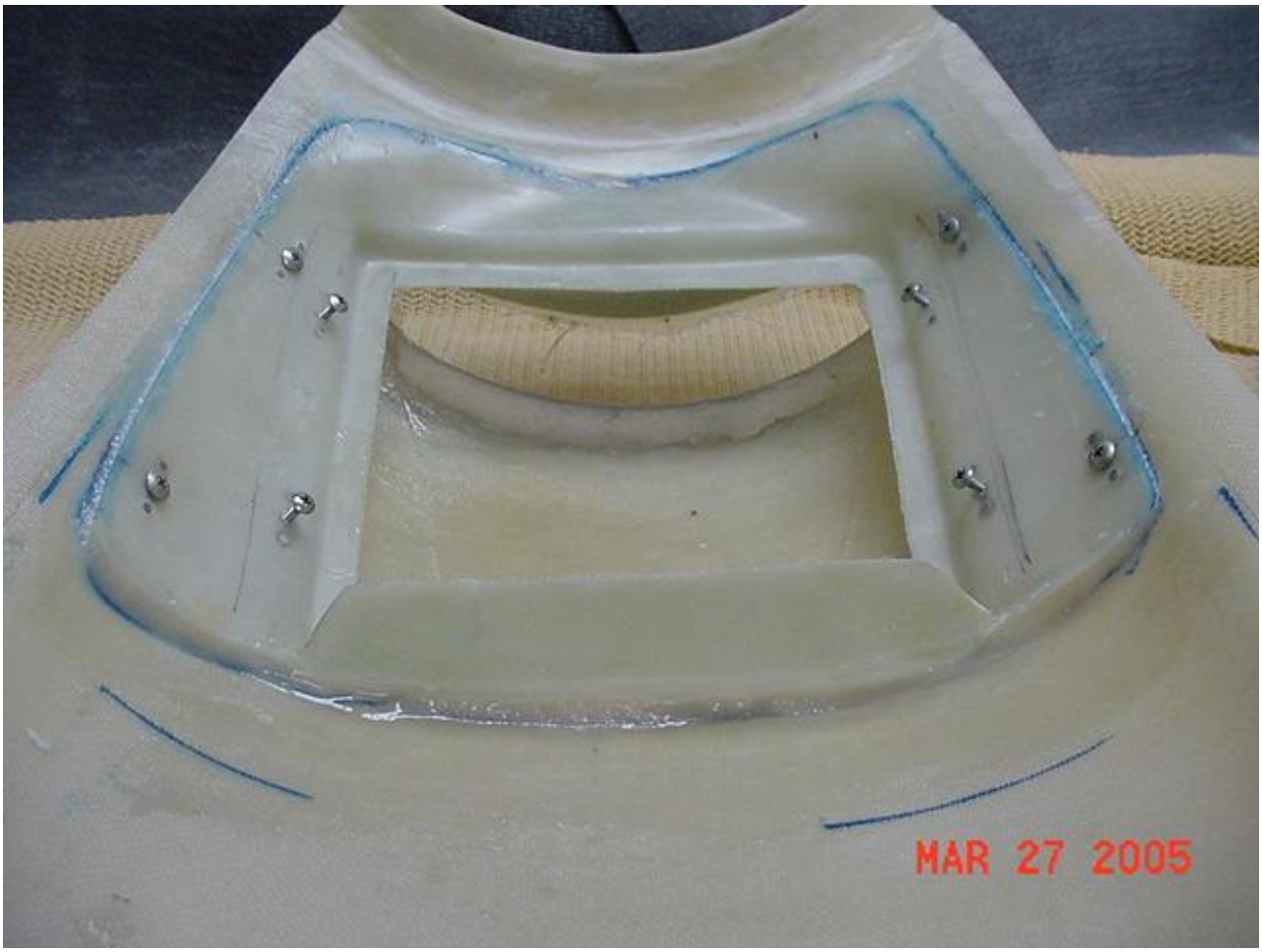
I will trim the forward skirt to match the smile of the scoop mouth. You can see the forward edges of the side skirts. I can epoxy all of these just inside the lip. After that, I was going to consider laying in some flox or micro to smooth out the lip transition to the scoop floor all the way around. Perhaps it will reduce turbulence and increase pressure? Well see how it goes.

You may be able to see the idea in the pictures above. I'll epoxy the skirts to the floor and forward down to the lips of the mouth of the scoop. Some trimming will be required at the front. On the two side skirts I could have made them wider (over 3 inches) and the definitely need to come from the back all the way to the scoop. When I'm finished the 4 skirts that I have installed should make a nice "barrel" into the filter without all that foaming time and expense. I like it. YMMV! I'm waiting for the cowl fixture. I want to put the cowl on the ship and line it up with the engine prior to installing the scoop and sub parts.

I had a little fun Easter Sunday '05. I mixed up about 3 squirts of West system epoxy and flox in separate batches. 3 squirts mixed at once would set to fast, even with flox, which really slows down the set. I prepped the areas to be mated. I used some dental wax and covered the nutplate threads (screw holes). I wet both the surfaces of the tray and the air scoop with epoxy.

I started making a rim of flox on the air scoop to go around the perimeter of the filter tray. Some areas around the tray have to be pretty thick to close quite a large gap. Some areas are thin enough to use just regular epoxy, but I used flox all around.

At this time, I wet the skirts that I bonded to the bottom rim of the filter tray with a copious amount of resin. Then I folded the 3 skirts in toward the middle of the filter area. Next I smooshed the tray down into the flox on the scoop until I got alignments with the tick marks I had made earlier on. I just used my finger to clean the excess around the tray. I used a disposable brush to move the skirts where I want them and pushed and pulled the wet cloth to position.



Looking back at this little process, I may have made a smoother internal airflow by attaching the skirts toward the middle of the filter instead of toward the outside of the skirt. At any rate, the throat of the air scoop is now a lot smoother and the nooks are closed off by virtue of the 3 inch skirts I glassed to the scoop from the bottom of the tray.

After the tray was glassed, I finally got some A-B expanding foam to fill in the scoop, then carve it out and glass it over to smooth out the airflow even more. I didn't really need to do the glassed "drapes", the glassed expanding foam would solve those problems and allow a lot of contouring inside the mouth of the scoop too.

