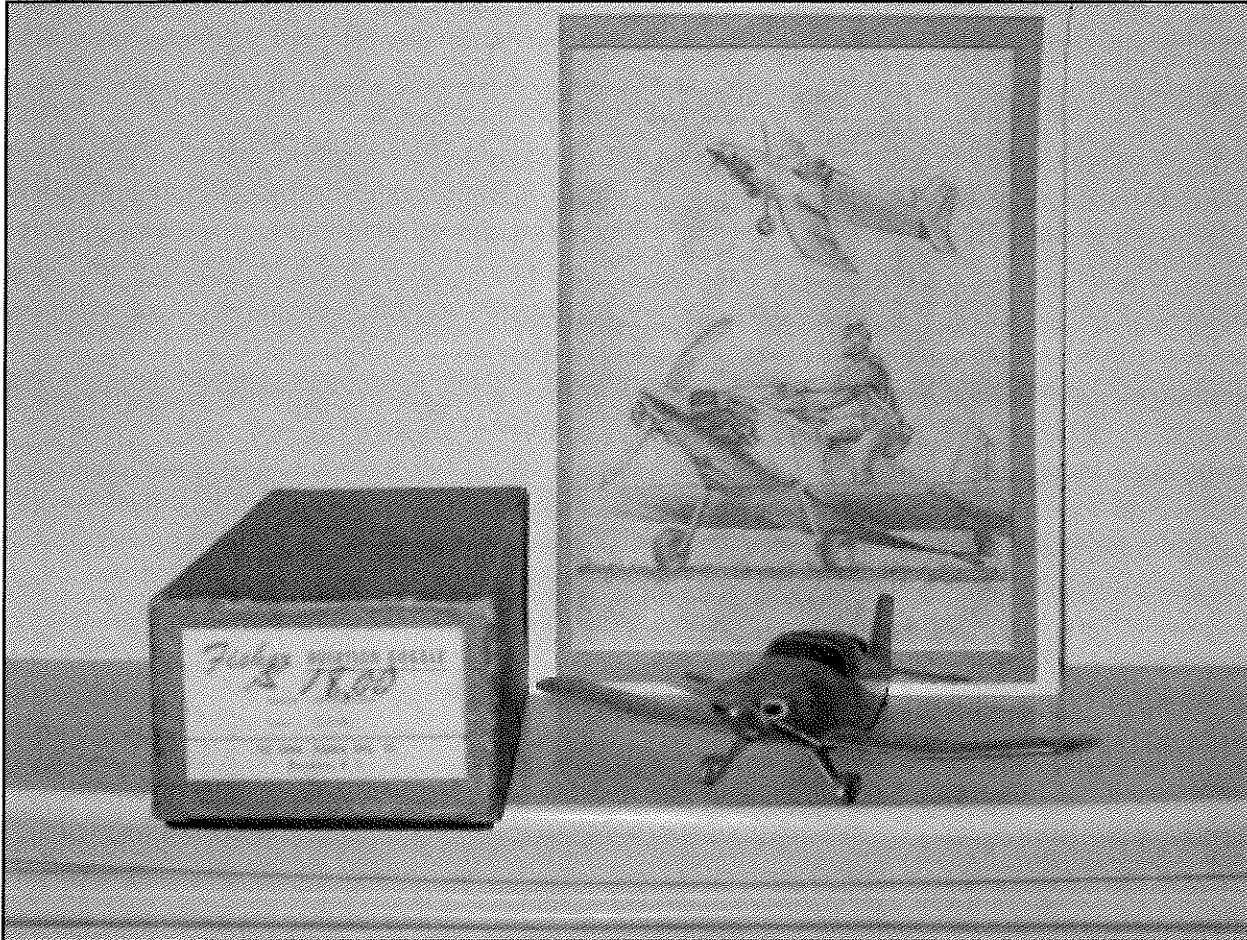


T-18 Newsletter

May 2008



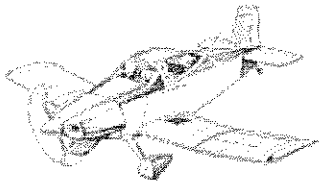
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Notice: (Standard Disclaimer) As always, in the past, present, and future newsletters, we wouldlike to make you aware that this newsletter is only presented as a clearing house for ideas and opinions, or personal experiences, and that anyone using these ideas, opinions, or experiences, do so at their own discretion and risk. Therefore no responsibility or liability is expressed or implied and is without recourse against anyone.

Thorp Electrical Systems

By: Jerry Miel



Editors Notes

By: Roy Farris

I was a little disappointed in the acceptance of the web based newsletter verses the printed hardcopy. Thank you to those who opted to go for the color downloaded version. I had about fifty members sign up to receive only the web based version and forgo the hardcopy.

For those of you who missed out on what we are talking about, I will run through it again. To save printing and mailing costs for the newsletter, I am asking that those of you who are computer savvy and like the newsletter in a color format, to download the newsletter from the web site and NOT to receive a printed copy snail mailed to your home. If you want to give it a try just let me know and I'll tell you how to do it. Just drop me an e-mail at: royfarris1@comcast.net. There is also a link toward the bottom the [T18.Net](#) home page that will allow you to register and sign up for this option.

For those of you who already download the newsletter, I am working on a way for you to check your password and membership status on the T-18 web site. Its not ready yet and I will let everyone know when it is operational.

I am having an increasingly difficult time finding enough material to publish these newsletters. Please send me something ... anything ...that might be of interest to the other members. I will be glad to clean it up and edit it as necessary ... just start sending me stuff.

On The Cover

I don't know if this sketch has been published in the newsletter. John Thorp said he was encouraged to design the T-18 when he found his old flying goggles. John's artist friend, Mr. Shannon captured the early ideas in this sketch. The model came later and shows what the design finally became. I do not know who made the model

Richard Eklund

I just finished spending many uncomfortable hours changing ninety percent of the electrical system in my Thorp. The builder of my airplane was a friend and a skilled builder, but the electrical system had plenty of built in problems. The wiring even looked nice, but it frightened me on every trip. So, I finally took the time to redo it correctly.

Many people would say that my standards were too high or that I was just nit picking, but electrical systems are something that I understand and have respect for what can go wrong when they are not right. After all, besides an in flight breakup, the next most dreaded problem that a pilot can have is a fire in the cockpit. Most of these fires are caused by electrical failures.

Besides being a pilot, I am also an A&P mechanic with IA. However, my formal training and most of my career have been in electronics. Despite this background, when I started working as an avionics technician, I found that I still had lots to learn about aircraft electrical systems. It's all in the details and the details are important.

Since I just finished this job, I wanted to share what I changed and why I changed it. This might be of a help to other builders, but also for owners doing their own inspections. Let me assure you that doing it right the first time is sure easier than redoing it later.

Wire: Most of my airplane was wired with automotive or hardware store plastic coated PVC wire. The plastic coating of this kind of wire is quite soft and melts at quite a low temperature. The insulation can fail easily if it gets too hot or rubs against anything. Over time, the wire can even migrate through the insulation around sharp bends or under the wire ties in a bundle. The most serious fault is that when it gets too hot, the insulation burns and when it burns, it gives off toxic fumes. That is not a good thing when you are cursing a 10,000 ft. Use only mil spec aircraft grade wire in your installations. The most common is called Tefzel. It has a very hard insulation the resists abrasion and does not burn. My airplane now has 100% Tefzel wiring.

Wire Size: I often find under size wire in airplanes, even certified airplanes that have been maintained by mechanics who should know better.

cont. pg 3

Thorp Electrical Systems, cont.

Every size of wire has a current carrying capacity (amperage). You can always use heavier wire, but never lighter. So, how do you know what size to use? For each circuit, you need to know the maximum total current drain. If you know the current drain of each item in the circuit, just add them up. If the equipment doesn't have a current spec, but has a figure for watts, just divide the watts by the voltage to find the current. Most avionics installation manuals will specify what size wire is required. Often it is larger than the minimum for other technical reasons. So, now that you know the current drain of the circuit, how do you know what size of wire to use? The best place to find this is in Advisory Circular AC 43.13-1B, Chapter 11. That book has tons of information, but for wire sizes, it can be very confusing with all of the different considerations. Let's make it easy. For a small airplane like a Thorp, all that you need to know is paragraph 11-49 and Table 11-3. That table tells what size circuit breaker or fuse is needed for each wire size. That also gives you the maximum capacity of the wire and the circuit. For design purposes, you shouldn't load the wire up to its maximum. Try to stay below 75% of capacity or go to a larger size of wire. The same rule of thumb goes for the circuit breakers.

