Stick Tube Receptacle

The Team Rocket manual leaves a lot of decisions to your imagination. There are no recommendations on how or where to run wiring for the control sticks. I contemplated running the wired out the aluminum stick tube, but was afraid to weaken it by drilling a hole down low, but above the steel receptacle. So I decided to run the wires out the bottom of the tube and through the steel stick receptacles. There was a very small opening at the base of the stick tube anyway, so all I did was expand it.

The hole you can see at the bottom near the rod end is actually too small for an 11 wire bundle. Next time the stick tube is out of the ship, I will probably double the size of the opening. That wire opening is at the front of the front stick, and at the rear on the rear stick tube. That is to keep the wires clear from the torque tube, and to give better access to the wires later on when the ship is fully assembled and in service.

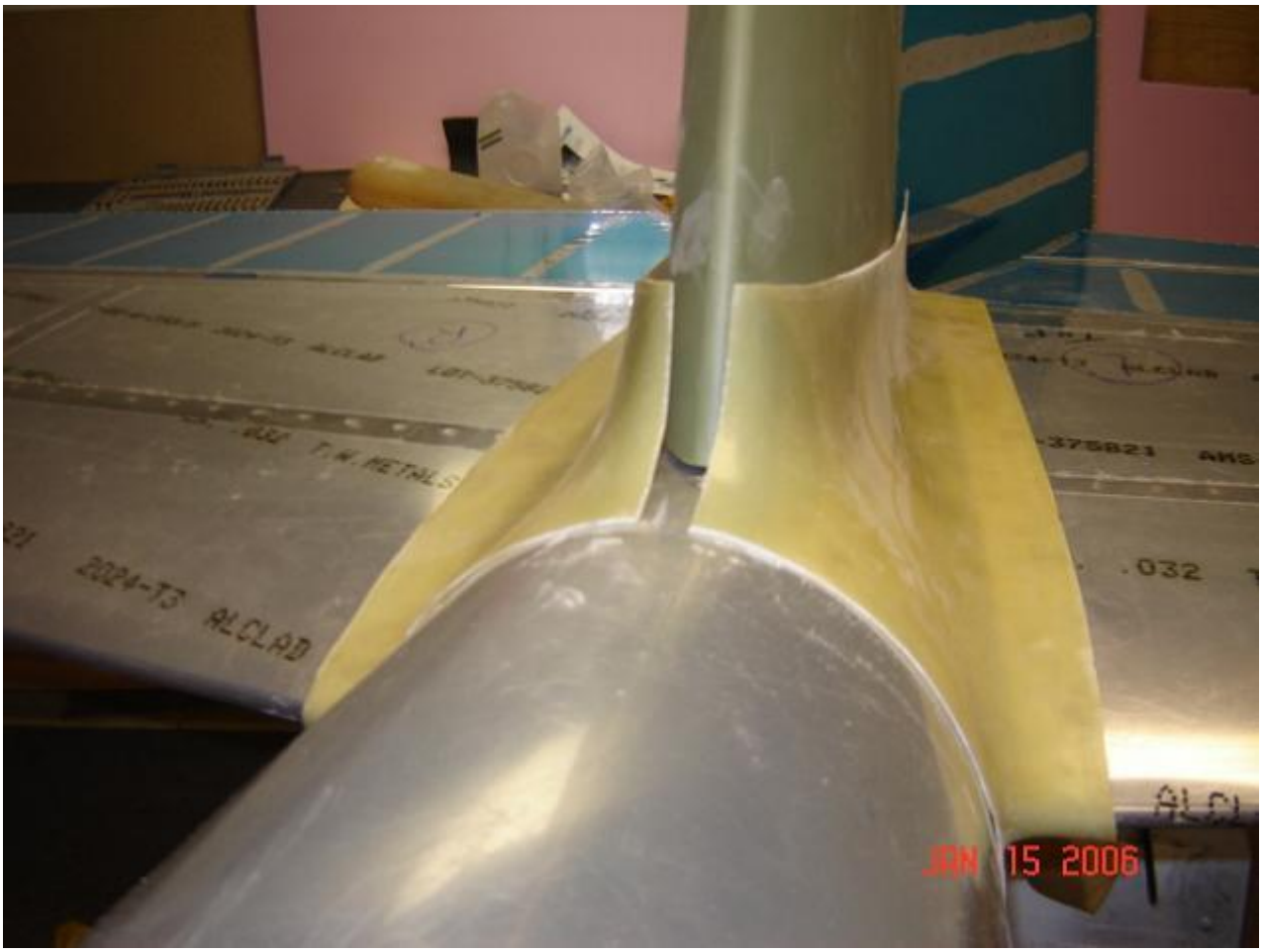
Note the AN3 sized bolt hole toward the top (left end in pic). The hole is centered more or less and goes completely through, side to side. I could have put in two bolts, but the stick sits so well in the steel receptacle that the bolt is really just to keep the stick from pulling out.

While I was doing these mods, I actually trimmed the pivot at the bottom of each stick receptacle so that the bearing would have more freedom from binding. Not a really big issue because there is so little movement with this mechanism, but the rear receptacle in particular needed trimming to prevent possible binding.

BTW, if you didn't figure it out, the actual stick tubes insert with the short end from the bend in the

receptacles. That is to ensure that the sticks get as far back away from the panel and seat back as possible.

Empennage Fairing



The HS on the EVO is tipped down a bit at the Leading Edge to set the incidence at 0 degrees.. It's not tipped down much (compared to the standard kit), but enough that the fairing as supplied from the factory did not even come close to fitting especially along the HS LE. So I split it down the vertical leading edge, and trimmed it to sit better against all surfaces. Then I prepared to glass it back together.

(Mark tells me something isn't set up right, and I should have had to split the fairing.)

A little selective grinding, and I got the parts to sit pretty well. I protected the ship with plastic tape, and then used a combination of BID cloth and flox with West System epoxy resin to reinforce the part, first from the back/bottom.

I cut the leading edge along the turtle deck back quite a bit, so I am going to have to come back and add layers to the top and front of the fairing. This part is still going to require a lot of work.

A lesson learned from others is worth mentioning: You don't really know if the VF or the HS are at the correct orientation until you fly, so the position of the BIG parts of the tail might need to be changed. With that in mind, I am going to leave this part very rough until after the plane is flown. Especially since the HS incidence is more or less a guess as far as the factory and the plans go with the EVO edition of the F1.

Another fubar worth mentioning, and I'll try to go back and insert this small tidbit back a page or two. There is supposedly to be about a 1/4 inch shim under the HS spar at the emp deck according to the F1 BOSS. I set my HS how I read the plans. Then he had me mod it to get the LE of the HS down to ZERO degrees. He and I went round and round about whether I did it correctly or not. I was using the "alternate method" in the plans with a digital level to set the airfoil incidence. Mark was telling me to use a different method after the fact, and the lowest rivet line that attaches the turtleneck on the

empennage for leveling and measuring. Well, that rivet line gimmicks the canopy rails/ cabin rails, and on my ship using the digital level they are precisely the same. And Mark suggested that ON THE EVO, you use a 3/16 bit at the HS front spar and a 3/8 bit at the rear spar over the airfoils with a level between them near the root. I did this. Lo and behold, I still have ZERO incidence. Why do I bring this up? Well, evidently I should have my entire HS up higher. That would make the emp fairing fit better. Well, I can tell you one thing, I sure as HELL am not going back and changing the entire tail just to fit the fairing. Mark assured me that there should NOT be any other consequences to having the HS front spar 1/4 inch or so too low, as long as the incidence is correct. And perhaps it is. I think the entire thing is set just as the plans describe. The rear spar is up 13/32, or whatever the plans said, off the deck WITH the emp deck panel in place. So I think I have it right, and getting my HS LE down to 0 incidence resulted in me having to put the HS spar right on the emp deck. Well, again, it's not going to change now, right or wrong. It's an "acceptable variance". Onward and upward!

EVO Battery Tray

The EVO F1 has a more aft CG than the standard model, so moving the battery to the floor under your right knee can really help with the W&B. Mark sent me one of the early battery box kits.

Wicks sells a pre-made battery box for the 680 and even sells an FAA/PMA version of the PC680.

The TR kit is for a PC680 battery, manufactured by Odyssey. It's a dry cell, long term storage battery with decent cold cranking amps. Although it isn't particularly light, it is smaller than your average aviation battery. Doesn't require any service either. You can mount it just about any way you want, no

chance for spillage.

The kit that you from Team Rocket is a piece of angle, channel, .032 sheet and a bag of rivets and hinge. No instructions yet, so we are winging it. Soon as Mark sent me a pic of Marcus's finished battery tray

Thankfully, the sheet has the cut and bend dimensions already laid out. At least mine did. So I took out the trusty dremel and cut off the corners. When you are going to do folds like needed to create this tray, I think it's a good idea to slightly over cut the lines. Also, drilling a stress relief hole in the corners is a good idea.

I used my 3-in-1 to bend the box. I had to finish it with a pair of flangers. Then I just set the battery in there to check the dimensions.

The battery hold down tray was a fun little project. I sat the battery in the tray and started eyeballing how it would best go together. I decided to start making it from the tray lip to the back. I cut the angle in three pieces, the first two pieces were only wide enough to sit flush inside the 2 inch channel. The longer 3rd piece I used at the floor of the tray to have more of a footprint along the front of the battery. The kit comes with rivets and one screw and nutplate. I'm thinking of using two nutplates outboard of the channel, instead of just one #8 screw in the very middle.

A note here, you are actually supposed to cut the angle in FOUR pieces, all of which are about 2 inches. I've noticed that when I sat the tray in the right knee bay, the parts don't reach the floor rib. I am going to just bend my own single long piece and make an "L" shaped angle to take up the slack, or possibly fashion an other piece of two inch channel. I still like having the longer footprint along the front of the battery.

I set the long angle on the foot of the tray along the end of the battery, then I sat the channel long ways into the angle. I took a piece of scrap, laid it over the top of the battery and scribed a cut line on the channel. I dremeled the channel into two pieces, and sat the longer one on top of the battery. You could set a 2 inch long angle over the corner where the two channels meet at 90 degrees, but there is room under the channels. And that way, it compliments the angle at the foot.

I chose to use 3 rivets along each piece at 1/2 inch spacing, but 3 rivets at 5/8 spacing might work better. I just wanted to be sure and clear the channel bends when riveting. Instead, I got in the way of

the clekos. I also chose to make the rivets flush on the battery side. If you were careful, you could probably make them flush on the outside and still have the worked heads clear the battery. I contemplated stepping up to AD4 rivets instead of using the AD3's supplied. I wonder if three little AD3 rivets will hold the battery in position at say 6 G's?

Next thing is to position the tray in the right knee bay, on the floor just to the right of the stick.The "foot" of the tray faces aft and the tray sits back against the bulkhead.

The 1x1 angle is too big for attaching to the airframe at the bulkhead. 3/4 x 3/4 would be better back here. I used the third piece of angle I cut from the piece provided with the kit, but cut one side down to 3/4 inch. For the bracket that goes under the lip of the bulkhead, 3/4 x 3/4 is OK, but if you want to be sure to clear the bulkhead when you flip the hold down up off the battery, 3/4 x 1 inch may work best here, too. The 1 inch side of the angle will protrude out from the bulkhead a ways, and the 3/4 inch part is where you attach the hinge (just like the opposing angle bracket). That extra 1/4 inch will help the hold down lay back and stay there while you try to fish out the battery. Personally, I'm just going with a piece of 3/4 x 3/4 here.

