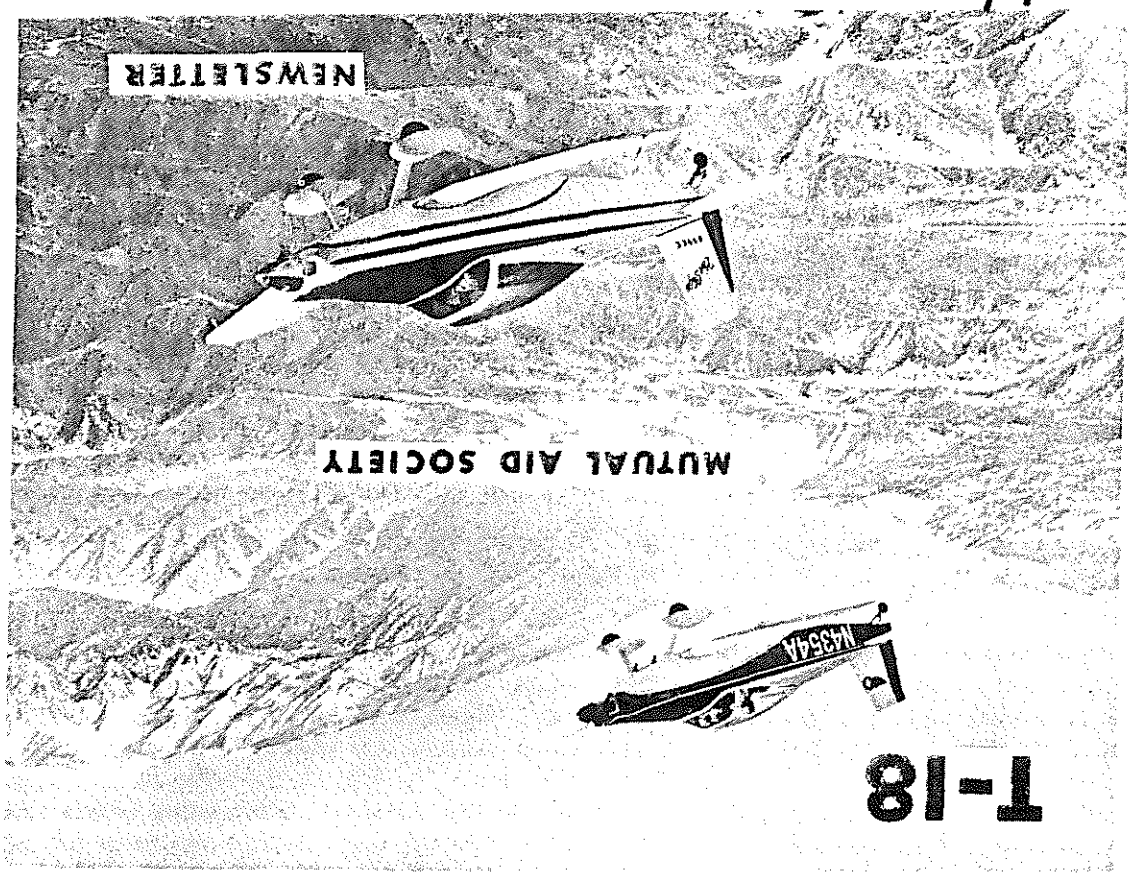
49



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Chris Fast
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90272

Comment on your articles
See you at Reno '80

T-18 NEWSLETTER #49 Dec. '79

DICK CAVIN 10529 SOMERTON DALLAS, TEXAS 75229

ADVISORY: Altho' this newsletter is being written and printed in Dec. '79 we'll delay mailing until Jan. '80 in order that our 3rd class mailings don't get lost in the holiday mail rush.

MISSING NEWSLETTERS: A number of you write that you didn't get one or more of the newsletters. No problem tho' now. Since #45 I've been printing about 200 extra copies each time, so just let me know if you need one. If you're in a hurry for it send a couple of 15¢ stamps along for 1st class postage- or if you can wait until next mailing it'll only add 8¢ to our postage bill. We'll have to expect our P.O. Dep't to lose some of the N.L.s each month, I suppose .

ADDRESS CHANGE: If you move and don't send me the new address you won't get your N.L., as the P.O. doesn't forward 3rd class mail.

CHRIS FAST: One of our most experienced and prolific builders, Chris has been a source of several very excellent, detailed building procedures in recent months. Last month I wrote of his final turn-down by the FAA on his medical and the deep blue discouragement that made him think of selling his airplane. Today I received a letter from Chris in which he said that he had re-considered that move and instead had sold a 1/3rd interest in his T-18 to an old friend, Frank Parkison, who had flown Chris' airplane some 200 hours in past years. He's now looking for some other qualified person to sell the other 1/3rd to, so this arrangement should soften the blow somewhat, especially since Chris admits that he gets as much fun out of building as flying. Chris is retired, so he can take on whatever amount of T-18 building as suits his fancy. Some very lucky Southern Cal gent is going to come up with a chance to own a part of a really superb T-18C one of these days.

In his letter Chris sent a detailed step-by-step procedure for a jigless rudder assembly, using the pre-punched material kit from Ken Knowles. Ken's pre-punched parts are made from templates which were made from John Thorp's master tooling. Chris has built six of them and he makes it a point to state that they are not easy. To that I would add "Amen!". In my opinion, the rudder is the most difficult part to build on the T-18. The fin used to be a toughy, but it's a lead pipe cinch to do with Ken's matched hole tooling layout of the skin and other parts. It's not really not hard to do with a modified matched hole technique (which we'll cover at a later date).

I thought Chris' rudder assembly procedure would be of immediate interest to many of you, so that I'm running it this month, ahead of material sent in previously. I think most of you will agree, too.

ASSEMBLY PROCEDURES FOR #569 RUDDER, USING MATERIAL KIT FROM KEN KNOWLES:

(1). Assemble 587 & 588 beams, using #40 clecos. Check alignment as you go and before drilling each #40 hole. Do not take matched hole tooling points for granted! Use them as a guide, keeping final alignment in mind at all times. This statement goes for the entire rudder assembly and is not intended as a put-down on the matched hole tooling concept.

(2). Assemble 568 rib to 587 beam with #40 clecos
(3). Assemble 585 rib to 587 beam in inverted position for easier riveting
(4). Assemble 586 & 587 ribs to 588 beam, using #40 clecos.
(5). Rivet the -5, -6 -7, -8, & -9 stiffeners to the -1 and -2 formed skins on your work bench over a small, flat steel block and drive the rivets against it. (See n.l. #46, pg. 6 for description of this technique) Make sure that stiffener flanges are opposite and will intermesh, so the -1 and -2 skins will mate.

Hi Chris! Hear you dealt the T-18 to Tennessee. Sure appreciate your article. Anything else (like building plans or whatever) would be great. Had lots of good

(6). Lay the completed -1 skin on the 587/588 beam assembly & check alignment of the #40 holes in the skin (peek thru) with the punch marks on the beam. If satisfactory, drill out every other #40 hole and cleco the skin to the beam.
(7). Assemble the -2 skin as in item 6 above.
(8). Punch out and cleco enough #40 holes in the trailing edge to assure that final alignment will be possible.
(9). Mark cutout for tail light clamshells on -1 and -2 skins, using template furnished with material kit.
(10). If all alignment is satisfactory, drill out all holes (except trailing edge) with a 1/8" drill. Do not use a #30 drill for this! Install 1/8" clecos as you go, in order to hold alignment.
(11). Disassemble, de-burr all holes and dimple where applicable (dimpling will stretch most holes of 1/8" dia. to almost a #30 size, so now you know why he said to use a 1/8 drill in 10 above....eh) The undimpled holes will require drilling with a #30 drill at the time of riveting.
(12). Make the tail light cutout in -1 and -2 skins and rivet in the clamshells for the light. Some hand forming may be necessary to get the clamshells to fit the light bracket furnished.
(13). Drill holes for the 2 tail light wires thru the 585 & 586 ribs, the 588 beam and install rubber grommets.
(14). Apply primer to all parts as necessary.
(15). Re-assemble the beam assembly to the ribs with 1/8" clecos and rivet, checking alignment as you go.
(16). Install -1 skin with 1/8" clecos and rivet with AN rivets.
(17). Install tail light wires.
(18). Install -2 skin and as much as can be conveniently done, use AN rivets. Finish the remaining fastenings with stainless or monel rivets (Pops). (Note: this will be the upper beam and some of the rib holes). Do not attempt to install an AN rivet where it cannot be properly bucked. A good Pop rivet is much better in such cases.
(19). Fit the -3 strips in the trailing edge above and below the tail light, using #40 clecos in every other hole.
(20). To get final trailing edge alignment apply 3/4 x 3/4 or 1 x 1 angles (drilled to match the hole pattern in the T.E.) with 2" holes, back to back on the upper and lower trailing edges. Hold these in place with a C clamp at every 3rd hole or so.
(21). Sight the T.E. and you will probably notice that the lower T.E. is slightly offset to the upper T.E. To correct this, remove all clecos (They are #40 at this point). Loosen the clamps Just enough to allow the two T.E.s to be moved in alignment by hand. Re-tighten the clamps. Now drill out all holes to #30 and install soft aluminum rivets (round head) with a hand squeezer, using two round head sets. This isn't a must, but makes for a nicer looking upset head.
(22). Remove the tooling angles and clamps.
(23). Step back and admire your work.

Well, Chris, that's a superb report. You really can't know the extent of the gratitude of who knows how many builders for that detailed and professional report, but I'll say that you have made a good many T-18 builders' life a whole lot easier and your efforts are truly appreciated. Chris' address is 507 Almar Ave., Pacific Palisades, CA, 90272, in case you'd like to thank him in person.

In the next issue I'll have an illustration of still another method of rudder assembly. This method requires the use of a jig and was used before Ken Knowles started his T-18 airplane store. I'll have to wait until I get a local draftsman friend to re-draw my scribbles into a presentable drawing.

MORE ON RUDDER: When talking to Lu Sunderland the other day I asked him if he remembered how he built his. He did, and said that he had pop riveted his entire rudder (with the exception of the trailing edge rivets) in only 30 minutes! He did remember that he countersunk both sides of the .040 filler strip and dimpled both skins. As the dimples touched each other slightly, he lightly filed the inside of both dimples, to prevent stretching the skin more on one side than the other, he alternated the rivet direction on every other rivet. He used a flush head rivet set and bucking bar and the rivets came out flush on both sides. In several hundred hours flying he's had no loose rivets, and was quite pleased with the appearance. If you like the idea do a little practicing on some scrap first in order to perfect the technique. Be especially careful not to over-countersink, as it would be very easy to enlarge the hole in .040 .

"HOMEBUILT AIRCRAFT" MAGAZINE continues to give the T-18 more long-overdue and most excellent coverage in their Feb. '80 issue. They devote 4½ pages to Lu's article entitled, "How to build a T-18 in Six Months". It's a well written and factual account of two T-18s that were built in only six months---and both were by first time aircraft builders! Even more remarkable, the first one was built 'way back there when the ink was scarcely dry on the complete set of plans. The other was done later by a man holding down a regular 40 hr./wk job and was built in spare time! You that are just starting to build, take heart, laddie. "Mount Everest" can be climbed. It has been done and you, too, can do it, so press on. Move out. Get in motion. Understand one thing, tho'. You must COMMIT yourself. A definite amount ofdedication is required. Expect adversity and numerous failures along the way. I've known builders that have built 3 or even 4 parts (i.e. the rudder) before they built one to pass muster, so expect a certain amount and don't go off in a blue funk and sulk, telling yourself that you just aren't cut out to build an airplane.

One builder I know told me that on his coffee breaks, etc. he mentally rehearsed each and every step to make in advance. He then wrote down those steps in order. Then that night he re-checked his list before beginning work. He always had an alternate project to accomplish in the event that some stumbling block showed up at the last moment. He nearly always had additional material on hand to re-make a part if he spoiled one.

Let me quote something someone sent me recently: "Press on! Nothing in the world can take the place of PERSISTENCE. Talent can not; nothing is more common than unsuccessful men with talent. Genius will not. Unrewarded genius is almost a proverb. Education will not. The world is full of educated derelicts. PERSISTENCE and DETERMINATION alone are omnipotent!

To that I might add,"Don't stop! Keep up the momentum!" Building an airplane is a whole lot like riding water skis; If you stop,you'll sink! Keep it going, even if your progress is only one tiny part of an assebly. Keep looking down at your next step ahead, not up at the summit of "Mt. Eversest".

#705 FLIES! Richard Manley, 3401 Sunnyside, Visalia, CA, 93277, called the other day when I was gone and told my wife, Lyndell, that he had just flown his T-18C (folding wing) that day. She didn't copy down any details except that it flewjust fine and he'd send stats later. Congratulations, Richard. We'll be looking forward to all those details as soon as that ear-to-ear grin gets under control.

