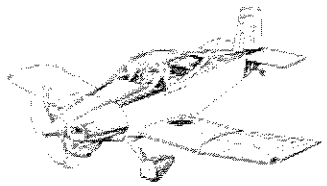
T-18 Newsletter

Janurary 2008

Elmer Hymen's Two Beutiful T-18's ~ N529BH and N36EH

In This Issue:



Editors Notes

By: Roy Farris

Hello everyone. Sorry that this issue is a bit late coming out. My eight to five job seems to be always getting in the way of my fun time. I guess that happens to most of us.

At last years Kentucky Dam get together we discussed the future of this newsletter. As everyone knows from some of my other ramblings it is getting more difficult to gather material for each issue, and the cost of mailing had risen. It was unanimously agreed that this written version of the newsletter needs to be kept alive and to continue as best as we can, and I definitely agree with that. I will address more on that later. Most everyone at the gathering also agreed that most of us now have computer access and could download this newsletter from the T-18 web site which would save mailing costs. I think what I want to do is allow everyone that will, to download the newsletter and those that do not have computers or computer access to continue to receive a printed paper copy. I believe that will drastically reduce both the printing and mailing costs and still keep everyone in the loop.

I have created a registration page on the T-18 web site. Would everyone that would gladly download the newsletter from the T-18 web site please click this link and fill out the short form? I will then update my mailing database so those persons will not receive the paper copy.

Here is the link: http://www.t18.net/registration.htm

If you still want to receive the paper copy, or do not have computer access then don't worry, you will still receive it.

Ok now lets talk about the newsletter in general. I have said all of this before, but I believe it needs to be said again. Sometimes we just need to be reminded of what's important and what we need to be doing. The newsletter cannot survive without member input. All of the material I use comes from information and articles that you the members provide. Today with the internet, blog spots, and personal web pages many of us forget about the newsletter. I am all in favor of you posting your Thorp info on any of these mediums, but I would ask that you copy the info and send it to me for inclusion in the newsletter. We all know that personal web pages die, blogs go away and sometimes we as people go a different direction in life. If you don't let me get your valuable contribution in these pages how can we preserve the information for the next generation of Thorp builders?

We recently had an incident on the ThorpList e-mail forum that caused quite a ruckus. We have lost a valuable member due to what happened. I am not going to go into details here, but this fine gentleman was attacked to the point that he completely withdrew all contact with the T-18 MAS, the ThorpList, and this newsletter. He emailed me and ask that I remove all information and links to his resources from the web site ... he is gone, but the articles that he submitted over the years are preserved in the pages of the T-18 newsletter.

So in closing let me just say it one more time, **Send Me Some Information For The Newsletter!!!!!**

Mutual Aid Society Dues

Well its that time again, time to renew your T-18 Mutual Aid Society dues. The annual dues are listed here:

U.S. Membership ----------$25.00

Non-U.S. Membership with mailed copy ------- $30.00

Non-U.S. Downloaded Copy Only ---------- $25.00

You can pay with a credit card online at the T-18 web site. Go to this link and use PayPal ---------- http://www.t18.net/renew/renew.htm Or if you are sending a check, please make it PAYABLE TO: Roy Farris and mail it to:

Roy Farris
1220 Stellar Drive
Franklin, IN. 46131

Words from Lyle Trusty

Lancaster, CA.

I read the articles with interest, including Ben Harrison's comment "where is Lyle when we need him.? Probably fishing". Thanks Ben, you have inspired me to revisit our T-18 family MAS, and help if I can. I've been in love with the airplane since 1964, started construction of N851LT in 1971, first flew it in 1974, and finally hung up my knee-board a couple of years ago. I have not forgotten all the help I received from the MAS, John Thorp, Lou Sunderland, countless others, and now Roy Ferris.

I'm encouraged to see there are several experienced and talented T-18 Builders and Owners taking up the pen too, helping less experienced new owners in the grand tradition of the EAA and the T-18 MAS. The advice coming through on the pages of the T-18 MAS Newsletter is refreshingly well prepared and thoughtfully presented. It's a great forum, and as you realize, Roy, more so than most, a person writing material for publication tends to be accurate, and remains open to questions or correction for what they have written. The end result is information that stands the test of time since it's based upon first hand accounts as known when written. I offer my comments on some of the issues mentioned in the newsletter, hopeful they will help someone better understand the subject. Tom Hunters efforts to continue to make available some of the small modifications I developed to "help improve the breed" are appreciated. Thanks Tom!

Fuel Vent System Installation: It's important to test the gravity feed fuel system fuel vent Installation in the T-18 to determine if it is properly designed and installed.. There needs to be a positive head pressure on the fuel feed to carburetor installations to avoid fuel starvation due to cavitation under critical low speed, as well as high speed flight conditions. The fuel vent must be pointed straight forward into the relative wind to satisfy a firm requirement for positive head pressure on the fuel in the main tank, If the vent line pickup is pointed straight forward the vent system will pressurize the fuel tank to five inches of water pressure (two tenths psi) at 100 mph, and 20 inches of water pressure (seven tenths psi) at 200 mph. Pointing it backward, or any way but forward, can cost some of that precious pressure recovery, or even suck a vacuum. The first critical condition occurs on an approach to landing with only one or two gallons of fuel in the main tank. If, for any reason you have to "go-around" a full throttle go-around may not be possible if you have inadequate fuel head pressure, resulting in fuel starvation and engine failure.

The second critical condition occurs during high speed flight. If the vent is facing to the rear it can cause engine fuel starvation due to the vacuum created in the vent line and fuel tank by cavitation at high speed. It's okay to hide a vent in the wake of a strut on a high wing airplane like a Cessna 150, because there's several feet of head pressure in the height of the wing fuel tanks above the carburetor. Don't do this on the T-18, you need that impact pressure for head pressure on the fuel. In the case of a vent pipe mounted 90 degrees to the fuselage mounting surface with the tip cut off at an angle and facing forward, the percent of ram air pressure it can recover depends primarily upon the degree the angle at the open end of the pipe actually faces into the wind. It can be shown mathematically that facing the vent pipe directly into the wind (at zero degrees angle) will provide 100 percent recovery; 45 degrees will result in 70 percent recovery, and at 90 degrees the percent recovery drops to zero.

Fuel Flow Test: Everyone is probably aware that at full throttle, the fuel flow at sea level on 0-290 to 0-360 Lycomings is between 10 and 14 gallons per hour, depending on which engine you have. It follows then, if it's never been done, and there is any doubt about it, a ground test should be conducted to determine that adequate fuel flow is available at low fuel quantities. Consider that 110 to 140 percent of full throttle fuel flow is your goal. Consider this, there is an AN fitting, a fine screen, and a needle valve downstream of where you are testing. The original builder should have accomplished a fuel flow test on the system and entered the test results in the aircraft logs, actually measuring with a cc beaker how much fuel flow could be

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obtained in a given time period without anything but gravity head pressure, at the carburetor fuel inlet port, at landing angle of attack. (Note: ten gph equals 631 cc's /minute, and 14 gph equals 883 cc's /minute). . It should be done first at the worst condition, minimum fuel, (one or two gallons) and then with full fuel. Fuel flow under the worst condition is more than likely to be inadequate on the first test, and the first question is "what's to be done next"? It's reassuring to attach a piece of flexible tubing to the main tank vent line, apply pressure by mouth, and see what a great difference it makes. The flow from a full tank is almost always adequate because of the head of fuel. Small changes can bring the system into compliance.

Fuel System Hardware: The fuel feed lines on the T-18 gravity feed system should always be made from 3/8th inch (Number six) tubing and AN fittings. Despite this, however, the number six bulkhead fittings, unions, elbows, and etc., quite often have only 1/4 inch bores. So, opening up the inside dimensions of the fittings and smoothing the sharp corners, can sometimes resolve low flow problems. You might have to go through your entire system doing this. The flow through the fuel shut-off valve can suffer from restrictions too. Going to the next size up and then adapting the larger valve down to the number six fittings may resolve that issue. Another failure point can be the main fuel tank outlet screen. It should be a finger screen with at least a couple of inches of vertical standing screen. Why? Because all it takes to cover the fuel tank outlet is a small paint flake, piece of gasket, or foreign material of any sort. There is a legitimate concern about mud daubers, and other insects, plugging the fuel vent inlet. One solution is to adapt a section of screen from a small finger screen, or solder up a tight fitting tube of fine mesh metal screen-wire about two inches long to fit over the inlet of the vent line, and protrude forward by approximately an inch. Finish it off by carefully soldering just the edges of a flat disc of screen the size of the tubing onto the front of the screen. Push the tube of screen wire onto the vent line about one inch, and secure it there with epoxy or a clamp. Even if it takes a direct hit from a bug that may splatter on the front of the screen, it won't plug up.