Decision time. You have to decide where you need the most adjustability when assembling this. I chose to attach the bottom of the two brackets and it's hinge to the battery hold down channel. Then I used some duct tape to trial fit the parts in over the battery on the tray.

The battery tray doesn't sit perfectly level on the floor, so the hold down isn't perfectly level, either. After I drill the top angle to under the lip of the bulkhead, then I can drill the top half of the hinge to that top angle. That sets the final angle and level of the hold down on top of the battery and tray.

You can put one nutplate in the center of the hold down foot. The nut plate goes under the joggled bend at the aft end of the tray. Pretty simple.

After completion of the hold down, next thing is to attach the tray to the ship. I'll drill both ends of the tray for AVEX countersink blind rivets (although I may buck the bulkhead rivets).

I may put some foam under the batter and the tray. Perhaps it will give it some extra cushion, and maybe it will help with some sound deadening. One thing's for sure, it might stop stuff from getting lost under the batter tray.

Time to prime and paint before final riveting.

This was a fun little project. A good one for beginners, or someone just wanting some relatively brainless work.

Once these battery hold downs and trays were positioned, I quickly found out that they trap every litte bit of anything underneath and to the inboard side. Before riveting the trays to place, I'm going to fill the space under the tray and to the side with either expandable foam or insulating closed cell foam. I planned on insulating the floor anyway for cold and mostly for sound deadening, Probably I'll just use one (at least) solid piece of foam, cut out for the foot of the tray and rivet it all down.

Throttle Quadrant

Regrettably, I never got an engine or a refund from that cheating bastard Mike Moore. But the work on my F1 EVO continued. I'd been working on wiring the cabin, and I decided that several of the wires are going to go up the left side, on the forward side of the #2 bulkhead, up to the back of the instrument panel. I had already made two different kinds of brackets to hold the CT-83F throttle quadrant from Vans. I have a good idea where the quadrant is going, but I need to go ahead and make the cable support bracket that goes on the back of the #2 bulkhead. The throttle quadrant cable retainer bracket holds the cables in a fixed fore and aft position.

***NOTE*: It has been reported by two builders that this quadrant does not have enough "throw" in it's stock configuration. I found that this was NOT the case, although I did have to redrill the mixture lever to increase the amount of travel to get the AP armatures to go stop to stop. It was necessary to drill the clevis pin holes as far up on the lever as possible for the mixture. I have the Airflow Performance FI system, MT prop governor and ACS cables, and I was able to make the CT83F work fine. In fact, I went back and used the stock clevis pin position on the throttle lever, but I did use the inner hole (shorter travel) on the AP throttle armature. That may make setting the controls very touchy and perhaps not precise.

I placed my throttle quadrant and it's bracket on the sidewall of the ship, back completely butted against the flange from the #3 bulkhead. That puts the forward edge of the quadrant at about 5.5

inches, which according to my guesstimates is where I want to be in the mid range of the travel of the cables. Since I STILL don't have an engine, and have no idea whether the cables are going to come up short, I've just mounted the quadrant temporarily to the skin. I tacked it down with a few dabs from my glue gun. That should hold it in place until I'm ready to final locate the quadrant, but I have a good feeling that the quadrant is located where it will be attached to the ship.

As to how high the quadrant sits on the sidewall, I just guessed. I wanted it rather low, just in case I wanted to put some switches or an air vent just below the instrument panel on the bulkhead. I ended up with the top of the quadrant about 3.5 inches below the instrument panel sub frame.

The throttle quadrant levers are about 1.2 inches wide, total, and they are about .55 inches apart. Each of the cables has a clevis that is pinned to the levers. These are simple push pull cables with rubber gaskets and special barrels on them for mounting in aircraft. There is really no set way to attach these, no parts provided for the purpose of securing the cable barrels at the #2 bulkhead. The plans give you fairly specific ideas, but I'm not real crazy about how they did it. So I'm going to try to fashion my own mounting bracket.

I want a simple retainer. What I am going to do is take two pieces of extruded aluminum angle and make a fixed, removable bracket. What I did was cut a flat side off of one piece of angle and make a trough to sit in the "slot" on the cable barrel of each of the 3 cables. I drilled 3 holes at the upper edge of the .125 piece of aluminum to match the slot, then dremeled the holes open so the cable can drop in. This part is riveted with AD3 rivets onto the forward side of the #2 bulkhead. Next I cut a side off of a 1 inch piece of angle to make a retainer to mate against the slotted holes and keep the cables in the slots. The retainer will screw down flush along the upper edge of the slotted bracket. I plan on using nut plates and #10 screws. These screws will also hold Adel clamps for wire runs up the left forward side of the #2 bulkhead.

The cables need to be removable. There are large diameter rubber bushings on the cables that have to go through all the bulkheads, so that dictates how big the holes have to be for the cables to pass through. I am going to drill the #2 bulkhead for the nominal diameter of the cable barrel, and then directly above that hole I'll drill a second hole the largest diameter of any part of the cable. That way I can remove the upper retainer, and lift the cables out of the slotted bracket and pull the cable through the larger hole. I hope the rubber bushings on the cable are removable so I can keep the holes, especially in the firewall, as small as possible.

I put the top of the throttle quadrant engraved plate down 3.5 inches from the bottom of the instrument panel sub frame, and it worked out great.

I made a quick bracket of .032 sheet for the quadrant and tried it on the sidewall of the ship. Hmmmm... I made the first bracket with the flanges running vertically. The curvature of the sidewall is greater in a vertical direction than horizontally along the skin. Boy, it's not much, but the middle of the bracket sits off the skin about 1/8 inch or so due to that curvature. So now I have to decide: Go with it as is? No. Shim it? How? Nah.

I decided to remake the bracket with the "feet" running horizontally? That's probably the best way. The tough part is hiding the rivet and flange along the top edge.

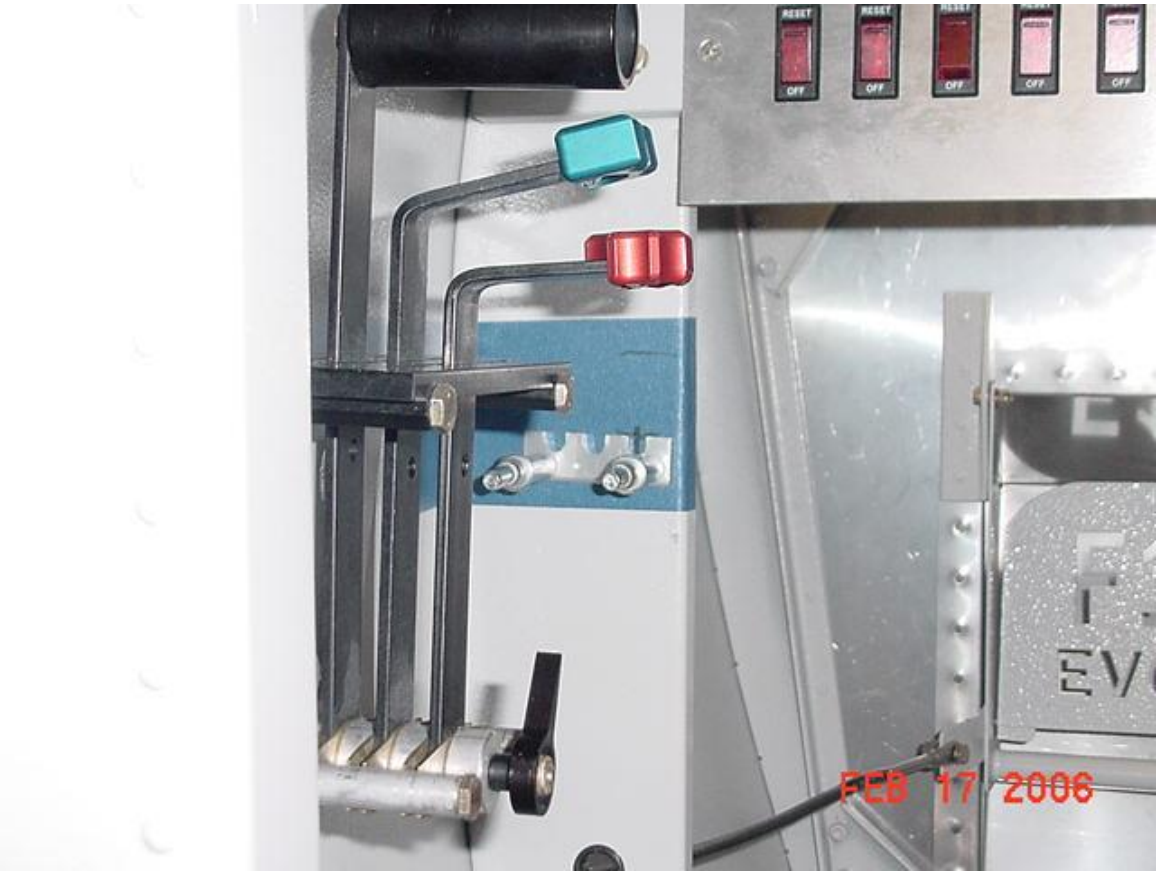
You know, I can't really tell if this sits against the skin any better or not. It seems to. But then again, the bracket that I made for the fuse block on the other side sits on the skin quit nicely. At any rate, I made a new bracket out of some scrap. The bracket is a two part bracket so that I could easily hide the flange at the top above the quadrant engravings. I could have just used 2 pieces of channel (one each top and bottom) as brackets and called it a day, but I like the idea of having a full sized bracket with the web supporting the quadrant. I think having bracket material between the top and bottom quadrant bolts helps make the whole thing a lot sturdier (not that it will get a lot of abuse).

I went ahead and guessed about the location of the cables and the quadrant. I did use the second attach bracket and set the quadrant back all the way against the lip of the #3 bulkhead on the side skin. I haven't drilled any holes in the side skin, but I did go ahead and locate cable holes and a retainer bracket for the three cables that come from the quadrant.