New Format: As I mentioned last month, our new format will give us twice the copy space at the same weight. It also cuts our paper costs drastically, no small matter

these days of escalating costs. Paper is on allocation, so we are lucky to get an adequate amount to do our N.L.s. More importantly, we'll now have room to publish more in-flight reports and statistics of individual airplanes each issue. I'd like to encourage all of you with airplanes flying, or almost flying, to send in complete listing of weight, equipment, power, prop, modifications if any, performance, building time, details of yourself, pilot or building experience, what you do for a living, etc. Perhaps you may not think that your statistics are very interesting, but when added to all the others compiled, there's a gold mine of information. Now follows an exceptionally good example of that type of report:

BILL COX, 419 WILLOW LANE, BAYTOWN, TEX., 77520 writes: "I've been intending to write this letter for some time. I am the builder of 2 T-18s, #181 and #141. #181 flew in 1972 and #141 flew April 1st, 1979.

N4WC (#181) was strictly by the plans as they stood in 1970. It is powered by a O-290-D, 135 hp Lycoming and cruises 160+. It is now owned by Roy Medan, of Santa Monica, CA.

N3WC (#141) has the folding wing and longer gear, as sold by Merrill W. Jenkins. It is powered by an O-360 AID, 180 hp, with a PS5C carburetor and a Hartzell c/s prop. It has an empty weight of 923# without radios and upholstery.

The stall shows no tendency to drop a wing, but there is no pre-stall warning. 75% power cruise is in the 190 mph range and will increase some when a few more items are complete.

The only thing unusual are short gear extensions. When the weight and balance was done the battery was moved back to compensate for the constant speed prop. Both the forward and rearward CG were well within limits, but when taxi testing was begun the plane showed a tendency to nose up on soft ground. The CG was again checked and was still found to be okay. A check of the wheel to CG relationship showed them to be too close. The cure was to insert a 1/2" thick 4130 steel plate between the axle and gear that moves the gear forward by 1.4" .

(Ed. note: This letter was written before OSH and at OSH Bill drew a little sketch of the gear extension. It is very similar to those seen on many Cessna 140s. It has 4 holes in it. The rear pair of holes in the plate index with the 2 forward holes on the landing gear boss. The axle bolts to the 4 holes in the plate, of course, with 1/2" longer bolts required in the rear pair. Bill told me that he was very pleased with the relocation of the wheel, which puts it back in the original (short gear) location. If any of you with big engines and c/s props have had the same problem that Bill had before installing extensions, I'd very much like to hear of it. I had heard that making a run-up while pointed cross-wind in a strong wind had been the cause of some nicked props, as the downwind side of the stabilator was blanked out and it then lacked the power to hold the tail down in that condition. Any comments?)

Continuing now with Bill's letter: "I now have well over 300 hours in 3 different T-18s and it is the most delightful small airplane I've flown. #141 has the dynafocal engine mount and this is truly the way to go I think. Being a small sheet metal airplane the occupants get a full dose of the vibration. The dynafocal mount seems to reduce the vibration considerably. I believe a crossover exhaust quiets the engine some, too. Maybe it only smooths the exhausts pulses, but T-18s with crossover systems do seem to be quieter. I bought 2 sets of stainless steel exhaust stacks at OSH for $25 and a set of ball joints from Lu Sunderland. I cut them up and built a close fitting crossover. My heat muff encircles both pipes at the front of the sump. The firewall is "slotted" at the bottom (2 places) and the stacks come out close to parallel with the airstream."

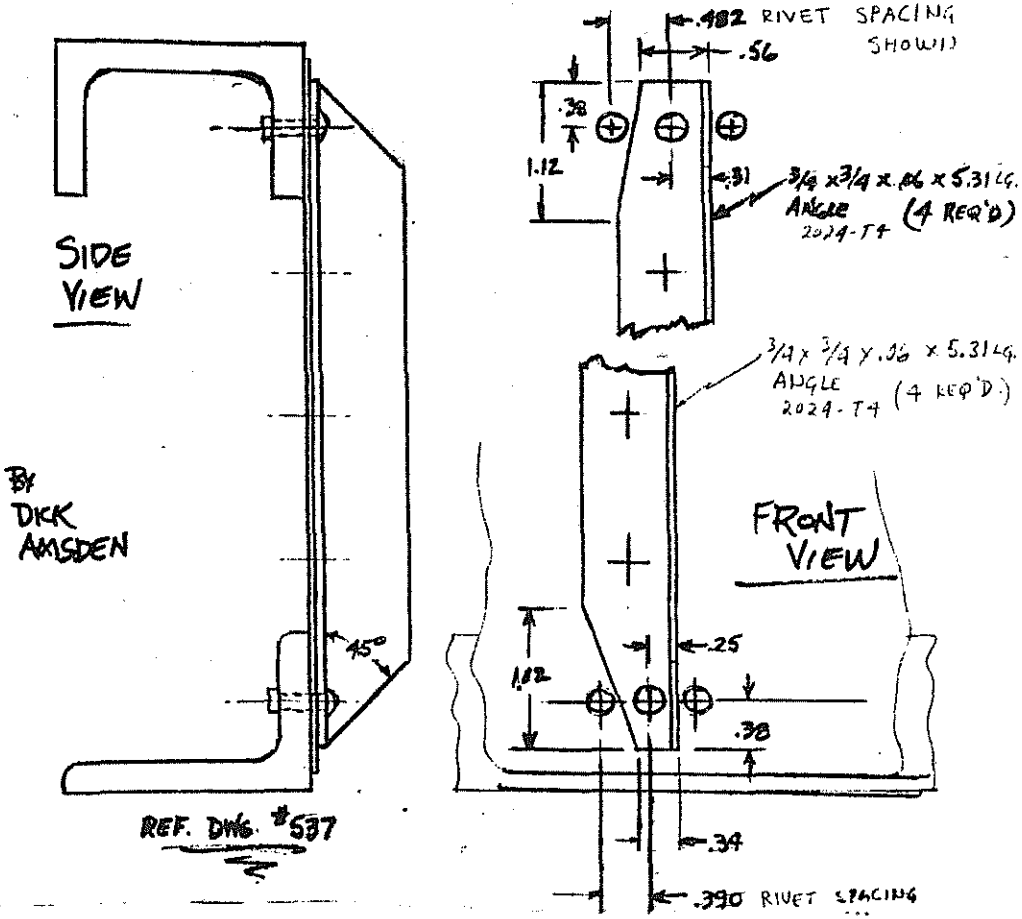
Thanks, Bill, for that info and also thanks for consulting the T-18 forum at the Southwest Regional Fly-in at Kerrville this year. Sorry to take so long to print your letter.

In the paragraph just prior to Bill's letter I should have added the complete weight and balance information, battery location, pitot and static port location, etc., to the list of desired information.

Perhaps it's superflous, but would any of you like a review of proper wt. & balance procedure? If so, let me know and if there's sufficient response we'll publish a how-to-do.

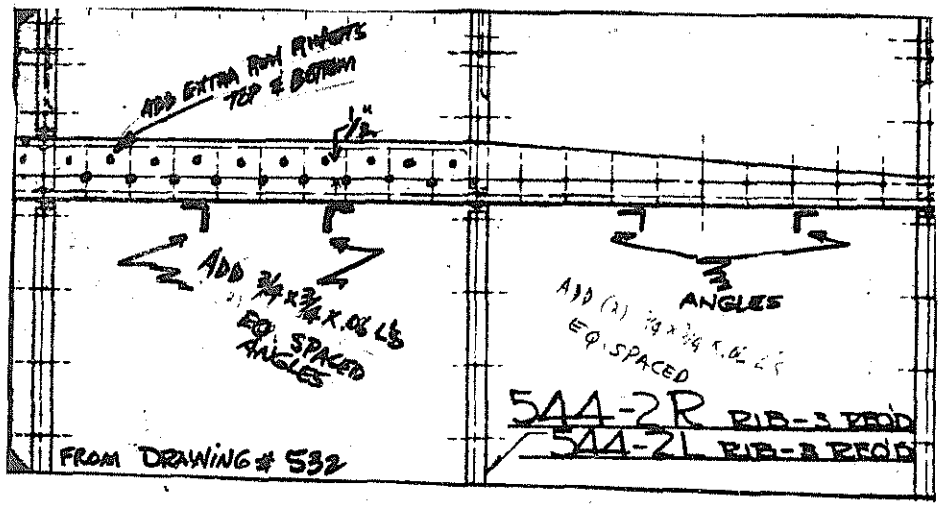
SPAR WEB MOD, ST'D T-18: (REFER TO N.L. #46, pg. 4 for explanation).
Dick Amsden sent in the following drawing of stiffeners to be added to the center wing beam web. Four angles on each side are added. Two between B.L. 21.0 and B.L. 35.25 and two between B.L. 35.25 and B.L. 50.25

We repeat, this is NOT a mandatory mod, but is suggested if convenient to do so while under construction. The heavier airplanes, with big engines are more likely to develop permanent set in the web- from excessive loads, of course.



Thank you, Dick, for the drawing and the letter from Mr. Thorp confirming it.

Dick also included an inset from wing assembly drawing # 532, which showed the spacing and location of the extra row of rivets in the top and bottom of the main beam caps. This is a service dictated mod of several years standing. Some airplanes developed loose rivets in that area, so it was recommended that the center wing skin thickness be changed to .032 and the staggered extra row of rivets added as per the drawing.



Last issue, #48, I made an inaccurate statement when I said Mr. Thorp had "approved" the changes on the T-18C wing as described. Actually, John Thorp gives no "approval" on any modification that he does not personally issue and even then on the standard T-18 only. Unofficially, he might discuss and examine the drawings on the convertible wing for the T-18 and the wide body fuselage and give a private opinion on them, but he legally disclaims any and all changes that he hasn't officially endorsed. A few years back he went thru a traumatic experience with an unbelievable lawsuit that was filed as a result of a spin-in accident, so understandably he is gun shy.

Last issue an error got in somewhere between the writing and printing of the Correction and Mod Sheet. Please make this correction:

On the T-18C wing (only) the .85 in. shortening of the aileron push-pull tube # is correct, but the moving of the bellcrank back by .1 inch is incorrect. It should have read, "Move the bellcrank pivot point aft by .25 in. Also, the moving of the bolt hole in the aileron mast forward by .6 in. is correct. The sum of .25 and .6 agrees with the .85 in. shortening of the aileron actuator tube. The .1 in. figure mentioned was the approxim te interference dimension with the rear spar.

At OSH '79 I made a few brief notes on some of the T-18s present. In the main I asked how their T-18 varied from standard, what was unusual, what interesting features were on it, etc. I'll reproduce my brief notes on some of them at this time

time and also in later N.L.s. In the meantime I'll try to get more details and stats to fill in the blanks. Here's one:

N13P, s/n 460, Ken Post, 2627 Lawndale Drive, Rapid City, SD, 57701. Ken's little tip concerned the trimming and drilling of canopies. He turned the teeth on the bandsaw backward so that they couldn't grab and he said it worked beautifully. To bore the holes he used a router and to seal minute cracks he used a soldering iron to surface melt the area. He used Rivnuts in the canopy frame and rubber grommets only... He mounted his dash panel 4" aft of the dash frame and used 8 shock units to suspend it.....used 1" plastic foam all around the cockpit ....except above W.L. 42, where he only used glued on upholstery for extra room at shoulder level...has no forward tunnel....used dual Cessna pedals and brakes ...has 180 hp Lycoming and constant speed prop...when weighed in the level flight position there was 32.5 lbs. on the tail.

