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15 April 75

T-18C WING PLANS - At long last, I have completed the detailed drawings for the new convertible wing. The T-18 with this configuration wing has been designated the T-18C. The C stands for "Convertible". I elected to use this designation rather than F for "Folding" because when the wing is converted to highway configuration it doesn't just fold up like a Corsair, but rather is rotated and swung back along the fuselage. And although I have designed systems for two of our swing-wing military airplanes, the F-111 and B-1, I never really liked the term "swing-wing."

Those of you who have never designed an airplane might not realize how much work is involved. This project has used up just about every bit of spare time for the last year, so I haven't had much time to put out Newsletters.

If you haven't noticed the ad in Sport Aviation, the price of the plans is \$35.00 for 38 drawings and building instructions. The original T-18 drawings are referenced for some details, but just about every drawing associated with the wing was re-drawn. The only change to the fuselage, and this is optional, is the elimination of the fuselage gap cover from the wing center section. The gap cover under the main spar can be attached to the fuselage instead of the main spar. Anyone who has ever tried to attach the wing to the fuselage with AN bolts will tell you that you need a triple jointed arm. Of course, there is no problem if Ball-Locks are used. Sealing the cracks around the center-wing gap cover in the fuselage has also been a bit of a problem.

The T-18C wing uses basically the same center wing as the standard wing out to BL 40. Thus, the same materials can be used for the center wing including the main spar materials. The skin has been changed to .032 for the center wing, but John has already been recommending that, especially for the higher horsepower engines.

The outer wing has been changed more significantly. The main spar has a .032 thick web and the extrusions are 1.25 x 1.25 x .125 angle with a short piece of 1.125 x 1.125 x .125 angle used as a doubler. Main spar fittings are 4130 steel. So, if you already have materials for the wing and want to build a new one, you perhaps can sell some of the main spar materials. Some builders already have the wing completed and expect to change. We should therefore see some wing panels advertised in the Newsletter before long. Ken Knowles is stocking up on all materials needed for the new wing.

Much effort was directed toward the design of the joint to permit one person to convert the wing quickly, easily and especially to make it fool-proof. The design originally included a lever-type pin extractor for each main spar pin. This was finally abandoned because of the building complexity involved. So, two tools are now required for wing conversion, a screw driver and a special pin extractor which is just a sliding weight on a rod. A built-in latch captures the main spar pins and this can't be left unlatched if the gap cover is in place. The gap cover has been simplified by using wing skin overlap up to the main spar - no separate piece - and a small D-section forward of the spar. This D-section can't be slid into place unless the spar pins are completely seated and the latch is secured. A single captive screw at the leading edge secures the D-section gap cover in place. The status of this screw can be observed from the cockpit. A single detented pin (Ball-Lock) secures the rear spar joint. To convert a wing from flight to highway configuration, it is simply necessary to: 1. Unscrew the screw in the D-section gap cover and remove cover. 2. Extract two main spar pins. 3. Remove detent pin in rear spar fitting. 4. Grasping wing tip, rotate leading edge up slightly, pull wing panel out, then swing back and rotate leading edge up.

It is recommended that the T-18C be transported on a trailer rather than on the main gear, especially if it is to be towed any great distance. Tire wear is too great on those little tires as it is, there is too much chance of damage, and as Molt Taylor says, an airplane structure just isn't meant to be a trailer. Plans for a trailer have not been included, but any low trailer could be adapted. Three channels for the three wheels could be built along with securing means. If two wing cradles are built onto the trailer, they could be hinged down until the airplane is pulled onto the trailer with a winch. This allows them to clear the horizontal tail. Then they could be pinned in place and wing conversion accomplished right on the trailer.

John Thorp has performed a stress analysis on the T-18C wing using 1500 pounds as the design gross weight. The wing was designed for the same design load factors (6 and 9 g's pos) as the standard wing, but I am not advertising it as aerobatic. Due to uncontrolled factors such as workmanship and substitution of materials, it is up to the individual builder if he elects to verify a safe operating envelope through static loading tests on the ground. The T-18 is such a clean airplane that it is easy for an inexperienced pilot to build up excessive speed in aerobatic maneuvers. For this reason, John is not pushing it for aerobatics. You will see why in a subsequent article.