Throttle Quadrant Cable Retainer Bracket

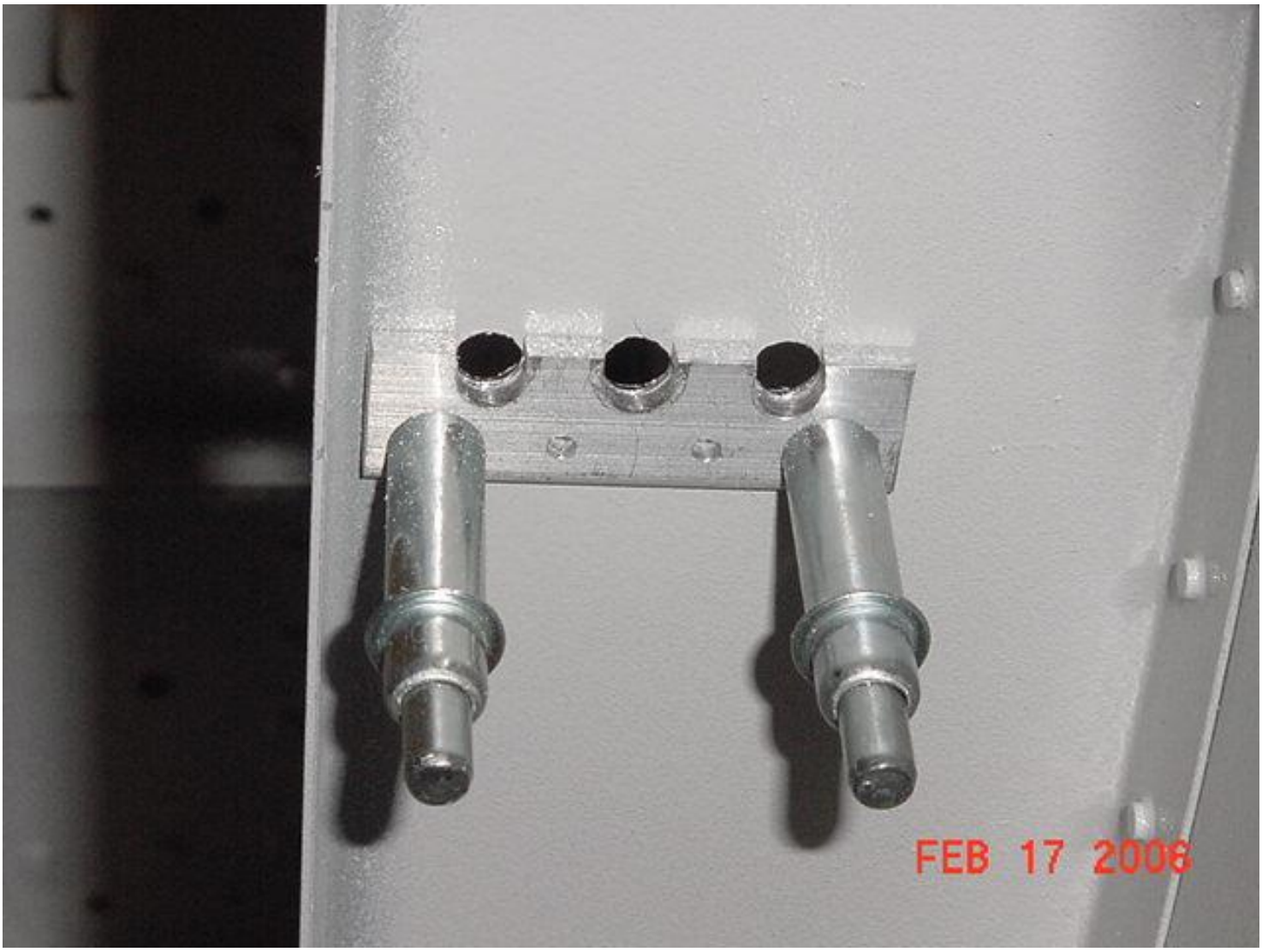
The 3 engine/prop control cables operate from the quadrant, through the #2 bulkhead and then

through the firewall. They have to be supported and "locked" into the #2 bulkhead. Here's a series of pics showing the construction steps of how I made mine.



I marked the height of the holes in the #2 bulkhead based on the test position of the quadrant on the side wall and the holes in the levers. I laid a piece of angle (as a straight edge) along the top plate of the quadrant to transfer a mark the upper most level of the quadrant onto the tape on the #2 bulkhead. I also used the angle clamped on the side of the mixture lever and transfered it's location onto the bulkhead tape. Next I measured down 1 inch from the top mark to the transfered lever mark and placed a hash mark. The hash mark (on the blue tape) corresponds to the cable clevis hole in the quadrant lever arm. This is where I centered the cable. There is some flexibility in the ACS cable barrel, so this isn't an exact science. However, the straighter the cable is and the more directly in front/parallel to the quadrant that the cable retainer/holes are, the smoother and easier the operation of the levers and cable will be.

I used calipers to measure the slot in the cable (.125 wide and the center is about .250 dia.). I drilled three holes .55 inches apart (to match the quadrant levers) in a piece of .125 aluminum. I dremeled the 3 holes in the part into slots. I centered and leveled the retainer over the hash mark on the tape (above) and drilled/clekoed the retainer to the bulkhead. I used the same drill bit that I used for drilling the cable slots in the .125 retainer to drill holes through the #2 bulkhead.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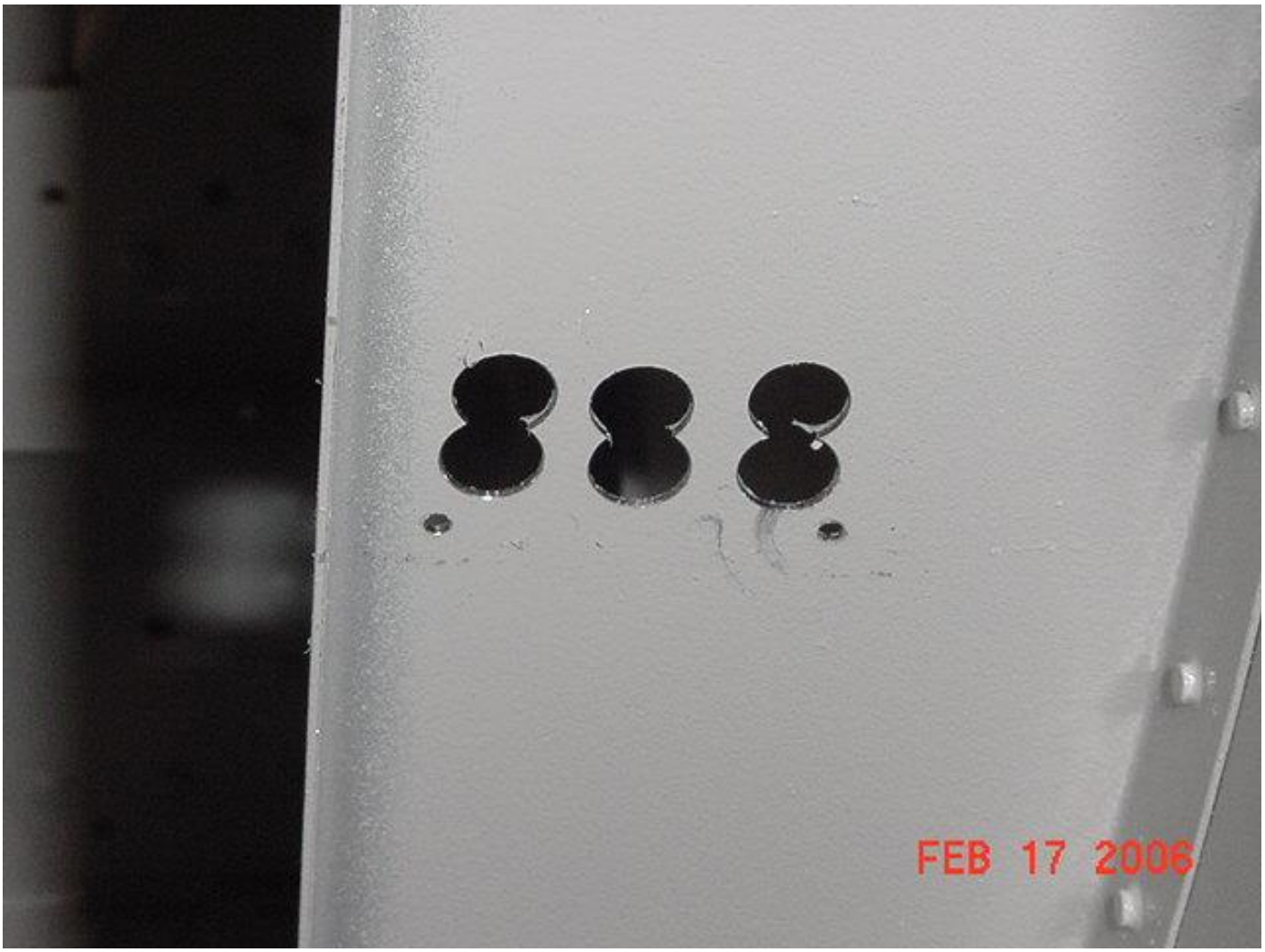
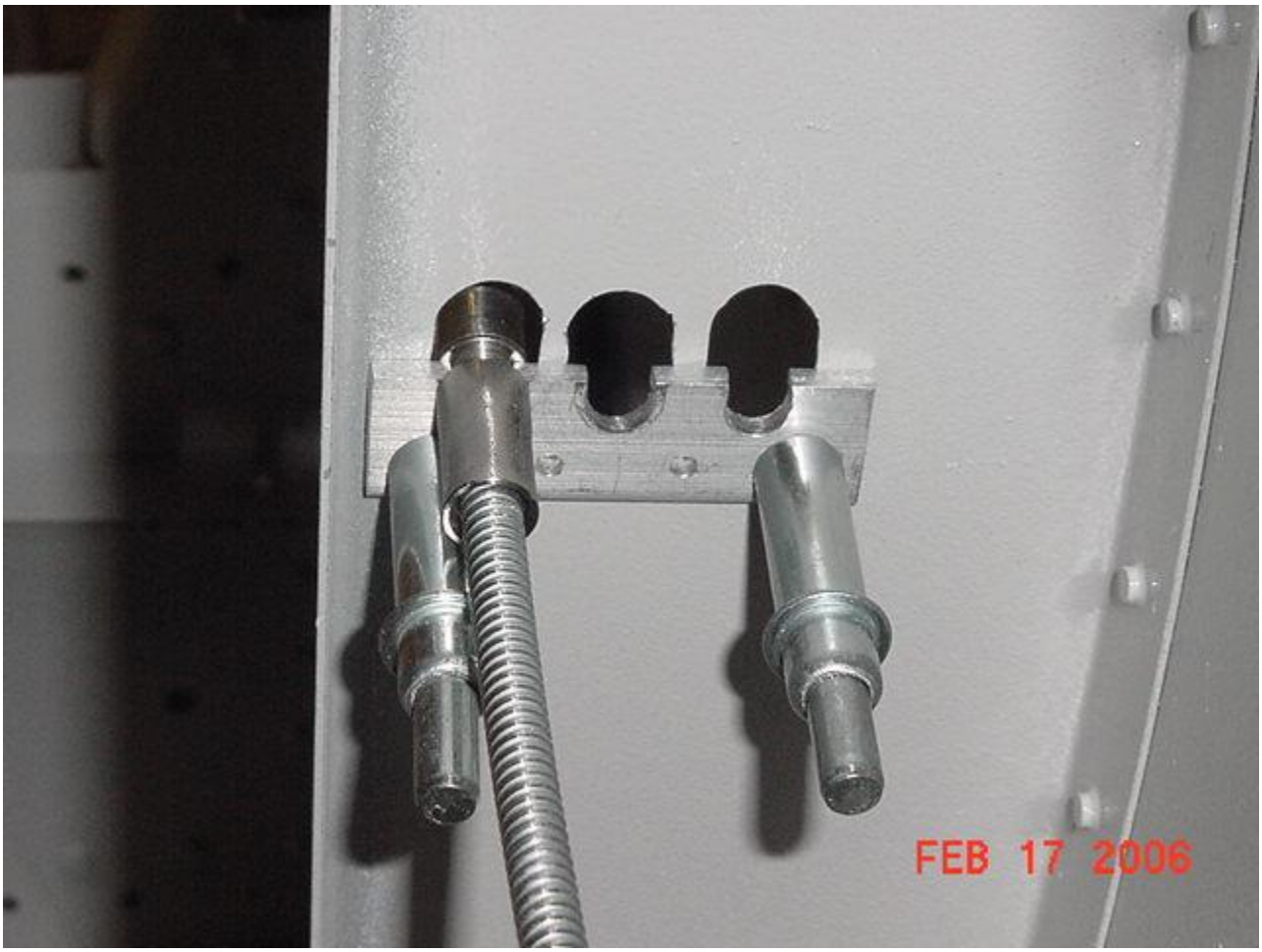


These holes are now large enough for the cable retention slot, but not larger enough to let the cable through the bulkhead. I removed the .125 retainer from the bulkhead and used a step drill to run each hole up to 3/8, the largest diameter of the cable (without the rubber boot). The holes were a little too tight, so I step drilled up one more size.