LEADING EDGE STRAKELETS: Those of you that closely followed T-18 events back in the so-called pin feather days well remember Bill Johnson, T-18 builder and an engineer for Boeing in Seattle and an indefatigable experimenter. His T-18 was the 12th to fly. It was also the first to fly with the now-common longer gear and was also the first to use the one piece bubble canopy, which is also the present day standard and was greatly admired at Rockford in '67 and '69. His activities were well reported in our early issues of the T-18 N.L.s. You may also recall the story in the June '74 issue of Sport Aviation that gave an account of a major modification to the T-18 in order to adapt a retractable gear to it. It would cruise 203 mph TAS and would go redline in a very shallow descent at low power. He still has N2287C and still continues to experiment. These days the main thrust of his efforts is directed towards improving the low end of the speed spectrum. He has contributed the following article that I'm sure you'll find both thought provoking and enjoyable:

"THE ADVANTAGES OF LEADING EDGE STRAKELETS ON THE T-18", by Bill Johnson, 913 Cherry Hill St., Kent, WA, 98031

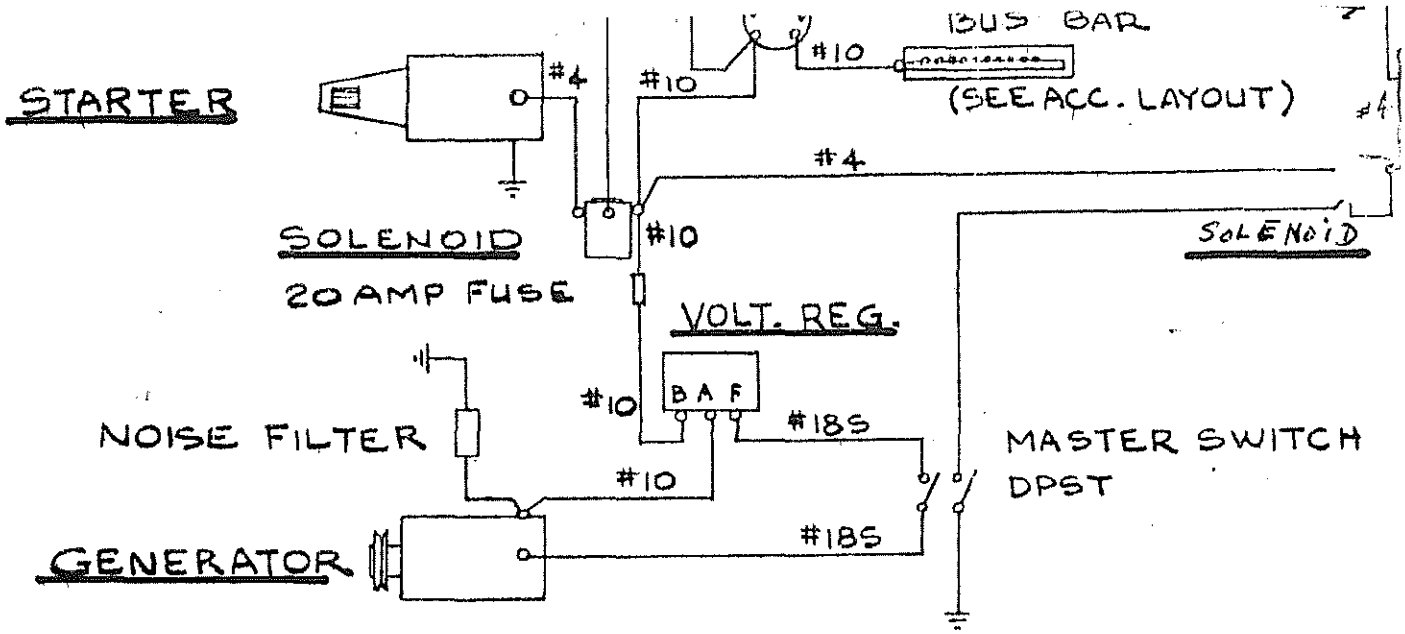
The addition of leading edge strakelets to the T-18 wing root can be beneficial if done correctly. Done incorrectly, the effect is pleasing visually, but has little or no effect on performance. The possible benefits are as follows:

1. Improved stall warning
2. Improved stall characteristics
3. Reduced wing/intersection (fuselage) drag

The use of simple stall strips can also accomplish the first two benefits, but cannot improve the third.

Extending the first (root) rib about 5" and adding a cuff to the second rib, with a sharper leading edge radius will give a more uniform straight ahead stall. The first cuff I tried was built this way. Stall warning was not improved over the straight wing.

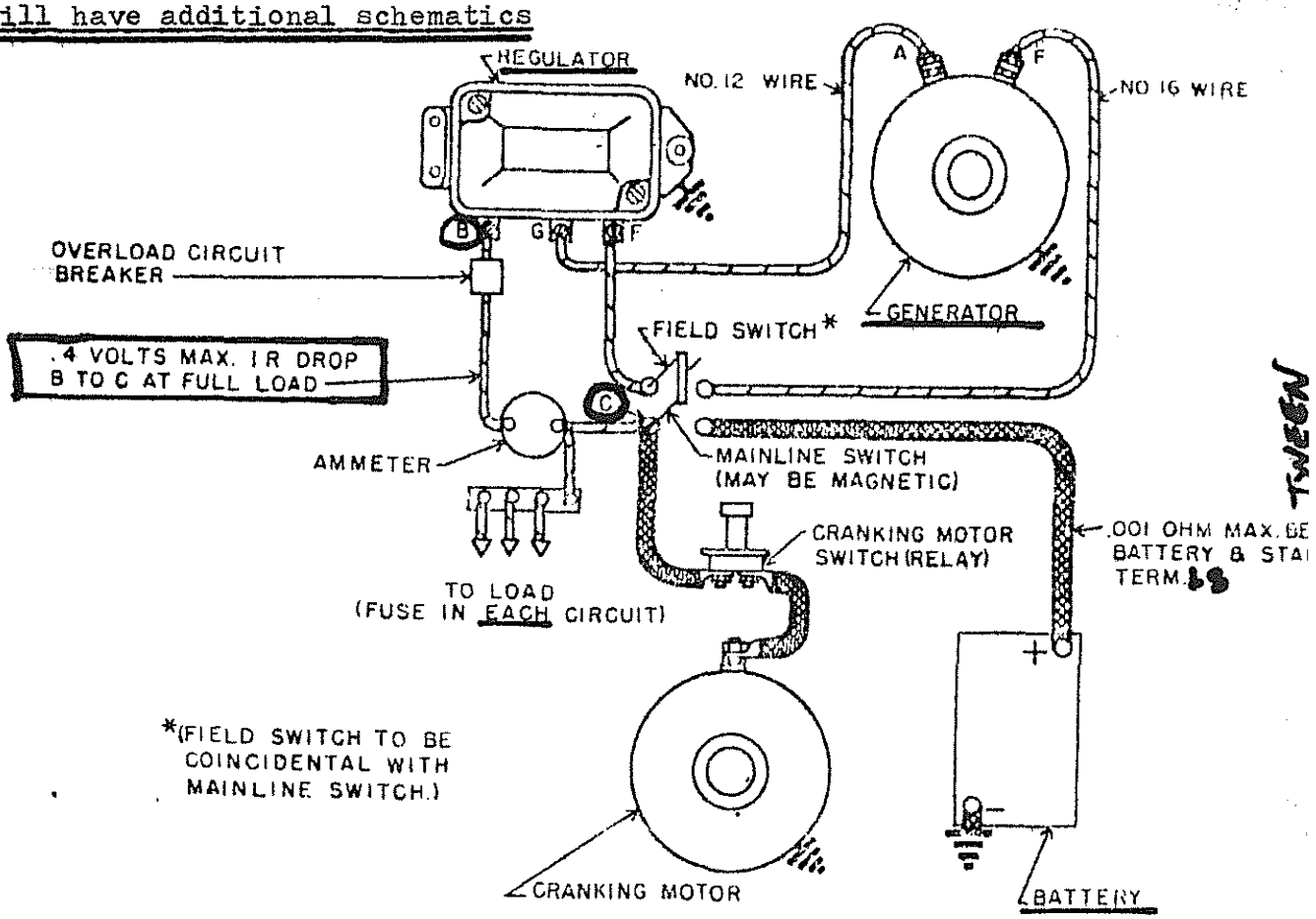
Turning the first extended rib upside down works much better. A buffet is induced 6-8 mph above stall and this provides excellent stall warning. An added benefit is a significant reduction in cruise drag. The drag reduction comes from the fact that the fuselage causes a reduction in local angle of attack on a straight wing (low). The wing has to fly at a higher angle of attack to produce the required lift, due to less lift near the wing root. This of course causes more drag. When the wing root is twisted UP the effect is to improve the lift distribution near the fuselage and give less overall drag. The forward sweep of the strakelet increases the Reynolds number and reduces the % thickness, both effects help reduce the drag coefficient.



TYPICAL LIGHTPLANE ELECTRICAL SYSTEM: CONTRIBUTED BY LOYD TOLL

PRIMARY ELECTRICAL CIRCUIT
(STARTER, GENERATOR & VOLT. REG.)

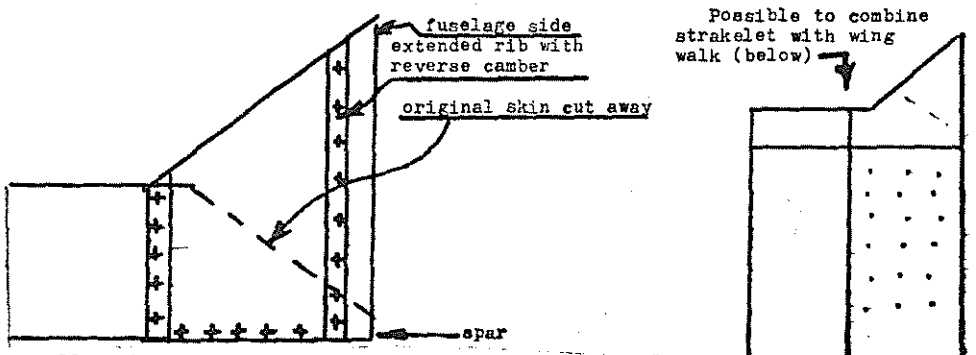
N.L. #50 will have additional schematics



Typical Single Engine Generator and Starting Wiring Diagram

With the short center section, as used on the folding wing, the strakelets can extend to the wing break.

In the two sketches below, note in the right hand one that it's also possible to combine the strakelet with the wing walk doubler and avoid the butt seam over the front spar.



Bill follows on with another article here below:

"Flight Test of The HBJ2 Airfoil" :

The June 1974 issue of Sport Aviaition describes the performance acheived with a 63-212 airfoil and retractable landing gear. This airfoil was found to be unpredictable at low speeds. Turbulence conditions could raise the stall up to 10 mph. As a result, I developed the revised airfoil described in the Januaury '79 issue of the T-18 Newsletter. I call this airfoil the HBJ2 (Home built Johnson #2). The following is an account of flight test characteristics:

Takeoff: The airplane lifts off in ground effect at about 52 mph IAS. This makes me nervous, so I hold it on until reaching 60 mph. After lift-off I accelerate to 80 and climb out at that speed.

Straight Ahead Stalls:

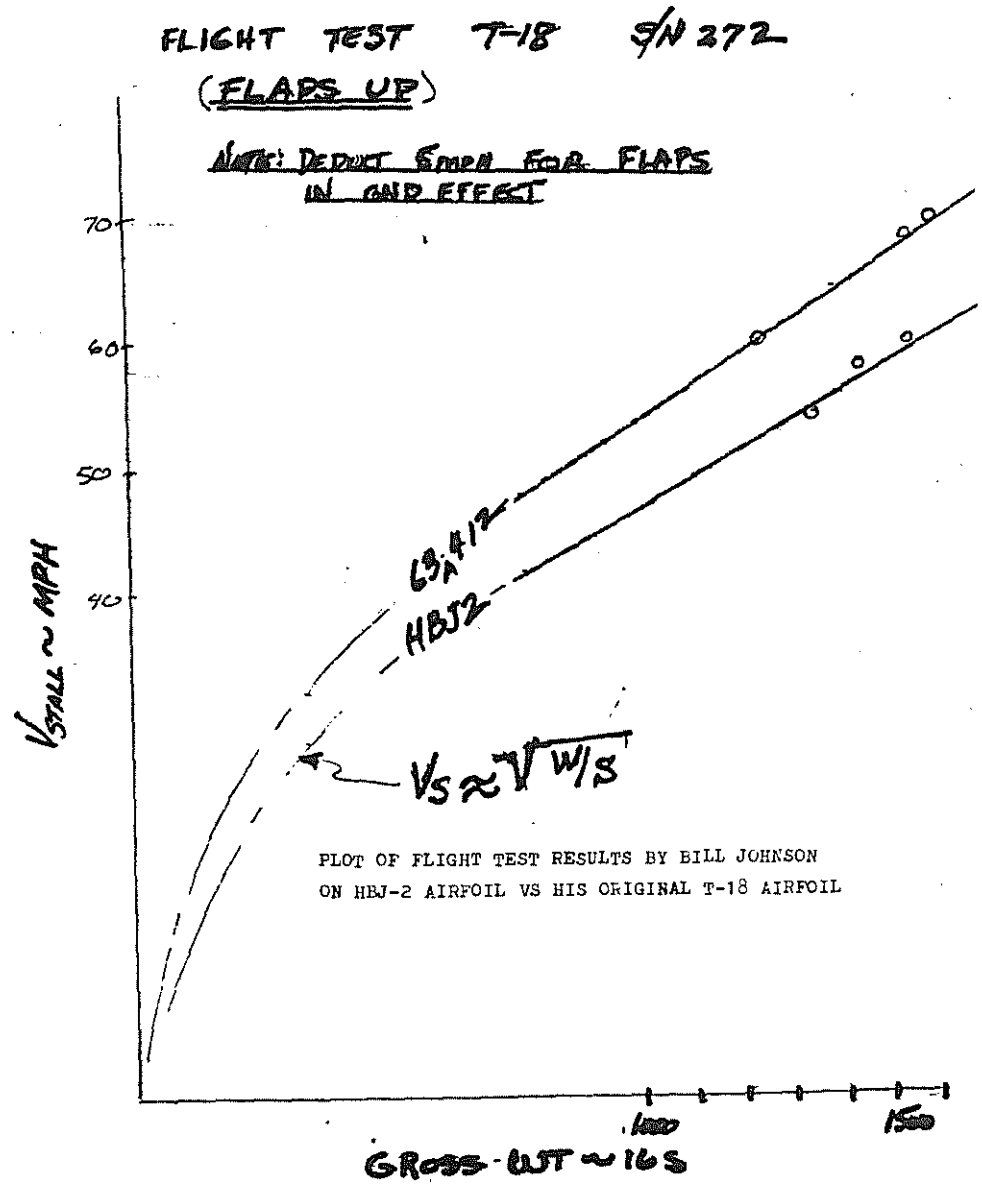
Power Off; A noticeable buffet starts at 64 IAS. This buffet increases until pitch oscillations occur at 58 IAS. The buffeting continues to increase in severity as the nose is raised. At 56 mph the fuselage starts to pound and the oscillations of the stick cannot be controlled. The airplane is still flying, even tho' the nose high angle is ± 25° !