Pressure Carbs and Fuel Injection Systems: Any fuel system that requires an engine driven fuel pump needs two fuel pumps. An electric boost pump is installed in-line to insure that an adequate supply of fuel under pressure is supplied to the engine driven pump under critical conditions, and, most importantly, so that in all but a catastrophic mechanical failure, an extremely rare occurrence, an engine driven pump failure will not result in total fuel starvation. Generally speaking, installing an engine with a fuel injection system, or utilizing a Pressure Carburetor requires that you duplicate the system utilized in the production aircraft the engine came from, adapting it as required by your unique installation.

Increased Gross weight: I read with interest the articles about gross weight. John Thorp's 1963 Concept T-18 was designed around a 125 horsepower Air Force Ground Power Unit that had become available in military surplus sales stores. I've been told the T-18 was designed to be in compliance with the Civil Aeronautics Manual (CAM-3) design requirement, qualifying it to be rated for aerobatics. That effort produced an open cockpit, partially cowled, no flap wing aerobatic aircraft with an empty weight of about 860 pounds. When a 170 pound pilot, 174 pounds of fuel, 16 pounds of oil and 30 pounds of baggage were added gross weight came in at 1250 pounds, where the load limits of plus 6 and minus 3 G's established the structural design. At that critical design point the wing structure enabled the wing to lift 7,500 pounds repeatedly, and endure that without signs of overstress for a reasonable number of cycles during the predictable lifetime of the aircraft. John was an experienced aircraft designer and knew that a simple design, easy to build, with growth potential had to be designed into the aircraft for it to remain competitive in the experimental aircraft market place. He well knew that as horsepower is increased the allowable gross weight can be increased, and performance and utility can be improved, however, it would come at the expense of a reduction in acrobatic performance, a totally acceptable compromise in view of the aircraft's expected agility.

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Words from Lyle Trusty. cont.

The downside to simply increasing gross weight is that the allowable G load decreases proportionally. I'll show you how to handle that in a moment, but first remember that the wing, and the airframe, were designed to be acrobatic within the limits of plus 6 and minus 3 G's at only 1250 pounds gross weight.

Now, supposing you want to increase your gross weight to 1650 pounds after installing a higher horsepower engine. The way you determine your new gross weight! G limit is to calculate it according to the following method.

$$\frac{\text{Acrobatic Gross Weight}}{\text{New gross weight}} \times 6.0 = \text{the new load limit}$$

Substituting: $\frac{1250 \text{ pounds}}{1650 \text{ pounds}} = .758$

And $.758 \times 6.0 = +4.545$ and -2.27 G's (round off to tenths)

So, the new Max gross weight limit is 1,650 pounds, and the new G limit is as shown, however, the acrobatic gross weight remains at 1,250 pounds, and the load limit at that weight remains at +6 and - 3. G's. If you wanted to raise the acrobatic gross weight you would have to analyze the entire structure, and beef up such items as the inboard wing spar web, increase the inboard wing skin thickness, and so on. Naturally, there will be some maneuvers that can be done safely at your reduced G limits, but you have to analyze and select the maneuvers you want to be able to do, so you can observe the new limits according to your new gross weight, and avoid those that exceed your reduced capability. Your request for an Airworthiness Certificate that provides for acrobatic maneuvers in your Operating Limitations is where you specify what maneuvers you want the aircraft to be approved for, and they will be listed on your airworthiness certificate. You normally are required to certify you have accomplished the maneuvers you've requested, and they are deemed within the flight envelope of the aircraft and can be done safely.

Background: The standard T-18 wing was designed and subsequently certified, or alternatively physically load tested, to the acrobatic limit of 6 g's at 1250 pounds. Translated into what the wing structure can lift, and return to a normal condition over a long period of service is determined like this. 6 G's X 1250 pounds equals 7,500 pounds NzW (Design Limit Load). Do the math for the change you've made: 4.545 G's X 1650 pounds also loads the wing to 7,500 pounds NzW. Of course you have to do a weight and balance for every configuration you're going to fly to assure you are always operating within a safe flight envelope. . The FAA likes to see the following cases analyzed: Empty weight/CG, most forward weight/CG, most aft weight and CG, and max gross weight and CG. You also need to do a small subjective flight test program to determine the effect upon the aircraft performance parameters such as differences in takeoff and landing roll, distance over a 50 foot obstacle, change in rate of climb, change in operational ceiling, change in flying qualities, and impact upon speed/range/payload, etc.. This is something that the builder/owner has to decide upon and flight test, or accept John's recommendations. A change of this magnitude has to be flight tested again, at least after the first time it's done. The problem often comes up after the original builder sells the airplane to someone not versed in the flight test requirements generated by putting on an a higher horsepower engine, or just arbitrarily increasing the allowable gross weight. The performance parameters go in a circle. Even though it climbs better, and goes faster, the engine burns more fuel requiring that you add fuel tankage. All these ideas are exciting, but require careful analysis. Increasing horsepower is a technical challenge to the uninitiated. It rightfully invalidates your airworthiness certificate , thereby invalidating your insurance.

cont pg.6

Words from Lyle Trusty, cont.

The bottom line: think carefully about the ramifications of increasing the gross weight number without carefully considering it's impact upon aircraft performance handling qualities, and mission capabilities.

Adding fuel to the wings: The result of putting fuel in the outboard wing panels of a T-18 has been good, and, as far as I know, free of operational or structural problems. Many examples are available, and have been in operation successfully over a long period of time. Having said that, however, the unintended downside to carrying fuel in leading edge wing fuel tanks is the increased loads imposed on the wing fittings and wing to fuselage structure during landing and taxiing operations with the added weight of fuel in the wings. Because of this, a beef-up in the areas of the fuselage wing attach fittings, and thicker inboard wing skins has been implemented by most builders incorporating fuel tanks in the wing. Avoiding unimproved runways or rough taxi areas when carrying fuel in the tanks is a wise operating policy. The limitations on the increase from 1650 to 1800 pounds gross weight mentioned by Jerry Miel. is probably not specifically connected to the amount of fuel in the wing fuel tanks because of any factor other than that amount of fuel, and where it's at, equals a known gross weight at a given center of gravity.. The extra weight could be carried anywhere so long as a weight and balance calculation shows the weight and CG is within limits throughout the intended flight, and the changes in aircraft performance and handling qualities are understood, and deemed safe. Several T-18's have been operated at 1800 pounds gross weight many times, assuredly with a safe weight and balance.

Increased Wing Span: The effect of increasing the wing span by 3 feet, and the wing area by twelve and a half percent distributes the amount of lift generated by the extra wing area over a longer moment arm, which has the potential for increasing the in-flight loads the wing can impose on the structure and attach point fittings. A ten percent reduction in G limits would be prudent until a more specific analysis could be done.

Wing heaviness: This phenomenon has been with small aircraft forever, the T-18 is no exception. It's generally because of built in wing twist, mis-rigged flight controls, unequal lateral load distribution, and possibly from asymmetrical wheel pant installations, A very good tool a person may find helpful is a wing rib profile board. You can make one if you have a wing rib drawing. The way you use it is to lay the Profile Board chordwise on top of the wing at each rib station and, with the aid of a propeller protractor, (or suitable substitute) map your wing twist, control surface and flap rigging conformity to the profile, and determine if the flaps and ailerons have full travel and are rigged correctly according to the plans. Drooping ailerons or mis-rigged flaps that don't conform to the airfoil contour are not uncommon. All these are part of a rigging check that the builder normally does in preparation for first flight. Once the aircraft controls have been rigged properly, all it takes to change the lateral trim of the aircraft is to massage the trailing edge of the ailerons in a direction to overcome the tendency to roll one way or the other, then trim out with the flap deflection trim system. This works mainly to overcome the left rolling effect of the pilots weight, and works okay for the basic design, however, when you have added auxiliary fuel tankage, are carrying vast amounts of baggage, or have unequal pilot/passenger weight it's inadequate. Something more conventional is desirable.

Electric Aileron Trim Tab: After all the rigging checks are done, and the aircraft will fly hands off with it's normal load, one of the best additions you can make is to install the electric aileron servo trim tab system.. It was designed in accordance with accepted aircraft design practices, employs an electrically actuated servo tab of standard aileron area percentage to provide lateral trim control with small deflections, under all loading conditions normally encountered in a T-18. The amount of servo tab travel to control worst case situations is actually quite small, with a half inch up or down at the trailing edge of the tab sufficient for all configurations if the aircraft rigging has been previously accomplished satisfactorily.