OSHKOSH POSTSCRIPT - It turns out that most of the speculations, including mine, about the reason for the substitution of materials in the T-18 wing were wrong. Al did have plans and saw copies of the Newsletter. The problem seems to be one of over-confidence in the T-18 design. A builder wrote a long letter to me in which he described a whole week of conversations at Oskosh 1974 with Al about his T-18. This builder was also putting a 180 hp engine in his T-18 and he said during the week of the Fly-In he went over practically every inch of Al's airplane and discussed with him how he made various parts. Al was so excited about the T-18 that he said, "The T-18 is so strong that I didn't even use steel bolts or Hi-Shears in the wing fittings, instead I just used aluminum rivets". He promised to change these as soon as he got home from Oskosh. The T-18 is a good airplane, but that means it was designed according to the numbers and there is no big extra safety factor above that specified. Don't substitute and DON'T modify anything which might affect the flight characteristics or strength of the aircraft.

CONSULTING SERVICE - John Thorp makes a living doing consulting engineering in the aircraft field. If you want to make a modification to your airplane, you can engage his services at a very nominal rate (probably less than you pay your garage to work on your car) and he will either do the design or analyze your design. For instance, he has helped Russ Basye with his retractable tri-gear design, Peter Garrison with Malmoth and Dick Cavin is having him do preliminary design on a VW twin - two-placer. If you know of anyone who wants the preliminary design performed of some new concept, John charges about \$500 for this. He works by the hour on small jobs and will give you a quote. Cheap insurance. John didn't ask for this free ad, but I thought you might like to know about this available service.

LANDING LIGHT INSTALLATION - Norm Buehler, Rt 3, Box 106, Scott City, Kan 67871 asked me if it was safe to cut a hole in the leading edge of the center wing to install a landing light. I suggested he engage John's services and here are the results: "I have installed landing lights in the first bay (near BL 60) of the leading edge of the center wing. Since the wing torsion from the outer wing panel has been picked up by the rear spar fittings, there is very little stress in the leading edge skin at this point. In the center of the center wing leading edge, the shear stress due to torsion is relatively high. However, if the hole isn't too large and if you reinforce the cutout with a doubler of at least .040 x 1-5, the structure will be OK. Functionally, the landing light in the outer position has been a notable success."

AUSTRALIAN T-18 - Don Brown, Wonthaggi Rd, Kongwak, Victoria, 3951 Australia visited me following Oshkosh last year. He and a whole plane load of people made the trip all the way to Oshkosh last year. There are quite a few T-18's under construction there because the T-18 design meets Australian certification standards. Don tells me that very extensive data and analyses must be provided to obtain certification on an amateur-built aircraft there, almost like a commercially built aircraft. The builder must submit samples of his workmanship and obtain approval before construction can begin. If you think it is a long way from your house to Oshkosh or to your material sources, just think about our builders down under, or in Africa.

MATERIAL SOURCES - Since I am not building, I don't keep too well informed on sources of raw materials. Please let me know when you find a good source for something. To my knowledge, the only sources for T-18 extrusions are in California; Ken Knowles Sport Aircraft and Merrill Jenkins. Both handle about all the metal raw materials and will fabricate parts. The last time I talked with Ken Knowles, he said he carried everything needed to build a T-18 structure except the wing tips, cowling and canopy. He will make any part for you. A complete kit with ribs, fuselage frames and landing gear etc fabricated was about \$2500.

Airparts Inc, 1430 So. 33rd St, Kansas City, Kan 66106 sent me a catalog with all sorts of goodies in it such as sheet stock, any length, rivets, etc. So far there isn't a T-18 supplier on the East coast.

TEMPLATES- The T-18 skin templates have finally worn out. There hasn't been too much demand lately since some suppliers have begun marking sheets with hole patterns. So, unless somebody wants to start up a template service, you'll have to make your own. Perhaps I can put some dimensions in the Newsletter which will help builders lay out the fuselage templates.

WING PROFILE LAYOUT -(LDS) Recent questions from a builder about airfoil contour layout indicate a need for some instructions on this subject. Drawing 547 gives the coordinates of the upper wing surface and lower wing surface in both percent of chord and in inches. To lay out the curves, first set up two reference lines, one horizontal line over 50 inches long and the other a vertical line crossing the horizontal near the left side of your paper.