Circuit Breakers: Circuit breaker ratings and wire size go together like a hand and a glove as you can see from the table in AC 43.13-1B. A common misunderstanding is that circuit breakers are there to protect the equipment. They are not! They are there to protect the wire from starting a fire. The circuit breaker rating and the wire size must match and must be adequate for the load of that circuit. An important consideration here is when one circuit breaker is used to feed many different low drain pieces of equipment. For example, say that you install one 10 amp circuit breaker to protect all of your electrical instruments. Let's say that you have 6 different electrical instruments fed from that one circuit breaker and each one draws only one amp. That is a total load of only 6 amps, so the circuit breaker load is conservative. Since each instrument only draws one amp, you might be tempted to wire them all with 22 gage wire which will handle 5 amps. No! Since the circuit breaker

cont.

Thorp Electrical Systems, cont.

is rated at 10 amps, all of the wiring leaving it must be 18 gauge to handle the capacity of the circuit breaker. Otherwise if one branch shorted, it could catch fire before the circuit breaker blew. All of the wiring leaving a circuit breaker must be large enough for the circuit breaker capacity. One way around this would be to put in line 1 amp fuses in each wire lead after the 10 amp circuit breaker. Another important detail is that the grounding wire for each item must be equal in size to the supply wire. For circuits that do not have an on and off switch in the line, it's a good idea to use a circuit breaker that can be switched or pulled off.

Circuit Breaker Location: The circuit breakers MUST be located physically at the source of the voltage, usually the bus bar. One of the most common problems that I see in airplanes is finding circuit breakers scattered here and there around the panel because there just wasn't room to mount additional breakers to serve added pieces of equipment. The problem here is that the supply line from the bus bar to the remote circuit breaker is usually sized for the load that the circuit breaker protects. The problem is that that supply line is no longer protected. The bus bar has the capacity to deliver several hundred amps from the battery. If that 22 gauge wire feeding a 1 amp breaker on the far side of the panel happens to short, it will be fire works because it isn't protected. There are two exceptions to this rule. The wire from the alternator to the bus bar is protected at the bus bar, not at the alternator. Secondly, the wire from the battery to the starter and the bus bar doesn't have any protection. You will notice that these wires are also especially large and would be capable to handle the current load until the battery discharges or the alternator burns up. So, what do you do when you need to add equipment, but there is simply no more room in the present bus bar location? One possibility is to use inline fuses located at the bus bar to feed the new equipment. Another possibility that I used on my airplane is to establish a second group of breakers and a second bus bar at a new location. These are then fed from the main bus with a "master breaker" large enough for the entire load of the second bus bar and with a large enough wire between

cont. pg 4

Thorp Electrical Systems, cont.

them to handle the load. For example: I put all of my avionics breakers in a group on the right side panel. On the main bus, I installed a 35 amp "avionics" breaker and used a #10 wire to feed from it to the second group of avionics breakers. This also made it easy to add an avionics master switch in the line.

Switches: Another mistake that was made on my airplane was the use of toggle switches which did not have a DC rating. Without going into the reasons why, let me just say that any switch that is used to switch more than 1 amp of current must have a DC rating. It takes a much more massive contact to switch a given DC load than it does to switch the same AC load. DC switches are much harder to find and much more expensive, but they are worth the cost in an airplane. AC switches when used on DC have a much higher failure rate and unfortunately, they often fail by welding the contact internally so that the circuit cannot be turned off.

Connectors and terminal: Finally, those little ring terminals that we use so many of: what could possibly go wrong with them? My airplane had the common hardware variety of terminals installed. These are notoriously unreliable. They have a plastic insulation sleeve which is easily damaged during crimping and often just fall off. In addition, internally, they only have one crimping area. Good quality terminals are made by companies like Amp, T&B, and Amphenol. They have a double internal crimp where the forward part crimps the wire proper and the rear part crimps on to the insulation so that the wire doesn't break so easily. The insulation is nylon or some other durable material. You probably won't find these locally. If they don't cost at least \$.15 each, they probably shouldn't be in an airplane. You will need quite a selection of these for both the different sizes of wire and the different sizes of screws. Never use fork terminals, only ring terminals. A ratcheting kind of installation tool is nice to have, but with practice you can make good crimps with a simple hardware type of crimper.

The good news is that with a little instruction and guidance anyone can do a first class electrical installation. The bad news is that the quality hardware is more expensive and usually not available

cont.

Thorp Electrical Systems, cont.

locally. The good news is that you can order everything that you need from sources like Chief and Aircraft Spruce or from any of the avionics sources.

I would be glad to answer questions from any of the Thorp list members about specific electrical problems or procedures.

Jerry Miel
jmiel@uim.org

**Fuel Quantity?**

Since the fuel tank is not linear top to bottom, anyone calculated the fuel levels in inches from the bottom of the tank to the top in increments of 1/4, 1/2, 3/4. I need those measurements to calibrate my new fuel gage.

Bill Beswick

I carry a calibrated fuel stick with me to get an accurate measure of partial fuel loads. I made it out of a 24" long piece of 5/16" dowel rod. I calibrated it by starting with an empty fuel tank and adding fuel until the fuel level just touched the float in the tank. (You can look into the tank and see that.) It took 5.7 gallons to touch the fuel float and that mark is 6.5" from the bottom of the stick. (The stick is inserted in the filler neck, touching the back of the opening and angled down to reach the deepest part of the tank.) The next mark is 7.5" from the bottom of the stick and it registers 8 gallons. 10 gallons is marked at 8 3/4". 12 gallons is 10". 14 gallons is 11 1/8", 16 gallons is 12 1/4", 18 gallons is 13 1/2", 20 gallons is 14 3/16". 22 gallons is 15 7/8". 24 gallons is 17". 26 gallons is 18 3/16". 28 gallons is 19 1/16". 29 gallons is 19 7/8".

If anyone else has made a similar calibration device, I would be curious to hear if their measurements were about the same. I suspect there is considerable variation due to the variances in the shapes of the tanks.

Fuel Quantity?, cont.

Even if they are made from the same form blocks, there will probably be distortions in the shape cause by oil canning during welding, etc.

I never trust the gauge to tell me exactly how much gas I have on board. The stick fits easily in the baggage bin behind my seat and it is easy to dip the tank and it tells me precisely how much fuel I have. During flight, when the gauge hits E, I know I have at least 5 gallons left. As a rule, if I am at normal cruise altitude of 6500 to 8500 ft and 60 miles from my destination when the gauge is steady on the 1/4 mark, I know I will land with the gauge bouncing close to the E. I know there are over 5 gallons remaining, but I start puckering anyway when the gauge touches the E. I think the most I have ever added on filling up is about 23 1/2 gallons.

Gary Green

I get similar numbers compared to Gary Green's. I use a wooden yard stick:

- 8 gallons = 7 3/4"
- 10 = 8 3/4
- 12 = 10 1/2
- 14 = 11 3/4
- 16 = 13 1/4
- 18 = 14 1/4
- 20 = 15 7/8
- etc.....

Jim Tomaine N335BW

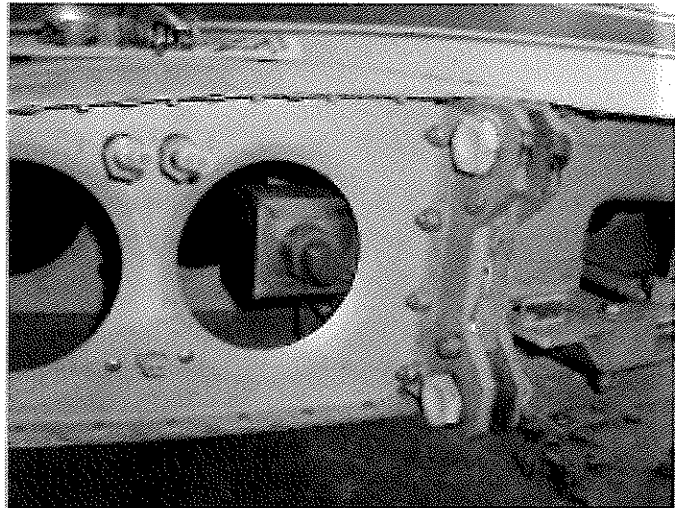
One of the design features of the Thorp fuel system is the finger screen in the bottom of the fuel tank. The purpose of this finger screen is to diminish the possibility that something foreign in the main tank will block the fuel flow to your engine. Without the finger screen, the surface area for fuel flow into your fuel line is less than the size of a dime. With the finger screen, the surface area is many times the size of a dime thus increasing the odds that an object like a leaf or some foreign object won't block off the entire fuel inlet.

Periodic inspection of the finger screen is an important element in the continued safety of your aircraft. While removing and cleaning the screen is a difficult job, visual inspection thru the filler neck when fuel is low can tell you something about the status of this screen.

Tom Hunter
N18XT

Wing Tank Ideas

For a vent in the outer wing tanks, I simply put a 1/4" 90 degree pipe/flare fitting into a tapped block riveted to the upper corner of the outboard rib. A tube is then routed straight down through the bottom flange. The tube sticks down about 1/4" and is cut off at a 45 facing forward. This provides enough ram air to positively vent the tank. Since my wingtips are butted to the outer wing, I don't have to mess with the vent when I take the wingtips off for inspection.

