

Luther D. Sunderland

FOLDING WING SURVEY: The survey showed an overwhelmingly high percentage of persons responding favorably to a folding wing design. Actually, only 75 forms were returned, but that is about par for the course. Only one of these indicated that they did not favor the idea. John Thorp feels the survey was akin to asking people if they would accept a free \$20 bill, but he is convinced a folding wing would be a desirable feature. It is not a simple matter of moving the wing break in and folding the wing. There are complications of breaking the flaps and taking the increased bending moment at the joint.

In any case, John says he is likely not able to take on the job of doing all the necessary redesign work due to health and work load problems combined. So your editor has undertaken the job of making drawings for the folding wing design. John is doing all stress calculations on structural parts. The wing will pivot at the rear spar on a pull-out tube and swing back along the fuselage. Two levers will be actuated to extract the two main spar fitting pins and one ball-lok will release the sliding tube at the rear spar fitting. No other actions are required before folding the wing. The break will be made at Butt Line 45, the dihedral starting at that point. If there is someone with a fair amount of experience who would like to build the prototype and could work just from preliminary sketches, contact me. I will have time to do any design work though if I have to answer a lot of mail on this subject, so I will keep you all posted on progress via the newsletter. Please try to have patience. The fuselage is not affected so if you plan to build a folding wing, just work on everything else but the wing.

RIVET GUNS: I see B & F Aircraft Supply, 6141 West 95th Street, Oak Lawn, IL 60459 (312)433-3220 has a good selection of rivet guns in their catalog which they will send you for \$1. A 3x size gun is \$45 used and a new 3-M-401 is \$47.50. Either would probably work fine for T-18 building. Their No. 5 Jr. Whitney punch is \$17 in metal box. Clecos are \$34 per 100. Ouch!

P-51 OR T-18? Perhaps you saw the sharp picture of Bob Dawson's T-18 in Sport Aviation and thought it looked more like a P-51 (N452). The color photo he sent me sure looks great and I hope it performs as well as it looks. So far, he has sent no data. He said, "I used to get upset when I read in the Newsletter that someone flew his plane and did not say how fast it went etc. Now I understand. I will send performance and other particulars as soon as I can." It is narrowed to a single place about 28 inches wide at the

cockpit. The main gear attaches to the spar and retracts into the wing. Tailwheel retracts also. A 150 hp engine is installed and equipped with a constant speed prop, inverted fuel system with pressure carb and inverted oil system. An auxiliary fuel tank is installed behind the seat. He says it is an exciting airplane. Now where is the data, Bob? He lives at 211 Savoy, Sugar Land, TX 77478.

FIRST-HAND PROP EXPERIENCE: Frank Boehulein, 6206 Timberline, Independence, OH 44131, T-18 #576. Your prop experience coupled with your forum at Oshkosh on the wooden props certainly points me in that direction. A recent experience by one of our chapter members also reinforces my tendency towards the wood prop.

Perhaps you do or do not remember the Ilse that was at Oshkosh last year. It is a high wing Cougar-looking four-place airplane with distinguishing full plexiglass doors and swept forward fiberglass wings. It was built by Rudy Segrist and is quite a performer. At any rate, he and his wife Ilse were on a return flight to Cleveland from San Bernadino, CA when his prop let go approximately eight inches from the hub. It just about tore the engine from the mount before he got shut down. They were at 8,500 feet and fortunately he remembered an abandoned mining strip they had passed over shortly before so he headed for it. He did not think he was going to make it and his last transmission to the FSS was that he was going into the trees. At this point he remembered he had dumped the flaps and quickly retracted them and got enough lift back to skim over the trees to plop it down on the airstrip smack dab in the middle of a hippy commune. They got out, looked at the airplane and found the cowling was gone, two feet of prop, and the 180 hp engine was hanging there by the two lower engine mount tubes.