Station measurements are taken as horizontal distances in inches to the right of the vertical reference line. Ordinates are vertical distances from the horizontal reference line. Positive distances (to the upper surface) are above the reference line and negative distances (to lower surface) are measured below this reference line. Just ignore the percent numbers for they are not needed. NACA data is always expressed in percent of chord but John has already converted to inches.

To make the layout, first draw the line on which the center of the leading edge radius is located. Start this line at the intersection of the two reference lines and slope it up to the right. The slope is given as 0.1635. Draw the line through the intersection of the reference lines which we'll call point O, and a second point, which we'll call point C located 10 inches to the right and 1.635 inches above the horizontal reference line.

The leading edge radius is given as 0.5435". Set a compass at this length and draw the leading edge radius arc with the center at point C. Note that the leading edge of the circle extends slightly to the left of the vertical reference line, but all stations are measured to the right of point O.

Now, lay out all station points along the horizontal reference line using point O as home base. Draw vertical lines through each station point extending about 5 inches above and below the reference line. Then lay out the ordinates for upper and lower surfaces on these lines. Draw a smooth curve through all points.

For this layout, as for all T-18 layout work, you need at least an 18 inch long scale marked off in .020" minimum increments. (See back Newsletters for sources.) The wing profile laid out according to drawing 547 is for the outside of the skin. So, to make everything come out right, you should make the master rib formblock smaller by the thickness of the skin and the tooling rib, (.025 + .025 = .050). Center rib formblocks for .032 and .040 ribs should be made smaller accordingly, but Rudy Adler says he uses all the same size form blocks and everything seems to fit alright.

ALUMINUM HEAT TREATMENT - Questions are sometimes asked about the substitution of T3 for T4 in 2024 alloy aluminum. There is only a slight difference between the strength of T3 and T4. T3 is solution heat treated and then cold worked while T4 is solution heat-treated and naturally aged to a stable condition. Generally, sheet and thinner sections come in T3 while sections over .060 are T4. Ken Knowles tells me that plate and extrusions are only available in T3511 rather than T4 and this is suitable.

WOODEN PROPELLERS - Just received a letter from Al Wedge, VP of Sensenich and he reports that they have sold a number of wooden propellers with both plastic and brass tipping. But I see they are still putting out information recommending pitches which in my estimation are too steep. Perhaps they have now changed their bulletin, but if not, here are my suggestions: On W66LM Props, 160 hp - 78", 150 hp - 76", 135 hp - 74", 125 hp - 72" or 74". I have a 74" pitch prop with plastic tipping and like it fine for a good low-rpm cruise, but it doesn't climb too well, that is, it won't do over 1000 fpm with a full load. Someone operating from a small field would probably prefer a 72" pitch.

I really haven't received many reports on the new props so you folks who have them should write in and let me know of your experiences. Bob Daniels of Eugene, Oregon tested the first W66LM on his 160 hp T-18 after John Shinn had tested it on his 135 and I had tested it on my 125 hp T-18. This prop had 76 inches pitch. It was too much pitch for both the 125 and 135 engines. Bob reported that it equalled his metal prop in top speed but didn't get quite the rate of climb. At 7500 feet altitude, he obtained 195 mph as checked over a 7.5 mile measured course. After 17.5 hours on the 160 hp engine, a piece of the plastic leading edge came off this propeller. All other propellers made by Sensenich with plastic tipping have had the plastic wrapped around the leading edge rather than just bonded on the very front portion and there have been no further reported problems. Some have had the finish peel off the plastic in rain. Ford Hendricks says that will happen to any propeller in rain but if you just throttle back to about 2000 rpm you can go right through rain. So far, this has worked with mine and I have lost only one small piece of black paint near the tip, about the size of a dime.