There may be circumstances where cables may have to be removed and replaced, so I wanted the cable to be able to lift out of the retainer and slide through the bulkhead and out of the ship. That means I had to have at least 3/8+ clearance above the retainer to raise the cable and clear the retainer. So I marked and drilled a second set of 3/8 holes above the initial 3 holes. The new holes actually became integral with the initial holes.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I filed out the figure 8 holes to where they were just oblong holes. The cable has to pass easily from the bottom of the oblong holes to the top in order to be removed from the ship. Now the holes in the bulkhead correspond to the largest diameter of the cables, and the .125 retainer slot corresponds to the retainer slot built into the cable.

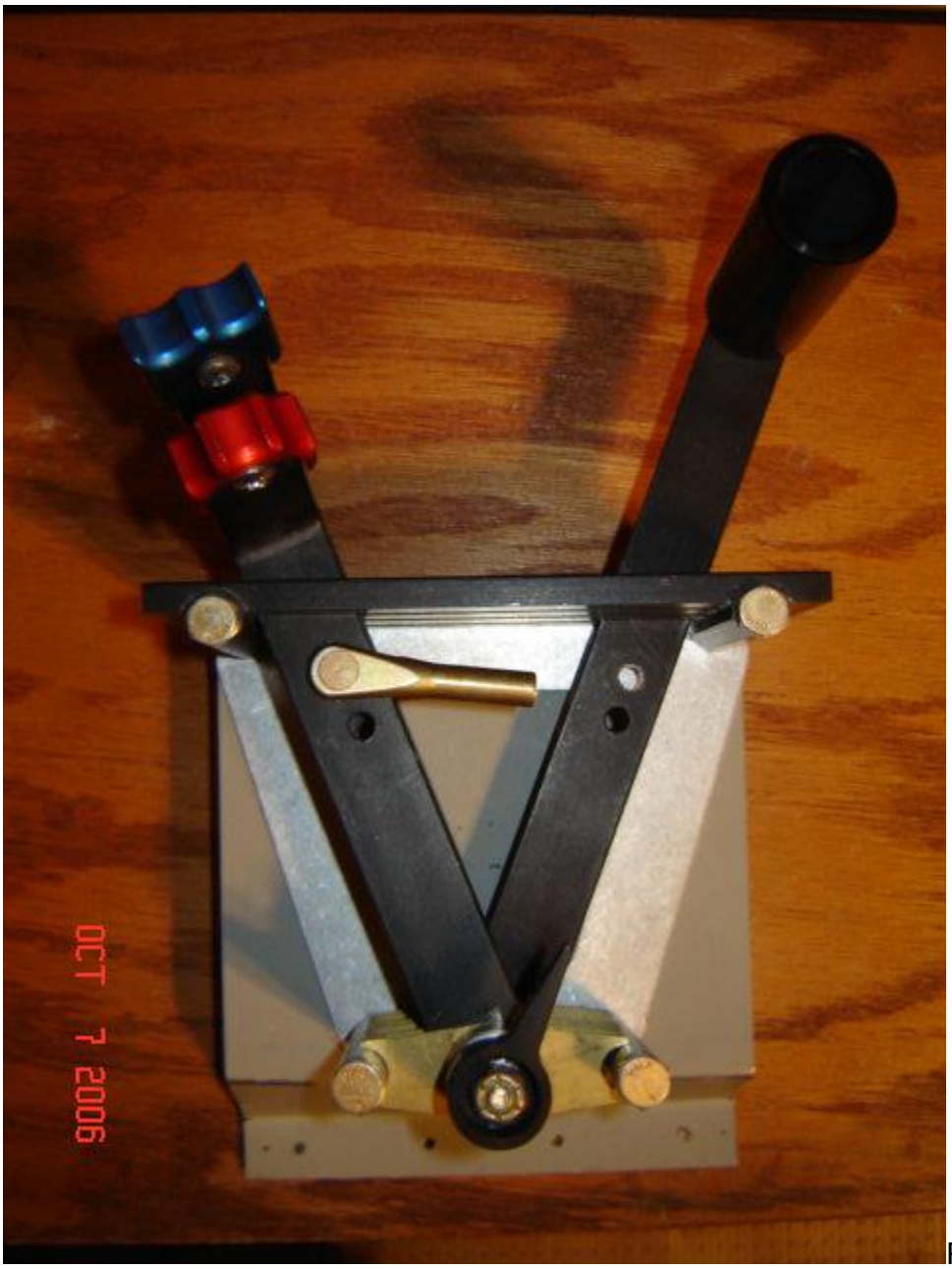
The next part to make is another .125 piece to hold down over the cable to lock them into the slotted .125 retainer. This "cap" was made by cutting the side of of a 1 x 1 x.125 piece of angle. I dressed the slotted retainer until the cap precisely rested along the retainer top edge and just barely touched the cable in each of the three slots.

You can see the roughed holes in the pic are actually larger than the cable and the retainer slots. You have to make sure that the cables actually completely clear the bulkhead and sit solely in the retainer. You can sure tell that I had some dressing to do on those holes. Making them larger isn't that big a deal. As a matter of fact, you could even just cut the entire area around the cables out as a large

rectangle and this technique would still work. I wanted to remove minimal bulkhead structure to leave it a little more strength.

I placed two nutplates on the aft side of the bulkhead for #8 screws and riveted them to position. That makes the cap pretty strong, and easily removed, and it also gives me a place to attach an Adel clamp for a big fat wire bundle. I'll prepare the retainer for cs #3 rivets and prime the parts. Now I know what I have to work around when wiring the left side of the ship, and of course I'm ready to install the throttle quadrant cables.

All this started when I was trying to figure out how much room I had to run supply wires up the left side of the ship on the backside of the #2 bulkhead. I wanted to fashion a cable retainer that I could also use to hold Adel clamps and a large bundle of wires. I was hoping to be able to get TWO bundles and Adel clamp on each side of the cables, but I placed my quadrant too far inboard to do anything on the right side. Mark Frederick recommends that you bias the quadrant and cables inboard. I think part of this is because the boot cowl tapers inward toward the engine so much, so the more inboard the quadrant and cables are, the straighter and shorter the cable run is to the firewall. At any rate, I think this is the best place to locate the quadrant cables.



Fall of '06 I'm finally preparing to install the cables. Airflow Performance has some pretty cool replacement armatures for the throttle and mixture side of the fuel controller IF you need them. They run about $35 a piece. I don't think I will need them but if I need to reduce the radius of the armature to shorten the travel, I can buy new armatures from AP for my CT83F quadrants and ACS cables.

Note: The AP ***throttle armature*** has two hardware mounting holes in it. The outer one has about a 2.5 inch travel, and the inner one is about 2 inches. The ***mixture arm*** has a single hole and travels about 1.5 inches.

I grabbed up a clevis and used my sharpie to mark the highest hole possible with the lever centered. That way, I get the highest hole that won't interfere with the top bracket (with the engraving).

The great thing about drilling these two new holes is that I DON'T have to buy new arms for the AP fuel servo. In fact, I should be able to use the outer hole on the throttle arm. That means I'll have more incremental control of the throttle.

One of my biggest concerns with drilling the holes higher of the levers is the cable might hit the forward bolt at the upper right corner of the quadrant. Where I test located the quadrant on the side of the ship, I can't remember if there is a slight downslope to the cable or not. If there isn't (and I think I made the original fitment had the cables going straight out to the retainers in #2 bulkhead) then I might have to make an entire new wall cover and relocate the quadrant a little higher to clear that bolt. That's going to suck for more than just having to re-do a panel. I'm kinda short, and I don't want the quadrant to get too tall along the side wall. Well, it would probably only have to relocate up a quarter to half inch. Not THAT much different.

I'll locate the quadrant's final position on the cabin wall for AFTER the cables are fixed in the engine compartment. The governor, mixture and throttle are all fixed positions. I just want to ensure as much as I can that THOSE brackets and retainers are conveniently and effectively located, THEN fix the location of the quadrant. That's going to happen soon. First, I have to drill some firewall holes and actually run some cables.

The firewall holes have to be drilled to 3/8, even though the cable is only 1/4. There are parts on the ACS cables that are fairly large in comparison to the spiral cable body. It's good to keep the firewall hole as small as possible to help keep the fire out. I already have firewall shields to cover the cables and rubber grommets to cushion between the cables and the FW.

The cables going through are a very tight fit. Getting the grommets over the cable is nearly impossible. The grommets I bought for other purposes (wire runs) are NOT milspec and NOT suitable. I'm going to have to order some from Wicks or Spruce and hope that they are stiffer. That's going to suck trying to get them over the cable and into the FW, but they shouldn't cut or tear like the POS OTC ones I bought at the hardware stores.

I had to cut out the back of my bracket, or disassemble the quadrant in order to cotter pin the clevises to the throttle lever.

It took quite a bit of adjusting to get everything to work together. It turned out that I had to redrill the retainers under the sump for the mixture and throttle cables. The retainers shorted me on travel due to the length of exposed cable I originally planned. I moved the retainers and the cables 3/8 farther forward on the brackets so that I wouldn't be at the very outer end of the threads on the rod ends.

It's hard to tell by the pic at the left, but the inscribed plate on the top of the quad is tipped. It's going to end up either horizontal, or slightly tipped facing me (aft).

T he nuts on the clevises will clear the forward bolt on the quadrant.

Using the higher hole I drilled on the mixture lever, I DO get full travel stop to stop at the fuel controller using the Vans quadrant. No problem with the propeller lever travel, or the throttle lever, either. I did go back and use the stock hole on the throttle lever, but I used the inner hole (shorter travel) on the AP throttle armature. SUCCESS!!!!!

The only (potential) problem I have encountered with making the #2 bulkhead retainers as I have them is that the quadrant DOES sit AFT a bit more than perhaps some pilots would like. With cushions on my seat, sitting in the cabin, I found that the temporary position of the quadrant is pretty agreeable for me. Since I'm short, and since I have the quadrant levers out away from the #3 bulkhead, I can easily get my hands on the handles.

The other thing that I like is that I can now add one or two cables (switches or a vent) in FRONT of the quadrant. I'm contemplating putting the purge valve cable on the #2 bulkhead just below the instrument panel. I may also put the parking brake cable there as well. Another thought would be to put both cables near the fuel selector switch in the center console. I'm going to install the fuel selector and all the associated plumbing before making the final decision.

After drilling the quadrant to position, I found out that I did NOT have the travel on the throttle that I was expecting. It was VERY close. I could get to idle cut off and just shy of full throttle. Not good enough. So I put the clevis pin back in the stock hole on the throttle lever and I bolted the rod end to the inner hole (shorter travel) on the AP throttle armature. Works like a charm now.