Power On; Similar to power off except buffeting becomes too severe at 54 IAS. Airplane continues to climb at 250 fpm with 50% power. Tufts on the wing are pointing forward, attitude indicator shows 27° nose up!

Stalls in a climbing turn; Power on** severe buffeting does not occur. The controls get sloppy and a high sink rate occurs at 48 IAS . All controls are still effective, but require large movements of controls. Coordinated turns are possible and aileron movement does not induce aggravated stall or produce a tendency to snap.

Recovery; In all cases relaxing back pressure gives immediate stall recovery. No tendency towards secondary stall during pullout was observed. Normal level flight is possible at 65 IAS.

Landing; Pattern speed is flown at 90, half flaps at 85 IAS, final approach at 80 IAS, full flaps at 76.



PLOT OF FLIGHT TEST RESULTS BY BILL JOHNSON ON HBJ-2 AIRFOIL VS HIS ORIGINAL T-18 AIRFOIL

At 80 IAS with only half flaps the plane tends to skip around like a Cessna.

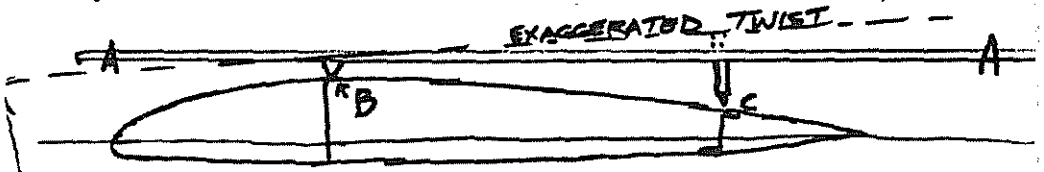
General comments: The potential of the high angle of attack cannot be fully utilized, because of the short gear legs on the T-18. Short field performance is truly fantastic!....END

I guess that I have to be an incurable inquisitive type about anything that flies. After reading Bill's articles several questions popped into my mind, the first of which was, "How do you develop the shape of the new nose rib at the wing root? You don't simply move the nose rib 5" forward and fair in the gap to the top and bottom of the front spar, do you?" That didn't make sense to me, so I called Bill. I asked other questions, too, like ,"What specific radius do you use on the strakelet leading edge?" and " Does the strakelet interfere with installing or removing the center wing?" I was also curious to know if it was necessary to cut the original wing skin to retrofit the strakelet as a cuffed "add-on".

Simple, brief answers aren't always possible to these and other questions, so Bill agreed to develop specifics for us in N.L. #50.

I was also interested in how he applied and secured the various add-on shapes he has experimented with and he'll also cover that subject. If one of these add-on strakelets peeled off on one side in flight (or worse yet, partially peeled off) it could possibly cause a roll problem that might be very difficult to control, so it's a question worth serious consideration. We'll certainly be looking forward to Bill's next article. In the meantime, thanks a lot,Bill, we do appreciate your sharing your experiences with us. That's what the M.A.S. is all about, tho', isn't?

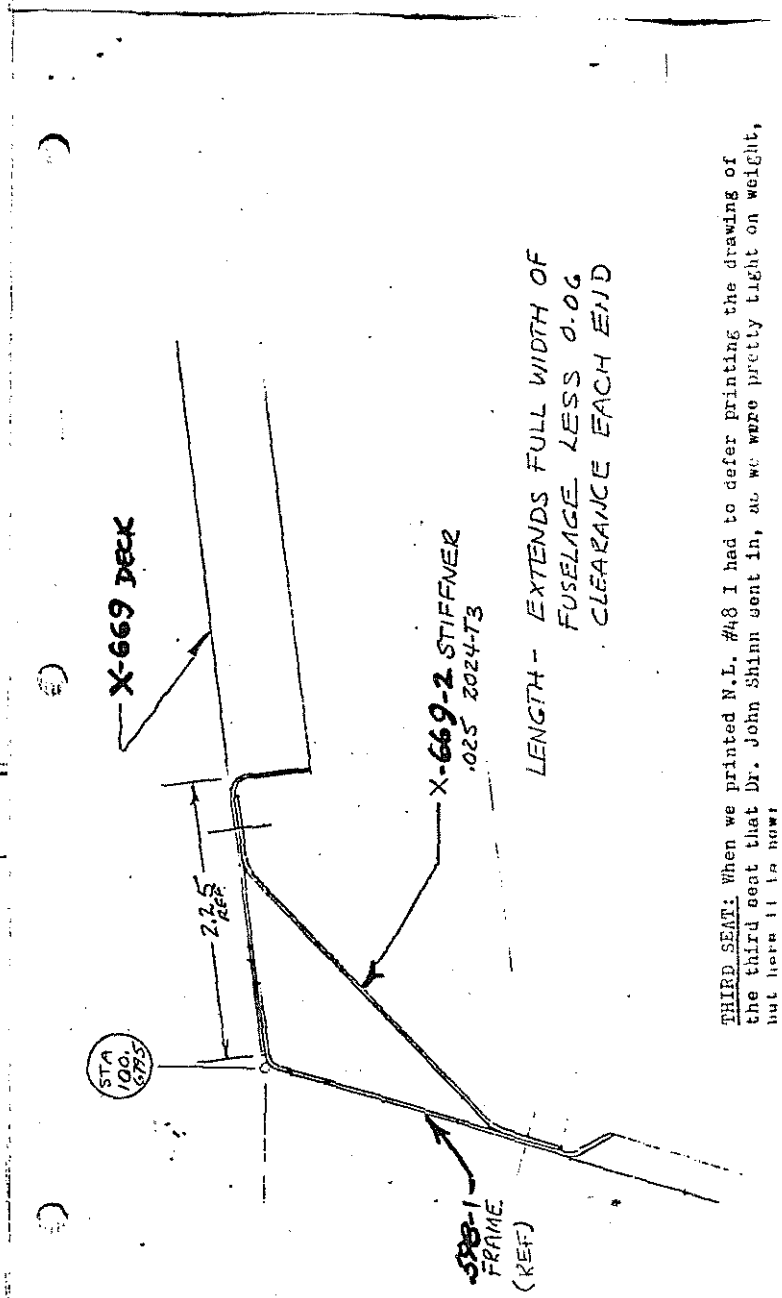
Incidence Boards: In talking to Lu Sunderland the other day the subject of incidence boards came up and in the discussion he reminded me of still another method of checking for twist in a wing segment, that was widely used back in the early days. The same method was used to check for twist in a control surface, too.



It can be built of almost any material tha's straight and reasonably stiff; wood, tubing, etc. A pair of them must be EXACTLY alike , of course. It would be desirable for the "A" member to be wide enough to set a level on and the B & C parts to have identical reference points or marks, so that the unit can be accurately positioned fore and aft. In the case of the wing I'd make the "C" point line up with the rivet line on the front spar and the "B" point with the rivet line on the rear spar.

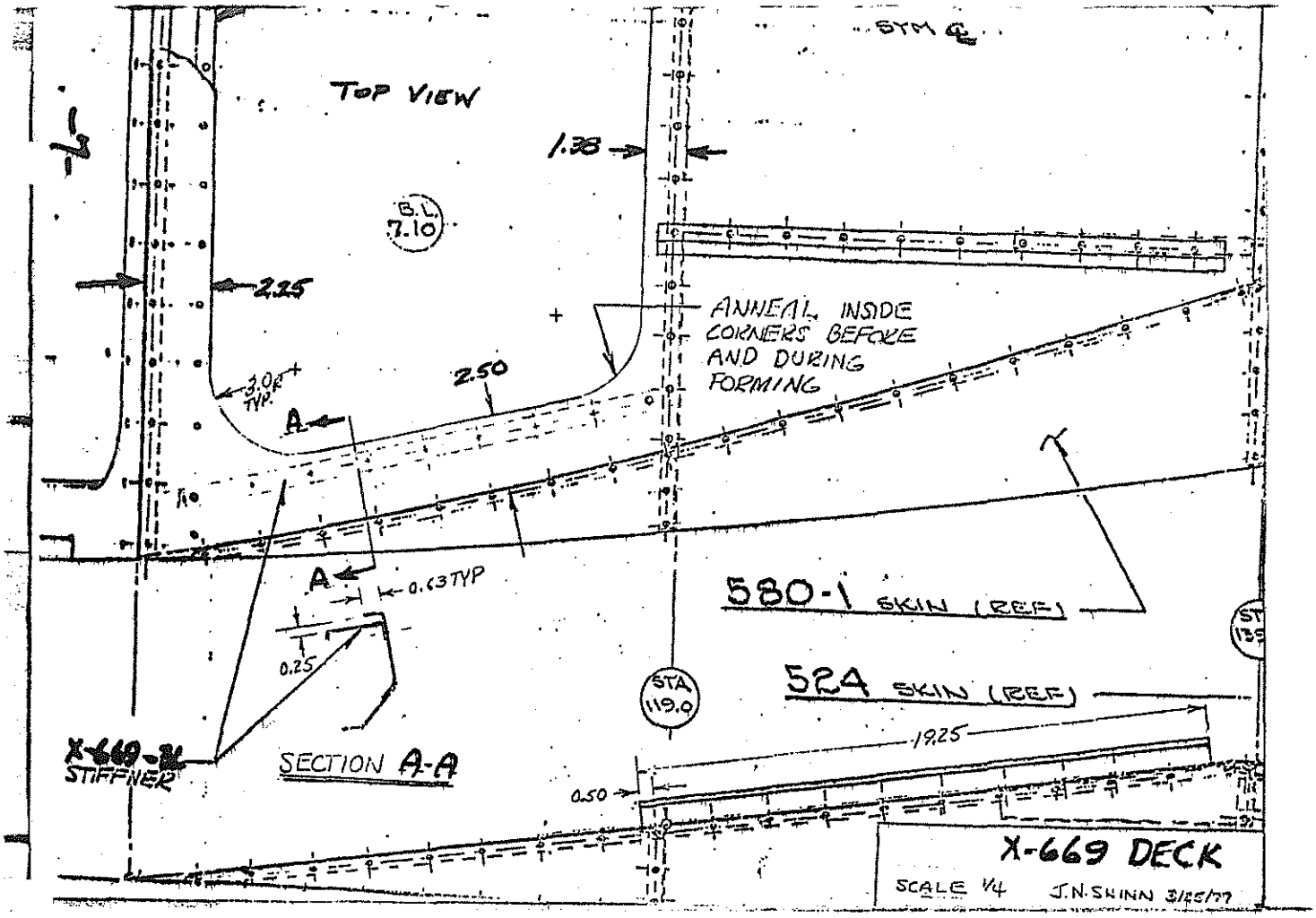
I remember one builder that painted the pair in contrasting colors; one white and the other red. When he got out at the wing tip and sighted them (spanwise) any twist was readily detectable.