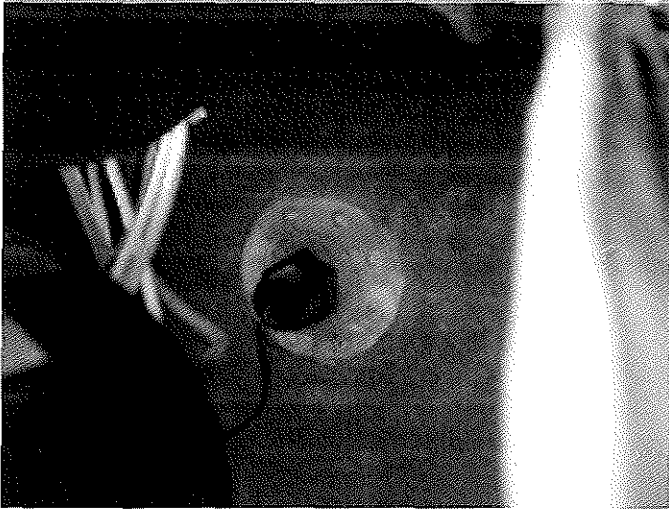


Above is the fuel transfer pump in inner wing. The feed from the outer tank screws directly to it.

On the next page is the fuel high level float switch in the main tank. This is at the top of the rear of the tank. It cuts off the transfer relay if the fuel level reaches the switch. The relay has a 3 sec. delay so the sloshing fuel doesn't keep cycling the pumps when it gets full. After level off, I just turn on the transfer and forget it. The system keeps the main full (and CG stays put as well) until the wings are empty.

cont. pg 6

Wing Tank Ideas, cont.



This is the control panel. The middle switch is the main power switch. It is actually in series with the high level float switch. These control power to the relay. The relay is mainly in the system because the Float switch won't carry the amps of the pumps directly. The outer switches are used to individually control the wing pumps in case of an imbalance. Normally, these are both on for transfer. I turn them off when the wings are dry so as to not run the pumps with no fuel in them. The amber light tells me the system is armed. The red lights are hooked up to low level float switches in the wing tanks. They are the only fuel level indicators in the wings.

Bob Highley
N711SH Ser. # 835
Lakeland, FL

Baggage Compartment Aux Fuel Tank

Remember N8428 (??)...This airplane has a 10 gal aux tank over the baggage compartment that works great. Picture shown below .. I also have a set of plans for it if anyone is interested.



Russ Verbael
N-8428

Editors Note: I believe this Aux Fuel Tank arrangement was used extensively in Australia. It works great as long as you consider the fuel weight in your Weight and Balance calculations.

More Fuel Related Issues

Hi guys, I have a problem and just wanted to see if anyone out there is a card expert. I have an O-320 E2D with a MA-4 carb. The first time I ran the engine it held fuel just fine, and now sometimes holds fuel, but sometimes it doesn't. It is spotless inside and out and it has new inards, including the brass float and it isn't fuel logged. It just overfills and runs fuel out the venturi. It has no trash in it or in the finger screen at the fuel inlet. It is a gravity feed system, no pump, very basic. I am stumped and afraid of it killing me and my wife. If it operates fine part of the time, and runs fuel out at other times, it could drain my tank while in flight, as did happen to one of my buddies. I am at my wits end, anybody want to tackle

cont. pg 12

What I Did on Spring Break

I bought my T-18 just over 8 years ago, right after my first son was born. I was the third owner of a project that already had the fuselage on the gear, the empennage built, and the outer wings complete. I thought that I would get a lot of building done while he was a baby and spending a lot of time sleeping. Boy was I wrong; the child rarely slept.

My project came with the outer wings complete, but I wanted the Sunderland airfoil, so I deskinning the outer wings to rebuild them with new nose ribs. I opened up the outer wings and discovered that, as nice as they looked on the outside, I was less than impressed with the inside. The countersinking on the spar caps looked as if it had been done with a drill bit, and some were knife-edged. I unbolted the spar caps, and then took a closer look at the attach fittings, the holes in which were not all round and straight. In short, I salvaged exactly one spar cap, and rebuilt the outer wings with new nose ribs, spars, and attach fittings. So much for considering my project the equivalent of a "quick build" kit.

After reading all the newsletters, I decided to do my own parts and started with the ailerons. The first set was OK, but not as nice looking as I wanted. So I now have two sets of ailerons. I fabricated flaps, and they looked OK, but the trailing edges weren't as straight as I wanted. And then when one of them fell off the wall, the trailing edge became a lot less straight than I wanted. I then tackled the control linkages and the center wing.

Now, 8 years, two children, and one MBA later, I have most of the major structure complete on my T-18, and I wanted to see how it looked. This year was a perfect alignment of my son's spring break, Sun n Fun, and Disney's lower rates, and I was all set for a great trip to Florida. But the wife has had a lingering infection that kept us from traveling, not to mention me lopping off a large chunk of an index finger, so the trip to Florida was scuttled.

So what I did for spring break was to haul my airplane out to the front yard and try putting all the big pieces together. The weather, and my sons, cooperated and I had several hours free for airplane time. I hauled all the big parts out to the front yard and started with dropping the horz tail into place. The prior builders had tried to minimize the cutout for the horz spar, but didn't think about dropping it into place. I was able to finesse the horz tail into place, but I will need to do a bit of additional trimming on the side skin. The best news is that the pivot fittings all line up and the tail pivots smoothly, without any binding. The vert tail and rudder both bolted on with minimal fuss. On to the center wing.

I brought out some boxes and wooden blocks so that I could ease the center wing up and into place. I had fitted it up prior to skinning, so I thought that it would do so this time. Not. Somehow, the rear spar fitting (both sides) had translated aft about 1/8" and was hitting the fuselage fitting instead of sliding in front of it. Once I had the center wing propped up under the fuselage, I crawled under it and tried various versions of angling the wing and trying to get it all to slide into place. My sons came over to help, but still no luck. My most vivid memory of the day is of laying on ground resting my arms, with the center wing lying on me after 20 minutes of holding up the wing and trying to get it into place, and my elder son asking if I didn't need to be working out more to strengthen my arms. And when it became clear that the wing just wasn't going to fit, hearing his expert opinion that "You made it too big, Dad". You just gotta love the authoritative voice of children when their parents have screwed up something.

Fortunately my neighbor came home and walked over to lend a hand and we were able to confirm the exact dimensions of the misalignment and verify that it was more than just the angle that things were going together. I moved the spars to the aft side of the fuselage fitting, clamped them into place, and kept going. The outer wings plugged into the forward spar fittings without incident, and the aft spars needed to be pushed down a bit to get their holes to line up. With that done, the major parts were in loose formation on the ground, and ready for engine noises.

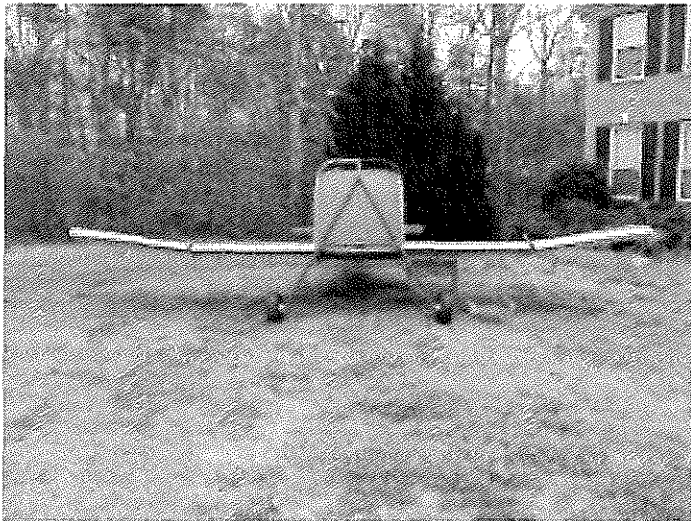
I sat the boys in the seats, put the control sticks in their sockets, and commenced to taking photos. That done, I pulled them out and let Christopher take my picture in the pilot's seat.

I think I forgot to make engine noises.

If you saw my email from the week of Sun n Fun, yes, I was quite ready to toss the whole project into the recycle bin. What had looked like nice, well-formed airfoils now looked lumpy and ill-formed. Thanks to everyone who responded with words of encouragements, and to confirm that others had also seen some of the same issues. In the meantime, I did have the satisfaction of seeing my airplane sitting in my front yard, which is infinitely better than seeing the individual parts hanging from the rafters. A couple of the other neighbors saw the airplane and had questions later that week. In the category of the question that most deserved a wise-acre answer (from a guy no less): "Andrew, was that a real airplane?". The answer I wanted to give: "Why, no. It is a 1:1 scale model. You should see the half-size C-5 in the backyard".