I used the expanding foam most of the way around the mouth, especially the sides of the scoop and the prop side of the scoop. Then I took a sharp steak knife and cut the foam roughly to shape. After that, I used a wood rasp and shaped it much more. Finally, I mixed up some West System fast set with a bunch of micro and layered over the top of the foam. The foam hadn't had a chance to completely degas when I laid on the micro. Consequently, there were bubbles through the micro after I sanded on it. That saves me the trouble of trying to get a drill in there to "vent" the foam through the fiberglass.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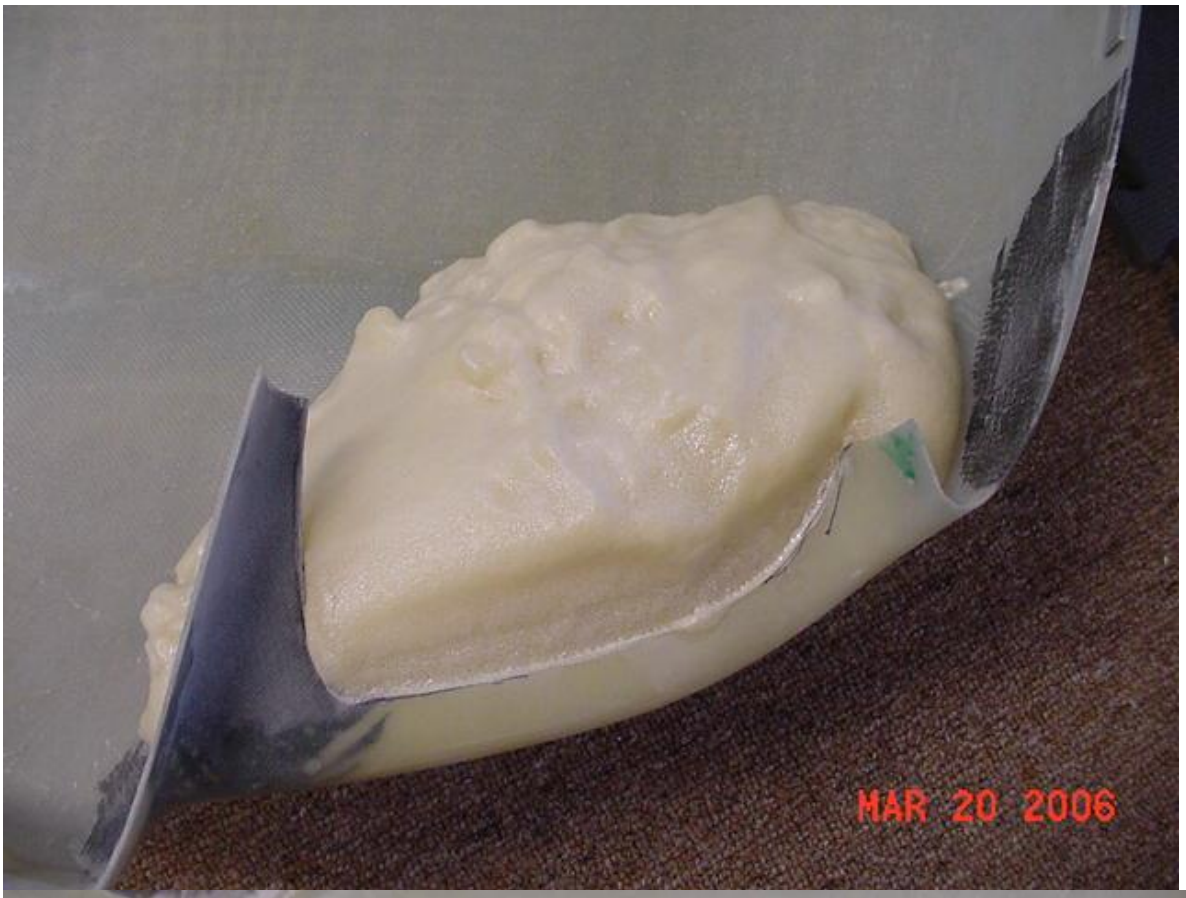
Upper Cowl Inlet Ramps

The inlet ramps for cooling air over the cylinders have to be modified. The plans state to cut back the inlet of the upper cowl to 3/4 inch from the LE of the inlet. Then, you are to use expanding foam to create a substrate to support a couple layers of epoxied bid. I got out my A-B foam and poured up about 3 tablespoons of each component and mixed it up quickly in a paper cup. Then I hastily poured it under the lip of the cowl inlet on one side. As the foam began to expand, I nursed, cajoled and otherwise persuaded it into position. Mostly, it does what it wants.