All the levers now work through nearly the entire slots in the face of the quadrant. It looks just about right. Regrettably, the position that I drilled the quadrant to the side of the ship was not where I made the bracket to sit, so the bolts on the quadrant won't be flush with a side panel. I'm going to have to do some fancy footwork to make that side cover panel look right. Time for some shims and rivets.

After riveting the bracket to the sidewall of the fuselage, I inserted the clevis pins and fine tuned the "throw" of the cables. Again, the throttle and prop used the stock holes on the levers. Tthe mixture

required drilling the lever as close to the center of the faceplate as you can get (and still clear the hardware), and the shortest throw hole on the AP fuel controller mixture arm was used. This is going to perhaps make the mixture a little touchy to set, but I do have the entire length of the lever throw for ajustment. I think I can get used to it.

Now to make a side panel to cover the cables.

NACA Style Air Vent

Note: Some builders have reported limited success with locating the NACA vent in the following location. Airflow may not be as good as expected. A wing root air vent might be more effective.

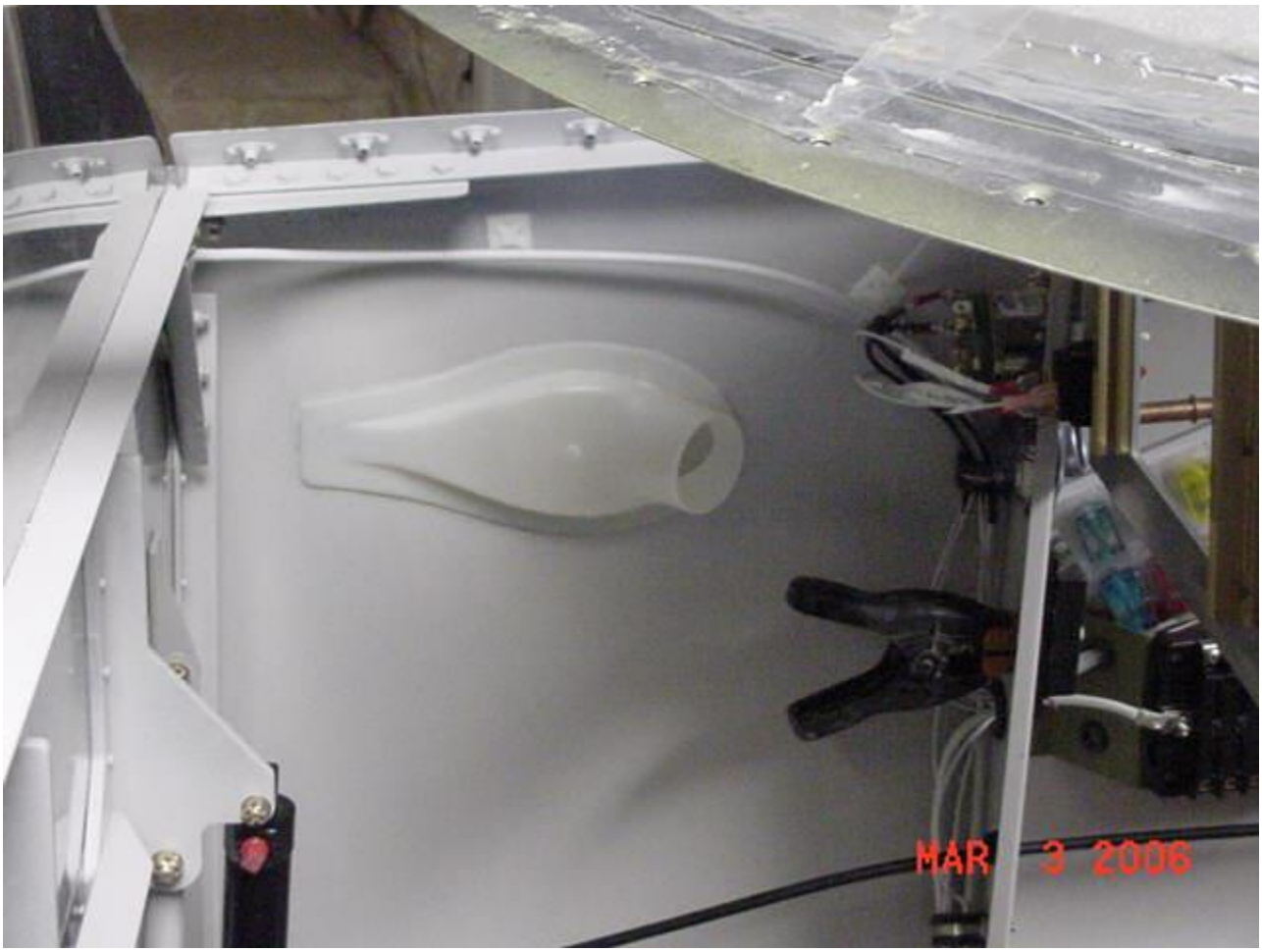
I installed a pricey eyeball vent below the right instrument panel sub frame, on the #2 bulkhead. The F1 kit contains a plastic NACA style vent to cut into a location
of your choosing on the airframe. I chose to cut the side skin below the boot cowl about 5 inches aft of the firewall. The cut is essentially parallel to the eyeball vent, and perpendicular to the firewall. This location puts the vent just below the widest part of the ship just behind the firewall. I thought about trying to put the vent where rain wasn't likely to get in there easily, but decided a short duct run was important, too.

Recently, *Sport Aviation* had an article about airflow and vents. Interestingly, after I rounded down the edges of the NACA cuts, the article reported that having square edges actually reduces the drag and improves

the airflow in and around these ducts. So I'll go back and square up the edges with a very fine flat file. Not that it matters that much, but what the heck... might as well do it the right way!

The plans with the NACA duct state that you should use RTV (or ProSeal) and then blind rivet the plastic part behind the cut. I chose to just use GOOP marine adhesive/sealer. I'm not going to put any rivets through the plastic to hold it on unless I find that it is necessary later on, probably after first flight.

The F1 kit comes with a LONG section of black duct and a cheap as hell eyeball to vent air to the back seat. I'm not using the cheapo eyeball, nor am I ducting to the rear seat. If anything, later on, if I find I need back seat ventilation, I may cut a second NACA duct at the rear seat and install another premium eyeball vent.



Andair Fuel Valve

Note: You might be better off ordering an Andair FS20x7T valve from Vans, which for about $200

already has the 90 degree -6 AN fittings installed!!!! Also, get a pair of -6 AN "Swivel Tees" from Vans or Summit racing to tap a bypass line and a purge valve line into the selector valve ports.

I bought an Andair FS20 Type 2 Valve a long time ago (thinking I was soon to get an engine). Now that my engine is hung, and I'm starting to install the plumbing, I had to think about where to put the fuel tank selector valve. I ended up going with the crowd and putting it at the aft end of the forward center stick bay. That's where all the fuel plumbing is going. All the rigid fuel lines, the pump and the valve will be just forward of the #2 bulkhead.

I fashioned a .063 aluminum mounting bracket for the Andair valve to mount in the very center of the #2 bulkhead, just forward of the stick and below the instrument panel. The bracket will be riveted to the face and the top of that center #2 bulkhead wall.

I was disappointed when I was working with locating my Andair fuel selector valve. I needed to mount it fairly upright in front of the stick. Then I was looking at how big a loop of rigid tubing I was going to have to install to make the decent to the AP fuel pump. All along I was trying NOT to block the center console between my legs, but with the rigid tubing I would be getting very near the panel. Bummer.

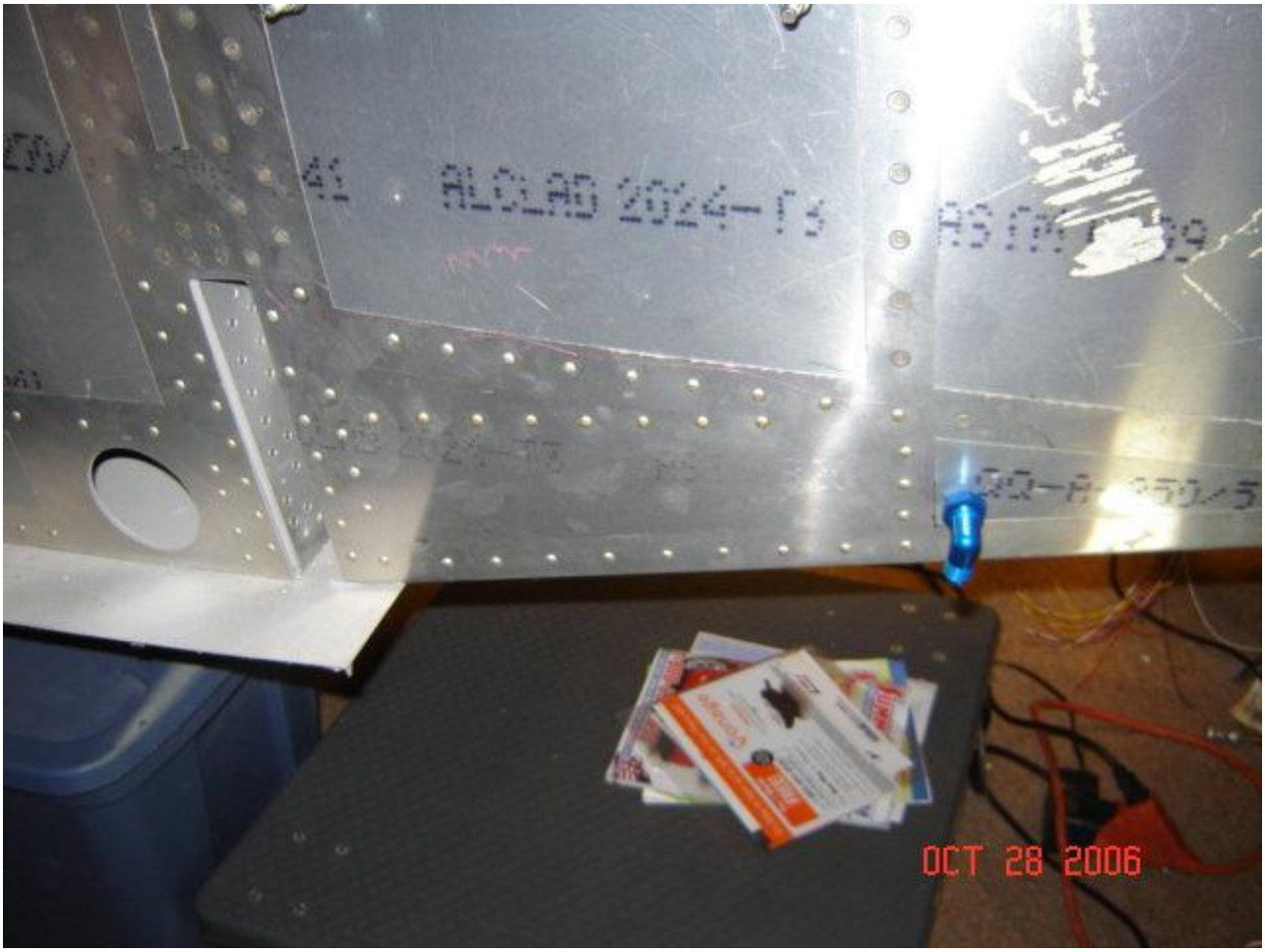
I kept looking and looking at the valves, thinking I must have had the wrong one. Surely they make a valve with lines from the bottom, not sticking out the top. Well, that's not an issue if it mounts horizontal, flat with the floor.