Anyway, for those of you who are still building sub-assemblies, keep plugging away at it. Eventually all those sub-assemblies will come together to be a full airplane.

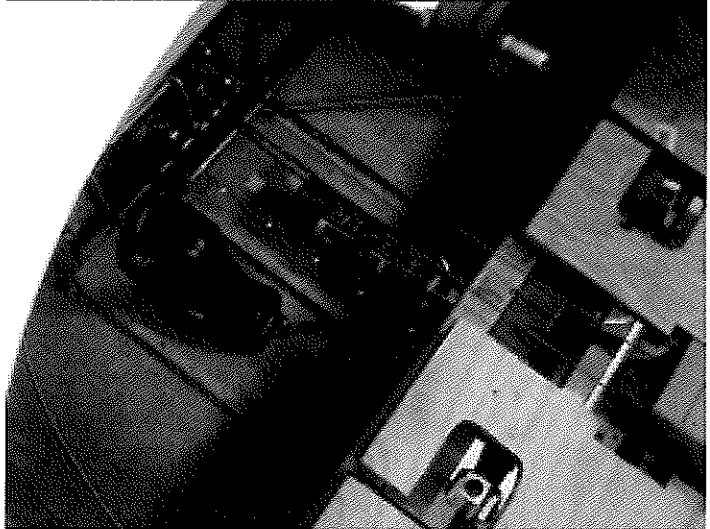
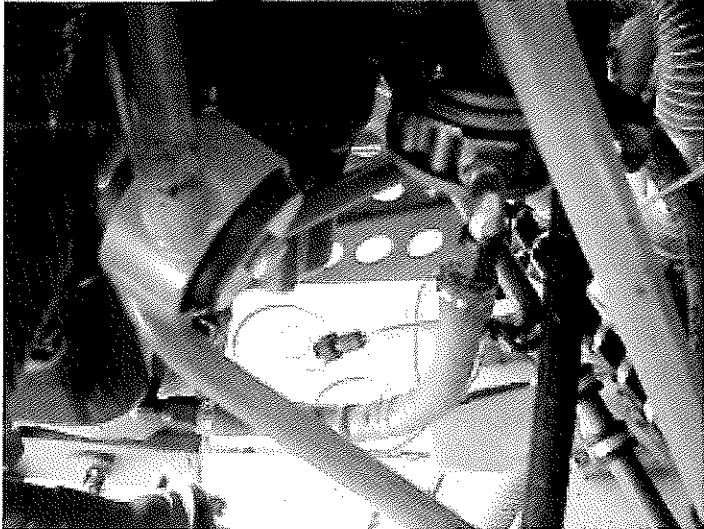
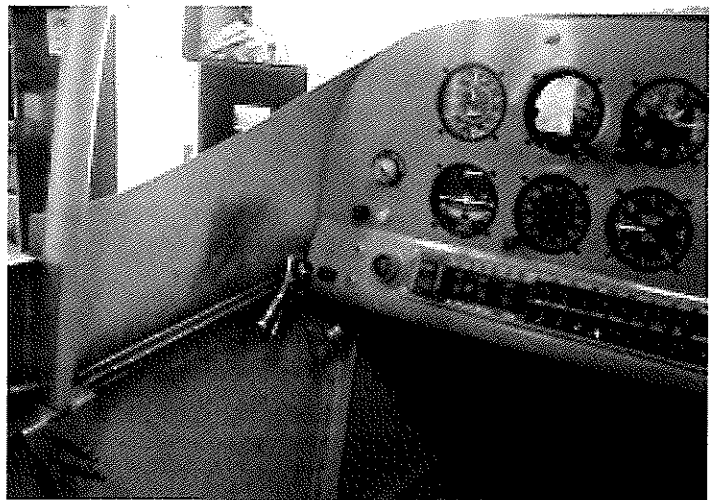
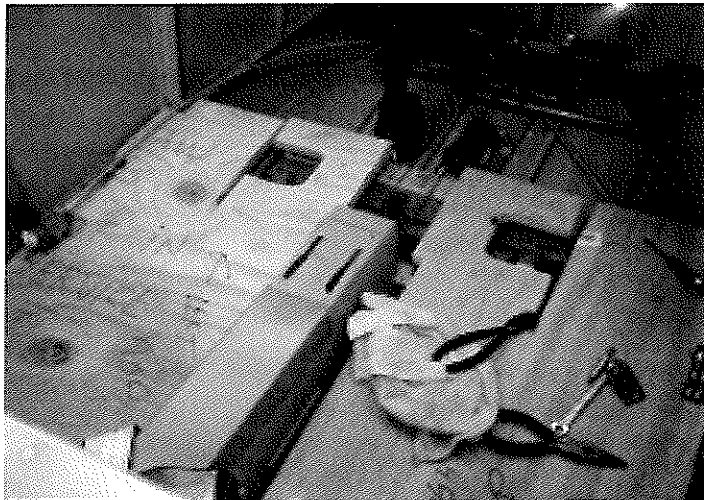
Andrew Robinson
SN 491



Some insights from Richard Brazell

Rather than cut out the floor and install a panel for access (I still may do it) I used 3/4 inch plywood and made inserts (in place of the seats) in which to kneel down and work under the dash, firewall and rudder pedal areas. A foam pad helps and is fairly comfortable (for a while)...this leads into my next subject.

I wanted to install some type of extinguisher system for the engine compartment (why you ask?) Well after all the years of flying A/C with a fire handle it just seemed the right thing to do, but where to put the system and which system to use? Doing my research all the systems were way too expensive! \$400.00 to over \$1,000. Plus the size of the unit was a problem. I finally decided to construct my own system. I found a 1.4 lb "HalGuard" rechargeable extinguisher (one of the new replacements for Halon). After days of trying to find a place to put the unit (looking for that unused space in a Thorp) inside the forward tunnel looked like a good home for the extinguisher. Plenty of unused space and out of the way. From the pics you can see it is mounted almost all the way aft when the tunnel is placed on top. I also put an inspection hole on the left aft side of the tunnel to check the pressure gauge during preflight. (the unused bottle has a shelf life of about 10 years). I replaced the discharge nozzle on the bottle with a modified AN fitting to attach the alum tubing that goes to the firewall and then into the engine compartment. There I have (2) discharge nozzles (modified AN fittings) that direct agent to the carb area, fuel pump area and battery box. To discharge the bottle I had to modify the existing fire bottle handle to attach a push/pull cable (with handle) using a bolt type terminal (similar to Spruce P/N 05-02500). The cable then runs up the left side of the fus. to just under the inst. panel. The handle has a safety pin to prevent accidental discharge and the pull is about 3/4 inch with a "twist to lock" on the handle so it's pull the pin, pull handle and twist to lock. Cost of the entire system less than \$100.00. Overkill...maybe. Peace of mind..."Priceless!"

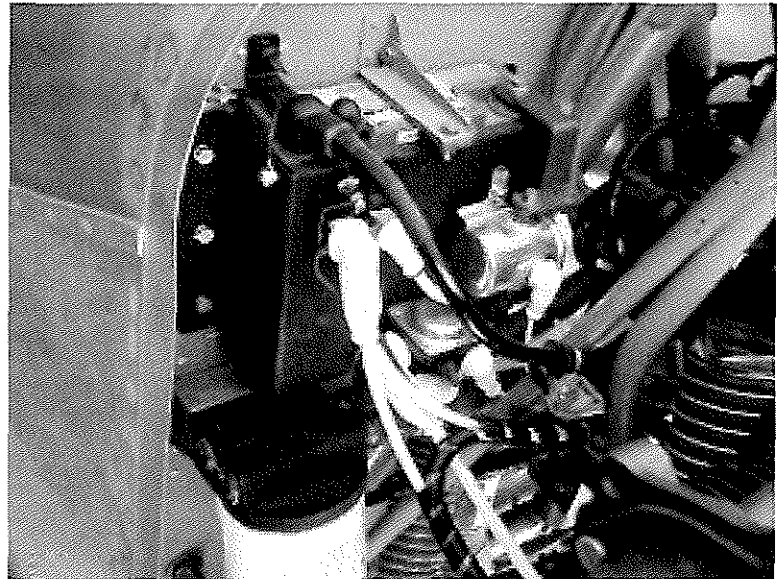


Some insights from Richard Brazell, cont.