Ilse, to say the least, was glad to be spared her life. The ride down in the crippled plane frightened her to death but the ride to town on the back of a hippy chopper really scared the -- out of her. They called FSS, told them they were OK and in fours hours had the airplane on a trailer on their way home. The young people could not do enough for them--helped them get a trailer, take the plane apart and load it for the trip home. Happy Ending!

A not so happy ending is the Mike Simkanan story. He crashed in his T-18 a week before Oshkosh at Akron, OH. A subsequent autopsy showed that he died of a heart attack. We have lost a fine individual and a fine T-18.

MATERIAL SOURCE: Airparts Inc., 1430 South 334d Street, Kansas City, KS 66106 sent me a catalog which has all sorts of goodies in it, such as rolled sheet aluminum, metal countersinks for \$1.50, dimpling dies, rivets, bolts, etc. (1986 Note: This is still a good source for aluminum sheet.)

BUILDING EXPERIENCES: John Austin, 1101 South Eric, Monahans, TX 79756. I just received Newsletter #39 and am returning your questionnaire. We live in a small town and hangar rent is only \$15 per month so not a big problem now, but many metropolitan areas have rent \$50 to \$60 which is another reason John Doe is not flying. The Newsletter has been invaluable to me and I sure want to thank you for your patience. I am about to take T-18 #630 to the airport. I started building in December 1965 with Larry Larcom and Curtis Whipps at Delaware, OH. Larry finished #194 at Delaware about three years ago. He has a beautiful machine, which now has over 400 hours on it. It takes about 45 minutes to go from his home in central Ohio to a cottage on middle Bass Island in Lake Erie. He really loves his T-18.

After starting my project, I moved to Huntington, West Virginia and most of my three years there were spent on small assemblies, going to night school to an adult education class where I made T-18 fittings. This was really great as they had all the power equipment and know-how needed. Also, since I furnished my own material, they were quite willing for me to deviate from their standard course of instruction. Actually I taught the class several new things due to the quality of the drawings, reference system etc. Everyone was quite interested in the project.

Just after I clecoed up the fuselage and was going to start riveting, I was transferred to west Texas. I am in the oil well service business. I am closing up the cowl, installing wheel pants, painting and upholstering now. I have a stock GPU, Delco alternator, Corvair cooler, filter, 283 Chevy air cleaner element and cut down deck with hole for jump seat. The gear is also extended and tapered. I had low oil pressure on the GPU but fixed that with a new spring (standard). Bought a 182 instrument cluster from Bob Kelley in Wichita and had a terrible time with it. Had tach, MP, two fuel oil pressure and temperature. The fuel and oil pressure had electrical inputs, others were mechanical. The Cessna sending unit for the oil pressure was \$27, so I shopped around and found an equivalent automotive unit for \$7. It took me about two months of bench work to get these gauges to work, partly due to lack of information. I installed it in my panel, which made a big hole 5 inches x 8 inches or so but lots of data in a small space. Then after about a year I started my engine, and neither the oil pressure nor fuel gauge would work. Replaced the OP with a mechanical unit cut out of its case so it would mount in the cluster and replaced fuel gauge with a new SW unit. Leon Davis, builder of the DA-2, told me earlier I would be ahead to scrap that cluster and start over but I did not believe him. I guess he was speaking from experience. I was disappointed in the length of time it took to get an answer from Pershing Larsen on my spinner order. (Editor's Note:

His spinner maker has moved out of the area and is not taking any more orders. He is referring all orders to George Rattray who makes them for \$50 I believe.)

I know there are many homebuilders traveling around the country. If anyone will stop by Monahans, Texas and give me a call, they will have a hospitable welcome.