So I decided to go to Andair's site and see what all they had. I saw that they have all kinds of AN fittings for their valves. And the one I REALLY wanted was the 90 degree elbow.

Each of these fittings is £18 each. Kinda salty at about $100 for two of these little gems shipped from the UK. But using these -6 AN adapters on the fuel valve will allow me to keep my center console as low as the top of the valve. Sweet! Maybe I can even make room for some storage in that bay. COOL!

No one but Andair seems to be selling these fittings in the U.S., and I don't think that the 90 degree option was available when I bought my valve two years ago.

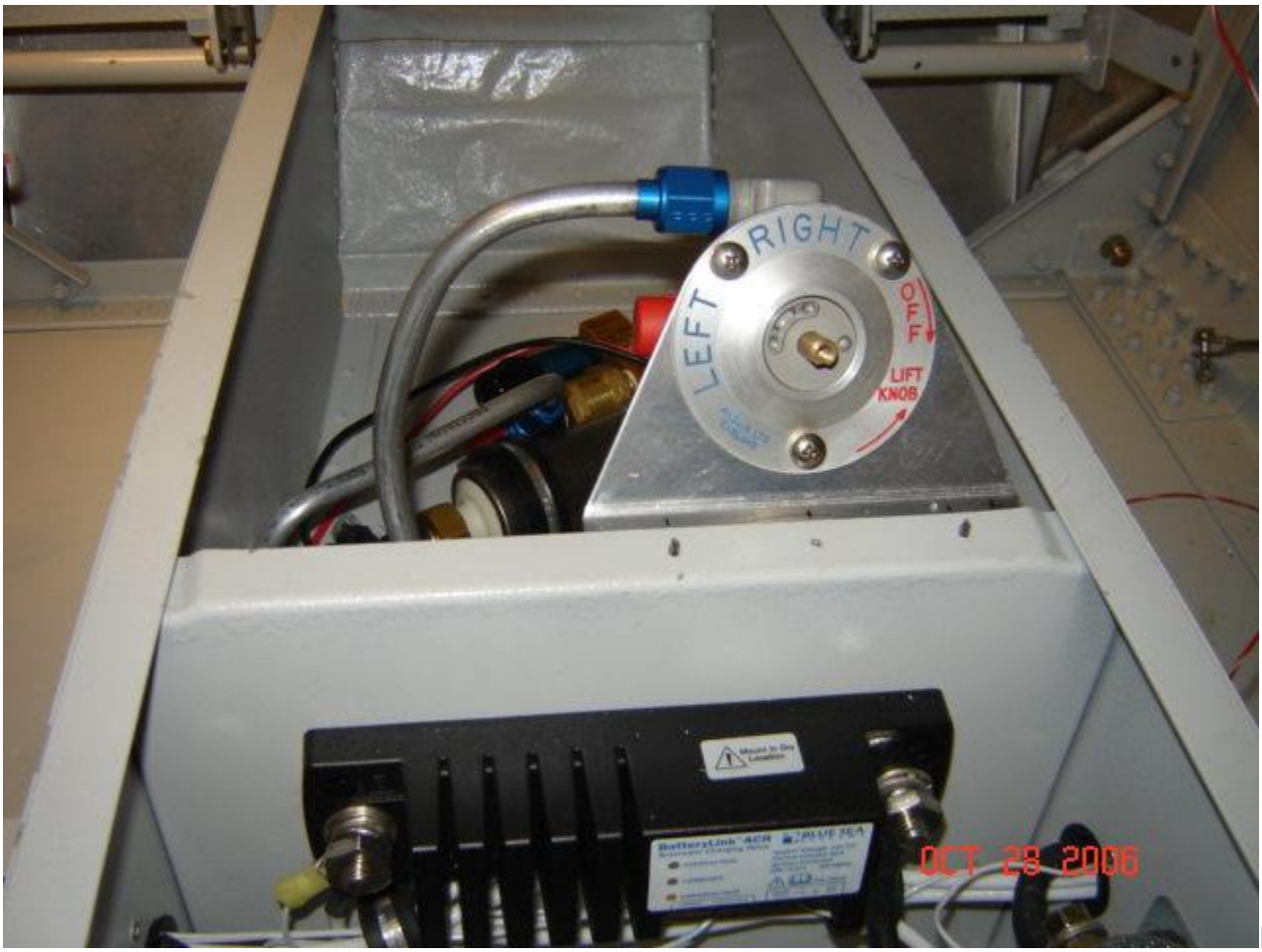
Cabin Fuel Lines



The fuel lines from the wings to the engine have to pass through the cabin in front of the wing spar. Where you put them it up to you. Aircraft construction convention is to keep the fuel lines as separate from electrical equipment as much as possible. Since I have dual batteries directly next to where the wing fuel ports are on the wings, I was either going to have to defy convention, or find another place to run the tubing. Mark Fredericks suggested running the lines into the cabin just in front of the #2 bulkhead (holds the instrument panel) along the floor. I never wanted to put the lines there because I was afraid I'd always be kicking them with my heels. Well, that location is simple and keeps the fuel lines out of the battery and stick bay where there's LOTS of wires and contactors. So here is where I made the hole in the cabin for the wing fuel lines to com into the cabin:

Some builders just put a grommet here and run the lines through all the way to the wing fitting. I used a -6 AN 90º bulkhead fitting. I'm planning on putting compact fuel filters between the wing and the cabin, so I need a loop of tube or hose there. It's much easier to do it with a right turn through the cabin wall.

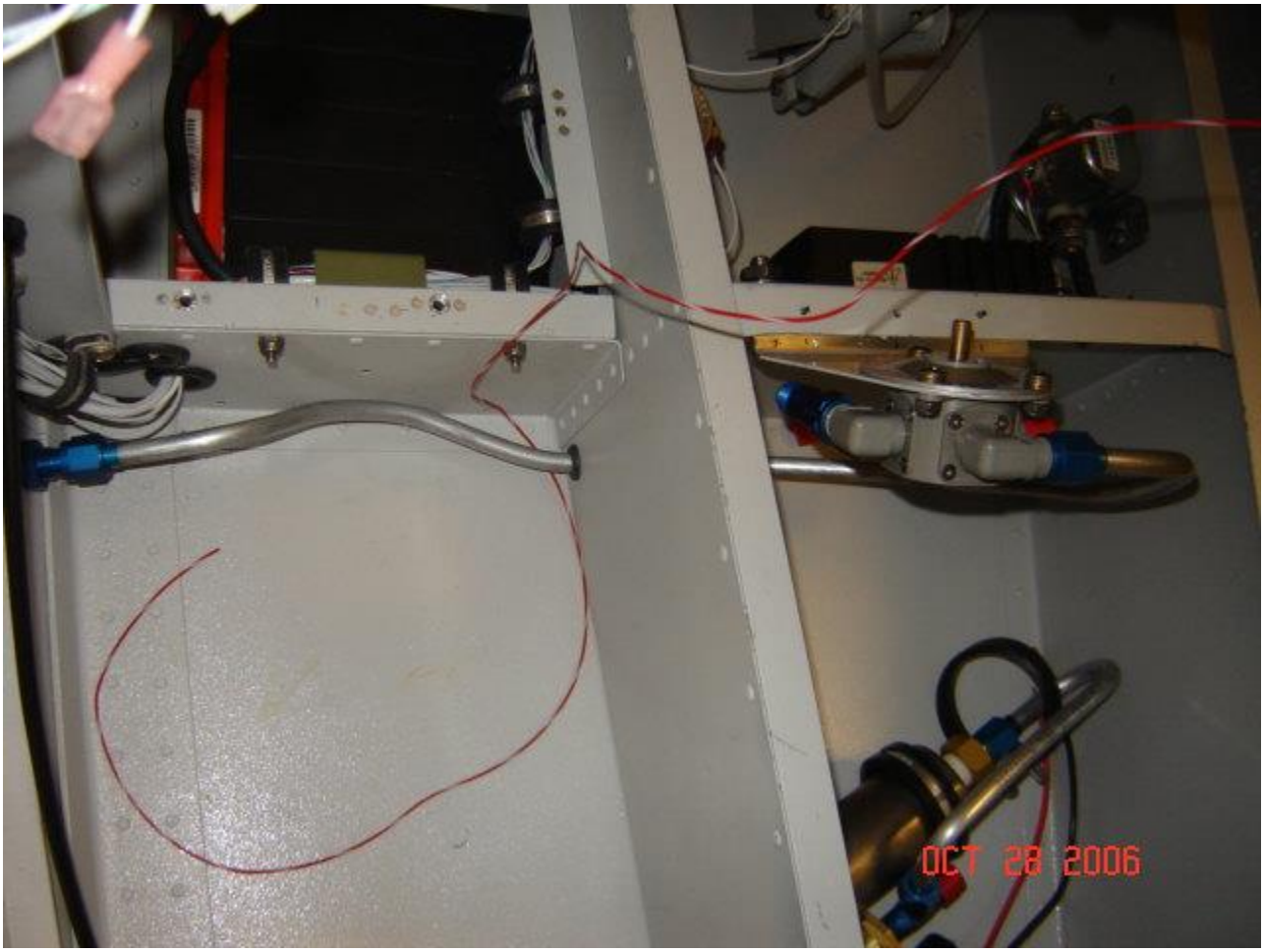
Now the question is where will that pesky front spar bracket attach in the doubler area of the wing and how can I get the fuel line around it. The wing fuel tank fitting is about 4 inches aft of the blue fitting. I think the forward wing spar bracket is going to be right next to the fitting.



I made a bracket for the Andair fuel control valve and drilled it to the forward side of the #2 floor bulkhead. I offset it to the right to get the red handle away from being directly in front of the stick. having the valve offset to the right and modified with 90º fittings made it a little easier to make rigid tubings with rather large radius bends come off to the left. I think that will let me keep the fuel pump a little farther aft. Maybe I'll be able to fit the high pressure fuel filter and fuel totalizer inside the cabin. I'll know more once I hook up some tubing.

After committing to the location for the fuel line cabin exits, I used a step drill and a close quarters POS drill I got from Harbor Fright and made holes into the center bay.

The tubing that Team Rocket provides is very easy to bend 3/8 inch aluminum tube. Mark provides a bunch of -6 AN fittings for the (not so) rigid tubing. I already had a mini tubing cutter and I bought a Rolo Flare tool about two years ago for this project. Then I borrowed a set of those "spring" type tube benders from my buddy Bruce. Those are the 1 foot long springs that slide over the tubing to keep the tubing round as you get into tight radii.



I tried to bend the right fuel line down and aft as much as possible. I still thing I'm going to kick it wit my heels. And I may end up making a kick panel to cover them.

Getting this first tube installed was tricky. I actually thought I had it right on the first try. NOT. I ended up having the outboard ferrule on backwards. I had to cut the tubing to get it off. Nice that I have a mini cutter.

I put a 3/8 grommet in the center bay panel and ran the bulk tubing into the cabin from the outside. Once I got the tubing into the center bay, I slid the spring bending tool over the tubing and started heading the cut end of the tubing toward the fuel valve fitting. After I had that close, I cut the tubing from the big spool just inside the outer cabin wall. I left a bit of slack knowing I would probably want to move the whole piece after I got the fittings installed.