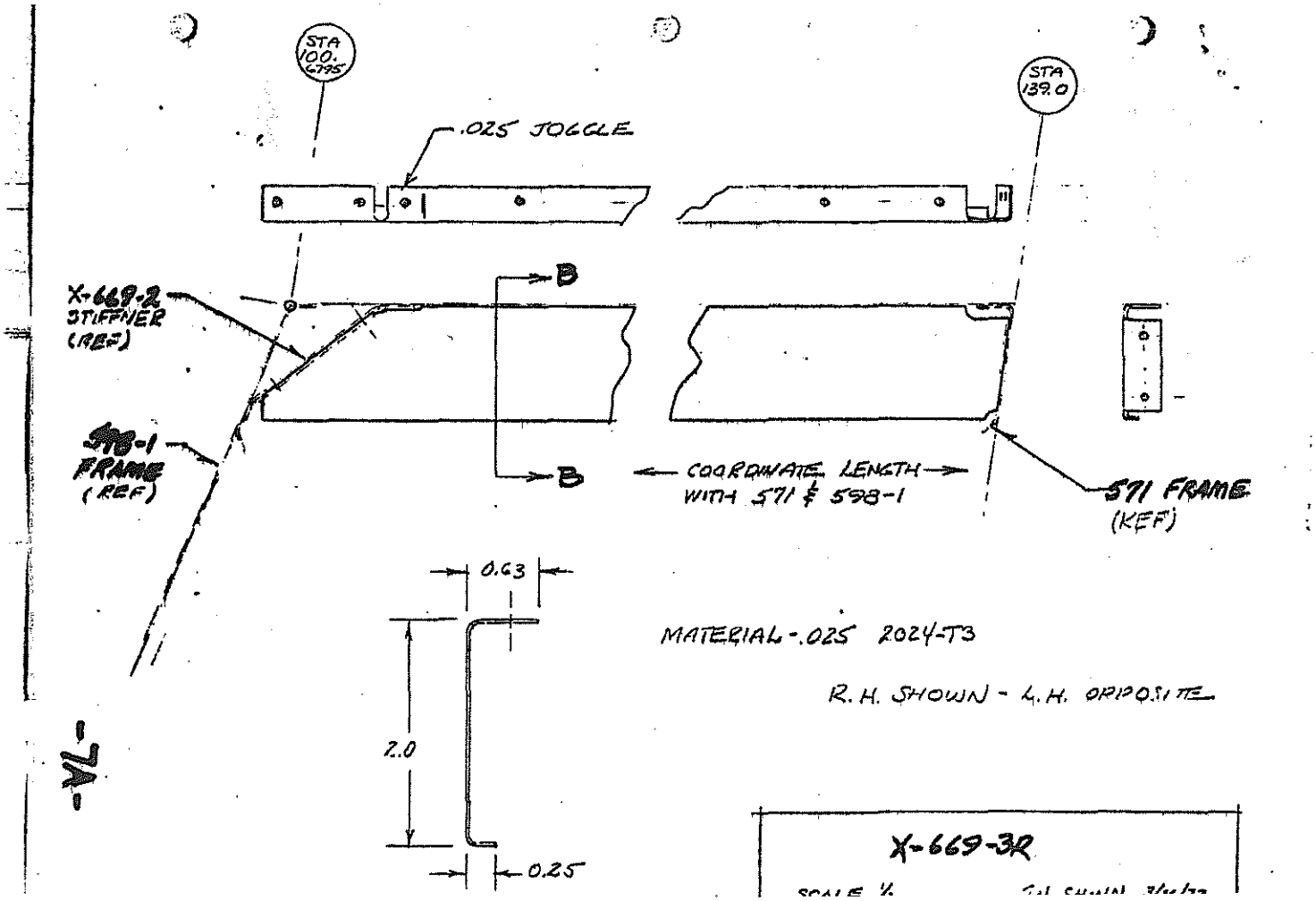
In making such units I'd make part "B" of such a length that part "A" would be parallel to the chord line of the airfoil. One pair I saw was made of wood and had an inverted "T" section (attached to part A) for parts B and C. The reason for the widened out "feet" was stability when using a level on A. He also had a side by side nails projecting thru the feet as accurate reference points fore and aft.



THIRD SEAT: When we printed N.L. #48 I had to defer printing the drawing of the third seat that Dr. John Shinn sent in, as we were pretty tight on weight, but here it is now:

X-669-2 STIFFNER
SCALE - FULL J.N. SHINN 3/23/77


TOP VIEW
STM ℄
1.38
B.L. 7.10
2.25
2.50
3.0R TYP.
ANNEAL INSIDE CORNERS BEFORE AND DURING FORMING
A
A
0.63 TYP
0.25
580-1 SKIN (REF)
524 SKIN (REF)
STA 119.0
19.25
0.50
X-669-3L STIFFNER
SECTION A-A
X-669 DECK
SCALE 1/4
J.N. SKINN 3/15/77


STA 100.6795
STA 139.0
.025 JOGGLE
X-669-2 STIFFNER (REF)
B
B
598-1 FRAME (REF)
COORDINATE LENGTH WITH 571 & 598-1
571 FRAME (REF)
0.63
2.0
0.25
MATERIAL - .025 2024-T3
R.H. SHOWN - L.H. OPPOSITE
X-669-3R

Please note on the three foregoing drawings by John Shinn that we have reduced copy size by approximately one-half, so drawings will not be true to scale. We want to thank John for this and other contributions he has made to our newsletter. John also sent in 8 pages of excellent drawings and instructions on step by step layout of bulkheads, wheel pants, firewalls, etc., using "Second Order" curves.

On the T-18, 80% 2nd degree curves are used at the corners of the firewall, dash frame, roll bar, and canopy frame. In past years it seems that exact procedures for laying out those curves weren't readily available to the troops and most of math reference books weren't very helpful. If space and weight permits we'll present a condensed version of John's 8 pages at the end of this N.L. If unable we'll publish it in N.L. #50. Thanks again, John, and keep those articles coming.

ROBERT CLAYTON: 1783 Harvard Ave., Salt Lake City, UT, 84108, writes: "I have been using Ken Knowles parts, mixed with Ken Brock's and my own. Holes don't always match up, as I found out when installing fuselage attach fittings to the T-18C center wing beam. After drilling holes at the lower cap position, the holes in the fittings (#?) already drilled by Ken Brock didn't match with the holes in KenK's layout at the upper cap position". This brought on a problem involving sufficient edge distance for Robert. If you do mix parts, be alert to check for hole match in advance of drilling. If there is some problem it's no trouble to get un-drilled or un-punched parts from any of our suppliers, altho' it might involve a little extra delivery time. Most parts are made up in batches to minimize machine set-up time. Robert also mentioned that laying out the rudder skin in the flat was a real headache for one not skilled in sheet metal layout.

RUDDER SKIN LAYOUT IN THE FLAT: In past years many of the builders made the rudder skins in 2 or 3 separate pieces per side. Others started with an oversize sheet of .016 and formed the V shaped bend first and then trimmed off the excess after fitting. I remember making some poster board patterns to locate the bend lines in the V bend area, and this worked out reasonably well. The upper and lower parts are simple flat layouts and are no problem. The only fly in the ointment was the V bend area. I just found some old notes on a method of flat layout that a T-18 builder at a Rockford fly-in showed me. This method involved brake forming of the V.

From my notes: Since the trailing edge is straight, use it is as a reference or starting point. Lay out the flat area above the #585 rib, including the rivet line for the #585 rib. Next lay out a parallel line .30 in. below that rivet line. That is now the center line of the bend for the upper part of the V.

Now where that scribe line on your template intercepts the extension of the L.E. of the upper skin , measure downward 2.1 in. This point locates the most forward rivet hole for #586 rib. From that point measure back upwards .4 in. This is the bend center point for the lower bend of the V. To locate the rear point of thatlin line measure down .1 in below the center line of the upper bend (at the T.E.).

From the rearpoint of the lower bend line of the V measure down .4 in. You can now locate the #586 rib rivet line on the line, which is parallel to the lower bend line of the V. Now to recheck your layout so far, the upper bend line of the V should measue 12.15 in. from the aft edge of the skin T.E. to the front edge of the skin L.E. That same measurement on the lower V line should measure 12.28 in. T.E. to L.E. That takes care of the skin above the V and the V itself.

To size the lower skin,(whose T.E. and L.E are NOT extensions in a straight line of the skin above the V) swing an arc of 16.28 in. from the forward rivet center of #586 rib. Now project an extension of the skin trailing edge (above the V) downward until it intercepts that arc of 16.28 in. That locates the rear rivet hole of the bottom rib. From this point scribe a line upward to the rear rivet hole of rib #585 and they should be close to 9.77 in. apart. From this same rear rivet hole in #585 swing an arc of 15.05 in. Going back now to the rear rivet hole

of the bottom most rib, swing an arc of 12.86 in. Where it intersects with the 15.05 in. arc locates the forward rivet hole of the bottom most rib. Now all you have to do is scribe a line that goes from the forward rivet hole in the bottom rib to the forward rivet hole of rib #586, which you previously located. You can now space your rivets on these center lines as per plans.

The final step in laying out the bottom skin segment is to lay out the skin T.E., L.E., and bottom edge the standard edge distance of .25 in. outside of each line of rivets. As a final check of shape, measure from the forward rivet hole in #586 to the forward rivet hole in the bottom rib and it should come out close to 9.98 in. Lastly, free hand fair in the L.E. line .25 in forward of the front rivet hole in #586 to join with the L.E. .25 in. forward of the front rivet in #585 rib.

The little V at the very top of the rudder is done in a similar manner. Set up a line above and parallel to rib #568 .35 in. above. From the very top line of rivets shown on the skin drawing scribe a line parallel to this line and below it .25 in. This is your top bend line of the upper V. Some builders chop the top off the skin at rib # 568 and install a fiberglas cap that matches with the one on top of the fin.

I cannot guarantee that the above method will work, as I've not tested it out, but I have every reason to think it does. The builder (whose name escapes me) was a professional layout man in a metal shop and he had his rudder on display that year and he had built it by that layout method. He checked the figures on my notes, also. I remember he was from Michigan, but not his name. Now if you are brave enough to try this method, take a piece of scrap .016 first and lightly prick punch points on those bend center lines. Put those points even with the forward nose of the brake's upper clamping segment. Then bend the angle on the skin and see if the center line of the bend lines up with your punch marks. Adjus as necessary on the next one.....Whew, that sure got long winded. I should have drawn a sketch I guess. Would appreciate comments from any who try it.

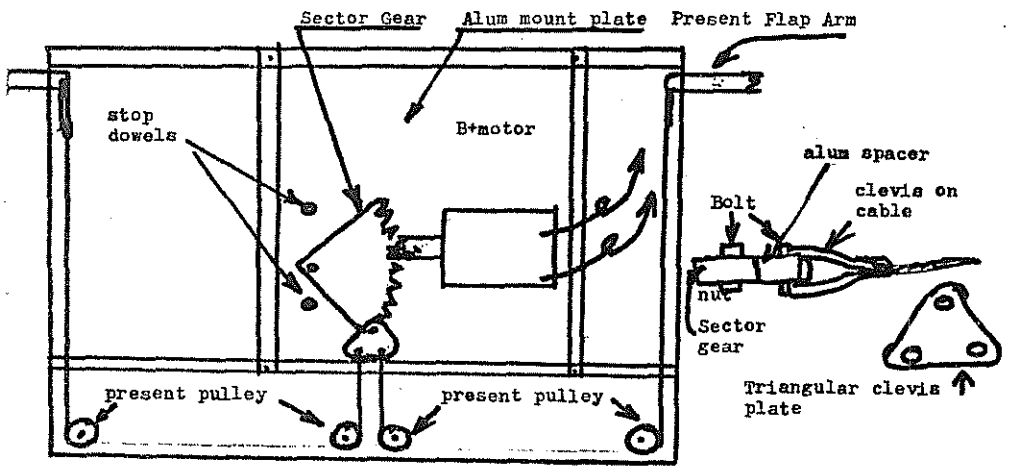
ELECTRIC FLAP INSTALLATION: Bob Dial, 5175 Wing Lake Rd., Blooming Hills, MI, 48013, 313/ 626-7975 was the first to install electric flaps. One of his goals was to eliminate the front tunnel and reduce the rear tunnel size to an absolute minimum. To eliminate the front tunnels he moved the rudder cables to the outside part of the cockpit (see N.L. #47). He used a 3" dia. tube (alum) to encase the elevator push-pull tube between the stick and #598 seat back frame, protecting it from interference.

Bob made the modification with a very minimum of change to the present flap contr system. Most of his original flap cable and pulley set-up was used. He cut the original cables in two about midway between #596 bulkhead and #571 bulkhead. He attached the loose cable ends remaining to a triangular shaped clevis plate. The clevis plate can pivot at any of the three attach points and this is necessar as there is some lateral motion involved. He used a rear window lift motor from a Ford station wagon, along with the mating sector gear. The clevis plate attache to the sector gear with a single bolt. Travel of the sector gear is limited in both directions by metal stop dowels.