HEAT TREATING ALUMINUM ALLOYS - Info supplied by Dr Jeff Shinn, a mechanical engineer and John Shinn's brother. It is possible to change 6061-T4 aluminum alloy to the T6 condition by a heat aging process called precipitation hardening. This is just a fancy name for heating at 350 °F for 8 hours. Room temperature aged 6061-T4 has a yield strength of about 22,000 psi. After 8 hours at 350 °F, the yield strength increases to about 37,000 psi - a factor of 1.7. It sounds like a good way to gain some strength. There has been no indication, however, that the present T4 ribs are not adequate.

RIK KELLER FLIES - 5146 Connecticut Ave, La Mesa, Ca 92041. Number 332 flew for the first time Sept 28. We are having cooling problems, cause unknown so far. Could be instrumentation. More later.

BANDSAW - James Borg, 1332 Jersey Ave So, St Louis Pk, Minn 55426 says he built the bandsaw shown in Sept 1973 Sport Aviation. It works great and he highly recommends it. These are the kinds of tips which are helpful to new builders. Send more!

REGIONAL MUTUAL AID GROUPS - Frequently I get letters requesting the names of builders in their area. My trouble is that I have no idea where Polecat, Tennessee is near and to sort out all the builders in Tennessee would take an hour. (Just try reading through 1000 names and addresses sometime.) What we need is a regional coordinator for each state or metropolitan area. If you would like to serve in this capacity, please send me your name and permanent address. I will list all coordinators in the Newsletter and I will send each one a list of builders. Then local builders can contact their nearest coordinator. So, let's have some volunteers. I am quite sure that you will be amply rewarded through your contacts with other builders.

HOWARD GINN REPORTS- 44140 No. Gillan Ave, Lancaster, Calif 93534. Howard sent in performance data on his 150 hp T-18. He has a 68 long x 75 pitch prop (metal I assume) which gives a max static rpm of 2000 and a max level flt rpm of 2700 at 2500 feet. He reports max speed of 176 without gear fairings or pants. Using a Corvair (large) oil cooler, the max oil temp is 200 °F. Construction cost was \$4000. Empty weight is 894. Most fwd cg is Sta 63.7, Gross cg is 63.4, Empty cg is 62.7 and Most Aft cg is 70.7. "Since the first flight on 22 June 74, I have flown just over 100 hours and have no problems except a terrible gas bill.

The total lack of problems is a direct result of closely following the excellent advice in the T-18 Newsletters. You have my sincere thanks and appreciation for your many months and years of devoted effort. Enjoyed your fine article on the folding wing and look forward to starting construction on one of my own. I agree that it is a dream come true!"

I appreciate receiving flight data so it can be included in the Newsletter and of course it always helps to know that the Newsletter has been of assistance. Thanks to all you who have been so generous with your donations and comments.

CORRESPONDENCE- I am always glad to answer questions from builders, but the mail load is really getting heavy. It would be of great assistance if you would enclose a self-addressed, stamped envelope when you expect a reply. Also, list all questions by number on a separate sheet of paper with space provided for an answer. That way, I won't miss answering any. If you ever fail to get a reply within a reasonable amount of time, please write again for your letter might have become lost. My wife Marilyn handles most of the clerical work. She requests that you always use your plans number and that Canadian builders not send personal checks. The bank tells us that they are going to start charging a couple dollars each to cash out-of-the-country checks. I can usually get currency changed OK. Money orders are OK, as are checks for US funds. If you buy someone's plans and don't know the number, look on a copy of an old T-18 Newsletter and the plans number will appear before the name.

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ALTITUDE RECORD?- Pete Roemer/his dad's 180 hp T-18 to what may be an altitude record for a non-turbo powered T-18. He went to an absolute ceiling of 26,100 feet in 1 hr, 25 min. Now he not only claims the world's FASTEST T-18 but also the HIGHEST. The rate of climb was impressive: at 10,000 feet - 1400 fpm, 15,000 - 695 fpm, 20,000 - 380 fpm, 25,000 - 50 fpm. Took 22 min 48 sec to 20,000'.

PLANS FOR OSHKOSH 75 - B. C. (Benja) Roemer, Manitowish Waters, Wis 54545 has some great ideas on how to operate the T-18 Air Force at the Fly-In. "I spent some time in the metal working tent, however, I believe we served the T-18 cause as much or more by being on the field every day of the convention. We helped start the T-18 parking area and plan to continue it for this is one of the best things for the T-18'ers that ever happened. People are really impressed by the row after row of T-18's. It gives builders and prospective builders ideas of how different ones are constructed, fairings, wing tips, canopies, cowles etc without hunting all over the place. I remember when I was building, I often wanted to look into

cowlings and couldn't find anyone around to open one up. I had many questions and found it hard to break in and ask when a pilot or owner came on the field to fly.