The tubing then has to come out, which requires some contorting by me *and* the tubing. This is the easy part... I put the AN nut on the tube, then the ferrule. I used my Rolo Flare tool and carefully flared the soft aluminum tubing. Then I cleaned out the tube. Even with a clean tube cut, the tube gets debris from the flaring process.

I had some problems getting the tubing back through the rubber grommet. I used fuel line fitting oil on the tubing and the aluminum tubing slid amazingly easy through the grommet. I snugged up the AN nut on the fuel valve and then used the spring bender gizmo to shape the tubing in the right footwell. Now the hard part. You have to put the AN nut on, then the ferrule (on the correct orientation with the wide part toward the flare... duh) and then flare the tubing in place. Well, I was able to pull the tubing up so I could get the flare tool on it pretty easily, but this it the easiest of the two wing line tubes to work on. Now for the rest of the lines.

Installing the left fuel line was pretty easy and relatively quick. Next thing to do was to position the Airflow Performance (AP) fuel pump. I didn't have enough coupling nuts to install all the plumbing, and I wasn't sure I was going to have enough tubing. So I made and ACS order. When ordering for solid tubing, you want "Versatube", AN818 nuts ***AND*** AN819 sleeves. I did not catch that the sleeves were a separate item. Heck, you get one, you always need the other, no? Anyway, I had to make a second order just to get the sleeves. I hop you learn by my mistake. Not really a big deal for me. Seems at this point in the game, I'm ordering every week anyway. Time to hurry up and wait again. Lots of other stuff to keep me busy, though.

Airflow Performance Electric Fuel Pump

The AP pump has a bypass built into it, so you actually have to install two main lines from the fuel selector. I bought a -6 AN "Swivel Tee" from Vans to help with the install. Regrettably, I should have bought *TWO* of them because I also have to tap into one of the fuel tank lines.

Summit Racing's free shipping is eating me up ($10 handling fee per order but "free" FedEx shipping). They also sell the swivel tee, and they get it here about a week faster.

Anyway, I positioned the electric boost pump as far aft as I could manage. That loop line built into the pump sure makes it take up a lot of room. I tried to keep the lines organized and run them as parallel and close as possible. I'm still contemplating making a glove/storage box in this bay after the fuel and brake lines are installed. Not a convenient place to put storage, but better than nothing. So I'm trying to keep everything compact.

My bends aren't very pretty but they are effective. And I'll probably have to bend them some more. I still have to tap into one of the tank lines to bring in a -4 AN fuel line from the purge valve.

The AP pump comes with two huge Adel clamps to hang it by the main pump body. One of the clamps has to have the rubber cut out to fit under the components stacked up on top of it. The unit is resting on the floor in the pic. It will only be raised enough to get a clamp under it. The forward screw will be inserted below the pump, and the aft Adel clamp will be screwed down from above.

The pump has only two wires to it. Pretty simple power and ground. Direct to the switch. Nice.

I have a high pressure fuel filter from AP, and I want to install it after the fuel pump. It won't fit directly in line physically, so I'm going to have to loop a couple lines to it. Also, between the pump or filter and the firewall, you want to use flexible line. I'm out of -6 AN fittings for the solid aluminum tubing, so I might have to use braided line from here out. Aluminum tubing is much nicer to use when you have a tight space. It bends so easily. Flexible fuel line only bends so much, and can put a lot of stress on the end fittings. Too tight a bend, and you start needing 45º, 90º or even higher bend fittings and they are pretty outrageously priced. I think I'll buy some more 3/8 tubing and some more flare nuts and make a solid line loop to the filter (much like the loop on the fuel pump). From there, I can use a nice straight stainless braided line straight to a firewall bulkhead fitting.

Talk about a bitch! I was Mr. Contortionist working on getting the fuel pump and fuel filter clamped. Finally safety wired the clamps onto the parts then screwed them to position.

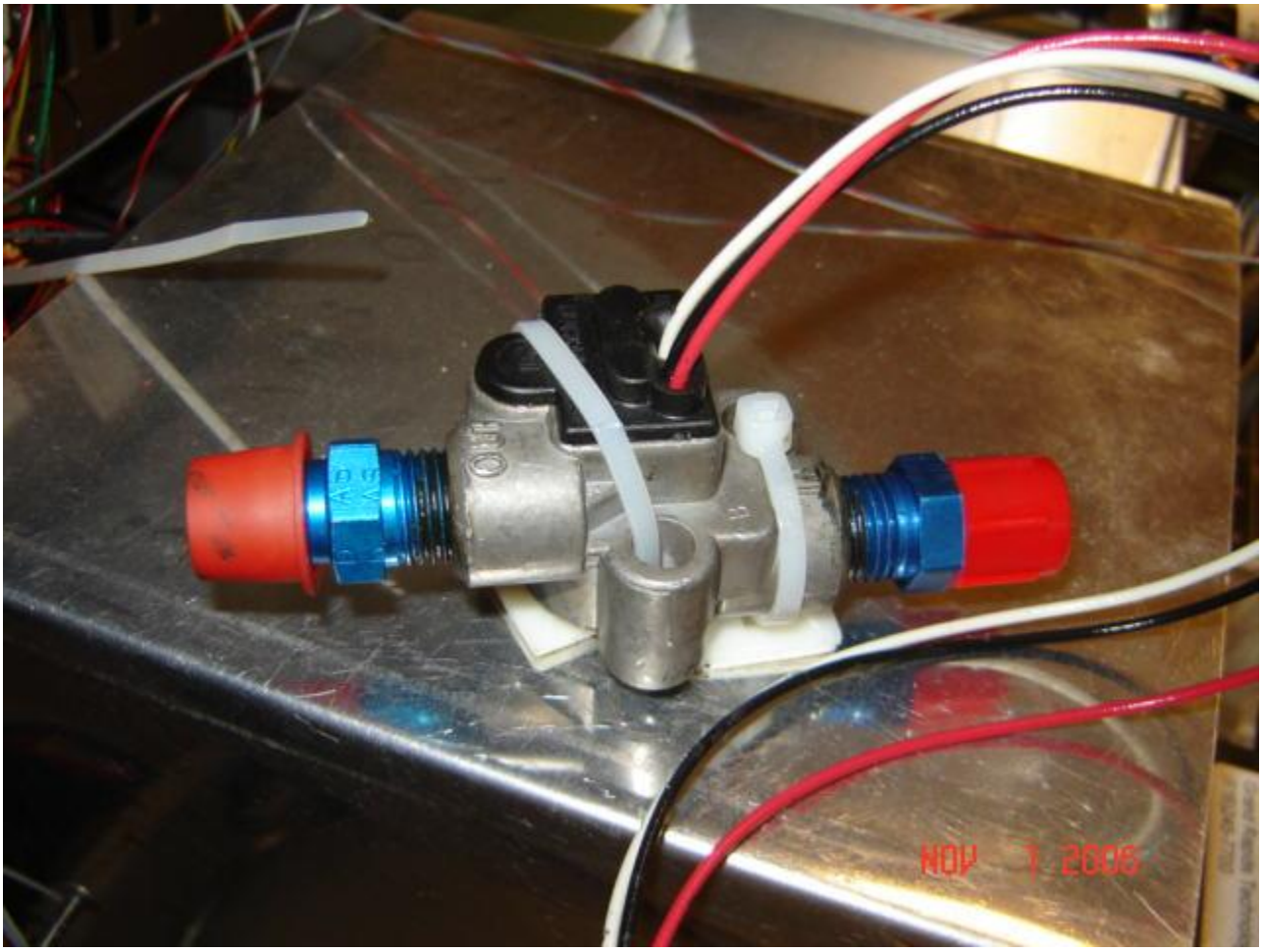
The fuel pump and fuel filter clamps are not all that tight. There is some movement. Especially since I have one of the clamps upside down. Had I to do it again, I would remove a lot of rubber from the Adel clamp and remove the factory tubing from the pump. Then you could put the forward clamp on and screw it from the top, with the fuel pump rotated on it's side temporarily. You could still rotate the pump and slide it back up to vertical. Or leave it sitting at and angle, I suppose. Again, I'm still trying to keep everything back against the walls in that bay as much as possible.

The AP fuel filter may be tough to service in this location, but I can get to it OK. It's not going to need to be checked THAT often. And I just have to remember the little safety wire trick that makes installing

Adel clamps SO much easier, especially when you are trying to put the screw in from the "wrong" side. I didn't want the nut and thread end of the screw sticking through the wall and cutting into my leg, so all the screw heads are on the outside and the nuts are on the inside of the center bay.

Still waiting for an Aircraft Spruce order so I can put flare nuts on the tubing. I don't think those red caps I have on the filter and pump are going to take much fuel pressure.

Fuel Totalizer

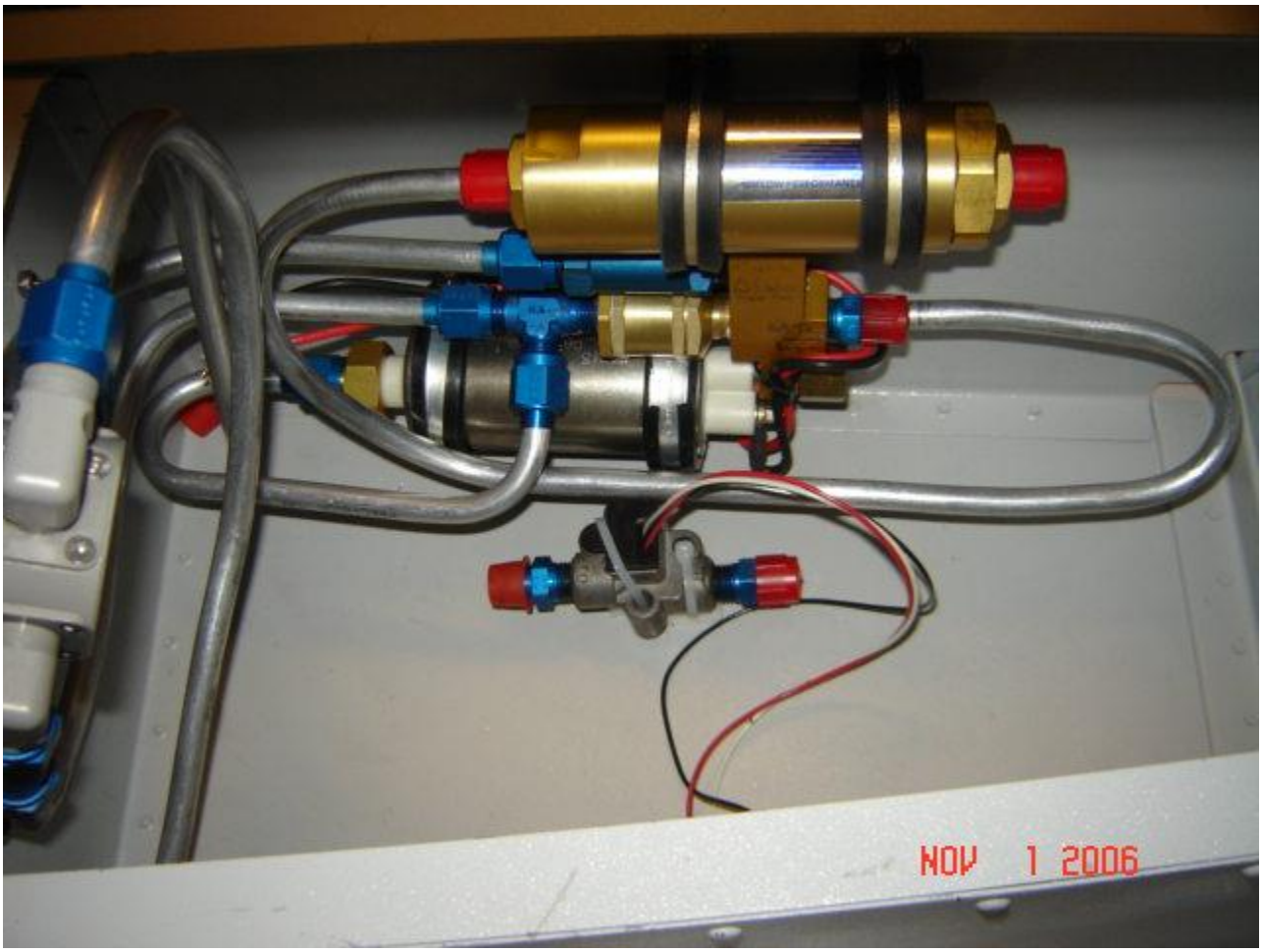


The totalizer comes from GRT without any fittings. It requires a 1/4" NPT to -6 AN adapter fitting on each end. I put them into the unit with some #2 Formagasket thread sealer. Now it's ready to just thread into the cabin plumbing.