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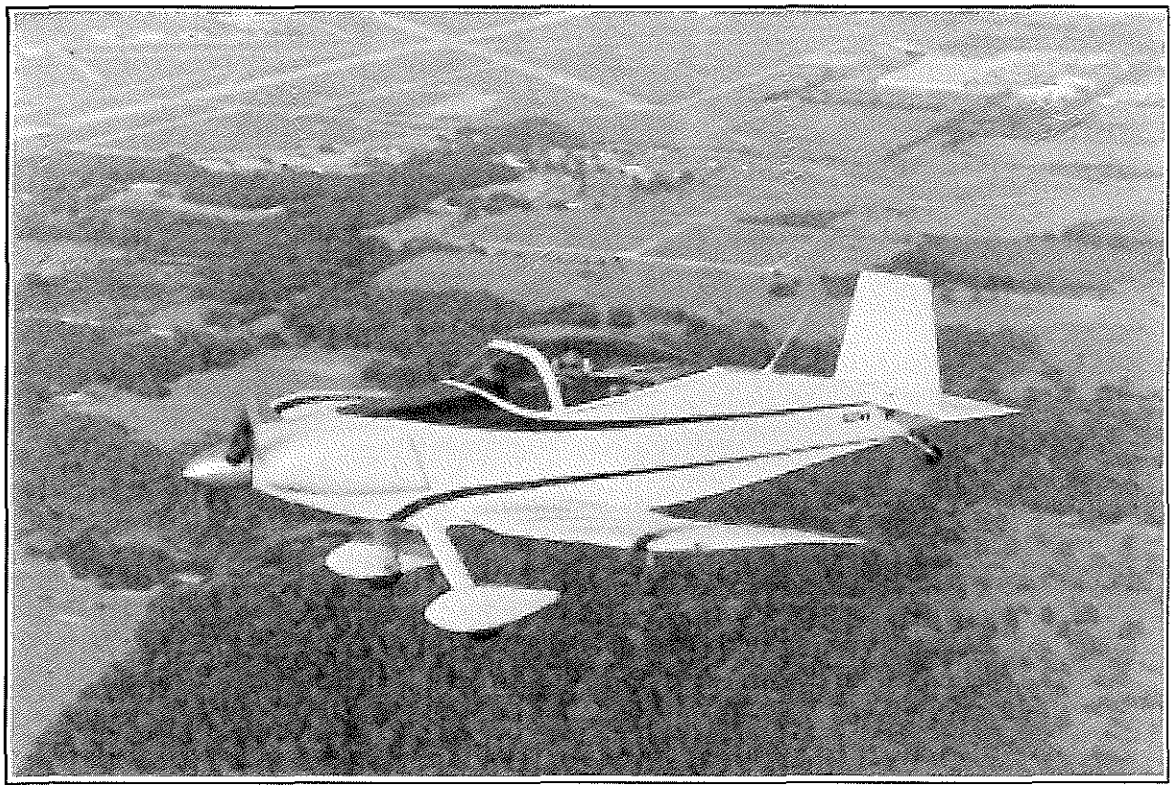
. Attaching an adjustable tab to the trailing edge of the wing tip is not an acceptable or effective way to control lateral trim. It's been tried many times, appears deceptively simple, but fails to function because it cannot generate enough force to affect the lift of the wing. It does generate drag, however, and results in yawing the aircraft. The servo-tab is of sufficient area to easily move the aileron the amount needed to correct for out of trim conditions, does not cause yawing, and is easy to install.

To T-18'ers everywhere, it's been my privilege to submit articles for your consideration over several decades. I'm proud to have contributed small changes to further refine an excellent design, always in compliance with the FAR's and home-built regulations. Please help second and third owners of T-18's to understand their obligations to preserve their privileges, by complying with the regulations, and operating safely. Remember that even small modifications to your aircraft will invalidate your airworthiness certificate, and subsequently, invalidate your insurance. Be aware of what you are obligated to do to preserve your airworthiness certificate, and the things you must not do in order to avoid the dire consequences of losing it. Generally speaking the FAA will only require a short period of time in a test area to approve of small changes. More often than not you get to sign off the system change yourself to re-validate your Airworthiness Certificate and your Insurance.

Regards,
Lyle Trusty

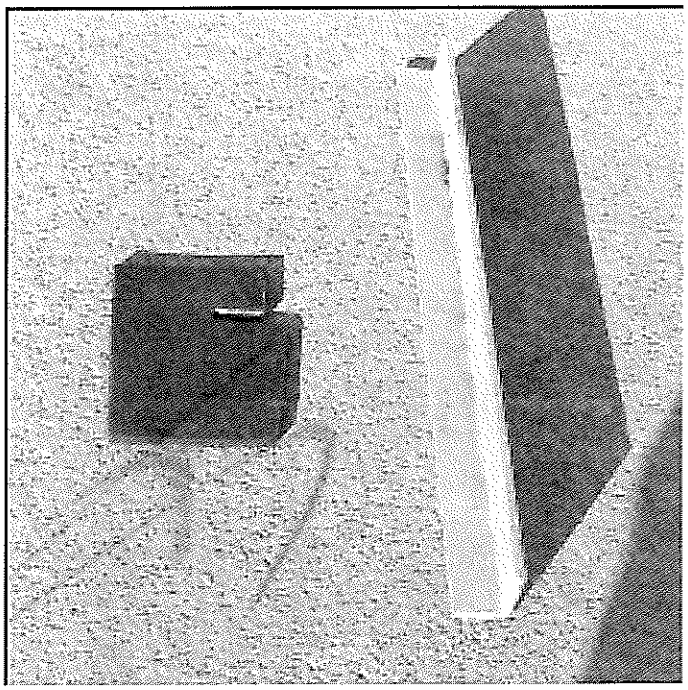


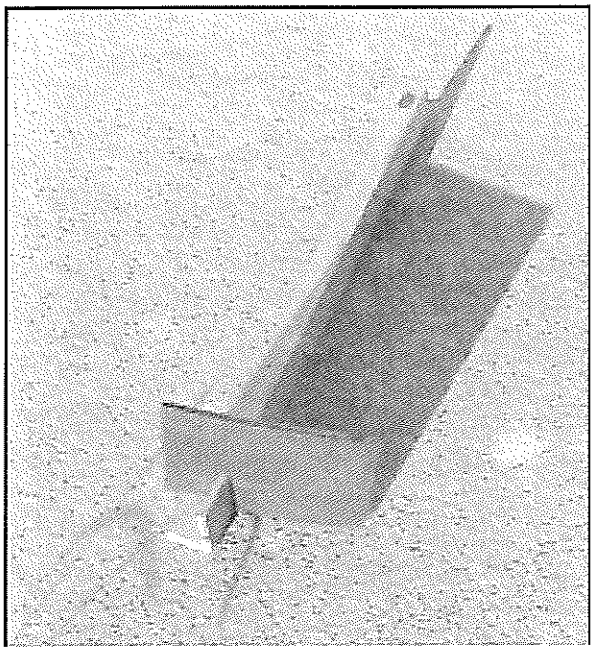
What an awsome shot of Bill Williams and N360WW

Joggle Fork

This is my tool for joggling the end of a piece of aluminum angle. The slot has to be wide enough and rounded so that the top and bottom of the "X" is narrower than the sides and then placed in a soft jawed vise and squeezed. While it is in the end of the vise you may have to hammer the straight side of the angle back in line.

Hurrant Karibian



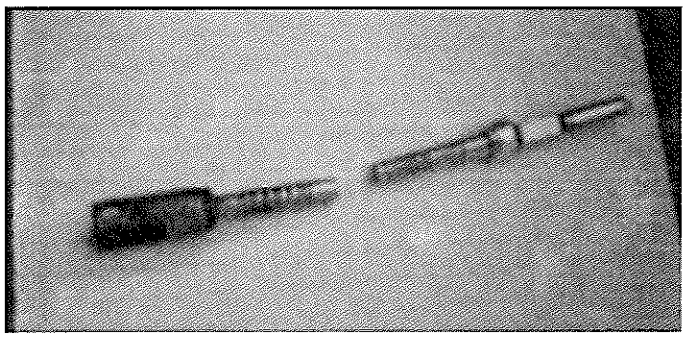


Gerdes Master Cylinder Problems

To: Those with Gerdes master brakes on your rudder pedals.

Subject: Disconnect of your brakes.