Mount your battery on the firewall! Are you out of your mind! Believe me I put a great deal of thought into this mod and I know there are those out there that will disagree with this placement of the battery until gas comes back down to \$2.50! Here are my reasons for placing the battery where I did>>>

(1) Ease of maint... battery is at arm level and not stuck in the baggage compt. The main reason (I believe) the battery was placed in the baggage compt was due to it's size. The old lead acid (25 pound plus) battery was too large to mount in the engine compt. and for W & B purposes it made sense to place it aft. (2) No high AMP/ Gauge wires in the cockpit! The longest wire I have running from the battery is from the starter solenoid to the starter...approx 3 feet. The ground wire from the battery to the engine is approx. 1 1/2 feet. (3) Both the master and starter solenoids are attached to the battery box and are ganged together using 1/8 inch copper bar. The battery box is hinged to the firewall so the battery tilts out to R & R. What about W & B! All that weight foward? I have the DeMuth wood prop (about 13 pounds if I remember right vs. about 30 pounds for a metal prop) and the S-18 fus. is 5 inches longer. Don't forget I can put 100 pounds of ballast in the baggage if I need it! Some folks have said that vibration and heat are not good for this battery and putting it in the engine compartment can't be good? The research I've done indicates that it is used for ATV's, motorcycles, commercial and military use. If it's installed on a Harley Davidson motorcycle (Hog) and they run these bikes through the desert SouthWest in the middle of August and God knows the Hog is a vib free machine!!!...then installed on my firewall with a blast tube next to the cowl cheek outlet and well above the exhaust should work just fine (time will tell!). Parts list to follow...

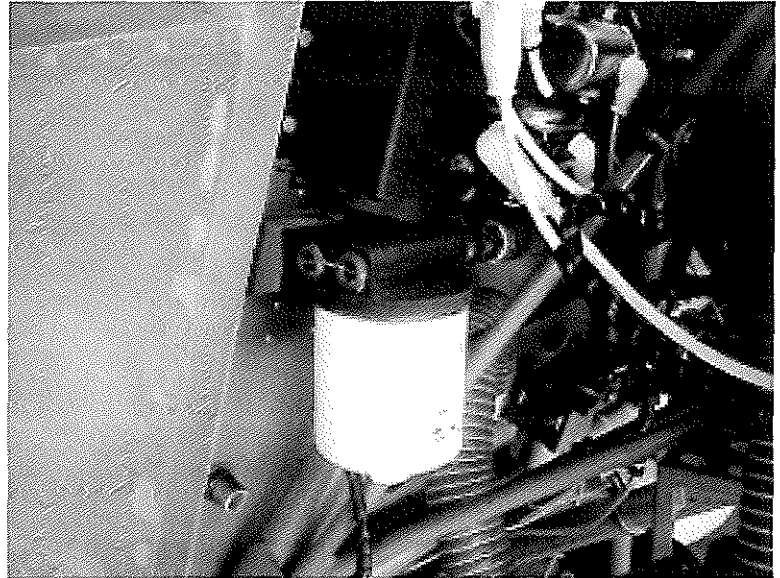
1. Battery. PC-680.
 2. Battery box. Off the shelf from Mama Spruce P/N 11-01853.
 3. Starter/Master solenoids standard Spruce items.
 4. Copper bar material. Industrial Metal Supply Co. By the pound. 1/8 inch x 3/4 inch.
 5. Wire... Spruce item. Also solder on terminals.
 6. Hinge material. Left over aileron hinge works just fine.
 7. Found some threaded attachments to attach the solenoids to the battery box at a surplus place. Flush riveted from the inside. P/N ???
- More time than money invested in the set up.



This is how I installed my remote oil filter. After looking at the \$500.00 "aviation unit" I did many hours of research and found "Hawaii Racing Products". They have about every high end racing product you could want. I found the Canton Racing Products 90 deg. rotating remote oil filter adapter and the Canton billet alum. remote spin on filter mount. Checked the site today and the prices have almost doubled? Both adapters are American Made (checked with Canton Racing Products) and machined out of a solid block of alum...not casted. I tried to use both factory engine adapter for the filter, but they would not work as the filter would hit either the engine mount or the firewall. The 90 degree adapter bolted right onto the engine and the only mod I made was to drill a hole in the attach bolt for safety wire. A neat unit as you can rotate it 360 deg. to suit your hose installation. The firewall mount adapter for the filter I modified by removing the L shaped mounting flange and attaching it to my own mounting bracket. This moved the filter away from the firewall and makes maint. easier.

Removing this L bracket and some other material from the alum. mount reduced the weight by about 25%. The filter was placed near the cowl cheek exit to take advantage of some "free cooling." The rest of the install was pretty straight forward. Did have to use reducers (1/2 to 3/8 NPT) so -8 hose could be fitted. If you have room I guess you could use -10 hose? Total cost for all parts...adapters, hose, fittings,etc. about \$200.00. Higher now. Parts list to follow

1. (1) Canton Racing Products 90 deg. Rotating oil filter adapter P/N CAN-22-595.
2. (1) CRP Billet Alum. remote spin on filter mount P/N CAN-22-625
3. Approx. 2 1/2 ft. AeroQuip -8 stainless steel hose.
4. Approx. 2 1/2 ft. Stratoflex firesleeve.
5. (2) 90 deg.-8 AeroQuip swivel hose fittings.
For 90 deg. adapter.
6. (2) Straight AeroQuip -8 hose fittings.
7. (4) Stainless Steel band type hose straps (cinch clamps).
8. (4) AN reducers.



The filter adapter will accept "aviation type" oil filters, K & N filters (they have a safety wire attach point just like the aviation types) or I guess Ford spin on filters if that floats the boat!



Victor J Thompson ~ Merrickville, Ontario Canada

More Fuel Related Issues, cont.

this one? I have spent two weekends taking it apart and putting it back together.

Dan Eggleston

These simple carbs can drive you nuts. It has been my experience that the float level setting is the culprit. I have forgotten the size, but a normal drill bit is used to check the clearance. I assume you replaced the needle, seat and float hinge rod while you were in there. Hinge rods can and will wear. Also, make sure the float is not able to cock sideways and hang up.

Bob Highley
N711SH
SN 835

Here is one way to check that the float does not drag on the sides of the float chamber:

Line the float bowl with a thin layer of modeling clay, temporarily re-assemble, and invert the carb a few of times to swing the float. Open it up to look for marks in the clay.

You can make thin wafers of clay by smashing it on a table top (the clay, not the carb), place a pair of 0.040" or 0.050" wire rods on each side of the clay, and roll a roller down the length of the parallel rods. This will yield a uniform clay wafer 0.040" or 0.050" thick which can be used to line the bowl.

Tom Kerns
N10TK

cont. pg 14

Engine Popping

My S-18 has an IO-360. The engine seems to be running great on warm up, takeoff and cruise, but occasionally after landing, while taxiing back to hangar, the engine pops 2-3 times at low RPM. Last weekend, I flew from Lancaster to Jackson CA (in foothills east of Sacramento). The airport came up sooner than I expected and I was couple thousand over AP pattern. When I pulled the throttle way back, the engine started popping a lot. I increased throttle to about MP

Engine Popping, cont.

15 and it stopped popping and was OK landing and taxiing.

About a year ago, I had an incident of major popping, vibration and power loss. I landed and went to the local shop. They said it was probably dirty injector nozzles. They removed the nozzles and by visual inspection they looked clean. However, they cleaned them with a solvent and reinstalled and ran great. However over the past year I have still noticed the taxiing pops a few times. During taxi I have changed mixture from full rich to leaning various amounts and doesn't seem to help when its in a popping mood.

Since the recent popping, I asked the mechanic again and he said was probably nozzle again. Even after talking with him and asking questions I'm still puzzled.

Could some of you guys who understand engines, enlighten for me. What is the popping? Is that fuel ignition at the wrong time or place? Why would it happen only at low power?

Then one more thing. I'm having trouble finding MP for 65% and 55%. I have the Lycoming Overhaul Manual and The Lycoming Operators manual, but all the numbers relate to RPM. I got figures from some other Thorp POH of 65% at 21"MP and 55% at 19" but I'd like confirmation from something official.

Hal Underwood

I am installing a fuel injected engine in my plane and have been studying up a bit on the beast. Most helpful was my conversation with Alan Jesmer at Precision Airmotive. He can be reached at (360) 651-8282 or alanj@precisionairmotive.com. He sent me a CD-ROM on operation and maintenance of the system and it has some really valuable tips on trouble shooting.

There can be many reasons for poor idle or off-idle performance. Most of them stem from air leaks in some part of the system. You can have an air leak in the fuel lines that doesn't show up as a fuel leak. The other source of trouble is the servo settings. These can get way out of whack while trying to set the idle mixture and speed. These are covered in the video as

well as hot start issues.

The popping you describe sounds like the idle mixture is incorrect. With our straight pipes and small airplane, you hear a lot more noises than you would in a factory built plane. The RV line is notorious for popping in the pattern, again attributed to excess fuel dumping in the exhaust pipes when the throttle is retarded. Remember, the idle mixture fuel continues to flow at above idle conditions. You normally correct for this with the manual mixture control, and can thus, mask a problem. When you go full rich, that's when the over-rich condition rears its ugly head.