I have no idea what to do with the foam on either side of the inlets, but from the plans, I can tell that the foam needs to go back about 6 inches to the seam that you can see through the fiberglass. One the foam gets workable, in about 15 minutes or so, I just used a sharpened steak knife and then a rasp to shape the ramp in the inlet. Here's what it looks like before and after... just a rough cut: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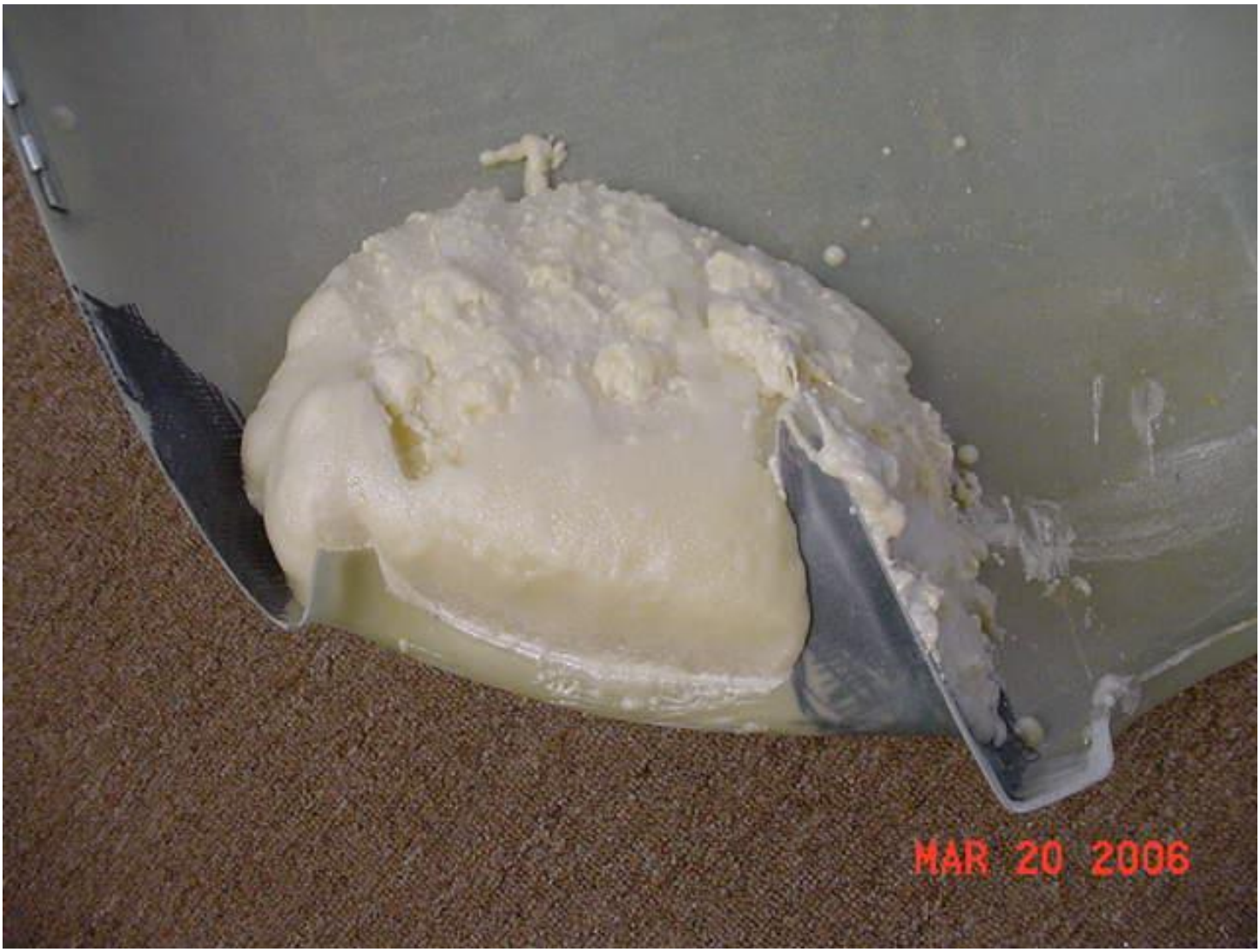
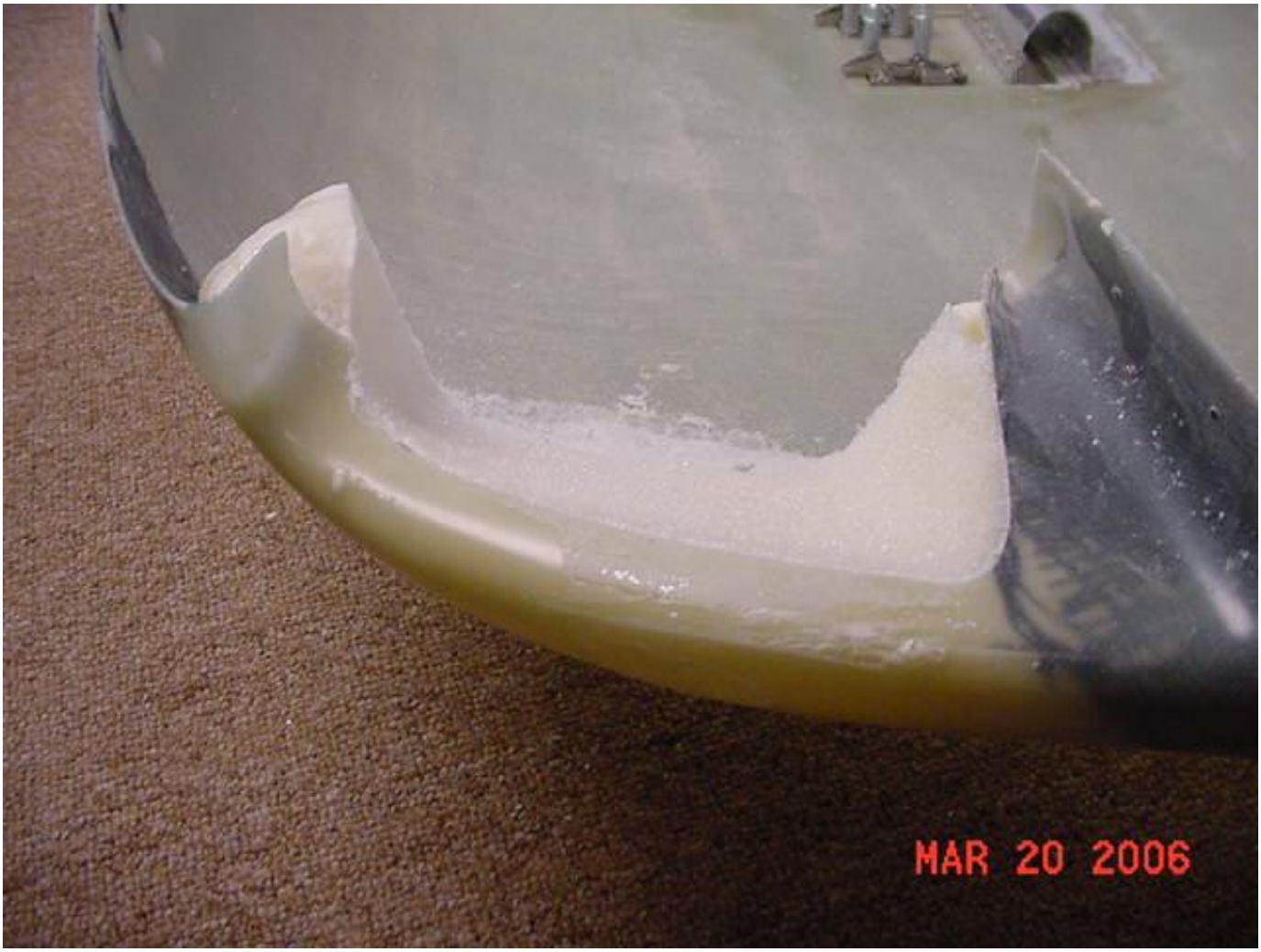
You can see that there is a lot of waste. It's fun to watch it grow, though, and you do want it to fill up the lip from side to side.





I think I need to have my engine with baffles mounted and fit the cowl on the ship before I go any farther. The foam is much easier to trim now, more so than after I add the fiberglass.

As is turned out, the left side of the ship has the cylinders set back farther than the right bank. Therefore I didn't have the left ramp going back along the roof of the upper cowl. So another foam pour is in order.

