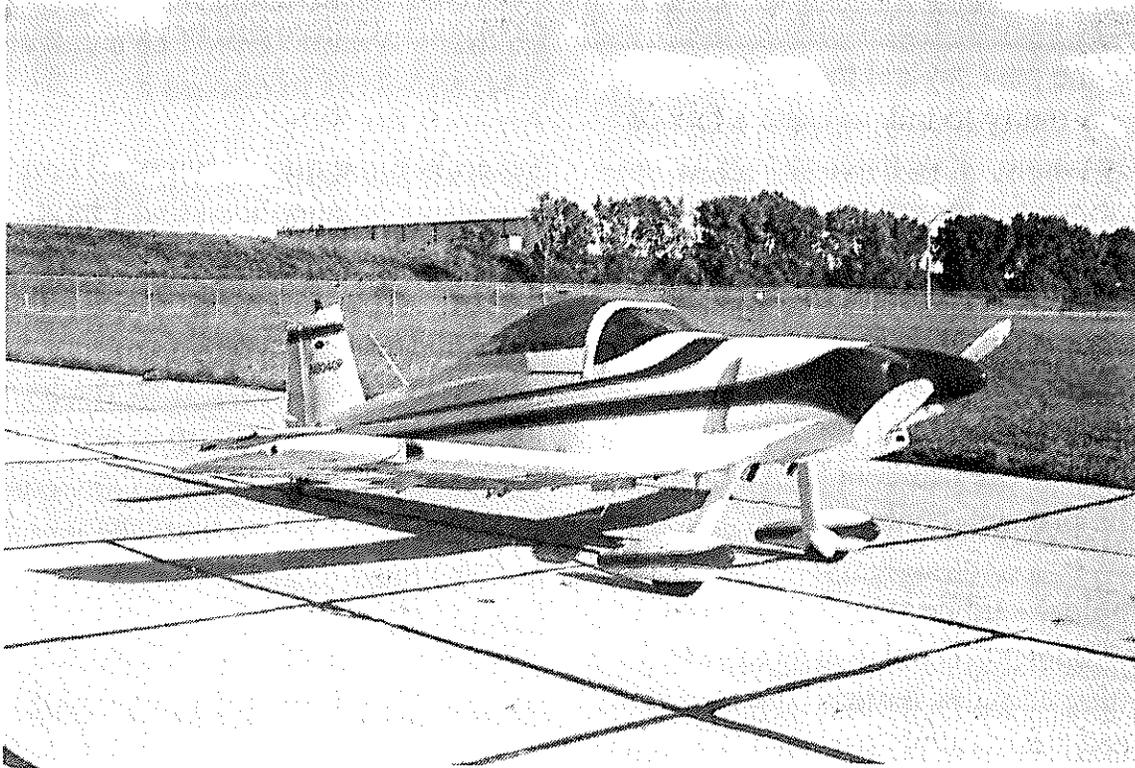


T-18 NEWSLETTER

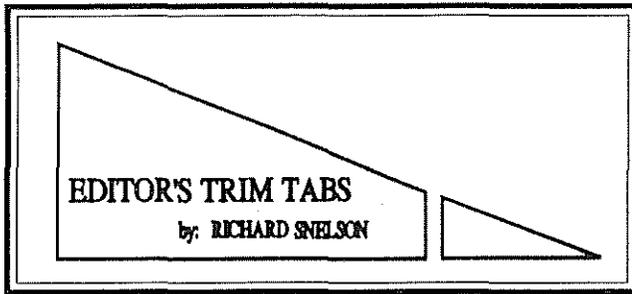


Harlo McKinty's Red over White S-18 (N9040P)

IN THIS ISSUE:

- Letters to the Editor*
- Over - G by Kim Nack*
- For Sale/Wanted*
- Electrical Workshop by Charley Wagner*
 - Cutting and Stripping*
 - Crimping*
 - Molex Connectors*
 - Soldering*
 - Shrink Tubing*
 - Splicing and Power Signal Distribution*
 - Bundling Wires*

NOTICE: (STANDARD DISCLAIMER) As always, in the past, present, and future newsletters, we would like 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.



During the past several months I've had the opportunity to talk to quite a few of you, by phone. I've listened to your suggestions for improving the newsletters and will incorporate those suggestions in future newsletters. A lot of you would like to see more articles on building and flying the S-18/T-18. "Me too." We have been getting what most think are great articles over the last couple of years and all hope that will continue.

One builder said he was tired of reading about Kentucky Dam. Not as tired as I am of writing about it. Notice, that coverage has been minimal the last several years!

CANOPIES

I still get a lot of calls about where to get windshields and canopies. So I would like to ask for your inputs to tell us what your experience has been with the couple of vendors that are still making them. Please send "price", "quality" and "delivery time." A lot of the older Thorps need replacement canopies and windshields.

Lee's Project

I had a call from Lee Skillman last week and he still has his Thorp S-18 project for sale. He's got it priced at \$10k and it's all the parts and accessories that are supplied by Classic Sport Aircraft in their catalog.

Fuselage is on the gear. He has canopy, windshield, dual brakes, and on and on. Someone is going to get a real deal when Lee sells this project. By the way Lee's work is outstanding, his first Thorp won a lot of awards including the Wright Brother's Award. Give Lee a call at (334) 633-3535 to discuss it.

Aircraft for Sale

Several of you that watch my Thorp homepage have noticed that I have N295RS for sale. This is the second Thorp that I have built. It was completed in 1992 and won the Wright Brother's Award in 1995. I have flown it 450 fun filled hours. Don't jump to any conclusions I'm going to continue the newsletter. In fact I hope to have more time to put into writing.

SPRING FLY-IN IN ILLINOIS

June 5 is just around the corner so it's time to get your reservations in for the Thorp Fly-In at the Coles County Airport (MTO) here in central Illinois. They are holding a block of room up until 2 weeks before the event. The phone number for the Ramada Inn is (217) 235-0313. Be sure and ask for the Thorp Fly-In group rate. We will have several shuttle cars to run you back and forth the short distance to the motel. We are planning to do the cookout again Saturday night and the airport authority said we can have the monster hangar again, to get the airplanes in side at night. Let's hope the weather is better this year and we can fill it up.

RoxAnne promises another tour of Amish

country for all that want to take a chance on her directions....

OSHKOSH LUNCH/FORUM

We have the Nature Center again for the Oshkosh Friday get-together lunch with the forum to follow. Ben Scola and Roy Farris are planning a sandwich fixin type lunch. I'm sure it will be a bargain compared to the "Oshkosh Deals." so join us there. I'll bring the mike and PA so we can all hear the speakers at the 1:00 PM forum.