PLANNING A PROJECT: Bill McKinley, 315 Harvard, Liberal, Kansas 67901 (316)624-7382. Received plans in June. John is very prompt. I have been gone on charity work since then. My wife, Irene, said the Mooney plans I ordered 3 January 73 finally got here July 21. The first thing I did was to sort the drawings, make a list (drawing number, name next assembly) then from the list I made flow charts in production sequence and arranged plans in this sequence. The back Newsletters--thanks to you all--came and Irene sent them to me (250 miles away). Reading the Newsletters told me I should reread and footnote each comment on structure and procedure. That is what I am doing now. The Mooney is a pile of little bitty pieces. It has info I want but I do not think I will build it. The T-18 has a real set of plans compared to some others I have seen. May I ask any T-18er flying through Liberal (real good old Army training field) to stop, and let me see their bird in exchange for a steak dinner.

PERFORMANCE: I am sorry to say that only 30 people have filled out and returned T-18 Performance Questionnaires out of the 106 or so that have flown. And many of those returned did not contain airspeed data. I have decided the reason is that some people are ashamed to admit their ships' performance. Since several of the 125 hp models have claimed speeds in the high 170s or 180s, it is understandable when a 150 hp owner who cannot go that fast would not feel like publishing his data. Frankly, I cannot figure out why some T-18s go so much faster than others, especially when the slower ones often have superior finishes. For one thing, I never believe airspeed readings if not checked accurately over a measured course. If we did have data measured accurately, it would be quite helpful for it might help determine what a builder should or should not do.

One way to check your airspeed system is to check a straight stretch of highway between two prominent landmarks at least five miles apart. Auto odometers can be checked readily by the mile markers along highways. Make many flight runs early in the morning when there is no wind and average the results. If you are lucky, you may find a straight stretch of highway five miles long. In my area, I was not so fortunate and I have to use a six-mile course from the point of an island in the Susquehanna River to a highway intersection as measured from a topographical map.

I am not sure how accurate these maps are. It is quite important to precisely measure your course, for a 1% error can mean almost 2 mph. Also, you need a stop watch which measures in fractions of a second for a one second error on a six-mile course can also mean almost a 2 mph error. Be sure to figure speed by the formula:

$$\text{Speed (mph)} = \frac{\text{Distance (miles)} \times 3600}{\text{Time (seconds)}}$$

As an example, I made my six-mile course in both directions in a total of 240 seconds.

$$\text{Speed} = \frac{12 \text{ miles} \times 3600 \text{ second/hour}}{240 \text{ seconds}} = 180$$

When checking the maximum speed, pick an altitude and establish it a mile ahead of the starting gate, then hold that altitude as accurately as possible, at least making sure you go through the finish gate at precisely the selected altitude. As you pass the gates, lean against your shoulder harness to obtain a fixed body position and sight down past the leading edge of the wing on your side of the aircraft. When checking intermediate airspeed indicator readings, do not worry too much about holding constant altitude. Pick a power setting that will hold a constant altitude at the selected airspeed, then vary pitch attitude to hold the indicated airspeed within one or two mph. Be sure to note fractions of a second. If there is a crosswind, you can minimize the effect by holding the course heading and allowing the airplane to drift.

KITS: Ken Knowles' Sport Aircraft Inc., 104 East Avenue, K-4 Unit G, Lancaster, CA 93535 (805)949-2312 has pre-marked kits available for the T-18 with many hardware items also (1986 address).

T-18 PARTS: Ken Brock, 3087 West Ball Road, Anaheim, CA 92804 (of Gyrocopter fame) has a T-18 parts catalog available. Examples of his parts are 905 driving lug \$1.25, 612 main beam fittings \$22 pair, steel bushings 554, 594 etc. \$1.25 each, canopy rails \$9 pair etc.

INTERNAL TAIL WEIGHTS: Many people have expressed interest in the design for enclosed horizontal tail weights. It is shown in Figure 17. It takes three pounds of lead on each side 1.2-inch deep by 10-inch long. An extra 0.032 2024-T3 beam backs it up and extends between the two outer nose ribs.

Dimple leading edge skin for 10-32 countersunk screws. The 0.032 backup is bent up as a channel and joggled to fit inside rib. File off edges of screw head if dimple is not deep enough. Bend up a trough-shaped form and pour in lead. Do not get lead any hotter than necessary as it will warp

making it difficult to fit.