With regard to the power settings, I offer the following diatribe. Contrary to popular opinion, percent power is not just a function of manifold pressure. It is a function of manifold pressure, rpm, and density altitude. See Lycoming curve 12850 (Page 3-41 in my version of the book).

Using the chart, 21" Hg X 2450 rpm = 117 hp or 65%, 19" Hg X 2450 rpm = 99 hp or 55%. This all assumes sea level on a standard day. As you go up in altitude, you will see a slight rise in hp at the same rpm x mp settings. This is due to the drop in ambient temperature. Again, assuming standard day.

Fuel flow on a properly leaned engine is another way to determine percent rated power. In the case of a straight valve injected 180 Lycoming, 10.0 gph at 2450 yields 65% and 9.2 gph at 2450 equals 55%.

Bob Highley
Lakeland, FL

I had the identical situation as you. Tried everything that folks suggested you try, to no avail. Engine always ran good after cleaning the spark plugs, which was a hint which I attributed to hot carbon deposits which were glowing red. They were igniting the incoming fuel at the time the exhaust valve was still open, which is the normal case. To make a long story short I ended up thoroughly cleaning the threads of the plugs as well as those in the head and reinstalled the plugs dry. The popping went away! I now use a very sparing amount of Champion thread lubricant and the problem has never reoccurred.

Bob Pernic

For an EFI/ignition controller developed specifically for aircraft use see <http://www.rotaryaviation.com/eficont.html>

There are quite a few of them flying particularly on Mazda rotary engines

Bruce Finney
N18JF T-18C
Auburn, WA, USA

For a full discussion on leaning, check this web site: [The Pilot's Manual for Leaning and Diagnosing Engine Problems. by E.I.](#)

Bob Highley
N711SH Ser. # 835
Lakeland, FL

Fuel Tank Vent

Well boys I fixed a big headache. Before I just tell you I will tell you how I figured it out. The gentleman who I bought the plane from said he was running down the same problem. So when I got it it only had 6 hrs. Ok Ok Ill tell you it was the, not so fast. It had a fuel pump with a check valve as it wasn't designed to be flow through. I scraped the whole system and made it flow through the pump. All new lines a new shut off valve (one made for gasoline not natural gas) and flow check it in flying attitude. 20 gals an hour with 15 gals and 12 with 10 gal. I knew it was not a restriction prob. What else is left? The vent line. Now dont all of you say we told you so because it wasn't obvious. I will explain. It was ABSOLUTLY clear and unobstructed And 3/8 ID. Plenty of flow. The cap sealed. You could blow into it and hold pressure in the tank. The problem was that after it extended past the firewall by say 3" it only faced forward somewhat. This is where it gets obscure. That's with the plane setting on all three gear. Do ya get it? Now raise the plane to flying attitude and you know what the T-18s firewall does, it does not sit 90 to the airstream! Infact the whole problem didnt become apparent till I bent the tube to have a 90 and it STILL

did not face directly forward! It had to be bent past 90. I also lenthened it 3 more inches. Took it up for a flight with 12 gal fuel fuel pump on take off. Got to altitude and shut the pump off. Waited and everything was cool. Pulled back on the stick for a couple a seconds and pushed it over hard and long. Whalla! No problem. Verified it several more times, and I am stoked! So now the question is How far bellow the firewall does everybody have there vent?

Skeet 7077J

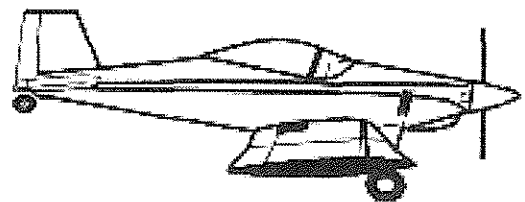


More Fuel Related Issues. cont.

I thought I would update you on my problem so you could pass it on to others. What I first thought to be a fuel starvation problem, turned out to be too much fuel. Let me explain....I checked all the things that could restrict the fuel flow and nothing made since. One thing I found was the governing factor in fuel flow volume was not the line or really how much gas(head pressure) that was available. It was the capacity of the needle and seat. Logic says if you increase the fuel pressure more volume will flow thru the same size opening... This is true but I found raising the pressure just a few psi, like raising vent pressure or full of fuel(head pressure) had very little effect. Not enough to be of significance. But after testing I found that if the engine ran the fuel bowl dry or very low with the fuel shut off and the engine died. When fuel was turned on the carb would immediately start to flood.... and only tapping hard on the carb would it stop.... **THE FLOAT WAS HANGING UP IN THE DOWN POSITION.** It took several attempts to get the floats to not stick,, They were rubbing on the inside at the very front. The bowl is horse shoe shaped, plus cast alum., so it also tapers inward at the bottom. This let the floats wedge at the front and not return up when the bowl filled with fuel and it would start to flood and kill the engine. The engine would not restart because of flooding, regardless of the mixture setting. I could duplicate this on the ground....So when climbing out at a relatively high angle of attack the fuel in the float bowl is lower in the front. The floats are at an already low position,(fuel is level with the ground) then add full power that consumes even more fuel, this

puts the floats very low. **EVEN IF YOU HAVE GOOD FUEL FLOW AND VOLUME.** This allowed the floats to stick and when I reduced power or leveled off some, it allowed the carb to flood...This also accounts for it not ever happening any other time except at take-off. I had ran auto fuel before and it never left any signs of flooding, but I had avgas in the tank this last time, although it evaporated fast it left a fuel stain around the gear legs,,,small but noticeable on white paint. I flew the airplane for about an hour, steep prolonged full power climbs etc. and I could not get It to quit again after adjusting the floats..They had to be bent outward. which they are not made to do, So I had to be very careful. I also did not want to change the float level while doing this. Twisting them a little would not do the job. That allowed them to hit in the back on the outside. They had to be spread apart, while maintaining the same float level. The biggest suprise of all was the fact you could pressurize the fuel tank thru the vent far above what ram air pressure would do and you saw very little increase in fuel flow at the needle and seat.. I know the engine at full power has to have a specific amount of fuel per hp. I'm sure the FAA and carb manufactures have more than met that demand in their designs. I'm just wondering how many other T-18 may have had this problem and mistaken it for fuel starvation. A quick and easy check is start your engine, turn off the fuel, rev it up a little and wait for it to die completely. Then turn the fuel back on while someone outside the plane watches. That way you don't disturb the floats by climbing in and out of the plane... If it starts to flood(might take 45 seconds or so) this may be your problem....Try it several times. Mine did it every time. But in the air the engine vibration probably loosened them 99% of the time... that 1% is when it quit. Roy, please pass this on to the other members,(your always looking for something to wright anyway) maybe it might help someone.

Len Baker



Is It Vapor Lock?, Maybe Not

I am experiencing Vapor lock (i think) Lycoming O-320E3d with pressure cooled cowl. After short flights , the engine will not restart (after 15 minutes of sitting). Then after about 3 hrs it will cool down enough to restart. Ideas ?

Lycoming O-320 carb engine
no fuel pump installed
tried normal start process,
then tried 2 shots on primer and 1 on throttle,
then tried mix lean ,throttle full open, no change...

I figured I would really flood it but haven't seen any indications of such. Would a fuel pump help this issue?

Mike Key

I had what I thought was vapor lock when I first bought my T-18. It turns out that it was a rusty impulse coupling. May want to look there.

Jim
831GR

I had your symptoms for a long time before mag failure put me down on a dirt road in the middle of the woods. The problem was bad coils that break down when hot and get progressively worse with time. I'll never understand why Bendix never put cooling fins on the coil end of the mags.

Hurant Karibian

Another suggestion for the hard starting engine with Slick Mags

It is generally believed that Slick mags produce less spark at cranking RPM than the Bendix so they need top notch spark plug and ignition lead maintenance. Good idea to see if the plugs are wet and they probably will be, telling you that there is fuel in the combustion chambers.... IMHO, check the spark plugs and be certain the gaps are up to spec. Make certain that the leads are clean and not cross firing. Your local shop

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should have an ignition lead tester if clearing up the spark plug gap/cleanliness question does not produce the results you are looking for.