Placerville 1998

7th Annual Placerville Fly-in.
Placerville, CA at the Hangtown VOR (40 miles east of Sacramento)

Placerville is scheduled again this year for Sept 4, 5, 6th. 1998

Contacts are:

Hal and Nancy Stephens	530/295-1867
Jim & Lillian Critchfield	530/621-1584
Mac & Rena Booth	408/363-8720

Accommodations: Camp out under the stars at the airport or stay at:

Placerville Inn	800/854-9100
Day Inn/Best Western	530/622-3124

Meals:

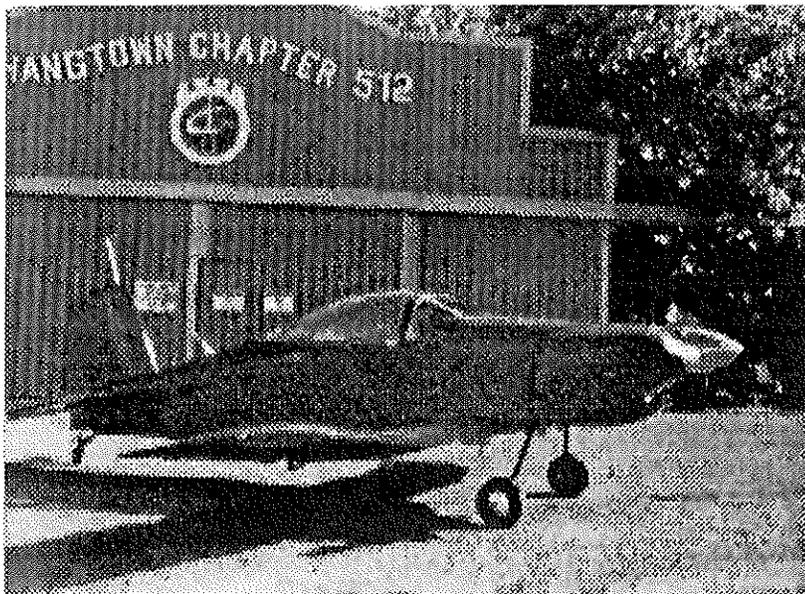
Friday night: Dinner at the Elks Lodge
Saturday noon: We'll go downtown
Saturday night: Steak & Wine Dinner (\$15 per)
If you fly a T-18 or a Sky Scooter, plan to make this fly-in. Please! a RSVP call is required so parking places can be made available and a steak dinner reserved for you.

EAA Chapter 512 Sanctioned Event *

This is an informal and friendly get together. If anything unfortunate should happen to you or damage occur to your airplane, it shall not be the responsibility or liability of the above named persons, EAA Chapter 512 or the Placerville, CA airport.

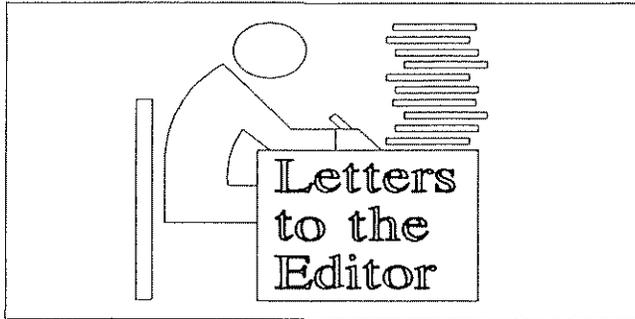
Editor's Note: Jim Critchfield is home from the hospital after undergoing 9 hours of surgery on his heart. We all are pulling for you Jim. Hurry and get well.

Send Jim a card or letter at: 1579 Sean Drive
Placerville, CA 95667
Phone is 530/621-1584



N8TT, Thorp Tiger. 31 years to complete. Moved 13 times during construction. Has 60 hrs on it. Have not made one change. Fly's with one person, hands off. 150 mph with 150 hp. Pacersetter Prop. 2700 flat out 170 mph. What a Jewel! Everything standard John Thorp.

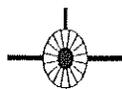
Regards, Jim Critchfield
Placerville, CA



Richard,
I'd like to say thank you to all the folks who helped me in my search for a T-18. I recently bought Evan Roberts' lovely rebuild N89ER. It now resides just North of Ft. Worth, Tx..

I'm indebted to a number of people whose help was invaluable. Rick Jones and Gary Green spent a lot of time preparing me to find a solid airplane. Rick flew me down and looked the airplane over prior to the sale. Gary weighed her, did a new W&B and has offered a number of bits of advice. Lyle Trusty was also a wonderful source of info and advice. He burned up a lot of internetrons helping me look and advising me on what to look for. There were others around the country who contacted me with helping hands as well. My Dad and I are taking the airplane to SnF and Oshkosh and I hope to be able to put faces to the voices I've heard on the phone and on the screen.

Thank you all again,
Damon Berry
FAMBER123@AOL.COM



Richard,

I can't thank you enough for your time and patience as well as your commitment to share information on the T-18, with the newsletters as well as in person. Since our flight together, I flew again for a couple of hours with Cecil Hendricks in Seattle and completed my bi-annual in a Citabria here in Anchorage.

My Thorp project has been built over a long period of time. It's Plan no. 1050 started in 1974,

and I was the third person to own it by 1986. The hardest part to the project is finding the time and space to work on it. It would sit for years then I would work on it for 3 or 4 months or so full time + then it would sit again due to my other commitments. I had time to finish it this winter and with the help I have gotten from you and others like Cecil, I think my first flight will be some time this month.

I'm a month or so past my estimated first flight date but I'm not one to rush into anything of this magnitude. The building part of my Thorp is all but done and I just received the new prop I ordered from Aymar-Demuth. I am working on my neglected paperwork now and could get the FAA's blessing soon. It seems I would have to fly an extra 15 hrs. to get certified if I fly with the new prop. The McCauly prop is certified & within manufacturer's limits. The Aymar-Demuth, although probably safer, is not FAA certified and the inspectors I have talked to want paper proof. I would like to compare the flight characteristics of the two and I would hate to throw out a good propeller. I was thinking of flying the first 25 hrs. with the metal prop then switch after certification.

I had my T-18 C weighed with the McCauly prop with a beefy extension, folding wings with tanks, and 8 qts. of oil in a O-320 and came up with an empty weight of 963 lbs. at CG of 62.6. I'm sure I'll lose a few lbs. when I switch the prop and extension but I worry about the CG moving back even further. I know I sound like the average aircraft builder, worried about their aircraft's weight but what it gained I lost in missed meals and long working days. It's good to be almost done.