Mounting The Engine Cowl On The Airframe

I'm still waiting to run down and get my core (...that never happened). In the mean time, I'm getting ready to get the cowl installed for real. I'm trying to complete as many steps as I can. I went ahead and cut out the bottom half of the cowl for the gear legs. Then just for fun, I taped the cowl on the fuselage:

OH BABY! Now I feel like I'm getting somewhere! The cowl is tipped upward a little more than it will be in service, but it's really close. Notice the cant of the left wheel. That's as broad a stance as I could get by hand. The plane is missing about 400 pounds up front, so the gear aren't as wide as they will be. Even so, they are 80 inches apart. They might be 90 inches apart with a load. That's OK, I have to take the gear legs off to get out the door anyway, and besides, if I can get the gear farther apart, perhaps it will bring the nose down 10 inches. I don't want to have to work on a step stool all the time. The top of the canopy is 80 inches, and at 5'6" I have a hard time getting to the top of the cowl, let alone the canopy.

Mark Frederick was kind enough to send me the cowl fixture, so as soon as I get the engine hung I can align the cowl and get it set up. Unfortunately it may be a week or two yet because my engine guy doesn't have the correct ears available for my engine, they are at the overhaul shop. So I have to hurry up and wait some more. I think I can go ahead and complete the air scoop with the cowl taped onto the fuselage. This is pretty close to the shape the cowl will be in service, so I can keep pressing on. That won't take long, so I'll have to figure something else to work on in the mean time. (Mike Moore never got ANYTHING to me and disappointed me at every turn. I wasted A YEAR without an engine because of him, and I STILL have never gotten my money back. What a loser.)

No sooner did I get the cowl fixture in my greedy little hands, I was contacted by two other builders who needed it. I still didn't have a crank or the mounting ears for my case (never got them), so I went ahead and sent the fixture out again. Now I'm back to #3 in line. Hopefully my parts will come before that fixture gets shipped around the horn again.

Jim Winings and Vince Frazier both used Skybolt C-Loc 1/4 turn fasteners (a Cam_Loc "compatible" product) to hold their cowls to the airframe. Originally, I was just going to use screws, but I figured what the heck. In for a penny, in for a pound! There's a bunch of fasteners around the aft edge of that cowl, and making them release with just a light 1/4 turn has got to make that cowl easier to remove. The way I look at it, I'm going to

be putting all that extra effort I would be putting into the standard screws into installing the C-Locs. My understanding is that they are not easy to work with. Jim used rigid receptacles, but Vince put in the floating/adjustable kind. That's what comes standard in Skybolt RV-8 C-Loc kit, which sells online at 20% off retail for about $370. Not cheap by any means, but an extremely nice product. I went ahead and placed my order. Now I'm just waiting for confirmation and shipment. I sure hope everything I need to get this cowl on comes at the same time. (Well, at least I got the C-Loc fasteners).

Jigging the Cowl

Here it is, Summer 2006 and I finally have an engine hung. I mounted my Mattituck TMX540 and let it set overnight. Now that the engine has settled a few microns, it's time to fit the fiberglass engine cowls. (It actually sat on the rubber mounts about 2 months before I was able to get back to working on the cowl.)

First things first. Protect the engine. I used a few layers of cloth and covered over the engine. Sure helps keep it pretty, especially since I banged the cowl on and off about 30 times in the process of fitting up the top cowl.

I borrowed a cowl alignment jig from Jim Winings about a year ago. I felt bad keeping the jig that long, but he didn't need it back, and neither did anyone else. Well, now I can finally put it to use.

I used the two bolts that Mattituck used to hold down the front of the engine (by the starter ring/prop mount flange) and attached the cylinder of Jim's jig. It has markings on it for different props and configurations. Next, I put the top engine cowl over the engine and boo/cowl flange and checked it out. Pretty! Then, I put the cowl

jig disc over the cylinder. Well, it didn't go on the cylinder, the cowl was too long. And I cut the cowl to the mark molded in the fiberglass. Well, I can tell you now that the molded line is about 1 inch too far aft, so cutting way proud of that line is OK. In fact, I started by cutting an inch off my top cowl to get it back to where it should be just to get started.

My cowl is already cut and trimmed to mate the top and bottom. Therefore the cuts are able to be lined up with the mark on the jig disc. Note in the pic above, the disc is clekoed to the ring on the front of the cowl. Well, you can tell that it slipped when I drilled it... the cowl isn't level. So, I drilled it a second time. Fiberglass is easy to make mistakes in.... patches up nice.

OK, the disc is centered symmetrically on the cowl ring and split lines, so it's time to start cutting some MORE off. I ended up getting the cowl to sit very nicely, THEN I went back and cut ANOTHER 1/2 inch off (with just a dremmel disc). Then with my Permagrit sanding block, I hand sanded the aft edge of the cowl until the middle ring on the cylinder showed through the hole in the disc.

Oooo LA LA!!! The top cowl looks SCHA-WEET!

Well, that was 4 hours worth of work. Time to take a break. Next chore is to drill some holes in the flanges for some fasteners, cleko the top cowl and start fitting the bottom cowl. WHEW! That's going to be a LOT of work.

Summer 2006 is nearly over. I took a over a month off of building to take a two week motorcycle trip and do other things. Now it's time to get back to F1 EVO business.

I removed the oil door so as not to booger up the pretty Mattituck engine. I covered the engine with soft cloth (carpet anti-slip).

TIPS: When handling the cowl halves pinned together and trying to locate them over the cowl flange, the jig disc must be off of the engine cowl. Also the best way I found to manage getting the sides over the flange is to handle the cowl by grabbing it by the lower lips of the air inlets. I grabbed the lower lips of the inlets and that flared the sides out a bit, then I coaxed the cowl up and on with my stomach/belt line.

The MT prop comes with the spinner backplate already mounted to the hub, so in order to fit the cowl at the nose end I'd have to cut the wires and remove it. I chose instead to use the entire propeller for test fitting the cowl. It's not like a fixed pitch prop with the MT. I was expecting the backplate to be loose so that I could use it by itself. That was not the case.

I took Jim Winings' cowl jig off and then mated the two halves of the cowl. Now the aft end of the top cowl was already VERY close, with the jig disc showing the second ring on Jim's crank barrel (that the jig disc slides

over). You can't get the cowl on the airframe with the disc clekoed to the cowl, so I left it off and threw the mated cowl back over the cowl flanges. I reattached the disc and marked the cowl where I needed to rough trim the aft end of the lower cowl, as well as marking the gear leg cut outs (which need to be a good inch or more in front of the tubes to clear the cross bars). I removed the disc and removed the cowl and rough cut the lower cowl and gear leg openings. I had to do this a couple times, more to get the gear leg openings right. The plans say you can make these quite large, but I'm not taking any chances. I'd rather have them close. I may end up closing them and making them quite tight later on (perhaps with silicone).