Joe Gauthier
N22607

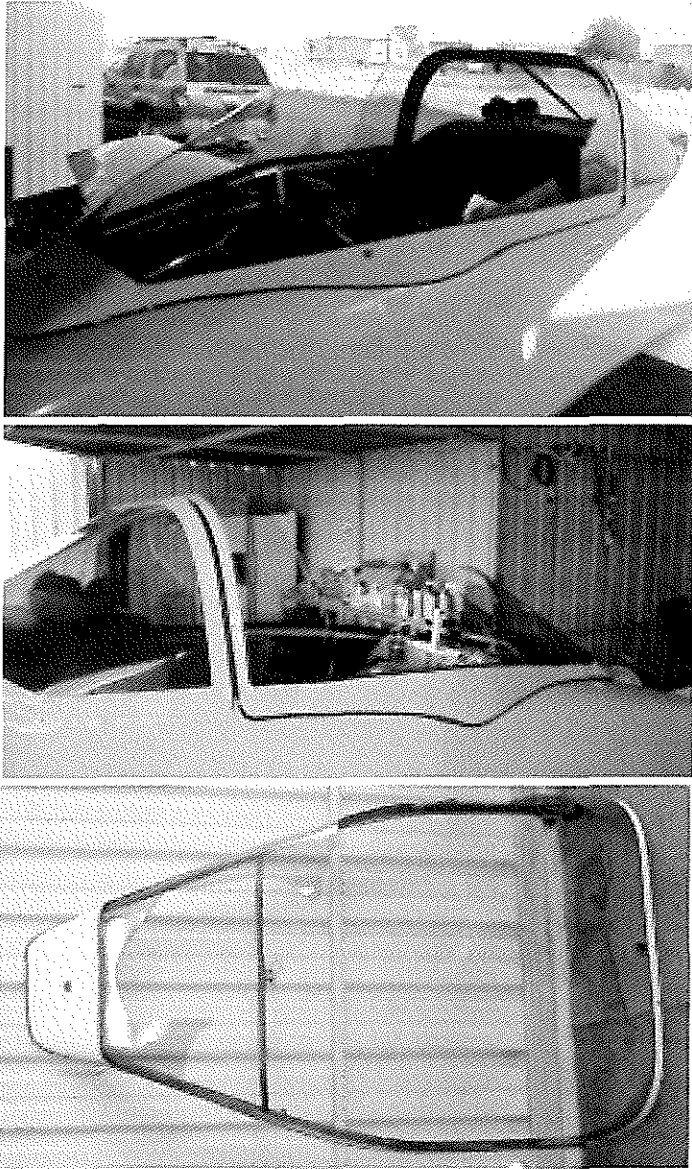


Canopy Breakup

I just came back from a really Surprising Experience. The T-18 style canopy on my Mustang 2 Imploded at TAS of 220 and IAS of 210 MPH !..

There was absolutely no warning The canopy broke in about 5 Parts, 4 of them got pushed into the airplane cockpit my headset broke in 3 pieces. No body got hurt. After pulling power all the way and pulling up the nose to reduce air speed to 100 mph, turned around to check horizontal & vertical stabilizers. Everything looked o.k. I was able to fully control the airplane, was out from my airport about 15 Miles
I flew the approach a little faster just to make sure if my stall characteristic would change, did a great short landing with all the drag I had. Anyway, the canopy was inspected before the flight had no visual cracks. The only thing we could find after this incident, the canopy edges underneath the canopy skirt was a really rough ground surface, which it might started from. We all know how much pressure we get on the back of the canopy just by high speed taxi at 20- 30 mph we probably get about 40 pounds of closing pressure. Having that said, at 220 mph it might be (220 mph / 25 mph = 8.8 x 40 lbs = 352 lbs) Our canopy have a large self supporting profile,if there is just a little crack anywhere where it's difficult to inspect, and you seat on your canopy, You know what will happen. The large part of the canopy that flew off the airplane hit the vertical stabilizer and the horizontal trim tap it left a nice scratch, but could been a lot worse and make the plane uncontrollable, I just remembered that the first prototype Mustang flew without a canopy which got made me confident that I can get it down safe.....Hope not to scare you guys.
On my new canopy I might add a supporting tube

behind my head so it's not affecting visibility. And It could carry and support the load $350 \text{ lbs} / 2 = 175 \text{ lbs}$ which then I have more margin for any crack to start or move. Anybody had any similar problems? Any better Ideas? How much is a new Canopy? (smile)



Mike E.

I would not automatically suspect that the canopy "imploded". I think a better description would be that the canopy broke away from the airplane. One of the local unlimited aerobatic pilots had the canopy break away from his 300KS custom built IO-540 powered beauty after only 75 hours on the plane. It turned out the canopy was improperly installed. An edge lifted at over 200 mph from the frame, then it (the canopy) began to break apart. It landed safely with some canopy remaining in the front, none in the rear.

I have no idea how the canopy is attached to a Mustang II but the fact that the accident aircraft had "rough" edges under the skirt would seem indicative of suspect craftsmanship. For those not familiar with the mounting arrangements of the canopy onto the Thorp canopy frame, I suggest you pull the plans out and familiarize yourself. Then, take off one of your trim strips...start at the one that goes over you head on the canopy frame. Then compare the plans with what you see. If you find anything suspicious then continue around the frame until you have inspected all the mounting points. While you are doing this you should find NO CRACKS emanating from the mounting holes in the canopy. Sliding canopies can depart an aircraft. The T-18 included. In the process of departing they can do major damage to the airframe which can result in loss of the airplane. Canopies can also lift away from the frame and break away in pieces due to poor installation or faulty maintenance practices. The JT design connects the Plexiglas canopy (and windshield) to the aircraft frame by compression between rubber chaffing strips. There is no direct metal on plexi called out in the prints. This is unlike the attachment of the RV series of canopies which are pop riveted onto their respective frames. Apparently John Thorp did not want to try to mix water and oil..IE two different co-efficients of expansion with an inflexible mechanical attachment due to the risk of cracking the plexi, etc. From a building point of view, the JT design adds extra steps and extra time to building the aircraft. However, if done properly, the JT design certainly has proven the test of time and hours of flight.

Tom Hunter
N18XT

I agree with Tom...I can't for the life of me understand why you would want "POP" rivet plastic to a metal frame. That alone gives you two different materials expanding and contracting, not to mention the drilled holes with a rivet "pulled" into it. I know there are 5500 RV's flying, but that doesn't make it right. Check and see how many have minute cracks coming from the rivet area. The three musketeers went over board, drilled a .250 hole, inserted a short length of wiper hose with a

TAIL SPRING UPGRADE KITS:

As many know, last year I made 10 kits available for upgrading to the Trusty style tail spring and Aviation Products Tail wheel. These have all been installed and I have none on hand.

A couple more Thorp guys have asked when these would be available again. I will need firm orders for 5 since I have to order 5 springs at a time. The last 5 kits I sold were \$650.00 each which included the dual fork Aviation Products tail wheel, upgraded bearings, spring, bracket, washers and new mounting hardware. In a couple cases I had to modify the mounting bracket to accommodate variations in the three mounting holes on the underside of the particular plane, since the layouts did not match the prints. In one case the layout matched, but the two bolts at the rear had been increased in diameter for larger bolts.

To avoid sending parts back and forth, I will supply you with a template to check against your bolster plate. That way we'll know ahead of time that the parts will all fit. If it turns out your plane is different than the prints, then you will send in your bolster plate, and the spring and bracket will be made to fit your plane.

All the holes are drilled in a milling machine in a fixture to maintain the correct geometry and to insure accurate matching to the three mounting points on your plane.

Please reply to me direct to confirm or reconfirm your desire to have your name on this run of tail spring kits. Also, if you would like more information on any of the following, again please respond off list. Or if you like, call me, Tom Hunter at 805-227-4571. And thanks to all the guys who have added one or more of my little upgrade items.

BRAKE FAIRINGS

As some are aware, I have made new tooling to create one piece brake fairings. These parts are made with a blend of carbon fiber and fiberglass for added stiffness. So far about 8 Thorps have these fairings installed. They are designed to fully enclose the Cleveland 500X5 HD brakes...which have larger rotors etc. The parts are made as one part in a two part mold unlike the original fairings which were made in two molds and then bonded together. You cut out the opening for

the landing gear fairing to fit and the rear opening to install the fairing. That way, you can get a very true fit. The two fairings cost a total of 150 bucks plus shipping. If you don't have the HD brakes installed on your plane, these fairings are still a good deal, since they will give your brakes slightly improved cooling and if your old fairings have gotten ratty, they will look better and lower drag. The surface trueness of these parts, as all the fiberglass parts are excellent and are made in production female molds.

Tail Wheel Pant

If you have a 6 inch Aviation Products Tail wheel, this little tail wheel pant will fully enclose it. It will reduce drag slightly. And my theory about drag is every bit you can reduce is a gain since you can fly more efficiently and use less fuel. The Tail Wheel Pant is 150 bucks, you make your own mounting hardware. 200 dollars with mounting hardware to bolt it on and fly. Currently there are 7 Thorps with this tail wheel pant. I currently have 4 on the shelf looking for homes.

Rudder Fin Cap...Bottom

The latest item I have available, is a closure for the bottom of the rudder. When you stand back and look at the rear of your plane, you will notice that the bottom of the fuselage does not blend into the bottom line of the rudder. The cap is made out of fiberglass and comes marked for the cuts necessary to make it fit to your rudder bottom. To install it, you will need to remove the rudder and using a rivnut installation tool, install two rivnuts.