Thanks,
Richard Marson
6620 East 8th Ave.
Anchorage, Alaska

Hi Richard,

I hope this letter finds Roxanne and yourself in good health with clear blue skies ending a short winter. With the warm Florida days and Sun & Fun just around the corner I'm seriously tempted but it's been an El Nino winter out here. What started out to be a two-week annual on my schedule is now going on its fourth month. It seems like it's going to rain forever and we have so much water on the floor of the hanger I'm afraid to stay too long with no lifeguard on duty.

The big news out west is the date for the Placer-ville T-18 Fly In - Sept. 4,5,6. We're looking for another outstanding turnout this year. We had more than 30 T-18s last year (as well as some strange looking RV something or others).

Jim Critchfield and the Hangtown EAA chapter 512 will open its doors for everyone with camping, picnicking and parking areas available for all guests. Shuttle service will be provided to lodging destinations and our scheduled lunch on Saturday. It won't take much arm-twisting to get Hal Stevens to take up his bugle as master of ceremonies again this year and open his hanger to the forum on Saturday. With Hal's direction and the aid of his sidekick (yours truly), we hope everyone finds the fly-in both educational and enjoyable. As is custom, the steak dinner is on for Saturday night.

I'd like to thank you for all your great work on the newsletter. It's a treasure trove of information for those of us involved with T-18s. Thanks also for being that link to help us better help each other.

Like free tickets left at the stage door for Elvis, we have two prime ribeye steaks and a bottle of California's finest waiting should you and Roxanne find your GPS programmed for our wild west. By the way, we've also got the cheese.

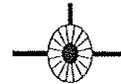
Best regards,
Mac E. Booth, Jr.

Hi Richard,

Add me to the T-18 list if you don't mind. I have N4588, ser #671. It was finished in about 1976--- it's going through a repaint/reupholster rebuild right now. No electrical, GPU for power, weighs 817#. Will probably reach 825# or so when finished.

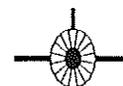
Do I understand that you have stall strips for sale? If so, I'll take a pair. See you at SUN and FUN. DAVID ALDEN

(Editor's Note: Sorry, I don't have stall strips for sale.)



Rich,

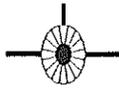
Enclosed find my check for 1998 dues. Sorry, but I absolutely REFUSE to cut up any more of my Newsletters in order to fill out personal info I KNOW you already have. Besides, if Susan found out that I chopped up her article, I'd never hear the end of it. In case I haven't told you, I bought a "T" hangar at the Landings condominium (private) airport last October. Heated, lots of lights, insulated, forty-four foot electrically operated bi-fold door and large enough to build in as well as house the Skylane. The airport is about six miles west of Elgin Illinois. Point of possible interest, in the spring of 1980 I went flying with the late, Bill Gilleon in his T-18. He rented space at the Landings in a hangar identical to mine. He was in the hangar with a Skylane!! It was tight but very doable. Like I said, "Point of possible interest" especially if anyone is heading this way before mine is finished. (Can't blame a guy for dreaming.) Hi to RoxAnne for us. Best Regards, Ben Scola



Rich,

Enclosed, please find my dues for the current year. Your letter is a great asset to my flying. I plan to attend a few fly-ins during the year & hope to meet some of the people who build and fly T-18's.

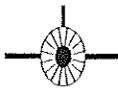
I have purchased the stall strips for my bird, but have not found the technical info on installation. If you could assist I would appreciate it. I would be glad to share the parts with another T-18 owner, because I have enough material for two airplanes. Sincerely, Bob Carman Phone: 607-754-7757 or email pnamrac@aol.com



Hi Rich

Just ordered a set of T-18 plans (my second, actually) and got your web site in the receipt of order notice from Eklund Engineering. Can you tell me what the annual sub cost for the Newsletter is? I got the cost for the back issues, but couldn't find the one year cost. From faulty memory, my first plan set was #279 from John Thorp. The project reached wings and tail stage before a career change made me sell it - which I regretted later. That was in Australia, 1977. I'm now living in Portland, Oregon and the bug is biting again.

Cheers! Ron Chernich



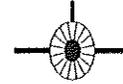
Dear Rich & RoxAnne,

Have been very busy - eyeballs deep in airplanes! Flew out to Georgia in October and bought a 1953 Cessna 170B. In 2 1/2 months I've put 80 hours on her. The Thorp is a little jealous but I still fly her enough. I let my girl friend and friends fly the 170 and I take the Thorp. The Pitts is coming along very slowly now but hope to start recovering the wings next week. I'd get a lot more done if work didn't get in the way!

Will be at Oshkosh with the T-18 and the C-170B this year. My brother and his kids will take the 170 out there. Hope to see you there! or

Placerville! or some other fly-in!

N28TG sure likes her 180HP engine I installed, (65 hours on it now since Aug 97). Can you help me find a prop shop that will twist my Sensenich to the pitch I need? Email me at aginn@ladc.lockheed.com. Thanks and fly safe! Tony Ginn 805/256-4829

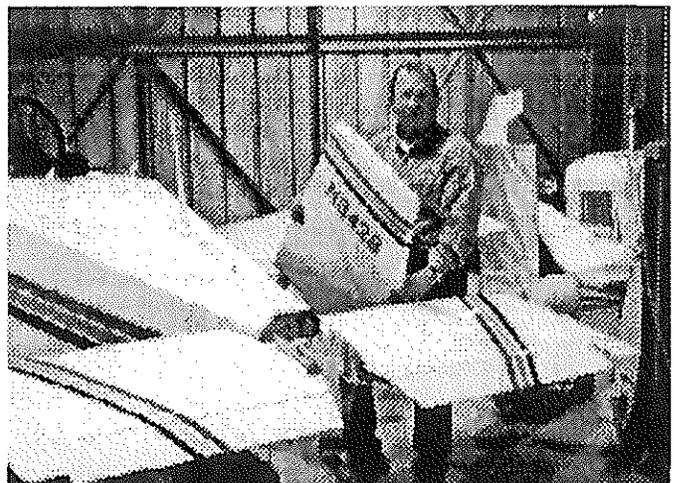


Rich: I purchase N8428 from Alvin Postin and flew it home to Montana from South Carolina last fall. During the ferry trip home the electric trim system failed (sheared pin at drive motor) and am now repairing and installing limit switches per T-18 newsletter articles and instructions. I find the newsletters very helpful and informative.