Jim's Jig is well made, and easy to use. Once you align it, mark and drill it to the upper cowl, the rest is straight forward. I already had the halves mated and the hinge material in place. I made sure the halves were symmetrical, particularly the air inlets. There are marks on Jim's jig disc for the approximate location of the cut line on between the halves at the round opening and inlets. You can't really tell, but in the pic below, the cut lines are actually nearly lined up with the F1 mark, which is just a shade lower than the split location on a Harmon Rocket cowl.

After I had the cowl over the flanges and the jig disc over the crank jig barrel thingy, I lined up the cowl and made some bold marks on the cowl to help ensure that I kept the cowl level. What's cool is that the closer you get the cowl sanded to shape, the more it seems to WANT to line up.

Now that the cowl is roughed out, I smoothed the edges and then put the cowl back up over the engine. It's a little tricky to get the cowl over the cowl flanges, especially if they aren't tapered properly. I put the clekos back through the disc and lined it all up on the crank jig. I noted that I really needed to adjust the left side of the cowl about 1/8 inch, and that would necessitate slightly trimming the top from side to side as well. Of course, while trimming with my Permatex sanding block, I had to bias the reduction so that as I corrected the fit toward the right side of the cowl, the amount of reduction was less and less. This only has to be close at this point because I am going to need to glass the aft end of the cowl over the cowl flange area to line the fiberglass with the ship's skin.

Before I do anything else, I think I'm going to go to my hangar and get the MT Prop and spinner in order to check the cowl alignment against the actual spinner. After that, the next step is to add a couple layers of fiberglass tape under the aft edges of the cowl and then measure, mark, drill and cleko for the cowl fasteners. Lots of work yet to do. I hope the propeller fits on the ship under my low ceiling!

I hopped in my trusty Chevy pickup and went to the airport to get my MT propeller. I never thought it would need to be at my basement shop, but here it is. I had to strap the box closed, then haul the prop standing on the end just like it came from Germany. Through it's travels, the bottom tips of the propeller have actually contacted the cardboard box. That was very disconcerting. They didn't penetrate the box, but the outboard tips have taken a bit of a beating. I wish they would have wrapped the blade tips in something much more substantial. I can guarantee you that I will do some serious wrapping of the tips before moving onward. Eventually, I will have to remove the prop, and box it back up to go back to my hangar for final installation.

Getting the box in and out of the bed of my truck is a breeze. The triangular shape is actually easy to manage. In my hangar, I set the box down directly on some old tires. In my driveway, I worked a 1200 pound movers dolly underneath the box and I moved it off the bed. I did it by myself, and it was easy to manage. Lifting the prop onto the crank flange by myself is another story. I could probably do it, but I don't want to risk dinging the blades. So I'm waiting for one of my builder/flying buddies to come and help. Then I have to find someplace around the house to store the box for a couple weeks.

My friend Bruce Dallman came to my aid again to help hoist the MT prop and thread it to place. These constant speed props are quite a bit of work to install. The prop is relatively light, but unlike a fixed pitch, the only way to get this thing to stay put and get the spinner backplate where you need it is to completely bolt it up. I liberally coated the crank flange barrel and rubber seal with oil, as well as the prop hub. Bruce hoisted the prop while I started the bolts. We got them all on a good 1/4 inch before relaxing the lift on the prop. Then working both sides at the same time, we each turned the prop bolts (which are pinned into the hub permanently) about 3 tuns each while gently and slightly working the hub to take the weight off the bolts. Once the prop hub was back near the crank barrel, and the metal parts were going to start overlapping, we used a 3/4 open end wrench to turn the bolt heads (a couple got tight because of the threads). Still, you could install the prop almost to complete contact with the crank flange turning the bolts with your fingers. I then snugged up the bolts with the 3/4 inch wrench.

I placed the top cowl to position and checked the gap from it's nose at the prop spinner backplate. The gap at the top looks to be very close to the correct amount. I think I may want to close it an additional 1/16 to 1/8 inch. Bruce got under the engine and held the bottom cowl to place and I pinned it in. OH BABY! Too bad I didn't get a pic of that, it looked quite cool! The backplate/cowl gap was very pronounced at the bottom, perhaps as much as 1/2 inch! That's due to the warping and manufacturing of the cowl. I'll have to build up the "nose" of the cowl all around to close the gap. You have to keep that gap minimal in order to keep air from escaping the cowl between the spinner and the cowl. Too large a gap could add to an engine cooling problem.

The top cowl is just about where it is going to sit. This scenario does not have the bottom cowl installed, so the vertical relationship is not quite right. If you finished the F1 with the cowl in this position, with new engine mounts it might not be so bad. You will get some sag of the engine though out it's life, and I think you get quite a bit initially early in operation. So finishing the plane with the spinner above the cowl is a good thing.

The MT prop spinner does not protrude aft behind the backplate, so what you see in the pic above is what your get!

Before you ask, no, the prop will not stay on the plane. I actually could get the plane out my basement french double doors with it installed, but I am not going to risk it. In fact, once I'm ready to move the kit to the airport the prop coming off, and maybe the engine, too. I kept the crates for both.

This pic doesn't look as cool as the setup did with the bottom cowl, but you get an idea of what the plane is going to look like. SWEET!

Now I have to add the layers of thickness/strength where the cowl attaches to the flange, and build up the cowl nose. Time to play with the epoxy again.

NOTE: If you plan on using Skybolt C-Loc fasteners, the RV-8 kit comes with "Skybeam" fabric which would be a great choice for reinforcing and building up the aft edge of the engine cowling. The Skybeam is a very dense bid cloth with a small, tight weave. I did not know I had this material before I glassed in the cowl tapes, otherwise I definitely would have used it. I think I will use it to over the air inlet ramps and run it to the back of the cowl along the inside of the top to help keep it from bowing up with air pressure.

I brought out my roll of 3 inch BID fiberglass tape and the top engine cowl. I took a pair of shears and rough cut a piece of tape for the aft end of the top cowl where it will mate against the cowl flange. I mixed up some West System fast epoxy and wet the inside lip of the cowl (after rough sanding it of course). I layed in the tape, brushed over some epoxy, then trimmed the ends to fit with just a small amount of overlap on the edges. Had to work around the hinge material and make sure I stayed out of the hole. I wasn't TOO sloppy. I used a plastic body filler squeegy to remove excess material and even out the tape. Once I was happy with the top cowl tape, I did the same thing for the two sides of the lower cowl.