CARB HEAT BOX: Chris Fast, Pacific Palisades, CA. Your neoprene canopy seal sounds like a winner and I will give it a try. Incidentally, I own the tooling that makes John's carb intake box and also the turned plate to lay up the silicone rubber seal. This is the banjo box that fits the O-290, 320 etc.--not the long scoop.

MOLDINGS: by Luther D. Sunderland. On my initial test flight I discovered that the U-shaped rubber molding or the inner wing skin did not work out too well. It cannot make a good seal with the fuselage and still provide clearance to permit wing installation without interference. Subsequently, I found some white molding which I cemented to the fuselage leaving a nice fillet for the wing to simply seat up against.

QUESTIONS:

1. Merrill Jenkins wrote me that I would need a heavier mount for the O-320 160 hp engine. How much etc?

Answer: John says the plan's mount is good for 180 hp.

2. I have never been able to successfully grind the little nib on a sheet metal grind drill and have not found anyone else who could.

Answer: Neither have I.

3. Have not been able to come up with the 3/4-inch micarta rod for flap hinges.

Answer: I never could figure why John did not use mild steel there also. I asked him but forgot the answer.

NORM SPILLMAN FLIES: Serial #257. You are right, It is hard to describe the feeling of a first flight in one you built yourself. Had my final inspection at 10:00 AM on the 10th of May and the inspector, Mr. Graither of the Kansas City area, treated me just great. Ended up with four discrepancies from the inspection; needed mark on tachometer; placard master switch; arrow marked for stabilator trim, up, down; deviation card on compass. He was very complimentary about my bird and even went to the point of getting his boss to come look at a T-18. This was done while I was in the process of "buttoning up everything." Got it all closed, then came the hardest part for me.

I had made arrangements for a test pilot because of the good advice coming from the Newsletter. I had taxied for four hours prior to the tenth, but did not feel I should make the first flight because I have not been flying regularly these last few months. So came the hard part, helping my test

pilot adjust shoulder harness, then watching the little bird taxi out, make one taxi run the full length of the runway just off the surface, turn around, taxi back, final check, apply power, roll very short distance in the 14 knot wind, tail up, plenty of speed, then make a gentle takeoff. The left wing dipped slightly, came up and he climbed out of the pattern. Sure was a long 90 minutes waiting for him to re-enter the pattern. He finally came in on a long final with no flaps, greased it on with a nice three-point. He said I would not have a bit of trouble with it, but I decided to wait till the wind quit blowing--sometimes quite a rare event in Kansas.

Well, Friday morning I got up around 5:00 AM, looked out and found not a breath of wind. Told my wife I was going to the airport and she and my son went along. Rolled the airplane out, taxied to the active, requested a high speed taxi check, started down the runway, increased to full power, tail up, relaxed on the forward pressure on the stick and suddenly found myself in the air six or eight feet. Called the tower and told them "I just changed my mind, wanted a go-around." Came around on final indicating about 95, cut power over the end of the runway and as it started settling out I eased back on the stick, touched down three-point. Rolled out with no braking. It all went so well, I taxied back and ended up shooting five takeoffs and landings. Since that time, it has been raining and the wind blowing hard.

Now I will give you a little data. I am using a 67-68 prop which turns 2100 static and only 2425 maximum level flight indicating 140 mph. It indicates only 59 mph in the stall with no flaps so I have got to do some calibrating. It stalls real good and just keeps hanging in there, then very little warning and falls through dropping off on the right wing a bit.

After 178 hours, Norm filled out his questionnaire and said he had only one small problem, an exhaust stack flange cracked at 53 hours. Engine O-290-G; cost \$3700; time to build 6.5 years; max speed 170 mph at 2000 feet; cg, most forward 63.52 - 17%, most aft 71.2 - 32.4%; empty 63; empty weight 900; no modifications; wheel pants; gear fairings; cuffs and flush rivets.