You can purchase this cap for 38 dollars plus shipping by USPS. As I mentioned, the cut lines are marked. The first part out of my tooling was used to get the correct fit. Without the cut lines pre marked it is difficult to determine the cuts to get the best fit.

Custom Air Scoop for Fuel Injection

Currently there is only one Thorp besides mine with this option. What is unusual is a floating baffle and a cold air plenum chamber with a 500 CFM air filter and Ram air capability. Of course if you don't already have fuel injection, you will need to upgrade from

your current carb to FI. This option allows for that to easily happen since it makes use of the standard updraft sump. If you want to consider this upgrade so that you can be more fuel efficient and gain a horsepower bump I will be happy to advise you on how to upgrade at a minimal cost. You can see pictures of this air scoop on the picture section of the list, or at www.finetuneflight.com

While I have only sold one of these, this part is my favorite. The male plug for this part was made in place on the plane to insure that it would clear the fuel injection servo and that it would fit exactly to the bottom profile. That process took 3 months of fuss and fiddle time. Once the male plug was done, it was finished to a high surface trueness and high gloss finish with tooling gel coat. And a single piece female mold was made over it.

Tom Hunter
thunter007007@yahoo.com

I need money to buy a couple of instruments and a comm to complete the instrument panel and thought of you goods folks to make my pitch.

I have a few elevator parts I'd like to part with. The items are all new unused. The beam and sleeve have pilot size hole. I have a reasonable reserve price. The list of items are as follow:

- 502-2 Locator.....2ea
- 502-3 Beam.....1ea
- 502-7 Sleeve.....1ea
- 503 Ribs.....2ea
- 509 Lugs with bearings...2ea
- 510 Mast Ass'y.....1ea
- 611 Ribs.....2ea
- 612 Ribs.....6ea
- 613 Rear Beam.....2ea

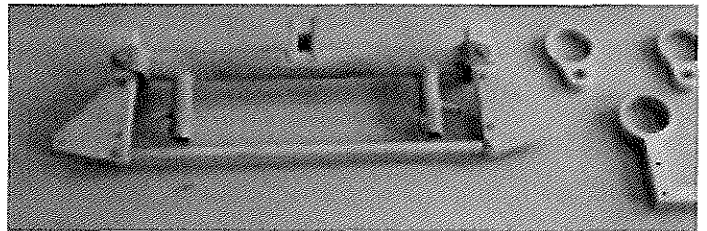
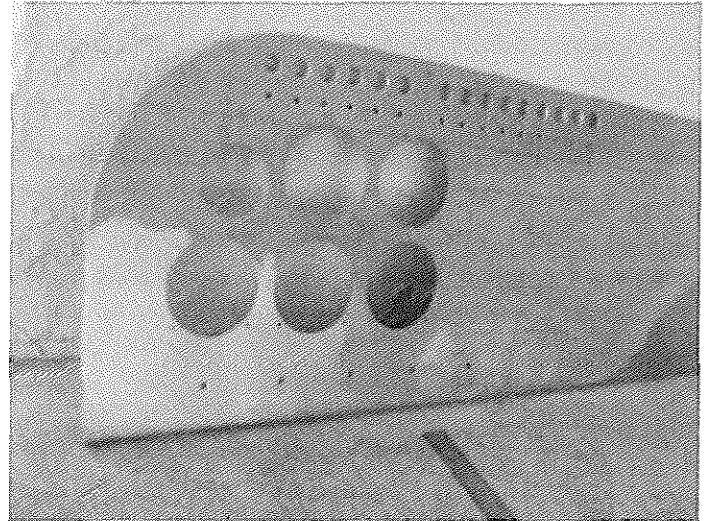
Have photo if interested.

Skins, tips weights and weight for the Mast ass'y, -6 doublers, hinge material and 517 trim tabs would be the other items needed to complete the assembly.

Contact me off-list or call 817-925-6025

Don D-Day dondday@hotmail.com

Complete walking beam, stabilator mast and pivots with needle bearings, instrument panel (.065" I think) wheel pant brackets and my old standard gear leg fairings. \$300.00 plus shipping. Those control stick sockets were \$186.00 a few years back.



Hurant Karibian
hkaribian@yahoo.com



Oshkosh 2008

AirVenture 2008 will be held July 28th through August 3. Our T-18 Lunch/Forum is tentatively scheduled for Friday August 3rd in the Nature Center. We have the big tent reserved again this year from 11:00 AM till 2:00 PM. We will have our usual lunch followed by an informative forum. Please visit the T-18 area on the flight line to get the last minute details. You can contact Roy Farris for more information at: royfarris1@comcast.net or call 317-460-5916



T-18 SPRING GATHERING
HOLIDAY INN DAYTON/FAIRBORN I-675
THE NATIONAL MUSEUM OF THE UNITED STATES AIR FORCE

The dates for the 2008 T-18 weekend are JUNE 6, 7 & 8. A block of rooms has been reserved for June 6 & 7. Please make your reservation with the motel directly. You must specify you are a part of the T-18 GATHERING to get the SPECIAL RATE. The Holiday Inn may be full other than those rooms reserved for our party. Your reservations need to be made prior to: MAY 16, 2008. Reservations made after this date will be filled if space is available. There are some King Size rooms available--- recommend you call early. Also, if you want to come early or stay longer, these rates are good +/- 3 days. For those who drive, take exit 17 (at North Fairfield Road) off I-675 and proceed north to Colonel Glenn highway (approximately ½ mile) to stoplight. With large arena called the E. J. Nutter Center at your right 1:00 o'clock turn left on Col Glenn. Take the second road (Center Park Blvd) left and proceed to the Holiday Inn.

CALL (937) 426-7800 FOR RESERVATIONS. Rooms \$92.00. You may cancel your reservation any time prior to 6:00 pm EDT on your scheduled arrival date without charge.

AIRPORT
Dayton---Greene County-Lewis A. Jackson Regional (I19), located approximately 2 miles west of Xenia, Ohio; Coordinates, N39-41.46; W083-59.52. The runway (7/25) is paved and 4500 ft long & 75 ft wide. Unicom/CTAF 122.7.

PLEASE BRING YOUR OWN TIEDOWNS.

For additional information on the Spring Gathering, E-mail Dan Wolfe at : airlobo@aol.com

T-18/S-18 Thorp Newsletter
Roy Farris
1220 Stellar Drive
Franklin, IN. 46131
Phone: (317)736-8903
email: royfarris1@comcast.net

Newsletter No. 139
May 2008

Canopy Breakup. cont.

metal bushing. Then screwed the canopy to the frame. The plastic now can move, expand, and contract. I guess it works, mine and Les' has flown for 13 years with Bob's 24 years.

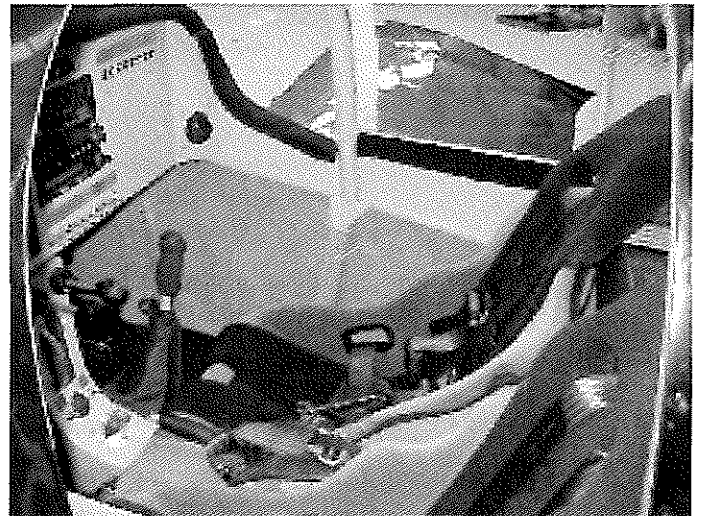
Bill Williams

Cool Seats

A few RV guys here in Australia have installed Vilo racing seats into their aircraft and apart from the cost they look great, very comfortable and due to the carbon fibre construction they provide an added protection in the event of a crash. I wanted to install them but there is no way they will fit a Thorp so with the help of Custom Aero here in Adelaide we contacted Vilo and asked if we could take a mould. A couple of weeks later we had a finished glass seat (I would have liked carbon fibre but was running out of money) which was re-moulded to fit the Thorp. We also recessed them into the rear "turtle deck" to maximise

leg room. I then took the seats to a local upholster who covered them for about \$AU150 each.

They are removable and only held in by the seat belts. The fit however is very snug and there is no movement once they are in. If your passenger has a large ass they will not fit... If anyone is interested, Custom Aero has the moulds. I can check a price for them to punch out a glass and carbon copy. I would be happy to bring some over to LAX, SFO or JFK as crew luggage next time I come over



Tim and Bridgit Burns ~ Australia