Bob sent Paul Kirik and John Hardy a sketch of his set-up and both have now made electric flap installations on their airplanes. We published some photos of Paul's installation in N.L. #45. Unfortuneately the plate we used is no longer usable, so we won't be able to include it our reproduction of the first half of N.L. #45 in this issue. However, I still have the negatives of some really excellent photos of the flap and new rudder cable installation, 24 pix in all. If any of you would like prints from these negs I'll be glad to send you the set. Send me a S/A envelop and $5 and I'll return the change or bill you for any add'l, since I don't know what the costs are.

Here's what Bob says about the electric flaps: "I have my flaps rigged so there is slightly more tension on the left flap cable than the right one. Thus in crz if you just "tick" the flap switch the left flap starts down just a few degrees before the right flap, thus giving roll trim. Works fine. Be sure and wire for 30 amps max and fuse or c/b the line". Bob originally had another motor in the system, but it operated the flaps a little too fast and he replaced it with the present one.

Here's a sketch of Bob's installation:



MORE ON FLAPS: I had a couple of letters from builders that expressed some anxiety about a combination of a balked landing and an electrical failure (thus preventing flap retraction on the go around). To put it very simply, there is no problem at all. With flaps fully extended, the airplane suffers no great drag penalty. It will accelerate smartly and climb right on out at a healthy rate.

When checking someone out in my airplane I always have them fly several practice approaches down to flare height and then take a wave off and we never touch the flaps until we have at least a couple hundred feet of altitude and 100-110 mph. It flies so well with flaps down that it might be easy to forget them. There is little pitch or trim change on extension or retraction of flaps, another feature that makes the T-18 a super-sweet airplane to fly. You've seen the TV commercial, that says, "Thank you, Paine-Webber"? Well, every time I fly my T-18 I always say, "Thank you, John Thorp, for giving us the finest airplane flying today!"

FLIGHT TECHNIQUES: First of all, I would recommend using full flaps for landings in all conditions. We have always used full flaps for all landings in airline work and the very same reasons hold true for the T-18. Like the jets, the T-18 has a relatively high span loading. As the angle of attack is increased, the wing tip lift loss increases drastically. The shorter the span the higher the span loading and percentage-wise the greater lift loss. In the high angle of attack position on a typical final approach with no flaps, it's analogous to

having a giant pair of scissors clip off most of your outer wing panels. Thus t "remaining" wing has to "work" much harder. The only way the wing can compensat for the loss is to go faster or go to a higher angle of attack. If the angle of attack is already close to the stalling angle that door may be nearly closed. I the wing cannot compensate for the loss of lift via wing tip vortex the result an excessively high sink rate. If flare height is approached in a super high sink rate condition it might take full power to achieve an adequate flare cushi

I've seen some low time pilots "dragging" in the T-18 at a very flat angle, nos high, carrying considerable power, and not using their flaps. This is a dangero practice.! Anytime you crowd your normal safety margin as a standard practice you are inviting big trouble. Sooner or later it'll bite you.

The real purpose of flaps is to allow one to make safe, steep approaches over obstacles without picking up excessive speed. This translates to a lower angle of attack, much better visibilty over the nose, less sink rate (per minute) and better speed margin over stall, and a slightly lower stall speed by virtue of flap extension.

Many T-18s have little or no pre-stall buffet warning, so it makes sense to maintain an adequate speed margin above stall. Approaching in turbulent or gust conditions you should tack on just a little bit more. Standard practice is to add a minimum of 30% of stall speed for approach.

For the low time pilot,or a pilot just barely tail-wheel qualified, I'd suggest you use full flaps on approach at 90-100 mph IAS (after you have flown several practice approaches at a safe, higher altitude and have verified that 90-100 mph IAS gives you a 30% to 40% margin above stall without flaps). I would also recommend making 2 or 3 practice approaches to flare height (2-3 ft.) without landing. Your first few landings might better be wheel landings. A wheel landing buys you a few extra seconds to gradually lower the tail and maintain direction control.

Most pilots that are new to tail wheel flying get into trouble directionally, because they either aren't aware of directional divergence of the nose, or they wait too long before doing anything about it. They allow the nose to move too fa directionally without correction and then they usually overcontrol badly, holdin opposite rudder too long and this allows the airplane to diverge strongly in the other direction. By this time the new t.w. pilot is out of phase with things and is falling farther and farther behind directional control. All this time the airplane's speed is decaying at a progressively faster rate and this in turn is affecting rudder response.

I feel the REAL value of taxi testing a new airplane is that it allows the pilot to become familiar with directional control requirements at constantly changing speeds. Obviously it is also of value in checking gear alignment. I think most experienced T-18 pilots will agree that the new pilot should not get up to 50-60 mph and suddenly yank off power. This puts you in the worst possible situation, because of the rapid rate of speed decay and rapid change in rudder response. It makes a lot more sense to gradually increase taxi speed in 5 mph increments, gradually reducing power to idle. 40 to 45 mph should be the absolute top limit of taxi speed. Don't advance your taxi speed bracket until you are truly competent to go a bit faster. Don't use brakes for this practice unless its really a necessity. Consider taking a t.w. qualified instructor along with you on some of your taxi runs and let him critique your proficiency. It's perfectly legal to do so. It's legal to even take him along on flites, if he is a bonafide crew member

One other bit of advice to the new T-18 pilot: Don't flare the airplane until yo

are within a couple of feet of the runway. We've had several "incident" and accidents that began with a too high flare. Most T-18s will pitch the nose down briskly at stall. Even at 10 mph above stall the stabilator begins to lose power to raise the nose (without power) at the same time the very high sink begins. If this high sink is allowed to start and the nose is falling thru rapidly at the same time a hard bounce, or series of bounces, leads to big problems. If you make your flare and aren't on the ground in a second or two, play it safe and go around.

That 's the reason that I favor a wheel landing attitude for new pilots and still another reason for using full flaps. Visibility is much better, along with better judgement of flare altitude. A slight ricochet from a wheel landing doesn't put one in a hazardous recovery situation. In case of doubt-punt-go around!

I've used the term "tail wheel qualified". In essence, this really means "compete - nt to control the airplane in cross winds or other directional divergence conditions". Be certain that you can control (any) tail wheel airplane in cross winds clear down to zero mph.

Don't feel that I am"talking down" to any of you with the above advice just because I've been flying almost 50 years. I'm not. It's just that any tail wheel airplane is a different kind of critter and when you give them cause to bite you they'll just do it quicker in a small, quick coupled, and responsive airplane like the T-18.

I did a little instructing of a friend of mine on an American Yankee last year. I had never flown one before and was surprised to find that control response and sink rate characteristics were quite similar to the T-18. A couple or three hours of takeoffs and landings in one might be a good way to warm up for T-18 flying.

In 48 years of flying I had never accidentally ground looped an airplane until last spring in my T-18. I had a 20 mph crosswind 90° to my right to my direction of movement. I was taxiing on a parallel taxi strip at about 5-10 mph when my right shoe got caught under the top flange of the rudder/brake pedal. . In the second or so that it took me to get my shoe out from under,it had weather-cocked into the wind and there was simply no stopping it even at that low speed. I was amazed at how fast it went around. If I had been going 5 mph faster I'm pretty sure it would have scraped the wing.

I'm blocking in a triangular area just below the toe rest on my new airplane, using hardwood blocks. This might be worthy of consideration of you new builders. It's a real pain to have to do any kind of work down under the tank and panel, so anything down there that you can do now will be mighty worthwhile.

REMOVABLE FORWARD FLOOR : Dan Dudash, 4641 Cartwright, N. Hollywood, CA, 91602, may have the right idea to get at things up under the tank and panel. He has a removable forward floor. He built most of his airplane in John's shop and when he came up with the idea John said okay. He put a nut plate at every other rivet hole. I'm sure he also made the 4 stiffeners (extrusions) removable, as this would allow complete access to remove the tank,if that became necessary some day. Those same stiffeners mount the rudder pedals and brake cylinders. Those are low maintenance items, yes, but tanks and fuel systems frequently give problems.

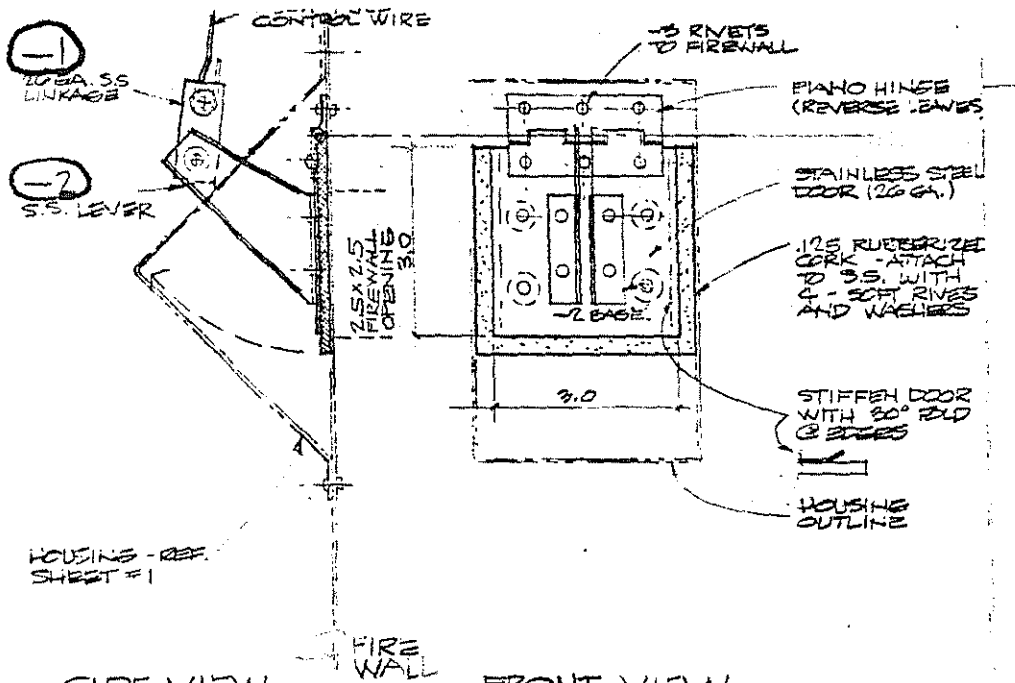
INSPECTION PLATE ABOVE TANK: Several builders have installed a circular inspection plate above the fuel quantity sender on the top of the tank. I know of several T-18 owners that have had sender trouble and had to take the tank out to get at it. If you install such an inspection plate, standard practice would call for an .040 doubler riveted to the bottom side of the skin. FARs aren't specific about rivet spacing unless you follow "patches" for a guide. Take a look at a factory built airplane's inspection plates for a guide in this respect.

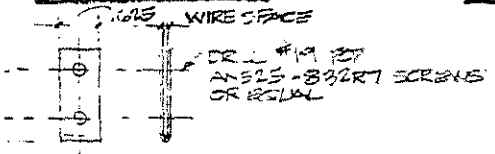
FAA HANDBOOKS : The FAA replaced the old CAM 18 in 1972 with 3 greatly expanded handbooks for airframe and power plant mechanics. You really ought to have all three handbooks in your shop library if you are going to build and then maintain an airplane. You'll find the accepted and approved method of fabricating or of maintaining nearly every component of an airplane or engine in the three volumes, plus proper use of tools, inspection procedures, etc. Each volume contains about 500 pages and are profusely illustrated. All three volumes make a 4" high stack and are letter sized.The "Airframe and Powerplant Handbook" series are titled Powerplant Handbook EA-65-12) priced at $3.75; Airframe Handbook (EA-AC-65-15) is priced at $4; The General Handbook (EA-AC-65-9) is also priced at $4, and all are available from Aviation Maintenance Foundation, Box 547, Berthoud, Colo. 80513. I don't know whether those prices are still valid or not, or whether they will ship COD. These books may also be available from EAA HQ. At any rate I would strongly urge you to acquire all three volumes. It will not only upgrade your proficiency and education, but also encourage a professional approach to problems encountered building your T-18. We might remember that most of the regulations and standard practices are predicated on service experience thru the years and a lot of such knowledge was the result of blood being shed by someone.

Addendum to Bob Dial's Electric Flaps:I just ran across a note I made, which identified the electric motor and sector gear as from a '73 Olds. The switch was from GM and is a tail gate window switch, as used in station wagons. The mounting plate for the whole assembly was .032 and was riveted to fore and aft extrusions used to stiffen the baggage comp't floor.

CABIN HEAT VALVE : In response to my request for some of you to send in details on their cabin heat or carb heat valve, GALE ABELS, 1226 Pennsylvania, Boulder, CO, 80302, came to our rescue in fine style. He sent in two beautifully drawn sheets that were equally beautifully lettered and dimensioned. This was his installation in his AT-19 (Which by now needs no introduction). We're very grateful to you, Gale,for such excellent drawings and we're equally grateful for your prompt respon I hope your example will inspire some of the other troops out there to send in at least a hand-drawn rough sketch of their carb air box or their cabin heat valve I feel reasonably sure that almost all those T-18s out there flying have one or more of the above. If you don't quite feel up to drawing something like that, how about a little sketch of your firewall, showing where you mounted the fuel filter, voltage regulator, engine control cables, etc. We're carrying the two pages of Gale's drawings elsewhere in this issue.