I used 3 inch tape because I had a lot of it around. I also like the idea of having a wider/stronger base. The attach flange is only about an inch wide, so using a wide tape is just overkill and adding weight. But I have the better part of a full roll, so I didn't want to waste it. And it's much cleaner than cutting cloth since the tape has woven edges. You do have to be careful with the woven edges, however so as not to over bulk the glass at the edge.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After the BID tape/epoxy set, I determined that the thickness is still a bit shy of the skin, so I'm going back over it again to put on a second layer of tape, which is what the plans suggest.

For the second round of tapes, I used 2 inch BID. After it set up, I placed the upper cowl back on the ship. The thickness at the skin looks very close, but I won't know until the epoxy completely hardens and I get a chance to dress the aft edges down again. But I think I'll be ready to move on to the attach hardware.

Just to show a ballpark of where the cowl ends up in relation to the spinner backplate (the MT spinner is flush to the aft edge of the backplate), I took the picture below. The cowl sits low because it's just resting on top of

the engine, and the aft edge of the top cowl still needs cleaned up after glassing on the tapes. But you get an idea of how close the spinner should be to the nose of the cowl. 1/8 inch seems to be the recommended minimum gap, but some cowl/prop combos might be better off with as much as 3/8 inch. I'm shooting for the minimum.

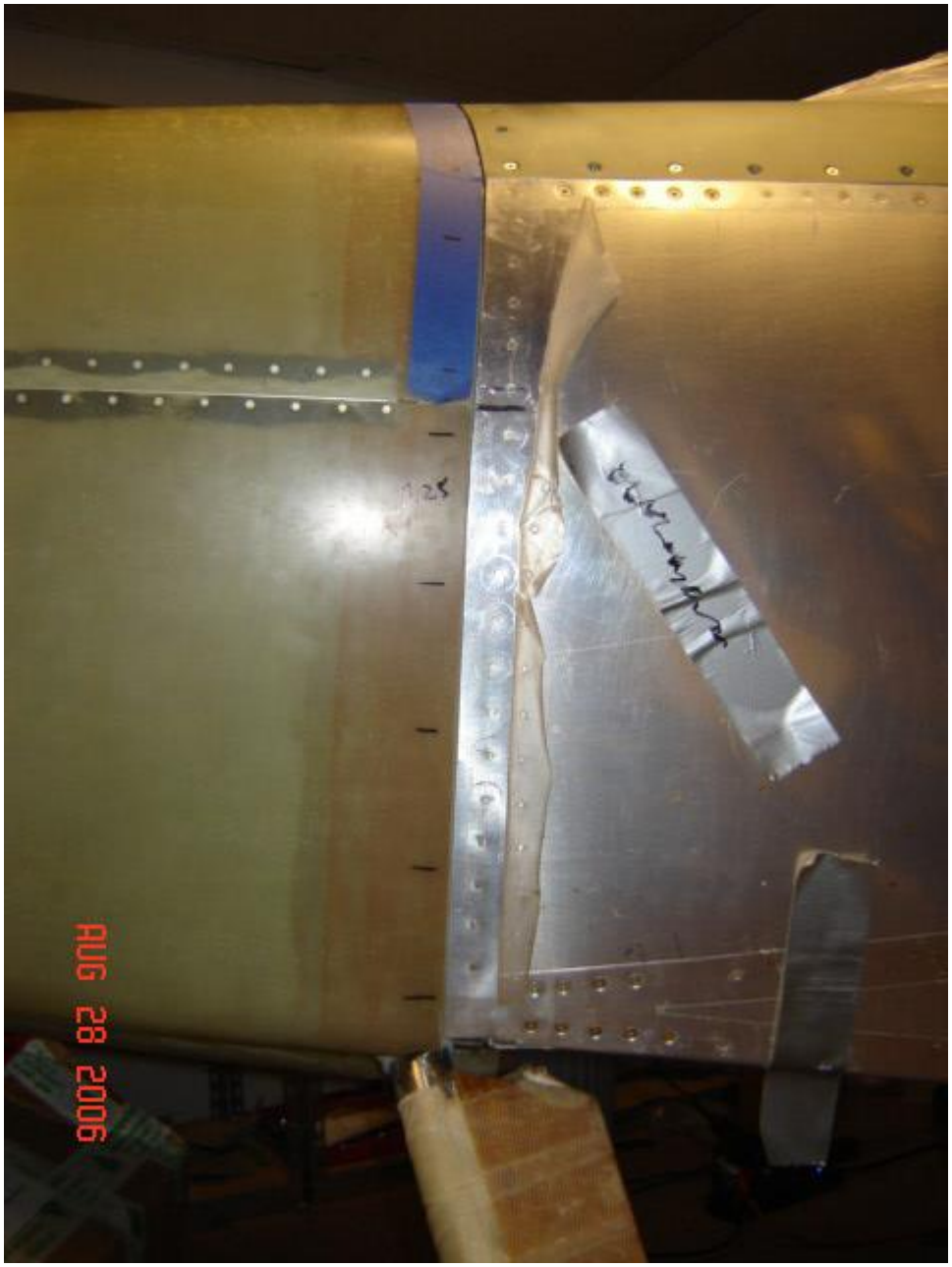
The spinner clearance at the bottom of the cowl round opening is more like 1/2 inch plus, so I'm defiinitely going to have to build it up a lot. Waiting until the cowl is at least clekoed to position before starting that process.

I went ahead and started the install of the engine baffles, but I could have just gone ahead and drilled the aft edges of the cowling halves for the attach hardware. I was a bit timid with the way I had adjusted the fit of the cowls at the aft edges and wanted to put off permanently locating (drilling) the cowls a little longer. After I glassed the cowl tapes, I was thinking about closing the gap to the spinner. As it turned out, I went with my original position, and I'll have to build up the nose behind the spinner. I would have had to build it up anyway because the disc is not symmetrical with the spinner. Man, I hope I have the engine and prop hung properly....

Time to commit. With the side and aft engine baffles roughed in, and the cowl halves set to place, the engine cowl likes to set in place pretty well. But it does still want to hang down a little and that opens a gap at the aft edge where I want to drill it. I'll use a couple strips of duct tape or get a buddy to help shove the cowl back all the way to the boot cowl skin and get ready to drill it.