Please print my name/address and telephone number to assist any T-18 pilots in finding a Montana contact for cross country help or assistance I may be able to offer. Thanks for your efforts. Russ Verbael P.O. Box 305 Dutton, Montana 59433 Phone: (406) 476-3315

MONTANA
Collector Cars
 P.O. Box 305
 Dutton, Montana 59433
 (406) 476-3315 / 3341

Russ Verbael



Dear Rich,

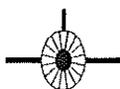
My wife and I sold our "Sweet Dreams" T-18 in October, 97 to a new owner. (4th for this airplane now). We owned N1014Z for 7-yr's and have many wonderful stories to tell, but to many to list in this short note. "Great Airplane" though. I've now owned six airplanes now and the Thorp T-18 will always be right up there with the best of them for me.

I sold the T-18 to a Mr. Sam H. McDaniel 3265 Flora St., San Luis Obispo, CA. 93401. He might like to continue the news letters? I gave him most of my copies when I sold him the airplane. Oh yes, he is 78 yr's old with two plastic knees. How about that! A real "Tiger."

So Long, "Keep-EM-Flying' Rich" Dave and Carol Tennant.

P.S. All the people who fly and own T-18's which we have known or met in 7 yr's were the best troops I've ever known.

(Editor's Note: Thanks Dave and Carol, Safe flying to you both.)



Hi Rich,

Here's a photo of Harlo McKinty's S-18, that he lets me fly. It's too bad I can't take it to the fly ins, but we are stuck with driving because of all of the booth supplies we need for our Temperfoam exhibit.

By the time Janice & I exhibit at Oshkosh, Sun N Fun, & Copperstate we've used up all of her vacation time not to mention the catch up work waiting when we return home.

Maybe someday we can make it to one of the T-18 Fly-Ins. Sincerely, Jim Fix
(Editor's Note: Harlo's S-18 is our Cover Photo for this issue.)

Dear Rich,



Please add my name to your T-18 newsletter subscription list. I've just purchased a structurally complete T-18CW from Jim Renniker of Minneapolis. The S/N is 866.

Please place a want add in the newsletter that I am in need of a conical engine mount and have a 180 hp dynofocal for trade. Also I want to purchase a used/unused "Garrison" updraft cowling that was sold through Air Craft Spruce for some time. I am aware of the cowling problems associated with these and believe I know the fix.

I have yet to inventory Jim's newsletters so I was glad to hear you have the back issues available.

I am 40 yrs old, married, one son. A&P, A.I., Pvt. Plt. I work for Northwest A/L's in DTW and have been here for 14 yrs.

I helped finish a T-18 in 1976 with Dr. Richard Burlingame, N62RB. Several yrs latter it was destroyed by a prop failure by its third owner. Thank you, Matt Null 3300 Goat Fell, Ann Arbor, MI 48108



Richard,

Sent you an email but with a new computer I don't know if I got thru. We had a problem deciding to have the 7th Fly-In. The EAA Chapter hungry for money put a \$2.00 a head charge on fly-in people, plus \$50.00 a day for a porta potty, didn't know whether we could swing it, so we said go for it. Sept 4, 5, 6th are the dates for Placerville No. 7. It's close to Labor Day but we've been successful on that date so far. More Later, Jim Critchfield 1579 Sean Drive. Placerville, CA 95667. (916) 621-1584
email critch@inforum.net

January 20/98

Dear Rich:

Many thanks for the back issues of newsletters that you forwarded some weeks ago. I have perused all of them and found owners with problem similar to my own so they already have paid for themselves. I finally got my permanent C of A from Transport Canada a few weeks ago and now have 43 hours on C-FLDP. It is certainly a nice aeroplane to fly and I am more than pleased with it (photo enclosed). The plane stalls straight ahead at something less than 55 m.p.h.. The ASI scale starts at that speed and the needle at full stall with full flaps is just under the first mark. I have the "new" folding wing design (S-18) and it seems to be performing as advertised. One problem that I am working on (with a lot of help from Mike Archer of Classic Sport Aircraft) is the lack of forward trim at higher speeds. We have tried lengthening the 521-1 link in the tab system (by 3/16ths) with some noticeable improvement. However at speeds over 150 m.p.h. there is still a need for slight forward pressure on the stick even with full forward trim. After reading Bill Mnich's report in Newsletter 104 I feel there may be something in Newsletter 93 that may be of some help. I also have an intermittent problem with rough running engine which I am attributing to over rich mixture. The interim solution is to slightly lean out the mixture but I shall be trying out Jack Waxenfelter's design as a

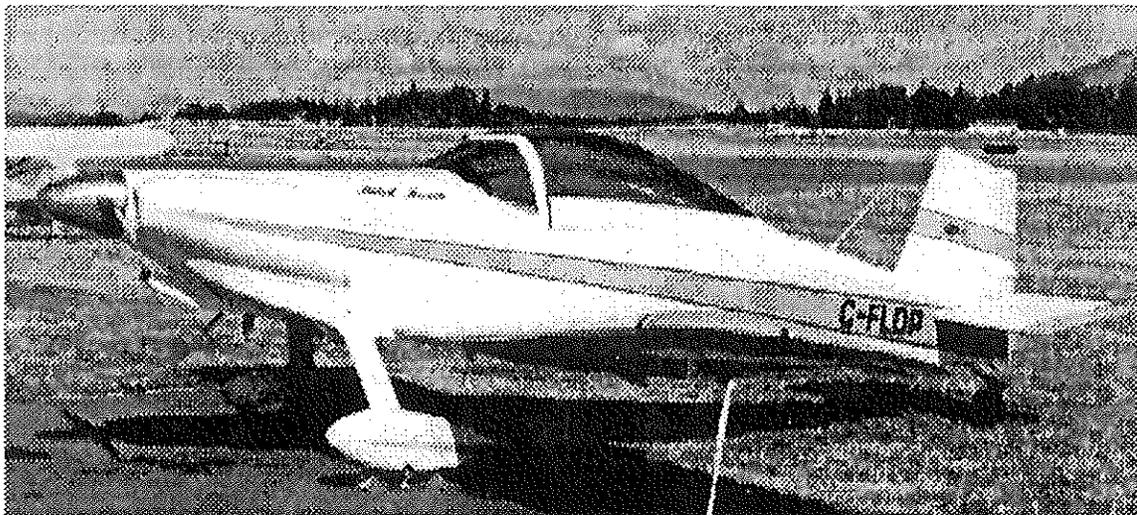
more permanent cure. I am very impressed with the new layout and clarity of your newsletter. I still have many of the old ones and there is no comparison for legibility.

Yours truly,
L. D. Perkins

More from L.D.:

Following the advice of Mike Archer I lengthened the 521-1 link in the horizontal tail assembly 1/16th inch at a time and ran flight tests on it each time. Finally at 3.45 inches the trim responded properly and I can now fly it at high speed without having to hold forward pressure on the stick, where as previously it was necessary to reduce the airspeed to about 130 mph to compensate. The down side is that I have six sets of links left over not counting the original. The problem of a (sometimes) rough running engine was caused by my carb heat box control arm being too close to the side of the carb air scoop and getting gradually bumped out during flight by engine vibration thereby creating a too rich mixture. The plane has all the in-service acrobatic mods built into it and I plan on aerobating it after I have a few more hours on it. I would appreciate any experience (recent or otherwise) which some of your readers may have acquired in that field.