Electric trim motor source: Dr. Harlo McKinty, 1310 Idylwild Dr., Lincoln, Neb, 68503, came thru on this one. He writes, "I came across this ad for the little reversible trim motors. I called out there and they have 150 of them for $7.21 apiece. I am buying one as a spare, as I already have one of the Chev '67 Camaro headlight eyelid motors. The place that Harlo is referring to is the "Surplus Center, P.O. Box 82209, Lincoln, Neb., 68501. The item in question is identified as a "slow speed geared DC motor, Item #5-953" 12-27 volts, 5 rpm, DC, gear reduction. High speed, very low current motor drives output shaft thru precision gear train. Output speed 5 rpm or less at 12v. but at high torque. Al ball bearing fully reversible. Overall size 4 1/2 in. x 1 1/4 in., Shipping weight 3/4 lb. price is FOB Lincoln, so you'll have to add shipping costs. Sure sounds good. It has a mounting flange to bolt it on the bulkhead. They will ship COD with a 30% deposit. The RPM may be a little on the low side as compared to the Camaro motor, but I really don't know whether it is or not. On the '67 Camaro motors: Corey Sylvester, 304 Alcott, Louisville, KY, 40207, tells me that he was able to find several of the Camaro motors in his area, and for less than $20 ea., too. It seems that only the large GM dealers in the large cities are hooked onto their computer so probably many small Chevy dealers may have several still in stock, so beat the

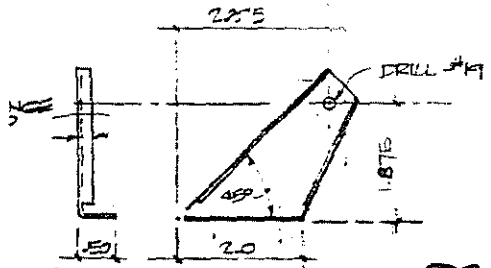




-1 20 GA. SS. LINKAGE

NOTES:
FOR T-18 + SIMILAR APPLICATIONS LOCATE FIREWALL CPS. AFTER POSITIONING BRAKE LINES.

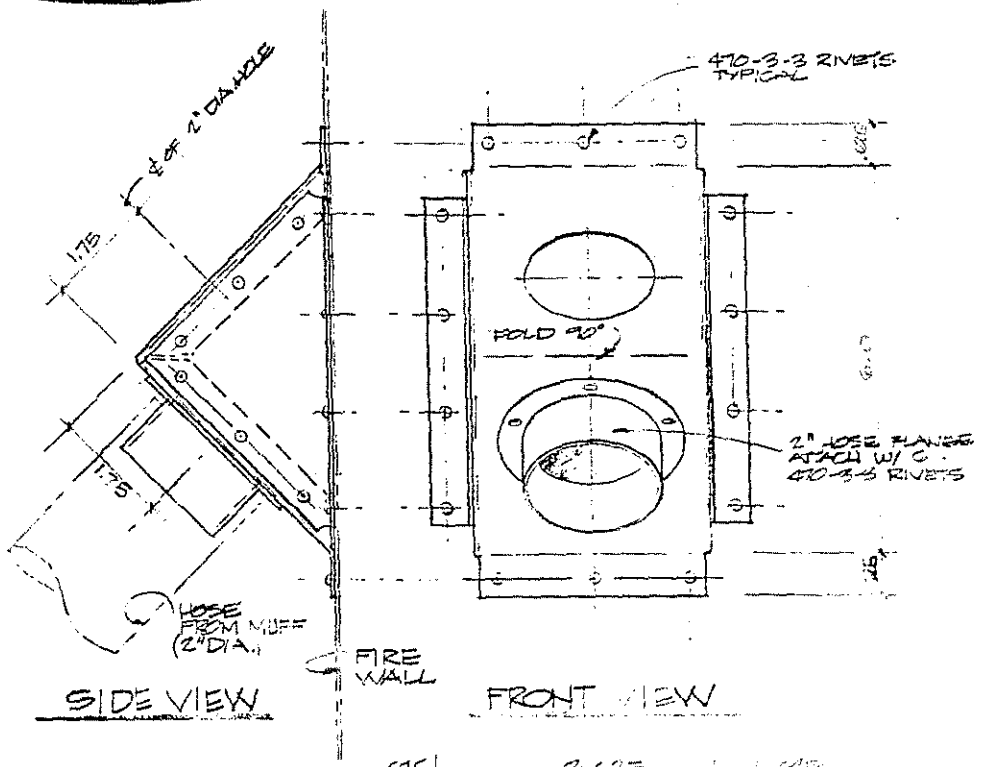
ATTACH -2 LEVER TO DOOR WITH POP RIVETS, TYPE - MONEL, SIZE = 1/8"

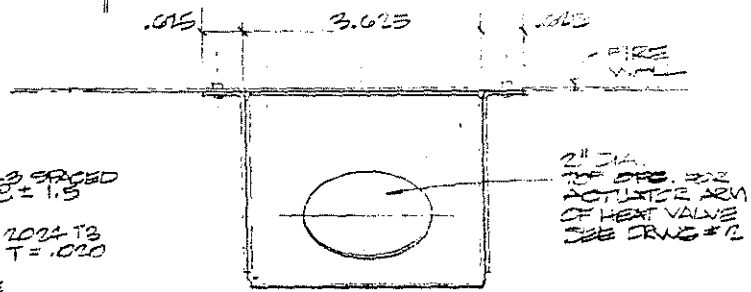


-2 LEVER 20 GA. SS.
2 - REQ. OPP. HAND

PG 11

AT-19 CABIN HEAT VALVE
L.G. ABELS 11-20-79
ONE HALF FULL SCALE





NOTES:
RIVETS = -3 SPACED C ± 1.5

HOUSING MATERIAL = 2024 T3 T = .020

ALUM. HOSE FLANGE BY "AIRCRAFT SPRUCE"

CUT 2 - 2" DIA STEEL HOLES BEFORE FOLDING FLANGES

PG IIA

AT-19 CABIN HEAT VALVE HOUSING

On the previous page I mentioned Corey Sylvester. Corey and I met by phone the past month and discovered we had several things in common in addition to our mutual admiration of the T-18 design. Corey worked as a machinist several yeaps and made some good investments and retired early. I learned that he has built 11 different airplanes of various types. Now he's enjoying helping others in the Louisville area to get their T-18s built. He also has a circle of friends that are quite skilled in the various phases of aircraft building and they, too, are retired. They have proved to be quite a help to Corey and others in the area. One of them in particular is a retired master welder and some time back he offered to make up Corey's landing gear (long) for him, just to have something useful to do. In jigging up for it and buying material he found he could make five of them for but little more than the first one, so he went ahead and made all five. Corey is using one and he has four more. Corey will sell them for him on a first come first served basis and the price is a very modest $250. They are to plans and are TIG welded, magnafluxed, and heat treated to specs. I assume they are also painted, but Corey didn't say. He also has one or more engine mounts, but I've misplaced my notes on those.....That's not all yet, tho. (Lost my notes here, too) Corey has a mill and a friend in the steel business and if anyone is having any difficulty getting steel for the C wing fittings he'll be glad to crank out a set for them.....One problem, tho'; Corey is going in to the hospital in early Jan. for some tests and his doctor tells him he possibly might be in for a month, so there may be some delay. If you care to write him his address is 304 Alcott, Louisville, KY, 40207 and his phone is 502/ 896-6466 . Don't forget the S/SA if you write.

Corey also said one of the local builders there that works for IBM was transferred to Calif. and was also having to sell his WB T-18 fuselage. It was built entirely from Ken Knowles parts and is riveted and up on the gear, has the dynafocal motor mount, tail wheel installed, part of tail complete, plus other parts. He will sell for $2400, which is less than his investment in parts. Corey is acting as agent, since the owner is already in Calif.

Bill Johnson (whose article on his airplane with the HBJ2 airfoil is in this issue elsewhere) just sent me the how-to to extend the nose rib 5", but I can't run it this issue. account time. He also said he plans to sell his retractable gear T-18 shortly. Bill didn't say so, but I'm going to guess that the urge to build another T-18 has become overwhelming. I don't know how many times I've heard T-18 builders say, "I sure would like to build another T-18, now that I know what I'm doing". Bill's phone no. is 206/ 852-7914, in case you'd like to call him for details.

Dan Culhane : Last issue I wrote of Dan's losing his T-18 in the tornado that hit Bradley Field, Conn. Dan called and gave me the details. The only salvage was his landing gear, wheels, tail wheel, and engine. The rest was smashed into junk. The engine had fins on one cyl knocked off, too, and it possibly may have a bent crank flange. Fortunately he had it insured for $8000, so he feels he can replace it, so he won't be hurt too badly, if any. He was very grateful to learn that so many had sent donations and were so compassionate towards fellow buiders, but he asked me to return the checks with his heartfelt thanks. He said he wouldn't have felt right about taking the money even if he hadn't been insured. I'll return all check as Dan requested and we'll all hope he can get a T-18 into the air again soon. He said he wasn't all that keen to spend another 8 years building, but that if he could find a really good partially finished project for sale that he might go that route. He did say that the insurance co. rep called him and said that if he wanted to buy the salvage that it cost him $2000. That's a good price for an engine & landing gear-IF the engine's okay. Aircraft insurance is very expensive unless one has a loss it seems. I carry a not-in-motion & liability policy on mine, even tho' it's hangared.

JANUARY 31, 1979

T-18 NEWSLETTER:

REPRINT OF FIRST HALF OF T-18

NEWSLETTER #45

Re-issued December 1979

#45

The last T-18 newsletter was published 13 April '76. At that time it was felt that almost all the necessary material for T-18 construction had been covered, so it was decided that the most pressing need was to use the time to condense and update all the previous newsletters.

This had become a necessity, as the original master stencils were getting pretty well worn out after they had served nearly 1300 plan holders so well.

When Lu and I published the first newsletters in 1963 a considerable amount of our efforts were directed towards locating materials and suppliers, tools, etc. A lot of this material has been obsolete for some time, so has been eliminated in the new condensed version.

This gives a small measure of relief to the Sunderland family after 15 years of faithful, unselfish service to fellow T-18 builders. At Oshkosh this year Lu told me he still gets an average of 5 or 6 letters each day from T-18 builders!

To introduce myself to some of you, I'm Dick Cavin (#16). I reluctantly said goodbye to 35 years as a pilot for Braniff International when I reached the Federally mandated retirement age of 60 two years ago. Since then most of my time and effort has been occupied building and flying T-18s and writing the newsletter for EAA Chapter 168.

This has given me time to consider some of the newer aspects of T-18 building that have been used the past few years, so I've volunteered to give Lu a hand on the newsletter for several issues.

Our EAA chapter recently purchased an offset printing press, complete with plate maker, and as we print about 300 newsletters each month (of about 20 pages per issue), we also buy our paper in bulk. We also take advantage of bulk mailing rates, which are only around .08¢ per issue, third class. As editor, I have been given chapter approval to make full use of all these facilities at a very nominal cost, which will cover future maintenance, etc.

All of this translates to the ability to turn out very sharp, readable copy, fully illustrated with pictures, at a very low

cost per issue. The T-18 printing and mailing fund is close to depletion, so we are asking for donations from all of you, as subscribers, to get it off the ground. We are asking for a minimum of $3.00 per man and hopefully this will take us through around 10 issues if we watch our costs closely.

As in the past, we need your input if we are to maintain the high quality of the newsletter. Remember, an editor has to have "reporters". He can't do it all, so we earnestly solicit your story, as long or short as you care to write. If you type, fine, but if not just sit down and scratch out your description of the subject matter, just like you were talking to a buddy over a cup of coffee. Don't worry about the spelling or punctuation, etc. We'll re-write it if it needs it. Don't consider any item (about the way you solved a problem) as too trivial to mention and don't assume that "everybody knows how to do that"!

There have been a lot of changes take place since the T-18 design left the runway in 1962. In the intervening 16 years the airplane has gradually evolved into a rugged, reliable, high speed vehicle, with a capability that equals or exceeds the finest, most sophisticated factory builts, costing many times more. About 250 have been built to date, with at least that many more somewhere in the construction process. Mandatory changes and "ADs" are remarkably few, certainly a tribute to the design expertise of JOHN THORP. Many of these airplanes are approaching the 2000 hour mark and several are well past that figure. Some of these "high timers" have done most of their flying from rough, unimproved landing areas, which is even more evidence of design excellence. Surely an aggregate total of 100,000 flight hours would be on the conservative side. Even the accidents have shown the T-18 to be very "survivable", as long as it isn't a stall/spin situation.