PROPELLER FLANGE REINFORCEMENTS: Roy Sweatman, 7016 Belle Road, Harbor Creek, PA 16421. As soon as I got back from Oshkosh, I ordered material to fabricate the clamp-around type crankshaft flange reinforcements as pictured in your article in November Sport Aviation. It has arrived and I now have reinforcements in production. I am forming a corporation called Air Tech Inc. to produce these and other machined parts. (Editor's Note: Roy made several samples which he brought to Oshkosh. They were cadmium plated and looked fine. He was asking \$45 each for them. They were

made to my design, as shown in Figure 18.)

NEW WOODEN PROP: by Luther D. Sunderland. I am now testing a new Sensenich wooden prop, W66LM76 on my O-290-G T-18 and it is too good to be true. Performance exceeds that of the metal propeller I have been using. Although I balanced both the metal prop and the wood one in-flight with a dynamic balancer, the wood prop is unbelievably smooth in comparison except at idle. It weighs only 14.1 pounds--19 pounds lighter than my M76. Sensenich inspected Dick Walen's W68LY80 after 70 hours and it was perfect. The W66LM props have a standard-size flange so take the standard prop extension but use 5 3/8-inch bolts. It is for the 125 thru 160 hp engines and costs \$170 the last I heard. Just tell Sensenich the hp engine and they will select a proper pitch. (1986 Note: The 76-inch pitch was too much for my O-290-G, so I changed to a 74-inch pitch. It is an excellent cruise prop. If you operate from a short field, however, you should get a 72-inch pitch in your W66LM prop. The 76-inch pitch is fine for a 150 hp O-320 and 76 or 78 for a 160.)