L. D. Perkins



L. D. calls his Thorp (C-FLDP) Bated Breath

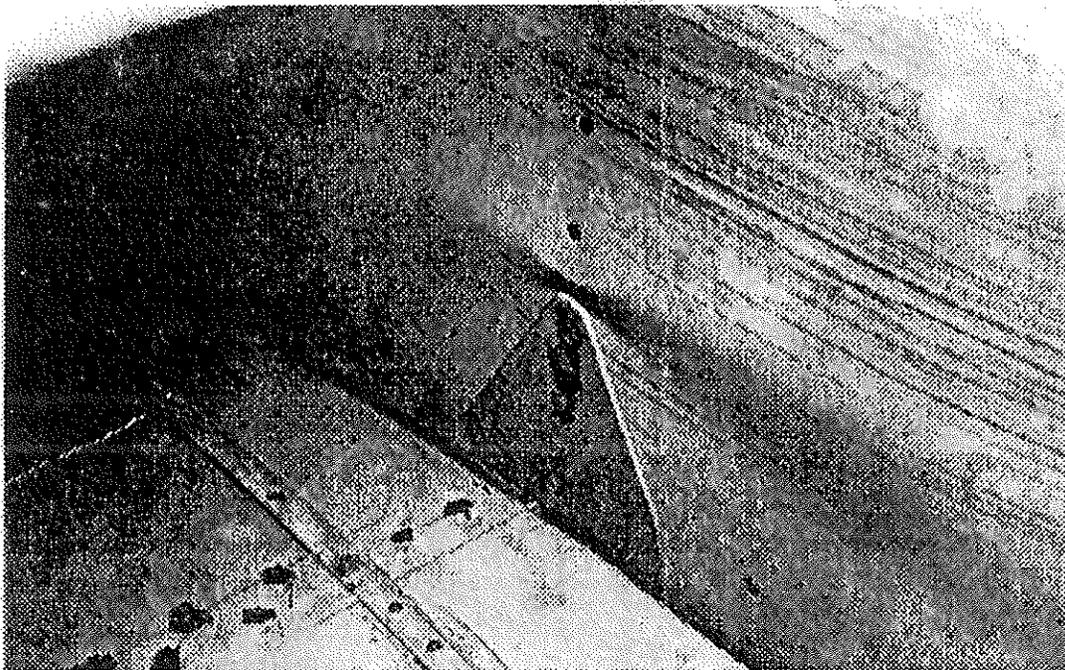
Results of an Over-G Event

Kim Nack

My aircraft was involved in an over-G flight and suffered some wrinkling that I would like to share with the T-18 community. Immediately after an early post Flight Test period flight with passenger, (26 hrs) I noticed some wrinkling of the outer wing panel skin at the upper main spar. I have pictures of this flight as it taxied out and as it taxied in. This shows that the wrinkle occurred during that flight. This wrinkle was greatest at the intersection of the nose ribs and the spar in the upper skin of the outer wing panels. Another wrinkle developed in the fuselage side skin (RH) just above the C-580-17 doubler. Also, the dash frame (603) collapsed with and at the skin wrinkle.

The aircraft weighed 1400 lbs (gross weight) and the recording G-meter in the dash, read 5.8 Gs. The wing skin was 2024-T4 of .025 thickness. The fuselage side skin was the same. My inboard wing was built with .032 thk 2024T3 material. The dash was 2024T3 .032 thk. Both failures were due to compressive loading. The pilot noticed no difference in aircraft handling. He and the passenger, who were wearing parachutes, were surprised to hear of the wrinkles after landing. I am repairing the wrinkled areas with doublers. The fuselage has doublers on the dash frame inside the fuselage and the wing has external straps at each rib.

The flight maneuver during which the wrinkles occurred is not easy to pin down but a loop is most likely the one.

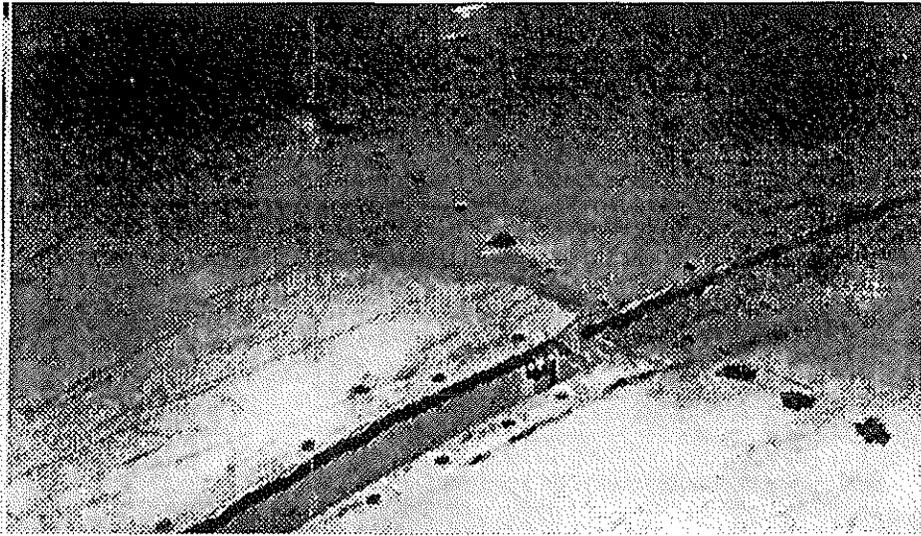


Right hand fuselage side

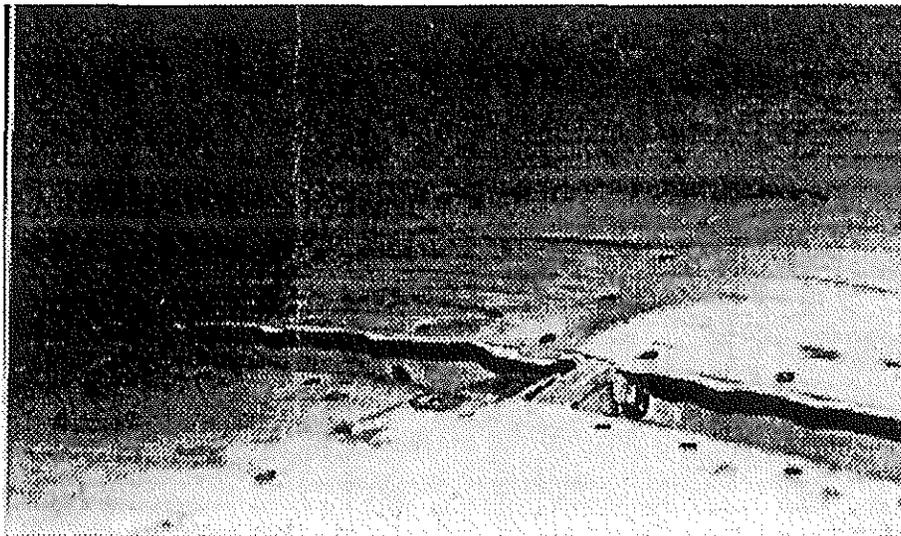
I hope this report is helpful. The aircraft is up to its intended structural capabilities and signs of distress occurred at the appropriate time and place.