By maintaining a "field station" in the T-18 area at Oshkosh 74 to answer questions, it took a heck of a lot of time but it was worth it. In 1975, I plan to have a card table and folding chairs with a sign, "T-18 Questions Answered Here". This will need more than one attendant so volunteers will be needed. Whomever mans the table could move it to their ship. We'll give all T-18 pilots a pink feather for their cap and all builders a yellow one. Can you imagine the questions the rest of the fellows would ask as to where they got the feathers? And it sure would identify the clan anywhere on the grounds! Of course, I will furnish the feathers since that's my business. (Archery necessities and Accessories).
So, there you have it. We should have a great time at Oshkosh this year. Don't have any firm plans for the sheet metal workshop but I'm sure you new builders will be able to learn how to form ribs and dimple and rivet.

BELT SANDER - Roger Weselmann, 4054 Suburban Dr, Waterloo, Iowa 50702. My favorite tool is a 1" belt sander from Wards. Cost \$18.00 plus motor. Absolutely indispensable because I hate filing. Much preferred over a grinding wheel. I even use it to sharpen drills. Think the plans are great and the Newsletters are the best idea since sliced bread.

Tip - Especially on good parts, I apply masking tape where lines etc will go. Lay out lines, holes, etc. on masking tape with ball point pen. Stand back and look. If not right, pull off masking tape and start over. Leave masking tape on when drilling. Seems as though the tape cuts down on drill wander. With a good-drill center punching isn't necessary, except for highly accurate locations. Also, I have added a .025 bent up angle down top centerline of the fuselage from the canopy to the fin. Reason: Other T-18's really vibrated in this area. ED note: Good idea. Many of us have done this.

Tip on flaring tubing. Many people buy automotive flaring tools for tubing and use them with AN fittings. Won't work for long cause AN fittings are 37° and automotive are 45°. Also, aircraft and automotive air disconnects are not interchangeable. Why can't these things be standardized? Maybe it will straighten things out when we go metric. Ed: Or just add a third to help confuse us for the next hundred years!

A. O. Chellis FLIES- 12 Henry St, Bridport, Tasmania 7254, Australia. Received a nice picture of VH-AKC powered by an O-320 A2B swinging a 74" x 61" pitch prop. It first flew 21 Feb 72 and was the 4th T-18 to fly in Australia.

O-290-G with WOOD PROP- William Oliver, 2369 Phillips, Beakley, Mich 48072 has a Sensenich W66LM 74 on his O-290-G, no gear fairings or wheel pants. He gets 2625 rpm at 2,000 maximum and indicates 165 mph at 72° F. Empty weight is 928. No flush rivets. Most fwd cg - 62.1, Most aft cg- 69.5. "I like the wood prop both for performance and peace of mind. My wife and I recently flew from Pontiac Mich to Salina, Utah and back - the longest and best trip I've ever made in an airplane. Averaged over 160 mph and 20 miles per gallon. At 14,000 it will turn 2450, indicating 125 - 128 mph.

CHANGE OF ADDRESS- If you move, send us a change of address for the post office won't forward mail after about a month. After each mailing we get about 50 returned.

TAILSPRINGS- A number of people have had the front bolt in the tail spring break, including your editor. This is so common that I figure we should have two bolts there, one padded with a rubber washer. Then when one breaks, the other one would catch it. The Citabria used for towing gliders at our local airport could sure use this trick for they are always repairing a bent rudder when the front bolt breaks

John replied on this subject as follows: The front bolt in the tail spring has been called out as 3/8" since 22 Feb 69 (A-590). I haven't been told of a 3/8" bolt failing. (Mine was 5/16). On June 20, 1971, I put out drawing A-862 for the heavy duty steel leaf tail spring. This also uses a 3/8" front bolt and I haven't heard of any front bolt failures with the steel spring which is noticeably softer than the aluminum spring. At the moment, I would advise all T-18 builders to install the A-862 tail wheel spring.