This may be a possibility with other master cylinders, but it is possible with the Gerdes Masters. The cylinder push rod has a spring around it. The push rod has a threaded hole at the top for a fitting with a threaded rod end that is adjustable into the push rod so you can adjust the geometry of the brake pedal. Anyway, it is possible for the cylinder push rod to unscrew itself from the threaded rod end thus disconnecting your brake pedal. When I assembled these parts some 8 years ago I did not think that this possible so I was not careful with the jam nuts (provided by Gerdes on the rod end).



If you have Gerdes Master brake cylinders I suggest you examine them carefully to see how much thread is exposed at the top. It is VERY DIFFICULT to see the threads since they are hidden both behind the brake pedal and under the spring surrounding the cylinder push rod. While I was under there working on the left one that fell off, I removed the right one and reinstalled it. I could not tell how much it had backed out, but it had worked out somewhat. You might want to reinstall and tighten the jam nut and also apply some blue locktite to the threaded rod. And while you're at it, lube the pivot points on the rudder and brake pedals. Interestingly enough after I reassembled and tested the brakes, I noticed the geometry was much more comfortable since the brake pedals were further toward the firewall and not as awkward as they were previously. That should have been a tip off for me that something

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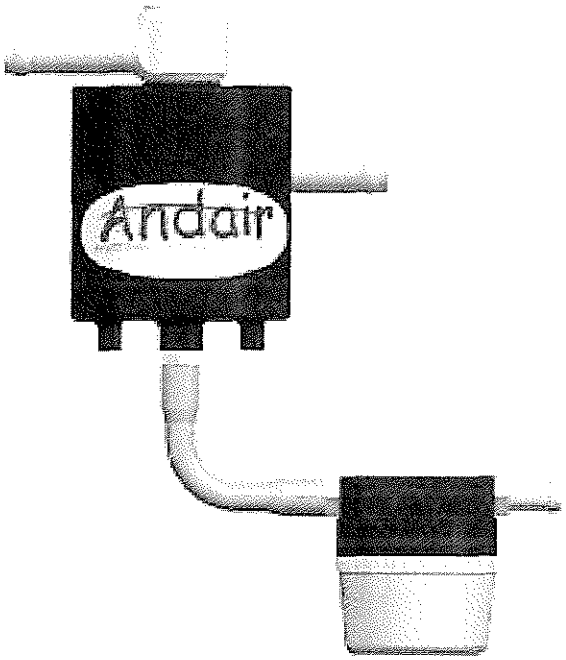
Gerdes master Cylinder Problems, cont.

was wrong (that the brake pedals felt awkward) but I told myself that I must have got the geometry wrong when I set up the brake pedals.

Tom Hunter

Oil Separator

This is what I have got for my breather. The top is the air/oil separator and the oil return line passes through a condensation trap at the bottom. I have plumbed in a drain valve at the bottom of the condensation trap so I don't have to unscrew it to remove water. It is very well machined, all attach points are movable , it weighs only a few grams but it costs. Available direct from Andair (in the UK) or Spruce sell them.



Cheers Tim
VH XME

If the web hyperlinks don't work when you click on them, just copy and then paste it into your web browser. Roy

The Grass Isn't Always Greener

Hi group, Well today was the day I had planned to buy a new airplane. I've had my eye on this Lancair 360 that was listed for sale for $125K. I figured sure that's a lot, but with the proceeds from this great T-18 I have and the fact that my wife has a great new full time job we could swing it! Isn't that a great thing? I mean that my wife has a full time job!!! Anyway, the Lancair was finished in 2004, beautiful paint job, a new Lycoming IO-360 B1B and new CS prop that each had 140 hours. It was advertised as a 200HP engine. Turned out it's only a 180HP engine that had some porting and polishing! Bear with me because there's a point coming soon!

Additionally, this aircraft did have a nice interior and a great Garmin stack of new radios, GPS, MFD, STEC 30 A/P....you know, the whole enchilada. So today, the owner takes me for a demo flight. It didn't take long to see that this Lancair had nothing performance wise over my T-18. In fact, I know there's a few of us that like to do mild aerobatics in our Thorp. The T-18 has a great roll rate and is a heck of a lot of fun to fly. But the owner, who has competed in many aerobatic competitions, hadn't ever rolled the Lancair and didn't think it was a good idea. When I was flying it, I could tell why. It didn't have nearly the roll response as the T-18. I'm sure you could roll the Lancair, but with the fuel carried in the outboard of each wing, that's a lot of inertia to overcome! Needless to say, while flying the Lancair, it felt like a bus compared to the mighty T-18! It was a nice stable platform which would have been good if you fly a lot of IFR, but I like to have fun too. And with that 180HP engine, we climbed up to 7500 to check some performance numbers. I didn't see the 200+ KNOTS, even TAS, that was advertised. Heck with my true 200HP IO360-A!A, I true out quite often at 220MPH. And as far as those great avionics, they looked beautiful. But the autopilot wouldn't hold altitude at all and would actually porpoise to the point where it had to be disengaged. The MX20 display was just the basic (no traffic, weather and worst of all didn't even have the Jeppeson IAP database which is a $2K option). I figured for the price the owner was asking, I wanted all the bells and whistles and I wanted them to work! Fortunately, I had to only fly

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The Grass Isn't Always Greener, cont.

40 minutes to go see this Lancair. I thought I would be more impressed, but wasn't. I even had a cashiers check ready to give the owner. I've had my T-18 listed for sale at various sites including ebay, but came home today and de listed them all! Some people don't know what they're missing!

I think I'll keep this great airplane and put some money into making my seat more comfortable! and maybe a good autopilot!

Cheers!
Steve
N48PW "Kong"

What's Your Favorite Breakout Tool?

* I'd like to survey the Thorplist for the following:
* What do you typically carry as an emergency canopy break-out tool?
* Where/how do you mount or secure it?
* Any info or data (even anecdotal) on its effectiveness?

Roger

Regarding a tool to break the canopy, I have what was a Navy-issued survival knife velcroed to the sidewall forward of my left knee. I thought that I would use it if I ever ended up being upside down on the ground. As the whole canopy structure folded back on my friend Roy Medan (when he came down inverted 2 yrs back), I wonder if the concept isn't just a moot point and the goal should be to never be upside down when hitting the earth.

Jack Kenton

I have a tool from Harbor Freight that was inexpensive and just about the right weight. I will have to look at it again to see what it was called.

cont.

It is kind of an all metal hatchet. I haven't found a good way to mount it yet.

Jerry Miel

I carry a 4 inch folding/locking knife - part serrated) edge, with molded hand grip - I Velcro it in the pilot side map pocket so it won't fly around the cockpit - never used it, but am pretty sure it will do the job if I am physically able to use it. I also carry a good leatherman in the same side pocket.

Fraser MacPhee
886Y

Military canopy breaker from a Cobra Helicopter, mounted in the standard bracket on top of my tunnel forward of the wing spar. A bit heavy; overkill. Documented adequate to create new exits in sheet metal of a military King-Air when adequately motivated by gunfire at the primary aircraft exits. Way more than adequate for a T-18 canopy!

Tom Kerns

Bent Tailwheel Spring

Guess I should know this; can the last three inches of the leaf spring be heated and bent slightly, The last three inches of my spring is slightly bent, upward. To my knowledge I have not experienced a hard landing that would cause this. Perhaps it was this way originally. I noticed it when installing Aviation Products Tail Wheel, with 45 degree angle mounting. The original Maul must have a little less than 45 degree angle mount as I do not notice the problem with it installed. If the spring can be heated with a torch and bent slightly, it would then be at the ideal angle for the AP tail wheel. My alternative would be to fabricate a shim that would mount the tail wheel at the proper angle. By proper angle I am talking about the angle required to have the vertical post of the tail wheel vertical and

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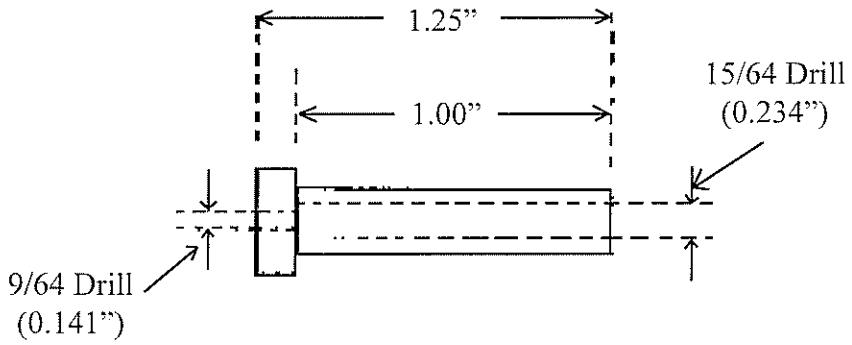
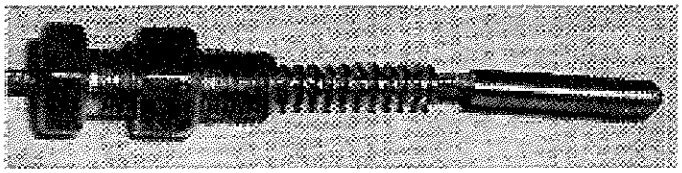
Making Your Own Bayonet CHT Probes by: Steven Willhoite