The rugged "A" frame landing gear and heavy members and attach beams from the seat back forward are mainly responsible for protecting the occupants from serious, or fatal injury. The outward curving shape of the fuselage in that area is also a potent safety factor, as crash researchers have discovered in Ag aircraft accidents.

With the gear acting as a "pylon", with the engine hanging from one side and the rest of the structure from the other, very high G forces on the airframe are greatly softened and slowed up, thus allowing gradual deformation of the structure, the key to survival

of high G impact. The A frame gear's ability to soak up huge amounts of energy before failure also validates its unique role as an effective barrier to prevent the engine from smashing thru the firewall and crushing the cockpit occupants. I know of no other single engine design that has this very valuable safety feature.

The T-18 basic design has given rise to a whole series of modifications, greatly widening its appeal to potential builders. From its starkly simple "plain Jane" beginning we have seen horsepower go from the almost extinct 125 hp. GPU to over 200, with constant speed props added, along with gear fairings, flaps, pressure cowling, canopies, and fuel in the wings. Fixed and retractable tricycle gear versions have appeared and also a couple of retractable conventional gear examples have been built, one of which was a single place. Several 3 place copies have surfaced, too, with jump seat capability to carry a child. Two inches more width at the cockpit is provided in the so-called "wide body" modification, that LU SUNDERLAND initiated. Cockpit comfort has been greatly enhanced with the addition of electric trim and electrically driven flaps, along with moving rudder cables to the outer walls of the fuselages. This allows both forward and rear tunnels to be eliminated, thus eliminating a universal complaint about the very cramped and restrictive leg room area. The 3" dia. aluminum tube between the seats, that encloses the push-pull tube, makes a big difference in comfort at the hip level, too. All these things add up to increased enjoyment of long cross-countries.

The astronomical cost and unavailability of hangar space has been the motivation for LU SUNDERLAND's folding wing design mod and no doubt those factors will mean that more and more builders will be forced to go this route if they are able to justify the increasing fixed costs of airplane ownership. Average hangar rent in metropolitan areas is around $100/month and that $1200 per year will buy a good radio, or lots of gasoline, plus pay for insurance each year! If the take-home idea repels you, a very practical alternative presents itself in the sharing of hangar space. In many T hangars just folding one wing of a T-18 would make it fit under any high wing Cessna easily. Four T-18s with both wings folded could share a single T hangar, with room to spare. Maybe 5.

Let's stop and take note of an important fact: All these modifications have added weight, so each of those 86 square feet of

wing has to work harder. Not only does the stall speed increase, but the former aerobatic capability is drastically compromised (or been wiped out)! Fifteen pounds of weight are added by the wing folding.

The light, early day T-18s are known to have good spin recovery characteristics, but be aware that a large "gray" area exists when we depart from the proven norm, so extreme caution should be observed in attempting maneuvers. If you have an overpowering urge to stretch your neck and break a few blood vessels in your eyes and brain, why not be sensible and do it in an airplane that's truly built for it?

As most of you know, new airfoils that are capable of higher lift and less drag are not only on the horizon but are here. MR. THORP is in agreement that we should pursue the testing of these new airfoils with the very worthwhile goal of lowering the stall speed.

AIRFOILS

BILL JOHNSON is an engineer for Boeing (Seattle) and he has done a lot of testing on computer-generated airfoils. He applies a mixture of polyester resin and microballoons to the wing of his T-18 and sculptures the various airfoils to shape. He then goes out and flies the airplane to prove or disprove predicted performance. Not only has he been able to apparently reduce stall speed to slightly over 50 mph I.A.S., but also to fly the airplane at angles of attack as high as 25 degrees. Such an angle for landing wouldn't be of any advantage with the present gear, of course, but it certainly points the way for safer, slower approach speeds. Think what that would mean if you were forced to land in a heavily forested area.

NASA has also been doing their homework on such airfoils and results to date show great promise. The pace of such research is quickening, so the coming year may yield some very tangible benefits. In our next issue we'll publish the coordinates of one of the most promising of these airfoils.

In our little review of T-18 evolution let's look at an important area, that strangely enough hasn't received but a very minimum of publicity: This is the maximum use of Matched Hole Tooling through purchased parts made from master tooling. Practically every part on a T-18 can now be purchased and with the assurance that it will mate with adjacent ones.

I personally believe a lot of people are choosing the Varieze to build for the reason that it not only goes fast, but they believe it can be built by them in a short time. The years have shown that a large number of projects are never finished for the simple reason that they take too much time to build. Family tolerance and enthusiasm reaches the vanishing point when too much time elapses. I think this has been the case with many of the early day T-18 plans purchasers, or else many, many more T-18s would have flown by now. I'm also sure that a considerable number realized (or thought) they were in over their head when they tried to make heads or tails of their plans for the first time.

We now have several "storekeepers" that can supply 99% of the parts you need to build a T-18, either complete or partially fabricated, so a truly giant step forward has been taken. Surprisingly, very little publicity has been given to this phase of homebuilding. Let me give an example of what this really means in time saved.

MATCHED HOLE TOOLING — OUTER WING ASSEMBLY

Last summer I made up an outer wing for the T-18 in a little less than 16 man/hours! Two days work, if you please. A weekend's work as another way of looking at it. Laying out the skin, drilling it, bending it, and dimpling took 3 hrs. 15 min., building the spars and attaching the fittings took 6:45, assembling the ribs, spars, and skin (by drilling skins and spars together) took another 2 hrs. 15 min., and riveting took up another 3 hrs., for a total of 15:15. A very relaxed pace was maintained, too, not a hammer and tongs effort.

The pre-formed ribs, with holes punched, were purchased from KEN KNOWLES. I had previously laid out a wing skin template, so I used it, but the scribed and center punched skin can also be purchased from Ken, so I did not include the time spent making the template. (One of Ken's skin layouts could actually have been done in a little less time).

BENDING WING SKINS

Bending the wing skin is done by clecoing the "false" line of rivet holes on the bottom skin to the line of rivet holes on top of the rear spar. A 2 x 6 was then laid spanwise on the top skin and pressure applied (gradually moving towards the leading edge) until the leading edge radius exactly fits the contour of the ribs at that point. I got lucky and hit it the first time, but it conceivably could take a half hour or so to bend, un-cleco, check for fit, re-cleco, etc. You need to be careful not to over-bend, so "sneaking up" on it is a wise procedure.

Some people have used 2" x 6" longer than the 4' skin width and laid certain thickness wood blocks on the floor underneath the projecting ends of the 2 x 6s, so they act as "stops" to prevent over-bending. It's also good practice to mark the forward edge location of the 2 x 6 each time it's used. This keeps it parallel with the L.E. and locates the pressure point, too. You may possibly need to "shim up" your 2 x 6 in the center, since more bending takes place at the outer two ribs than in the middle two.

When checking the bending of the skin the best procedure is to have the two center nose ribs cleco'ed to the front spar, so that the unit can quickly be re-cleco'ed to the skin and checked. If skin fit looks okay on the center two then slip the outer two in, cleco, and check them, too.

Again, be cautious. A too sharp leading edge can mean the airplane can be pretty nasty at stall. It can mean you'll have a wicked wing dropper at stall (maybe starting a spin) if you also get a little twist in the panel. I never cease to be amazed at how little "massaging" of the trailing edge of the aileron is required to correct a considerable wing heavy condition. (It's so little that you actually can't see it.)

When FRANCIS RICHARDSON and I joined forces last year to build two sets of folding wings we checked and re-checked our leading edge skin bends about 4 times each panel, being careful to get all 6 skins with matching bends.

MODIFIED MATCHED HOLE TOOLING, WINGS

Francis and I used a jigless method of wing assembly, that I believe is best described as Modified Matched Hole Tooling. All skin holes are pre-drilled and all rivet holes in the ribs are pre punched, too, but no holes are pre-drilled in either the front or rear spars. When all the ribs, skin, and spars are cleco'ed together we lay a large level on top of the front spar, carefully leveling it. The level is then placed on the rear spar to compare. When the two readings are identical the wing is square, with no twist. Be aware that you should take care to exactly align the level parallel to the spars to get an accurate reading. At this point clamps are attached to the ends of the spars, holding the skin tightly in position. Now thru the row of spanwise holes in the skin the spars are now drilled and cleco'ed.

Prior to drilling the skin, while it is still in the flat condition and has been scribed and center punched, take time to check your hole layout for accuracy. First measure from the lower left corner punch mark to the upper right corner punch mark. Now compare this distance with the measurement from the lower right

corner to the upper left corner. This is sometimes called "X" checking and is a very accurate way to check for squareness. You are actually measuring the hypotenuse of two triangles. They should be equal.

This might be a good time to remind you to check your sheet aluminum in the same manner, if squareness is essential to the part. You cannot safely assume that the edges of the sheet are parallel to each other! Francis and I found at least half of our sheets out of square when we were laying out our folding wing skin templates.

RIVETING WINGS

We found that riveting and bucking on the outer wing panels (standard wing) is easier to do with the panel standing vertical, with one end resting on the floor. The outer folding wing is something else. It takes a really long arm to reach far enough in to buck the #4 rib from the end. You might want to use blind rivets here or get a bucking bar with a long handle. Personally, I'm very reluctant to use Pop rivets anyplace except where the space for a bucking bar is very limited. Without going into greater detail on Pops here, just consider one point: Pops are known to loosen after awhile. Also well known is the fact that a loose rivet will pop paint loose all around it. Ask yourself if it is worth it to spoil a paint job.

SKIN SPLICE

On the folding wing we wrapped the skin chordwise, which requires a skin joint, unless you can find a 6 ft. wide sheet of aluminum. We chose to make a butt joint over one of the ribs, which in turn required a double width flange on that rib. A simple lap joint would have been much quicker - and better, too, but we didn't know that then.

Our double width flange was a separate piece, of .040, riveted to the "web" part of the rib, with rivets spaced about every 1/2". Bend relief cut-outs were made at about the same interval, so obviously it was a time consuming job. The .040 flange did not give the degree of lateral rigidity desired, allowing a slight amount of spanwise "rocking". As a result Francis' outboard skin wound up with a little "oil can" in between the spars adjacent to the splice joint. I lucked out on my wings, but as a result of this experience I would strongly recommend using a lap joint, even tho' it theoretically might not have the eye appeal of the butt joint.

I would further recommend you purchase the big steel attach fittings from KEN KNOWLES, unless you have access to a big metal

cutting bandsaw and have a buddy at a steel company that will cut you off the 6 blanks of the thick 4130 steel plate needed. You'll also need a buddy at the heat treat plant, so that you won't have to pay the minimum heat treat poundage fee.

I further would recommend you buy the entire folding wing package from Ken; skins, ribs, spar stock, push rods, bellcranks, ailerons, flaps and fittings. The total cost really shouldn't rattle your cage. Look at it this way - the folding wing will completely pay for itself in about 2 years! Further, you'll get all of your money back again when you (or your heirs) sell the airplane someday down the line! Maybe more.

Now if that isn't a truly handsome return on your money, I'd sure like someone to show me another investment (in these days of galloping inflation) that will even begin to approach the handsome dividends of a folding wing. Furthermore, what other investment will let you have that much fun in the meantime, too?

Had you ever really stopped to consider your T-18 in the light of being a good investment? Have you noticed that when T-18s and T-18 projects are advertised in Sport Aviation or Trade-a-plane that they are only advertised one time? I think that pretty well establishes the T-18 as pretty saleable. It's an open secret that all makes of airplanes are appreciating in value at a pretty handsome rate - from 10% to 15% per year the last 2 or 3 years. That rate pretty well parallels the annual increase on new aircraft. Would it shock you to learn that Cessna's 152 trainer carries a price tag of almost $20,000? And a new Bonanza around $100,000? Does all that change your viewpoint towards what you are investing in your project? It did mine. When I took note that my savings were shrinking by at least 10% per year, due to inflation, and I was losing 3% in the exchange between the 7% interest received, plus having to pay tax on that 7%, I decided to put my money into T-18 parts, engines, etc. At least I can have a little fun out of things and maybe break even down the line.

Quite a few of the T-18 builders, including Lu and I, were pretty upset with the members of the working aviation press at our last two national conventions, actually the last three. The past three years the aviation press has studiously ignored the fact that there were 45 T-18s there in 1976, 36 of them there in 1977, and 43 were present in 1977. There was much made of the fact that 24 Variezes wre on deck and that does speak well for Burt Rutan's design, but why the T-18 wasn't accorded the honor due it I don't know. I do know that several T-18 builders left their T-18s at home because they resented the situation the years before.