SHOCK TEST- Howard Warren, Flint, Mich reports that he washed out his T-18. He was making an approach in bad weather when he struck a utility pole and went into a utility building. His son received a broken nose and a few cuts and he got away with two broken ankles and a broken wrist. Following this accident, two of his friends who were quite far along building wooden airplanes switched to T-18's.

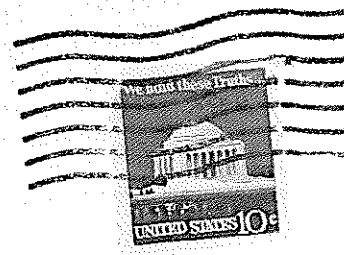
LOAD TEST- Chuck Borden took someone from the local airport who knew how to do aerobatics for a ride in his T-18. When Chuck was in the middle of a barrel roll inverted at 160 mph, his passenger for some reason yanked back on the stick. The result was a split S at very high speed and the g-meter registered over 6 g's. Weight was over 1400 pounds. Wrinkles occurred in the center wing skin and in the fuselage sides at the dash. The center wing was reskinned and it was found that there was no permanent set in the spar except that the inner wing main beam (.040) became wrinkled. Thus, we have added 3/4 x 3/4 x .062 aluminum angles vertically on the front face of the beam in the T-18C wing. Two angles are equally spaced between the ribs in the center wing and are attached to the beam with five 1/8" rivets. It would be a good idea if stiffeners were added to the standard T-18 inner wing also, even though design loads were exceeded in this incident.

HOWARD HENDERSON FLIES- 444 Bryan, Kirkwood, Missouri 63122. I flew the first flight on SN 600 October 21st after carefully heeding the advice of others to do lots of taxiing. It is slightly left wing heavy, but otherwise trims out OK. I selected a flight day with a steady 15 mph breeze almost down the runway. For the landing, I set up a long approach at 90 mph with half flaps, cut the throttle at the end of the runway and proceeded to hold it about a foot off the runway for a three point which caused a little bounce. The rollout was easy because of my taxi experience. Engine is a 150 hp and the prop is a 74DM, 68x68 purchased before the prop requirements were well understood. Ground vibration tests (suspended on a shock cord) showed a first mode resonance of 2750 rpm so am placarding the tach at 2600. I'll get another prop after my test period. The gear is double tapered, both inner and outer tubing and 2" longer. It feels fine to me. Am using special foam soundproofing supplied by "Sound Coat" and two Pazmany mufflers, so as soon as I figure out how to seal the canopy, it should be fairly quiet. Have a large Corvair oil cooler and my oil temp never got over 160°F.

LUBRICATION- The T-18 drawings specify Lubriplate for lubrication of all bushings, bearings etc. John now recommends one of the dry lubricants such as graphite or Electrocilm. I've specified Moly-Kote on the T-18C wing. It is also a dry lube. After 1000 hours, John disassembled N2997 and bushings were still adequately lubricated. (with dry lube) Oil and grease tend to collect dirt which is abrasive.

TRIM WHEEL- Lyle Trusty, 43 Conklin St, Farmingdale, NY 11735 sent a report on his 150 hp T-18 with Hartzell Constant Speed prop. It weighs 950 pounds empty and has a top indicated airspeed of 170 at 3700 feet, climb is 1700 fpm. Building time was 22 months. He has sent a sketch of his trim wheel installation which is located near the center of the tunnel rather than on the side. The side-mounted trim wheel is especially bad for someone of my stature (6' 3") because the edge of the trim wheel is the only thing my right leg has to lean against. Lyle mounted the 716-1 wheel and 721 hub in a slot in the top of the tunnel and on a 1/4" shaft. The shaft is mounted in the 722 bearing on the left side and in a gearbox on the right. He used bevel gears from a Terry drill adapter mounted in a frame made from 3/4" plate, hollowed out. Anyone else have a good solution with available parts?

T-18 NEWSLETTER
Luther D. Sunderland
5 Griffin Drive
Apalachin, N. Y. 13732



407. J.R. Wood, Jr.
705 N. Cross
Robinson, Ill.
62454