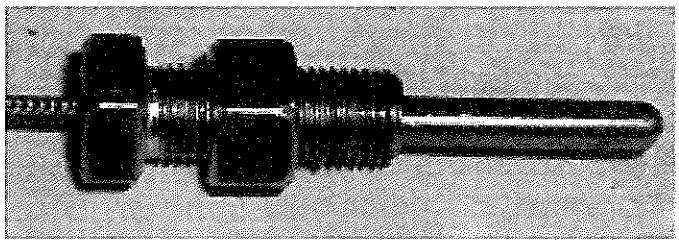
Subnitted by: Bob Jaeger

I got tired of paying over $30 for a bayonet style CHT probes, so I decided to build my own. I started out to buy a spool of type 3 thermocouple wire, and then found a really good deal on cartridge type 3 thermocouples which have a 47 inch braided stainless steel sheath like the expensive ones offered for aircraft.

IMS Company (http://www.imscompany.com) sells their part number 103682 cartridge thermocouple for $9.05. It Includes a 3/16 inch diameter by 1 inch long tip which works well for Insertion into the thermocouple well on the bottom of Lycorning cylinders. All I needed to do was build a thermocouple holder to hold the probe into the bottom of the cylinder. The Lycoming well is about 1 inch deep and includes 3/8 - 24 threads. To make the thermocouple holder, get a 1.25 inch 3/8 - 24 bolt from the hardware store (and a nut to use to lock it to the cylinder) and drill the bolt according to the following drawing. The 15/64 hole is drilled 1 inch deep from the end of the bolt leaving about 0.25 inch drilled to only 9/64 inch. A spring will be inserted into the large end to lightly pre-load the thermocouple tip into the bottom of the cylinder.

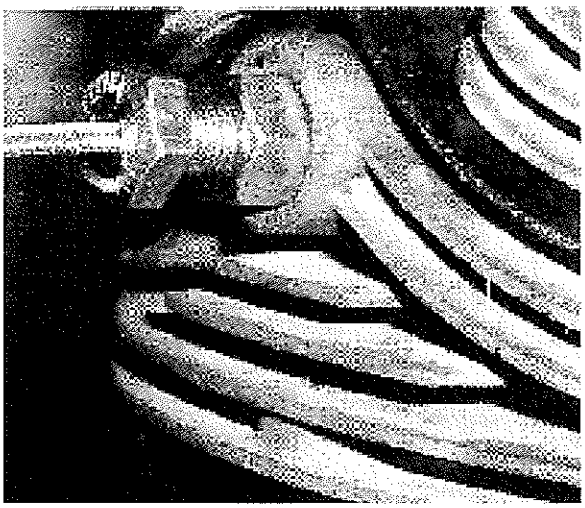






While you are at the hardware store, buy a 1 inch long by 7/32 inch diameter spring. A stainless spring is preferred if you can find it. You will need to cut the spring down to about 0.8 Inches in length.

To assemble the probe, slip the spring and then the bolt over the bare leads and slide it up to the tip.



To install the probe, screw the bolt into the thermocouple well only until the tip is pressed lightly against the bottom of the well. Don't forget to use some of the same anti-seize compound you use on your spark plugs.

When installed, the bolt should be secured with at least 0.25 inches of threads. Tighten the lock nut and connect the thermocouple leads to the readout. The type 3 thermocouple is made of iron and Constantine. The iron lead is the positive lead and can be easily Identified because it is magnetic.

not in a slightly trailing position. Comments!

Ken Morgan
N118TX

I think you'd want to have the spring re-heat treated if you do that, Ken. An automotive spring shop could probably do that for you. That steel is tough, though. When I made my spring it took a lot of leverage & a big vise to do it. In my opinion there's nothing wrong with a shim. Also, I know there's been some comment about this, but I think the vertical shaft should be at a slight trailing angle. At any rate, it's going to be that way when you get some weight in the airplane, even if it's vertical when empty.

John Evens
N71JE

Aviation Products Tailwheel, Revisited

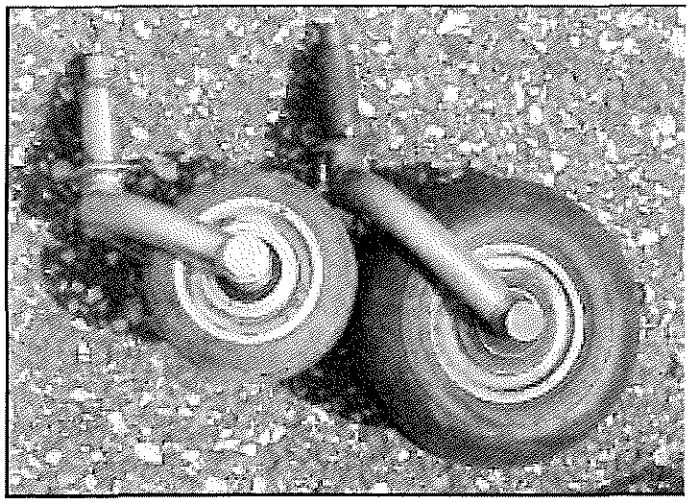
I have had a 6" Aviation Products single fork tailwheel on my standard leaf spring for the past several years, today I installed the 4" Aviation Products double fork tire and yoke to test for differences. I made eight landings and some wild maneuvering on pavement, but was unable to try grass, it is so wet here that the local grass strips are closed.

I could not tell the difference in stability or control power. I made some hard pedal stabs and severe swerves at varied speeds; the airplane was well behaved as it always has been. My reputation at the airport is shot, but the airplane is fine!

Changing from the 6" setup to the 4" lowers the tail 2.5 inches! The wheel is smaller and the fork is a lot shorter. It should be a lot lighter and less drag, but I did not have a good scale to put the wheels onto. Tire patch contact width is pretty much the same. The attitude change is substantial! I have the original short main landing gear and original short roll bar. Dropping the tail this much makes it necessary to crane my neck a

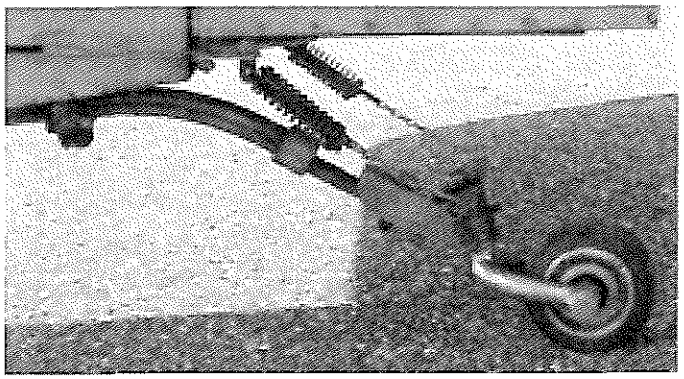
cont.

bit, get my headset close to the canopy to see ahead, but no S-turns were required. If I also had a long main gear S-turns would be mandatory without a raised roll bar. The small wheel is a lot noisier when crossing pavement seams; it will pound the mounting brackets a bit more. I have replaced both steel mounting brackets with heavier gauge due to cracking which occurred earlier in the life of my T-18. If a builder uses a longer tailwheel spring, loads in these brackets will be even higher, but shock loads may be attenuated some with a softer spring. I would suggest heavier fittings in any T-18. The single fork Aircraft Products setup seems



The 4" and the 6" Aviation Products tailwheels

to be plenty strong for the T-18, my 6" single fork has not bent and it has seen a lot of sod fields. I know they CAN be bent; a friend ground looped his Pitts S-1-11 and twisted the single fork unit. I have a double fork for my own Pitts because it is heavier in the tail than a T-18, and if that tiny wheel drops into a hole, the dual forks should work fine as sled runners to climb up out of the hole.



Tom Kerns - N10TK

Lets talk Brakes

I'm wondering how hard it would be to fit dual brakes to my T-18. I seem to have the standard single-sided configuration, built per the drawings, with Cleveland master cylinders right now and I can't see any easy way to double up. I'm guessing that this has been done before, does anyone have any suggestions, drawings, kits, whatever-might-help?