My test pilot, who has 6000 hrs with 4000 hrs in light tailwheel type, is very pleased with the way the T-18 flies, especially the stall with the stall strips.

Editors Note: Before someone out there writes to say: No reason for pulling 5.8g's to do a loop in a Thorp. I'll say it for them! I had the opportunity to check out this test pilot in my Thorp. Although very experienced, he has a hearing problem!!! He doesn't listen! I discussed G loading and the limits on the Thorp with him. While flying my airplane he started to enter his own spin test program when I took the plane from him!!! What a cowboy! Thank you Kim for the willingness to share this problem and bad experience with us. Kim lives at 2940 Devonshir Dr. Florissant, MO. 63033



Right hand outer wing panel



Left hand outer wing panel

FOR SALE:

T-18C Airframe basically completed. Most everything from spinner to tailwheel. Has LDS airfoil. No radios. Engine is O-320 150 HP, conical mount. Has yellow tagged std. solid flanged crankshaft, yellow tagged cam shaft, all new rod and main bearings, new pistons and rings, cylinders 47 hours since chromed (per log book), wet vacuum pump, metal float and one piece venturi in carb. All fiberglass. Maybe 2 or 3 months to 1st flight. \$14,000 FIRM

I have for sale a complete set of S-18 drawings with builders manual by LDS. I bought these drawings from LDS and was issued S-18 serial number 18. The drawings are very clean and are completely unused in any way. \$180.

Barrett M. Kemp
(501)968 7318

FOR SALE:

For Sale: T-18 damaged on landing. Damage to left wing, hor. stabilator, aft fuselage and minor damage to landing gear. Will sell decertified. Prefer selling as whole assembly but will consider parting out. Jack Waxenfelter (501)967-3100

FOR SALE:

T-18 C with O-320 150 hp Lyc. Aircraft and engine has 450 hr. Aircraft won the Wright Brother's Award in 1995. IFR equipped. Price is \$44,000 For details and equipment list contact: Richard Snelson at 217/939-4215

(Editor's Note: As of 5/2/98 a sale is pending)

FOR SALE:

T-18 N252F

Built by Lyle Fleming, Lancaster, California, finished construction 1990

S-18 folding wing, Trailer, 237 hours total time, airframe and engine, No damage history, Lycoming O-360, fixed pitch metal prop, Ellison Throttle Body, 200 MPH at 75% power, Professional electrical wiring, Electric pitch and roll trim, IFR Panel, Two Radios, Loran, Transponder, White over blue paint, June Annual \$27000 or best offer

Contact: Paul Reukauf 43740 N. Lively Avenue Lancaster, CA 93536 805-258-3076 day 805-948-2478 evening paul.reukauf@dfrc.nasa.gov

FOR SALE:

Lee Skillman's Thorp S-18 project is for sale. He's got it priced at \$10k and it's all the parts and accessories that are supplied by Classic Sport Aircraft in their catalog. Fuselage is on the gear. He has canopy, windshield, dual brakes, and on and on. Someone is going to get a real deal when Lee sells this project. By the way Lee's work is outstanding, his first Thorp won a lot of awards including the Wright Brother's Award. Give Lee a call at (334) 633-3535 to discuss it.

Wanted

A conical engine mount for a T-18. I have a dynafocal to trade. Also: New/ or used single inlet Garrison fiberglass cowl. Contact: Matt Null 3330 Goat Fell, Ann Arbor, MI 48108

Electrical Workshop

The following electrical wiring information is from Charles A. Wagner from EAA Chapter 1000. Thank you very much Charles for letting us use it in the Thorp Newsletter.

CUTTING AND STRIPPING

- Note: Prices indicated generally represent the lowest price I know of for a tool of reasonable quality. Cheap tools will not produce good quality results.
- Cutting: Wire-cutting dikes, flush or semi-flush cut \$12 - Use for small wire up to about 14 gauge.
- Shearing type wire cutter \$20 - Use for large wire and coax cable.
- Caution: Never use wire cutters for anything other than soft copper or aluminum wire.
- Stripping: Pocket knife - Do not use!

Guillotine type stripper - This is the most popular type and is widely sold. Relatively inexpensive. I do not recommend them because of the high risk of nicking the wire.

Ideal Custom Stripmaster for Teflon \$120 - **Obscenely expensive!** This is my personal favorite. Easy to use and virtually impossible to nick wire. Although intended for Teflon, it works extremely well on all types of plastic insulation. To save money, I purchased a regular Stripmaster with guillotine blades (much cheaper) and a set of Custom Stripmaster replacement blades (they fit). The combination was about half the cost of a Custom Stripmaster. One blade set fits wires from 26 to 16 gauge, and the other blade set fits wires from 14 to 10 gauge. Both sets are extremely useful.

Round Cable Stripper \$41 - This works for coax cable and wire that is too large for the Custom Stripmaster. Requires much more care in its use. Must experiment to set blade depth.

- Strip Length: Other than not nicking the wire, this is the other critical part of stripping. The correct strip length must be carefully determined for each type of terminal you are using. In general, too little strip length will weaken the electrical connection, while too much strip length will reduce the strain relief needed to avoid fatigue failures.



GUILLOTINE
BLADES



SHOULDER SITS ON INSULATION O.D,
CUTTER BLADE NEVER TOUCHES WIRE

CUSTOM STRIPMASTER BLADES

CRIMPING

Insulated

Barrels: AMP Super Champ and similar tools \$10 - The best of these tools can make barely acceptable crimps if you use them properly. Some of these cheap tools have crimp cavities that are completely unacceptable.

Ideal CrimpMaster frame and die set \$60 - This is the least expensive good quality insulated barrel crimper I know of. AMP makes good tools also. The AMP ProCrimper is probably a very excellent tool, but is more expensive.