I asked around about where to install the fuel totalizer, and some suggested in the cabin. The way I've run my solid fuel lines in the cabin, it is going to be hard to locate the unit anywhere but in the big "trombone" looking loop. GRT sez that you are supposed to keep that thing 5 inches away from fittings, curves and whatnot to give the fuel flow a chance to stabilize. I've been told by a few builders not to worry too much about that.

I decided to try to install the unit at the aft end on the bottom side of the loop, right next to the fuel pump. And I'm going to attach it to the floor. The unit has two big holes for AN bolts, but I don't want to poke any bolts up through the cabin floor (hanging out in the air stream). Since the fuel line is rigid (sorta), I'm just going to *ass*ume that just installing the totalizer in line will be quite stable, and also

use adhesive zip tie attach pads and essentially glue it to the floor. These adhesive pads are notorious for coming loose over time, so I will check them closely. Down the road I may have to RTV or epoxy them down.



This is where I had in mind to attach the totalizer in line. I'm still waiting on parts from Spruce, so I can't splice it in yet. At this point I still have to splice in the fittings for the purge valve return line, too. Everything should be here within another day or two, so it won't be long.

There is just about 5 inches in the solid line forward of the totalizer, so I think this will be an adequate location. The wires will be quite close to the fuel pump wires, so I should be able to bundle them up and run them up and aft out of the bay together.

Once installed, I tucked the totalizer back against the fuel pump. That will make the fuel line loop on the fuel pump the most obtrusive part of the system. Also, I want to bend the "trombone" line outboard toward the wall a little so I can drop some sheet metal all the way to the floor and make a storage area in the rest of the bay.

It turned out pretty nice. There's still room in that bay to make a big closed box for charts and small items. It's not the most convenient space to access, but it's better than nothing. Next job in this area is to build the box and a cover.

The MOVE to the Airport !!!

Here's the fuselage on my back patio. Indy's watching as the tailwheel goes into the grass for the first time!

Here's Keith helping me get the fuselage out my walk through gate in my dilapidated fence. Good thing Keith was there to help. He had great ideas, a truck and trailer, and a strong back! Thanks Keith!!!!

Keith and I went over the tie down arrangement a couple times. The tailwheel was actually strapped to the trailer frame outside the bed. The trailer deck was exactly 16 feet, and my F1 was about 16' 2". Note that there isn't landing gear on the gear legs, just the steel feet.

The Rocket rode very well on Delbert Smith's trailer. Since the Mattituck TMX540 hung off the back of the trailer and that was most of the weight, Keith was worried about fishtailing. With the fuselage on a trailer in this configuration, it was very stable. But when you hit a bump (like the tracks we're getting ready to cross), the weight of the motor would lift VERY hard on the ball hitch. We were most concerned about the ball hitch coming loose. But it was chained and pinned.

Once out to the airport, I left the hoist hooked to the engine lift hooks. Without the tail on the plane, that engine could drop nose first to the ground very easily. There's a 40 pound bag of lime on the HS deck at the empennage, but I wasn't taking any chances. One of the first things I'll do is install the tail feathers to help keep weight on the tail.


07/15/2007

Aileron Control Tubes

Once I had the fuselage in the hangar, I busted ass getting the wings inserted and set up. After several long evenings and a full weekend, I had them set and bolted in. At that point it was time to finalize the aileron control tubes. I had already finished the outer long push tubes, but the inner short ones are supposed to be sized and adjusted in final assembly. So there I was, in the 105 heat index, finished getting the wings in and playing with the aileron control tubes. Only to find out that they didn't fit. Both tubes hit the top of the hole and could not raise up enough to attach to the control steering torque tube bracket.

The plans don't tell you, but you have to modify the aileron push tube hole through the fuselage skin to allow more clearance with the EVO wing. You probably will want to "egg out" the hole at the top, and will probably have to cut slightly into the longeron above. Evidently that's normal.

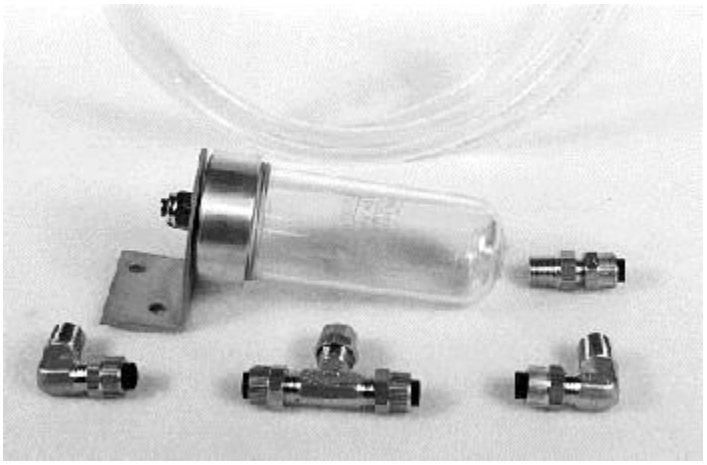
Now what might not be normal is the control steering torque tube mechanism. I'll have to double check that to see if I have the rod ends that support/hang it oriented properly. There is a short one and a long one. Perhaps I have them backwards. (I didn't.)

In the mean time, I'll fire up the cut off wheel and the dremel and get ready to waller out the hole. Mark sez the hole needs adjusted no matter what.

The good news was that my control steering torque tube and hangars were set up properly. And I was able to egg out the holes in the sides of the fuselage for the aileron push tubes without too much trouble. There's no contact of the tube with the fuselage through about 32 degrees of travel. The autopilot control arm isn't going to let the push tubes travel quite that far, so there will be a bit of additional clearance in service. Too bad. Would be nice to have the ailerons going stop to stop. Maybe I can adjust that servo arm to allow a little more travel.

These tubes can be inserted through the wing tip. You just need the tip off of course, and the aileron push rod has to be disconnected. Otherwise, it's no big deal to move the push tubes through the wing into the fuselage.

Brake Lines



The low pressure side of the brakes consist of Nyla-flow 1/4 ID tubing with compression fittings. There is a single line from the fluid reservoir that T's off and branches out to a master cylinder at each rudder pedal. I bought a clear plastic reservoir so I could easily see the fluid level. Also, I placed the clear plastic Matco reservoir up in the upper right hand corner of the firewall, just inside the boot cowl panel. Easy to get to and service.

The high pressure side of the brake system starts

at each master cylinder and heads up to the parking brake valve, which is bolted to the top of the firewall footwell. This is a nice central location, but it will be tough to get a cable on the parking brake valve arm. From there, more high pressure compression fittings and high pressure Nylaflow tubing to steel bulkhead fittings that penetrate the firewall footwell into the engine compartment. The bulkhead fittings are located slightly above and directly between the engine mount bolts that attach to the fuselage frame in the footwell.

Nyla-flow tubing is rated to tolerate brake or synthetic automatic transmission fluid at 1000 PSI. I think the fittings and tubing are more than up to the task. If you are the nervous sort, you can get Nyla-seal tubing which is more rigid, but is rated at 1500 PSI.

Once all the brake lines were installed, it was time to fill the system. I bought two quarts of Valvoline synthetic ATF to use as brake fluid. Half a quart is more than enough to load the entire system, but I wanted enough to get the job done and some "stock". Good thing. Loading the system from the reservoir introduced a LOT of air into the lines. The only way to get the pedals hard is going to be get a bleeder adapter and bleed the system from the bottom up. Not a big deal, but I don't have a bleeder adapter any longer. Soon as I buy or borrow a bleeder, it will be a quick but perhaps messy job to pump out the air from the bottom of the calipers.

Parking Brake

The Matco parking brake valve is bolted to the footwell "roof" using 2 each AN3 bolts. I put it far enough forward on the footwell that I can get a cable onto the arm from around the back of the unit. It seems the unit works backwards from what it should, but you can't change the configuration by reversing the valve arm. It's a simple unit that has an arm and a cylinder that simply blocks off the flow of fluid when it's closed. Press on the brake pedals and pull the handle and your set.

I bought some 1/8 NPT fittings for the parking brake valve. I needed to hook into the valve with the lines pointing down as much as possible. Regrettably, the morons that designed the valve made it so that you can't put 90 degree fittings on the unit, so I made do with 45 degree fittings. Those compression fittings are easy to work with, and the Nyla-flow line is transleucent. Just make sure those connections are tight, otherwise you won't need to see through the lines to tell what color your brake fluid is!

For the push pull cable, I bought a couple different kinds from Aircraft Spuce. The cable I want to use is a T handle and locks. Theoretically, you push hard on the brake pedals, pull the T handle and twist it to lock. Now the plane won't drift along the ramp. I wanted to put it over by the key switch, but the handle is pretty large. Not sure I'll be able to get my hand on it due to the cramped space with the glare shield and canopy rails looming nearby. Second choice is down on the panel where the fuel valve is located. That would make the cable run very simple, and the handle would be out of the way. Perhaps too much out of the way. But for the sake of simplicity, that's probably the best choice. However, if I put a fire suppression system on the plane, I was going to put the fire handle right next to the fuel shut off valve. Just hate to think I'm setting the brakes and pull the fire handle by mistake. That's a costly mess. Another choice would be to put the cable in front of the throttle quadrant. That's a fairly easy run, and when the throttle (and other levers) are pulled back to idle, there is plenty of room on the bulkhead below the instrument panel for the T handle to operate.

The T-handle cable is a simple locking push-pull from AS. To operate the cable, you pull (or push) in and turn clockwise until it stops. The parking brake valve arm doesn't have a stop, it actually rotates 360 degees, 1/2 of that range being "open" and the other being "closed". So pulling the cable doesn't really go to a positive stop, just pull gently as far as the valve arm will allow it to go, then twist the T-handle to ensure the cable doesn't slide back and open the valve. The brakes should hold steady as long as there are no hydraulic leaks between the parking brake valve and the pressurized brake calipers.

Time to get the T handle cable out to the airport and try to locate it.