Simon Roberts

I added dual brakes to my project after my friend finished flying the initial time off. I wanted to use my plane to train in. The training is going okay. I had tabs welded to the rudder foot bar tubes like the LH side for the pedal pivots. Then built up the floor mount tabs like the LH side. Then added the brake pedals opp (Mirrored) the LH side. I ran the hydraulics from the LH side thru the RH master cylinders. Everything has to be lined up and travel checked for clearance. I found the cylinders at a local airplane salvage yard. They had no reservoirs. They had the same general travel as the LH side. I was able to adjust the installation to accommodate the inch or so difference.

Kim Nack

Do you know what parts the "slave" master cylinders should be? Does it make any difference if the master cylinder-with-reservoir goes on the left or the right? Can one mix this, so that the right master-with-reservoir is on the left, but the left master-with-reservoir is on the right?

Simpon Roberts

Master should be on the left, which is standard. Slave on right The top of the piston rod for the Slave is threaded so you can "make" the adjustment thimble any length you want for clearance and adjustment. No specific p/n just a Cleveland slave that will fit.

Stephen R. Peirce

cont.

I would advocate reversing the cylinders. Put the cylinders with a reservoir in the right seat, feed them to the left seat cylinders. Reason is that if fluid is lost, the pilot side brakes are the last to go. Leaks or most failures of the copilot cylinders are less likely to harm function of the pilots cylinders

Tom Kerns
N10TK

Have been following the communications on brake installation with great interest, picking up lots of useful info from the guys who have been there! I am about to make the pipework connections to my brakes on a single brake system and would be interested to know where to run the pipe to get the best route to the disc brakes. I have studied the S18 drawings which shows the pipes routed down the rear side of the u/c leg but where is the best place to bring the pipe though the fuselage skin? And do people mount a bulkhead fitting in the fuselage wall or just run the pipe through a rubber grommet? Would appreciate any comments on this one.

Alan Fraser
(UK)

Brake lines routed thru the firewall via a grommet could be troublesome over time as the tube would be abraded by dirt particles imbedded in the grommet. Best lines out there are Aeroquip 3/16" Teflon with stainless steel braid and steel fittings. Very strong, durable, and they do not swell under break pressure. Go to http://www.summitracing.com I buy my Aeroquip form them, cannot detect any difference from that and aircraft stock except for the price which is half! The smallest -3 TFE is appropriate for brakes (Check P/N AER-FCM1100 and AER-FCC0310 as start points). They also have 90 degree and 45 degree fittings for close quarters. In My T-18 the master cylinder openings face forward. I used a 90 degree elbow to angle Starboard toward the centerline of the airplane, then attached the hoses.

cont. pg 14

Lets talk Brakes, cont.

They route along the floor to about 8 or 9 inches in from the sides (the left hose has a 180 degree loop to return to the left). A 90 degree Aeroquip fitting connects to a thru-firewall fitting there (near the bottom of the firewall under the landing gear cross tube). On the firewall side, the thru firewall fitting can be 90 degree or you can use a 90 degree Aeroquip fitting, just get the forward of firewall hose routed outboard, secure to the gear leg and run down. Provide a service loop at the bottom so you can slide the brake caliper on and off it's slide pins without having to unhook the brake line (you will appreciate this when changing brake pads later). Connect to a 90 degree elbow on the top hole of the caliper, put the bleed screw on the bottom.

Bleed the brakes by pumping oil uphill from the calipers, you cannot force air bubbles to flow several feet downhill bleeding the other way. I use a cheap pump oiler form the hardware store and a length of clear plastic tube.....

Tom Kerns
N10TK

Just a note on the dual brakes..... I have provided dual instruction to several people over the years in several different Thorp's and I have yet to fly one with dual brakes. My recommendation would be that you don't really need to have dual brakes at all. The main thing dual brakes do in a taildragger is add another potential for ground loop when the two pilots are not communicating clearly about who is charge.

The training technique that I have used is to provide a new Thorp pilot with initial training in the right seat. Then when the ground handling, landings and take-offs have progressed to a satisfactory point then I trade seats and the new pilot moves to the left side and gets to use the brakes. The caveat I always teach with is: Don't use the brakes unless the tail is down and you're going slow. After a hundred hours of flying time then you can experiment with applying brakes with the tail up and at faster speeds.

Food for thought!
Ross Mahon
N467JF

cont.

Lets talk Brakes, cont.

In my T-18 I have dual brakes. For a long time I had it set up with standard pedal geometry (lousy mechanical advantage) on the right, and improved geometry on the left. Guest pilots could not get in too much trouble this way. Years ago I went full strength on both sides and I allow guest pilots to fly from either seat. The airplane can handle an amazing amount of abuse, can get very sideways and still recover. Caveat is you (instructor) need to be up to speed in the T-18: after a few thousand landings it gets to be manageable!

Tom Kerns
N10TK

Another great source for -3 Teflon / stainless Aeroquip (or the rest of the sizes and types) is http://www.summitracing.com have purchased a lot of Aeroquip form them, cannot tell the difference from what Aeroquip at aircraft houses except for the price. I replaced the Nyloflow lines at the bottom of my brakes with a length of -3 braided stainless / Teflon Aeroquip after the Nyloflow lines wept when hot: I did not want one pulling out and I did not like the leaks, and they are stronger in the remote event that I snag some FOD on a grass strip. I also use Viton seals in my brake calipers which remain intact to very high temperatures, and I use fire resistant synthetic brake fluid with a 440 degree F. flash point (vs. 220 for mineral base hydraulic oil).

All of this costs nothing more, makes a more durable brake setup (hate it when one fails when I need it), and pretty much eliminates the risk of brake fires. The fire resistant brake fluid is Mil-PRF-83282, I use ROYCO 782 which I mail order from http://commerce.acilubes.com/SearchResult.aspx?CategoryID=7 ($25 for 1 gallon). This oil is 100% compatible and mixable with standard mineral based oil and our standard brake seals; however, any more than 5% mineral oil mixed in will compromise the fire resistant feature....

Tom Kerns
N10TK

cont. pg 15

Lets talk Brakes, cont.

Just to reiterate what others have said, Teflon hose is generally unaffected by most all chemicals, petroleum-based or not, has a wider usable temperature range than most rubber compounds, has an unlimited shelf life, and makes your airplane go faster (just kidding). It usually has a smaller O.D. than a comparable rubber hose such as Aeroquip AQP monomer, and is lighter. If you're going to use it for hydraulic lines, it just has to be designed for the proper pressures. I believe I used Aeroquip #2807 or 2808 (can't remember the number for sure) for my brake lines and fuel lines.

Regarding silicone-based brake fluids... if your wheel cylinders are designed for it, you'd better make sure the masters are too. I considered it because of all the good reasons previously stated, but after talking to the Cleveland guys at OSH years ago, I found that the o-rings they were using were incompatible. Oh, oh... I already had it in my system (fancy racecar stuff), and sure enough things swelled and jambed. I had a lot of fun flushing, changing seals, etc. This was long before the airplane actually flew. You can get the red aircraft stuff at most any airport. Might have a harder time matching the fancy stuff with a compatible fluid off the shelf... then again, maybe not.

John Evens
N71JE

This is a photograph of the Brake pedal system I used in my Thorp. It is simply a Pitts style brake pedal which is a welded assembly made up to suit the dimensions and clearances needed. The tube sizes are strictly off the Pitts drawings. I sized the lowest horizontal tube to allow slipping it right over the standard Thorp rudder pedal weldment. It is held in place with tubular rings and pop rivets. Regrettably, the picture I have here at home on my computer shows the control stick blocking the view of the area that interferes with the Fuel tank support. On that side, I simply moved the top tube on the brake pedal weldment over to clear the tank support.

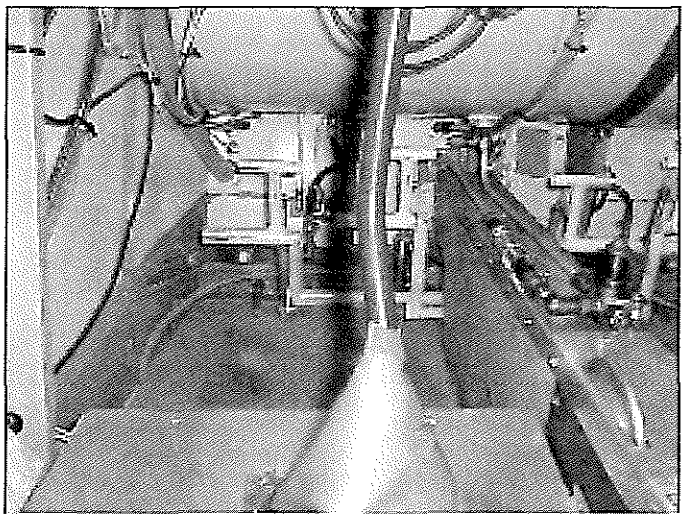
That view is a bit clearer for the left pedal in the right seat. The pedal can go past the tank support and clear it by a half inch.

cont.