The cowl flange/cowl attachment requires minimum 4 inches between fasteners. On the top cowl that works out pretty well.If you start drilling for cowl fasteners at the top center of the cowl, 4 inch spacing clears the doubler and junction of the top and side cowl flanges. The lowest side fastener at the bottom of the top cowl,

however will end up being positioned less than 4 inches to the attach point above. I decided to use 3/4 inch clearance from the edges between the top and bottom cowl. On the sides of the bottom cowl, I opted to use 3 1/4 between fasteners. Mark Frederick suggests that since there is no attachment along the bottom of the cowl, that a little extra support (one or two fasteners) might be beneficial. Starting from the top edge of the bottom cowl, I began marking at 3/4 inches down and marked 3 1/4 in between holes. The last hole at the bottom is more than 3/4 from the lower edge, in fact it's over an inch. I might move the hole a little lower when I drill it. The important thing here is that the bottom attachment is going to hidden by the root gear fairing, and the fastener above is not. Come to think of it, I might adjust the hole spacing a little so that I don't even have a fastener under the gear leg fairing, but have one just above it. Time to email Mark and find out what he thinks.



I'm glad I held off drilling the cowl to the flange. After rummaging though my stuff, I found my C-Loc fastener and read the instructions. Then I noticed that there are two steel templates with the kit. AHA! Now I don't have to measure the edge distance to drill the hole through the fiberglass and the flange. Once the cowl is fixed to position, just line up the template at the aft edge and drill for home! COOL! The fastener instructions suggest that you can use 1/2 inch edge distance for the C-Loc fasteners, but that 5/8 is recommended with fiberglass. Since my attach flange is very close to 1 inch from the boot cowl skin in a couple places, 1/2 inch sounds

better, but initially, I'm going with whatever the edge distance is fixed into the drilling templates.

Well, I didn't use the Skybolt template after all. The template was over 5/8 wide and the hole was off center. Sorry, but I build in enough slop myself. And in this case some of my flange was so close to an inch (under the 1 1/8 that was supposed to be minimum width of the flange) that I had to consider the distance from the skin on each and every hole. Never less than 1/2 inch from the edge of the fiberglass, but biased as much as possible toward the flange side, and trying for 5/8 wherever possible.

Along the top, the final measurements were 4 inches starting from the top center. Then the bottom two holes on the top cowl were 3.5 inches apart. On MY cowl (maybe not YOUR cowl) that put the hole near the hinge at 3/4 from the edge. Then on the bottom cowl, I started at 3.4 inch down and then went 3.25 inches between each hole. Including the bottom one.

I asked Mark and Randy Pflanzer how they handled that area around the upper gear leg fairing (uglf). They both said make it an attach for both the bottom of the bottom cowl AND the uglf. Randy said put it in there, but leave the uglf on the ship when you remove the bottom cowl. He said the fairing acts as a second set of hands to help hold the bottom cowl when taking it on and off, a sort of shelf to help hold it in position as it starts going to place.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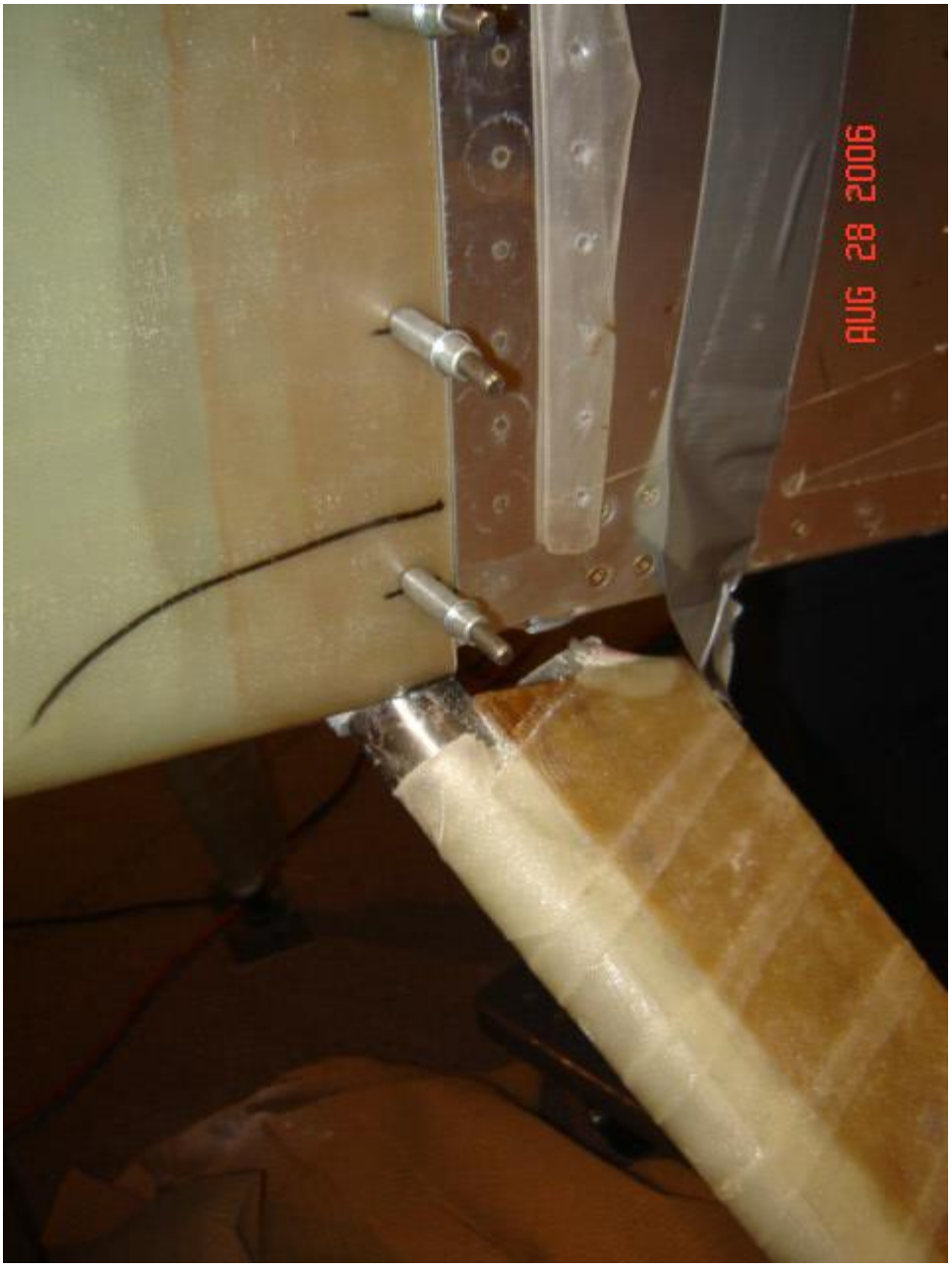

You can see where I traced the upper edge of the gear leg fairing on the cowl. The fairing is quite flat to the cowl in this area, so no problem getting a flat contact between the fiberglass parts. Dunno if I can get a C-Loc to work under both of them though. Two layers of fiberglass might be too thick.