Open

Barrels: Molex pins and various other terminals use open barrels. Each barrel type has its own specific crimping tool. Use only open barrels that have both a conductor crimp and an insulation crimp for strain relief.

Battery
Cables

Del City crimping tool \$142 (1989 price) - This is the least expensive big wire tool I know of, and it crimps many sizes and types of very large wire terminals.

Hints

Make a sample crimp of each type of crimp you plan to do, and pull test it to destruction. See what fails. A good crimp will deform the wire inside the barrel, demonstrating the extreme pressure present. If the wire cleanly pulls out at only a modest force, the crimp is inadequate. If some strands break off and stay inside the barrel, you have a good crimp.

It is imperative that every crimp provide both an electrical crimp and an insulation crimp. The insulation crimp prevents vibration-induced fatigue failures. Do not use terminals that have an all-plastic "funnel entry" barrel. These barrels are not meant to crimp the insulation. If you do crimp the plastic barrel, there is no assurance that it will remain crimped for life. I recommend the AMP PIDG series of terminals. These have a copper sleeve inside the barrel that is meant to permanently grip the insulation. In my opinion, these are the best terminals available, and they do not cost much more than the cheap ones.

Battery cable lugs do not have anything to crimp the insulation. I recommend using shrink tubing overlapping the crimped barrel and the wire insulation, but this provides only minimal fatigue protection. For best results, support the cable to prevent excessive bending at the terminal.

MOLEX CONNECTORS

Comment: Molex connectors are about the cheapest connectors around. They are light in weight, reliable, and fairly easy to work with. Considering the major advantages in building in electrical disconnect points in your project, Molex connectors offer an unbeatable set of features.

The small .062 pins take wire from 18 to 24 AWG, and can carry 5 amps each. The large .093 pins take wire from 14 to 20 AWG (large wire version) or 18 to 22 AWG (small wire version). Large pins can carry up to 12 amps each, but you must derate the total capacity for larger connectors. You can carry 12 amps on two or three pins while carrying much less on the others.

Strip

Length: About .125" for small pins and about .165" for large pins.

Crimping: Molex 11-01-0008 \$154 for small pins and 11-01-0084 \$128 for large pins. These are the tools I use and recommend. Molex also offers low cost tools 11-01-0015 \$13 for small pins and 11-01-0014 \$13 for large pins. I have not used these tools, and cannot comment on their crimp quality. However, they are not ratcheting tools and the user must make sure a full crimp is completed each time. Also, two separate crimps must be done, one on the conductor and a second one on the insulation.

Insertion: Molex pins are simply pushed into the back end of the connector body. If the wire is stiff enough, you can push the pins in using the wire itself. For small wire, a small screwdriver can be used to push the pins in. Make sure the pins are in all the way so that their tangs engage the notches in the body.

Extraction: Molex 11-03-0002 \$10 for small pins and 11-03-0006 \$10 for large pins. A sleeve on the tool compresses the tangs and a spring-loaded pin inside pushes the pin out of the body. After a pin has been extracted, **very slightly** expand the tangs if it is going to be inserted again.

Hints: In your documentation, make sure you identify each circuit with the pin number in each connector. The connector bodies have pin numbers molded in. Also identify each connector. I use J-numbers (i.e. connectors J1, J2, etc.) for both the male and female halves, so J2 mates with J2, etc.

Remember, female is the hot sex. When a connector pair is disconnected, the female pins (which are normally used in the "receptacle" bodies) should be on the hot, or electrically live side. They are less likely to short out.

SOLDERING

- Where? Certain electrical connectors (radio, instrument, etc.)
 Printed circuit boards (if you have any)
 Certain switches, mostly small ones
 Potentiometers
 The center pin on BNC connectors
 Certain wire splices
- Wire: Do not solder PVC wire. The insulation melts. Automotive wire type GPT, irradiated PVC, Tefzel, and Teflon can all be readily soldered.
- Tools: Soldering iron. The best type is thermostatically controlled, but, as usual, is the most expensive. I have taken a low cost iron that gets too hot and mated it to a lamp dimmer to make a poor man's controlled temperature iron. Make sure the tips are iron plated. Unplated tips don't last long.
- Wet sponge, or at least a wire brush. This is used to clean the tip, which needs cleaning very frequently.
- A soldering gun or very large iron is needed for heavier jobs, such as soldering a tray mount RF antenna connector. The whole body has to be heated to solder on the shield and to seal the cover.
- Solder: Use only electrical grade solder, with rosin core. I like to use .031 diameter solder made of 63% tin and 37% lead (known as 63/37). This formulation solidifies instantly when cooling. However, 60/40 is also quite common and works well.
- Tinning: Always tin the wire after stripping and before mating it to the device it will be soldered to.
- Solder cups: Connectors with solder cups should have their cups partially filled with solder before the wire is inserted. Then by simply heating the cup, you can plug the tinned wire in without adding any more solder.
- Hints: Always make sure that whatever you are about to solder is very clean. Use a mild abrasive such as ultra-fine Scotchbrite to clean oxidized surfaces.
- Always wet the soldering iron tip with a small blob of solder before attempting to heat anything. This provides a heat transfer path.
- Carefully inspect all work for proper wetting. Cold solder joints are bad.

SHRINK TUBING

Types: The most common types of shrink tubing are PVC and irradiation crosslinked polyolefin. While PVC is cheaper, it shrinks about 20% longitudinally (that's a lot!), and has a lower operating temperature, 105°C. The much better polyolefin shrink tubing shrinks only about 5% longitudinally, and has a 135°C operating temperature.

There are many specialized types of shrink tubing also available, such as high temperature Teflon, extra heavy wall, extra high shrink ratio up to 4:1 shrink tubing with a meltable adhesive inside for sealing, etc. etc. I use shrink tubing with a meltable adhesive for sealing battery cable crimp connections. The adhesive seal keeps corrosion out of the crimp joint.

Sizes: Shrink tubing is available in a wide range of diameters ranging from 3/64" 2" inside diameter, unshrunk. When heated, it will shrink to 50% of its unshrunk diameter unless restrained by whatever is inside it.

Uses:

1. Insulating otherwise uninsulated electrical terminals.
2. Insulating solder connections on connectors.
3. Insulating inline splices.
4. Encapsulating isolated electrical devices such as resistors and diodes that may be installed in wire bundles.
5. Protective wrap around wire bundles.
6. Used as identification sleeve on wire.

Tool: Heat gun \$58 - produces the hot air required to shrink the tubing. Polyolefin tubing shrinks at 121°C (250°F), and these heat guns provide air over 500°F to quickly heat it to shrink temperature. Hair dryers won't work.