Lets talk Brakes, cont.

I thought of putting end plates or tabs to keep my feet in the correct place and found I didn't need them.

This has worked very well for me for the ten years I've been flying N22607..



Author Unknown
N22607

For a while I have experienced brake lock up when used for taxi. It is the left unit, I have removed, cleaned, inspected and installed new "O" ring. Still have the problem. After a short cool down, it then works normal. Can anyone give me some advice on the problem and a possible fix. Comments!

Ken Morgan
N118TX

I have had experience with brake up identical to what you experience. The problem turned out to be in the master cylinders. For some reason the cheapo cylinders I attempted to use, utilized silicone valve seals which shredded in practice, these pieces plugged the fluid return path, keeping the pressure applied on the wheel cylinders. Sort of like a parking brake! What I thought was the brakes cooling was just the fluid slowly leaking down. When testing everything seemed fine but as it turned out I never applied enough pressure in test. When braking for real, I always applied much more pressure.

cont. pg 16

Lets talk Brakes, cont.

I solved the problem once I figured the cause by replacing them with Cleveland master cylinders.

Bob Pernic
N966RP

If you happen to have Scott master cylinders, or similar design, you might want to check the write-up on my brake lock problem in Newsletter 107. Problem turned out to be intermittent movement of the small nylon bushing located in the cup at the base of the actuating rod. Loose bushing can slip up on the shaft where it blocks the pressure relief hole at the base of the of the cylinder and prevents return of fluid from wheel cylinder to master cylinder leaving brakes locked until pressure is released. Insidious part is that bushing may return to proper place in the cup and not cause problem for many more cycles. My cure was to push bushing firmly in cup and center punch the cup edges enough to retain the troublesome part. Hope that helps. Gary's fly-in was great and I was pleased to renew so many old friendships. Long live the T-18.

Walt Giffin
N78WG

Look at the pads. when did you last replace them. If they get worn unevenly they can cause the piston to cock side ways and with a little wear on the piston while its hot it will stick. You might eventually have to replace the piston but I am sure you can get some more time on the part.

Skeet Wyman

Check the piston on that brake. They wear (ever so slightly) and get cocked sideways. Brake fires due to dragging while taxiing are no picnic!

Bob Highley
N711SH

Lets talk Brakes, cont.

The Parker web site has a very useful maintenance manual for the Cleveland brakes in pdf format. http://www.parker.com/ag/wb/cleveland/pdf/maincov.pdf It includes wear limits.

Richard Eklund
Eklund Engineering, Inc.

Brake Fluids

Seems like this might have been addressed before, but can't remember. Is there a problem with use of automotive synthetic brake fluid on the T-18? thanks.

Hal Underwood

The issue is the rubber parts in the system. Traditionally, rubber parts that are compatible with oil don't like brake fluid and vice versa. I like the convenience of replacing the O-rings in my cylinders with O-rings that cost maybe 10 - 20 cents each at the local bearing supply house. Seems like I change the O-rings in some part of the system every 5 years or so. The 5606 gets at least partly changed out then - no thickening evident.

Ed Pernic
N137EP

I have never heard of anything other than 5606 or equivalent hydraulic fluid used in any general aviation hydraulic or brake system. Does anyone out there know of an exception? If your master cylinders are made for general aviation aircraft they should have seals that are compatible with petroleum based fluids (5606). I believe Nitrile rubber seals are standard.

Automotive brake fluids are mostly DOT3 and DOT4, which are glycol ether based, and are hygroscopic (absorb water). The seals are likely to be Butyl rubber. Automotive brake fluids are described in this reference: http://www.shotimes.com/SHO3brakefluid.html

cont.

Brake Fluids.cont.

For those who don't know, the phosphate ester fluids, such as "Skydrol", are used in the hydraulic and brake systems of modern commercial jets, 707 and on. This fluid is used because it is non flammable, but it is nasty stuff to work with. At the airlines, you can spot the hydraulic mechanics - they are the guys who wash their hands very thoroughly BEFORE they go the bathroom. Leaks are often detected by the paint peeling off. Seals are typically Ethylene-propylene elastomer.

Military airplanes still use 5606, because it is cheap and they can afford to burn up the occasional airplane or expendable pilot.

There is no suitable fluid that is benign to all the various seal materials. There are seal materials that are compatible with multiple fluid types, but they are expensive. On the commercial jets we have seals that are compatible with phosphate esters and with turbine oils (basically synthetic motor oils). One of these is a material called AFLAS. These are used where the hydraulic pumps attach to the engine gearboxes.

The following web site is instructive. Just select the fluid and the list of compatible seal materials will be displayed. http://www.efunda.com/designstandards/oring/oring_chemical.cfm?SM=none&SC=MIL%2DH%2D5606#mat

Keep life simple, use 5606 on your airplane. Anywhere you land your airplane, this fluid should be available. If an airplane mechanic is doing the servicing, that is the fluid they will expect to use.

Ben Harrison

I'm very sure both Regular and Synthetic auto fluid are an Ester base. Any auto type fluid will destroy your seals. If the fluid in your master cylinder was or is red (Mil-H-5606) your ok. If your unsure, change your seals out with new ones. They have kits in Aircraft Spruce. Everyone continues to reinvent the wheel. Yes it would be nice if there was only one type of fluid.

Stephen Peirce

Brake Fluids.cont.

We've just about beaten this subject to death, but this is my experience... About 25 years ago, when I was building my T-18, silicone brake fluids were becoming very popular with the race car drivers. So I thought, why not? After all, they are fireproof, won't harm paint, have a higher boiling point, are a better lubricant, and aren't hydroscopic (don't absorb water). In fact they repel it. Water condensing in your brake fluid when it cools off lowers the boiling point, causes corrosion, etc. My airplane was a long way from flying, but the brake system was plumbed, so I bought a can of the expensive stuff and filled it up. Sometime later, at Oshkosh, I visited the Cleveland booth & asked them about it. They said "don't do it... not compatible with the seals". Sure enough, when I got home & checked, the seals in the master cylinders swelled so much that you could hardly move them. I flushed everything, took the cylinders apart and changed all the seals, then refilled with the standard red stuff. You can get it, if you need to, at any airport. I believe it was Tom Kerns who posted info on a higher flash-point Mil version... sounds good to me.

I don't know what compound they used in the seals, but most of the Vitons, Buna-N, SBR, and others should be perfectly compatible with DOT 5 silicone. Silicone rubber would not. Also, never mix fluid types. Silicone fluid with others produces sludge, big time. Silicone has not proven to be that great in some ways. It produces a "softer" pedal feel, and the moisture that condenses in the system, instead of mixing with the fluid, remains as droplets, which can really boil, & cause corrosion. This is probably all academic, and much more than anyone wanted to know. Don't know 'nuthin about the other "synthetic" fluids.