The final gap with the engine cowls to the spinner was just about 1/4 inch at the top, and the opening was over 1/2 inch at the lowest part.. before the cut out for the air box. Going to have a ton of build up down there. Also, the nose of the cowl is not that round, and not consistent. No matter how you go about it, you have to rework the front end. I would imagine that it's the same on every ship.


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Doesn't seem like much, but that disc is awefully large. There's going to be a lot of finishing there. Oh well, at least I have the cowl REASONABLY centered around the spinner backplate. And maybe JUST a TOUCH lower than the spinner at the top. I still think allowing for a little engine sag is a good idea.

Now I can either work on the C-Loc fasteners or the engine baffling. I think I'd rather get the baffling under control first so I can also be ready for cables, wiring and plumbing. Using #40 clekoes to get the cowl on and off it actually faster than 1/4 turn fasteners.

Air Box Funnel

Now that the cowl is clekoed to the cowl flanges and the engine baffles are roughed out, it's time to start organizing the engine for cables, wires and plumbing. First, the Mattituck TMX540 is shipped without the Airflow Performance throttle body assembly on the bottom of the sump. The instructions from AP suck in this regard, but the parts are installed. With the bottom of the cowl in place, I started placed the air scoop to position after drilling a small hole in the center point of the back of the air box. This is where the filtered air will pass to the AP unit. With a small hole in the air box, I could look through the inlet of the air scoop and see the brass colored gizmo in the center of the AP unit. I took a marker and guesstimated at the round opening needed for the AP unit and funnel. A quick series of slices with the dremmel and then I took the air box back to the cowl. Another trip around with the marker, then I set the funnel over the marks and fine tuned them for trimming. Once I got the back of the air box opened to about the size of the funnel, I mixed up a batch of West System epoxy and floxed the funner to the back of the air box. Some trimming of the funnel flange was necessary before mating the parts.

After the epoxy set up, I put the parts back on the ship. The funnel was too long, so I cut it back to about 1 inch. A piece of flex SCAT goes between the funnel and the AP throttle body, so all you really need is a flange for the flex tube.

Skybolt C-Loc Cowl Fasteners

The aft edge of the engine cowl takes a lot of stress. The entire weight of the cowl seems to hang on very few fasteners. And then in flight I suppose there is a lot of force shoving it back to the firewall, but it's also pushing up or down, and blowing into the inside of the cowl placing a lot of outward force on the cowl (especially the top). Naturally, I was a bit concerned about which fasteners to use along the aft edge of the cowl. I bought an RV-8 C-Loc kit from Skybolt over a year ago when numbnuts was supposed to have my engine finished. I almost forgot I even had them. And I was contemplating just keeping it simple and just using #8 SS screws. But then I thought more about what that would do to the fiberglass and then later on having to use tinnermans. So I decided to use the floating adjustable C-Loc fasteners after all.

These fasteners can be purchased with a fixed depth or an adjustable depth. I'm not good at measuring and I don't have the patience to wait for a bunch of special sizes. So I went for the "one size fits all" kit and will just have to hope they are as good to work with as the instructions and the price suggests.

The kit from Skybot that was recommended for the Rocket has twice as many fasteners as needed for a Rocket. That is, twice as many if you use a hinge pin along the sides. If you plan to pin the clam shells, then I'd suggest just buying what you need. The C-Loc kit is pricey, and having a couple extras is a good idea, but enough to do two ships is a waste of money... unless you have a buddy also building a Rocket (Or RV8, or ?).

Fitting the C-Locs is pretty easy. Just like riveting a nutplate, except there's more drilling. I used the template provided with the kit, directly drilled all the holes in the boot cowl flange to #30, then drilled open the center hole and countersunk the rivet holes. On the cowlings, simply (and carefully) use a step drill and bring the holes up just big enough to insert the "screw" retainer. This whole process was easy, and the results look great. And the fit is VERY nice!

BTW, the template didn't fit flush in several places that I drilled. No big deal, I just clekoed it into place as close as I could get it, and it turned out fine.

Putting in the clip rings behind the screw retainer was tricky. But after you get the first one (and a big hole in your thumb), the rest go very quickly. I did have to sand a bunch of the area behind the retainers to get the fiberglass thin enough for the retainer to accept the clip ring. Also, putting the "screw" into the retainer was tricky too. I just used a pair of need nose pliars. I compressed the spring on the retainer with the pliars set at right angle to the pin in the "screw", then pushed the pin in and under the rim. With maximum comression on the screw and spring, the "screw" drops right in! Nice!

After all the C-Locs were in (with the little black "keeper" in under the clip in the floating retainer), I simply screwed the screw and floating retainer until the screw face was flush with the fixed retainer in the cowl. Then, with force and speed, I popped the screws loose by a quick hard reverse quarter turn. I took the cowl off, pulled the keepers out, then with a blade screwdriver, I just turned the threaded part of the floating retainer farther down and out until the spring clip engaged in the floater. IOW, I erred to making the floater a little tighter. I put the cowl back on, and locked down the "screws". BEE A YOOOTIFUL! The cowl stayed EXACTLY where I had it clekoed, and it looked SO purdy!

Final Fasterners

I asked several people about putting C-Locs in the air inlets at the front of the cowl. I knew what the answer was likely to be. A resounding NO. If one of those little fasters gets out of the retainer, it would probably hit the prop (even with the wind blasting rearward). Then you're in trouble. So, in the end, I used 3 standard #8 sized nutplates in each inlet and also one screw on the side just in from of the hinge pin. I countersunk all these holes. I may use a pan head on the hinge pin holes as a pin retainer, but all the others, I'm using cs screws. In fact, I have tinnermans for those holes, but first go round, I'm just using the screws. I'll go without those

tinnermans as long as possible.

I wanted to use C-Locs on the airbox/scoop to, but decided to use #8 screws and regular nutplates here, too. I drilled the scoop and cowl for 8 screws. I hope that's enough to hold it. If there looks like too much stress on the scoop, I might go another screw in between all of the others, making 14 screws. That's a LOT, and I hope I don't have to do it.

The needlenose pliars don't make very pretty bends in the hinge pins, but I formed a loop in the end of each one, and screwed down the cowl pins. Oh, that cowl looks SEXXXY when it's all screwd together! Just going to have to figure out a prettier way to hide the forward end of the hinge pin.