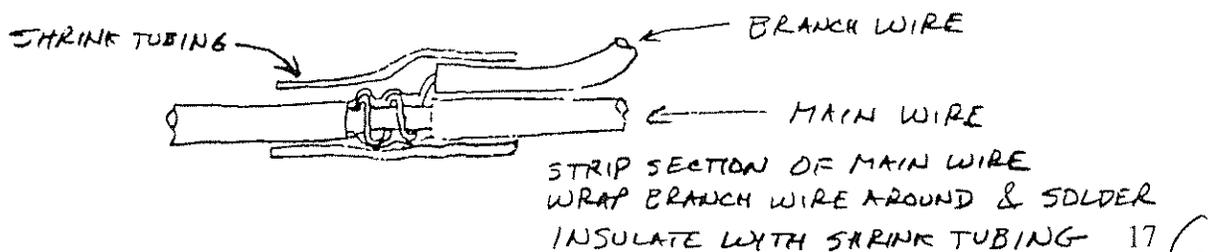
Hints: Don't forget to slide your shrink tubing onto your wire before soldering it on, if you plan to insulate the joint.

The heat gun can seriously damage many things with the high temperature air it delivers. Use caution, and heat just enough to shrink the tubing.

Do not use heat shrink tubing on PVC wire. The insulation melts easily.

SPLICING AND POWER SIGNAL DISTRIBUTION

- Intro: In any wiring system, it is necessary to distribute certain signals, power leads, and ground leads to multiple devices. Thus there is a need for a way to connect multiple wires together. Some possibilities are:
- T-strips I do not use terminal strips because they are bulky, uninsulated, heavy, and a royal pain to work with. Besides having to bolt them down, I also have to deal with loose hardware during installation and maintenance.
- Splices Crimp splices can be used to add wires by crimping more than one wire into each end. I do not use them because they add unnecessary bulk to my wire bundles.
- Bus bars I use these only in specialized circumstances for power distribution. When needed, I fabricate one to fit the application.
- Solder In-bundle connections can be made by soldering on one or more branch wires to a main line and insulating the joints with shrink tubing. I use these a lot, because the resulting connection is extremely compact and lightweight, measuring and weighing little more than the basic wire itself. *SEE SKETCH BELOW.*
- Crimp Crimping multiple wires into a single crimp barrel is acceptable, provided that the total of all wires is equivalent to an acceptable gauge for the barrel. It is also very necessary to make sure that all wires are fully inserted into the barrel before crimping. Common examples are two #22 wires into a red (22-18) barrel, and two #18 wires into a blue (16-14) barrel. This type of termination is particularly useful for forming daisy chains, such as supplying power to a group of circuit breakers or instrument lights. I recommend this type of distribution.
- High Current When the current required in a circuit exceeds the rating of a conducting element, say a connector pin, the simple solution is to double up and use two wires or two pins in parallel to carry the current. If both halves of the circuit are built up identically, with the same wire gauge, same length, same pin type, etc., the resistance of each half is the same, forcing the current to divide itself equally between the two halves. This is a time-honored way to get a lot of current from one place to another.



BUNDLING WIRES

- Intro** When multiple conductors follow the same path, it is desirable to bundle them together for neatness, compactness, and to add stiffness. A bundle of wires vibrates much less than individual wires, and is more reliable. An external wrap also adds abrasion resistance to the wire bundle. This discussion covers several ways to do this.
- Cable** Factory manufactured multiple-conductor round cable with a jacket is perhaps the very best way to handle multiple conductors. Unfortunately, this approach is not often practical, because there are many different numbers of conductors in the various cables, mixtures of various wire gauges, combinations of configurations (shielded, twisted pairs, etc.), and other problems making this solution usable in only a limited number of cases.
- Sleeving** Vinyl sleeving is available in a variety of diameters, and makes an excellent jacket for wire bundles. I use it wherever I can. The only problem is that sleeving with an inside diameter over .263" can only be purchased in 100 ft spools. Cost is typically about \$30 per spool, so I cannot afford to stock too many sizes.
- Shrink** Shrink tubing can be used as a jacket for wire bundles, but it has certain disadvantages. One, the bundle becomes very stiff, perhaps too stiff. Two, shrink tubing is expensive on a per-foot basis, say 75¢ to \$1.00 per foot for 4-foot lengths at 3/8" to 1 2" diameter. Three, continuous lengths over 4 feet require purchasing extremely large spools at very high prices. Four, shrinking the tubing could damage the wire inside if it is PVC.
- On the other hand, in tough environments like under a cowling, shrink tubing works very well. Stiffness is a plus. If you only use Tefzel or Teflon wire (I think you should), shrinking the tubing cannot possibly hurt the wire. The safe operating temperature of polyolefin shrink tubing is 135°C (275°F) which is probably high enough for most locations under the cowling. The 4-foot length limit should cover almost any under-the-cowling run.
- Tape** Vinyl electrical tape works well as a bundling device behind the panel. It permits breakouts of branch cables, adapts to any size or shape of cable, and is low in cost. But it takes a lot of time to wrap long bundles with it. And it does not provide much in the way of abrasion resistance. I use tape in selected locations.

Others I do not use lacing tape because it provides no additional protection for the wire bundle. Besides, I don't know how to tie it and see no need to learn how.

I do not use expandable braid because it has to be clamped at the ends to keep it from sliding around and bunching up. Besides, it is hard to pull it thru a grommet.

I do not use spiral wrap because it does not fully cover the cable, adds bulk, cannot easily be fed thru grommets, and does not please my aesthetic senses.

I do not use split loom tubing because it is too stiff, too bulky, and never stays together well enough to suit me. Also, it is not available in very small sizes.

The above electrical wiring information is from Charles A. Wagner from EAA Chapter 1000. Thank you very much Charles for letting us use it in the Thorp Newsletter.

Hi Rich:

I went to an electrical workshop last Saturday that was expertly hosted by Charley Wagner from EAA Chapter 1,000. Charley is a retired NASA Electrical Technician, presently building a RV-6A. Charley is a very practical homebuilder electrician and uses materials and techniques in keeping with our kind of airplanes. He uses Molex plugs and receptacles in those places requiring a "cannon" plug, for example. He has summarized several subjects and provided many good pages of advice and data for presentation in the workshop. I feel sure you will want to use a lot of it. He gave me permission to use the material in our T-18 Mutual Aid Society Newsletter. Please give him credit for whatever you publish. By the way you can get an excellent electrical catalogue by calling Mouser Electronics at (800)346-6873 or going to www.mouser.com on the internet.

Sincerely,
Lyle Trusty

T-18/S-18 Newsletter
Richard Snelson
Route 3, Box 295
Clinton, IL 61727
Phone: (217) 935-4215
email: rsnelson@dave-world.net



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