John Evens
N71JE

Upcoming Events

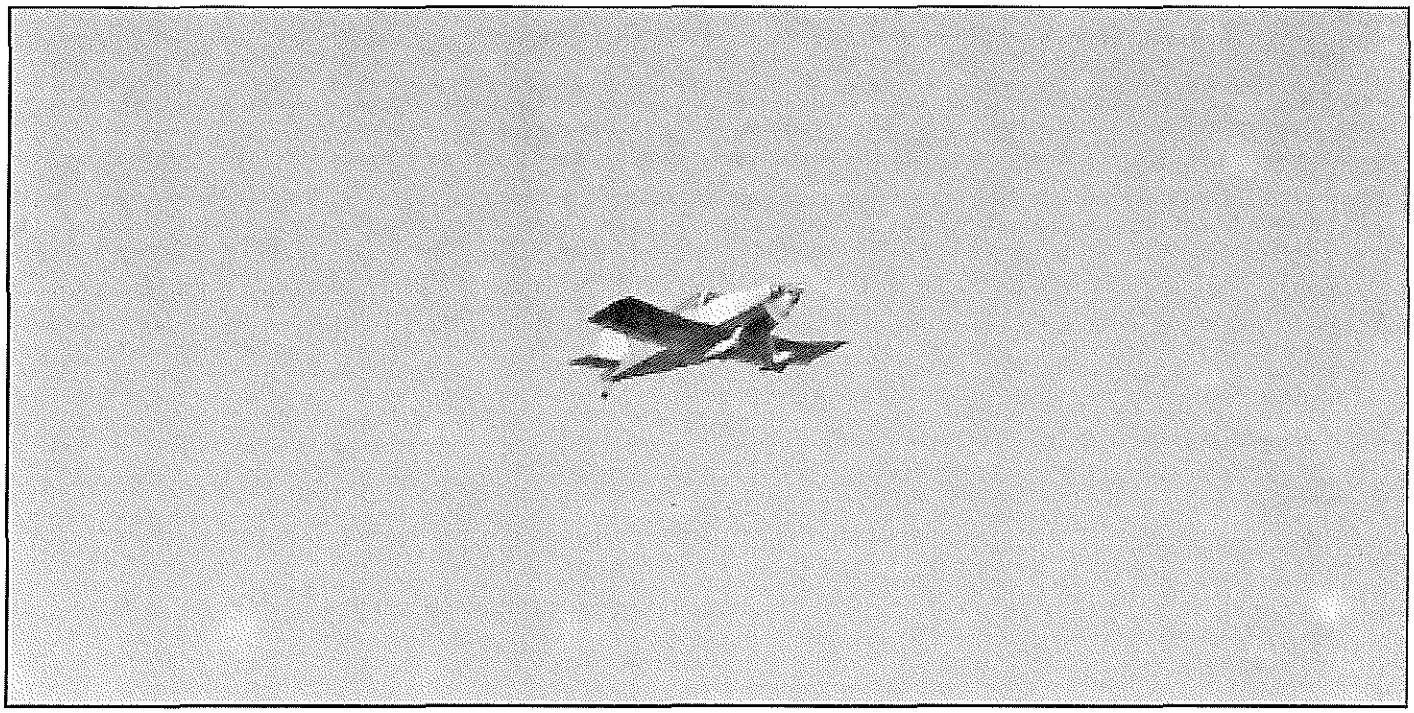
June 6-8, 2008 Spring T-18 Gathering in Dayton, Ohio ... Check www.t18.net for details.

Pictures from the 2006 Kentucky Dam Gathering

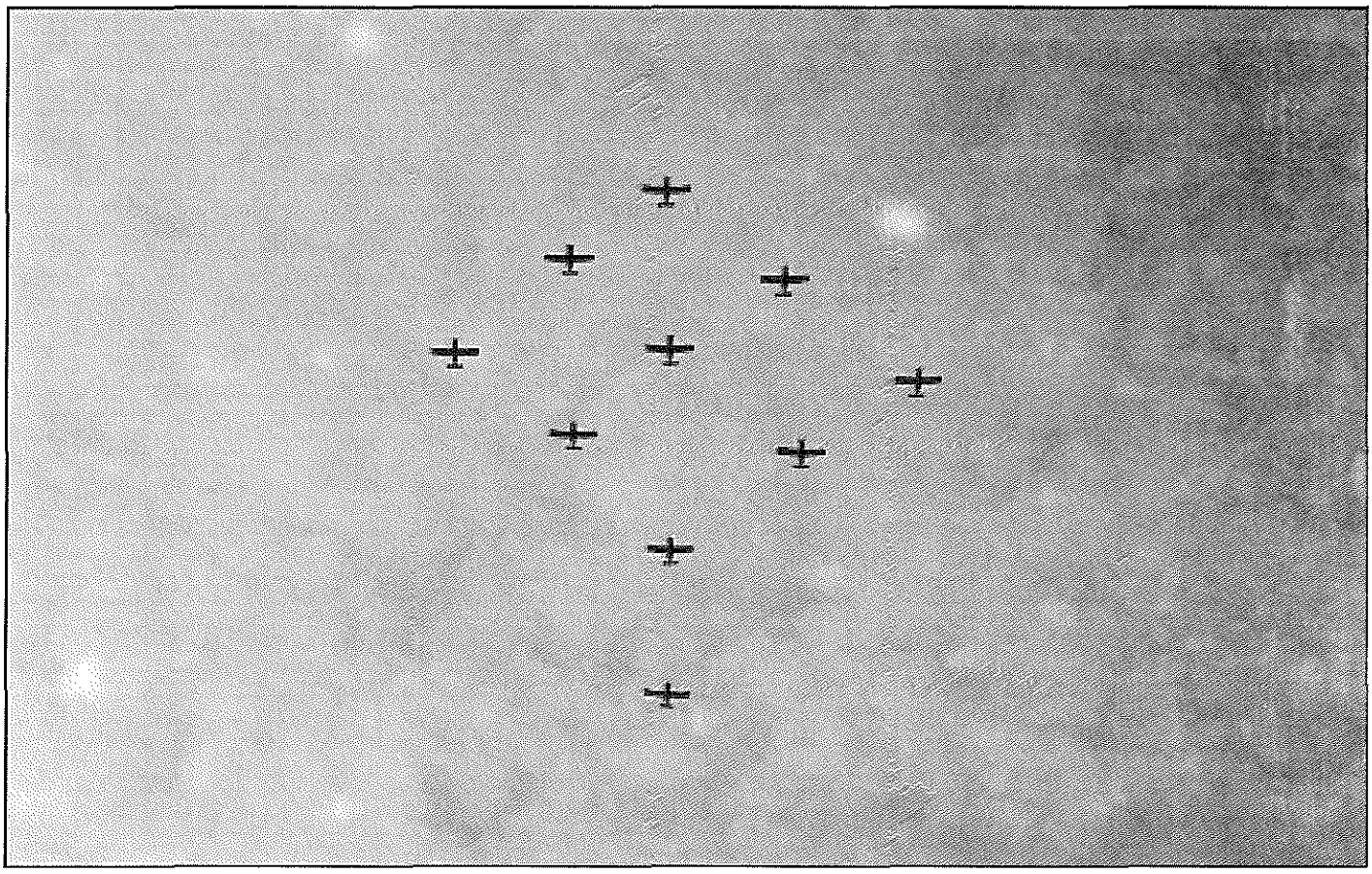
A portion of the ramp. Looks like Lew Conwell there checking out his S-18

The group headed out for some formation work

Pictures from the 2006 Kentucky Dam Gathering, cont.



David Read's new T18 ~ N718DR



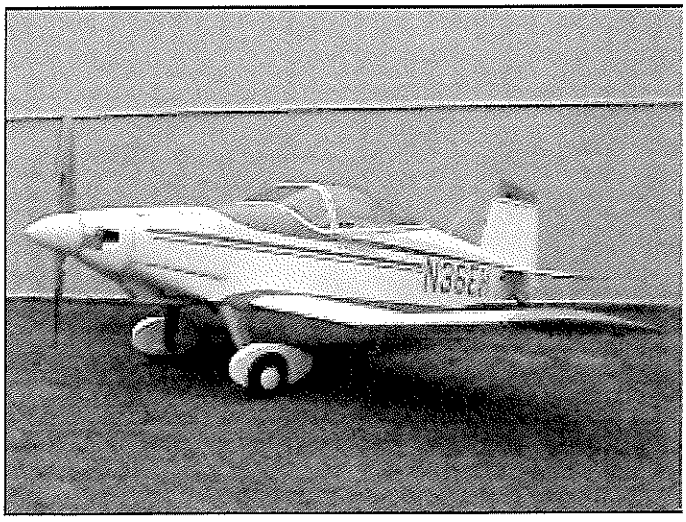
A shot of some of the formation work. Looks nice guys.

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

Newsletter No. 138
Janurary 2008

For Sale

1977 T18 Standard Body N36EH 900TT 900SMOH Custom O290 with O340 Crank. 150HP. 2000fpm climb! Built and owned by career sheetmetal craftsman. Recent updates include hi-lift Sunderland wing, New THORP style metal wheel pants, New VFR panel. Always Hangared at MGJ. Clean Bill of Health! 201-444-7432 New Jersey $32,000.00



Elmer Hymen

I have a nav/aid auto pilot new for sale incl servo. $850.00 Frank R. Seats 423-878-4522 seatss@wmconnect.com

Eklund Engineering is seeking new builders who need the 537-2 and 537-3 center wing main spar extrusions. If we can get $400 prepayment from a minimum of 6 builders, we will be able to order new extrusions. Alcoa is stating a lead time of 11 weeks ARO. Buyers would have materials in approximately 4 months after the order is placed. If we cannot presell the six sets and order the extrusions in the next 60 days, we would refund the $400 if the customer so desires. If builders are interested please e-mail and we will keep you posted on progress.

thorpt18@jps.net