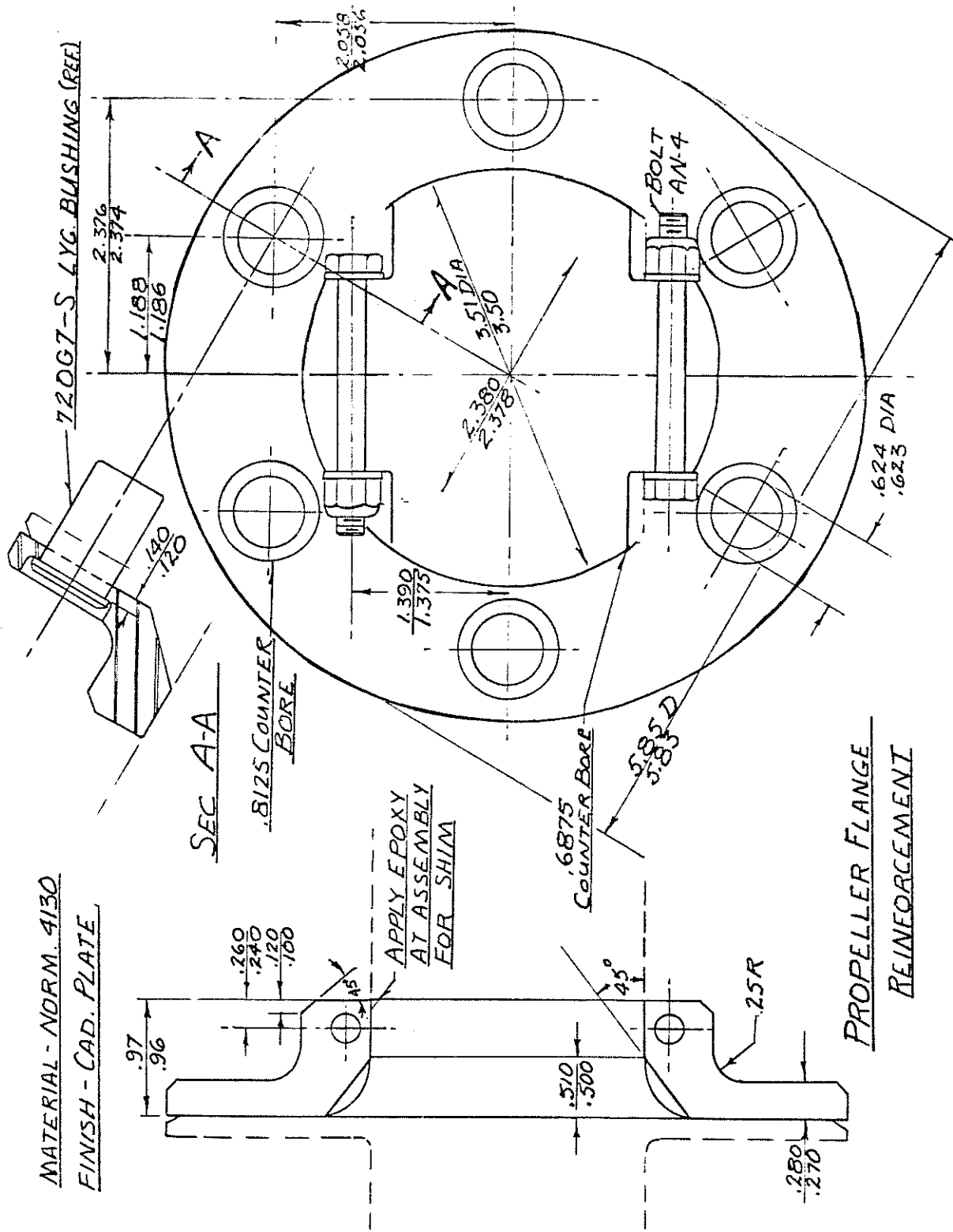


Figure 18



Luther D. Sunderland

FOLDING WING PROJECT: I have completed a sufficient number of drawings for the T-18 Folding Wing to permit a prototype to be built. John Thorp stress-analyzed the joint and spar, and a prototype being built by Ken Knowles will be tested before plans will be made available. Ken plans to be at Oshkosh (in his own T-18) and bring a set of pictures which he took while building the new wing. Today he told me that he had completed most of the parts and is starting assembly. It will not be completed before Oshkosh, in all probability.

There are very few completely interchangeable parts between the standard and folding wing, but the center section spar is the same (except that the new one is shorter). Ailerons have been shortened and flaps lengthened to help lower minimum speed a bit. If all works as well as planned, the folding operation should be a one man job.

WHEEL PANTS: B. C. Roemer says he cannot get at his tire valves without removing the wheel pants, so he cut a one-inch hole in the side of the pant for access. He then got two long plastic valve extenders from a service station, forced them into one another, glued them together and spun onto the valve. Then he removed the extender and installed a snap plug in the hole. I lucked out and can reach mine from the bottom. John Thorp would probably say he does not have any problem with his half-pant design!

SERVICE TIPS: B. C. Roemer sends this list of service items he has found necessary in the first 400 hours. You other owners should also send in any items you may have.

1. Two 1/2-inch rubber washers on landing gear failed. Replaced with belting type.
2. Oil cooler bracket, carb heat valve, carb heat box and mixture control wire all failed or cracked.
3. All rivets from skin to horizontal tail tube had to be replaced, were Pops and he replaced with cherry structural type. Also a number of Pops in leading edge wing ribs were replaced.
4. Horizontal tail tabs next to rudder are flexing with air loads and need strengthening. (Editor's Note: This is a very important point and relates to the flutter modification. My observation is that an 0.020-thick tab is much stiffer.)

It has not been previously reported that so many rivets have come loose. Usually, the only cracks in paint around rivet heads occur in the main spar to skin rivets near the fuselage, but they have never seemed to really get loose.

John Shinn reports that everyone should frequently check alternator brackets for cracks. It is absolutely essential that the nose piece be easily removable without removing the propeller.

TAIL SPRING ATTACHMENTS: Bill Johnson just had a failure of the front attachment point for his tail spring. The bracket cracked off right through the bolt hole and the two rivet holes for attaching the plate nut. He also found cracks in the aft attachment fitting near the two 1/4-inch bolt holes. It would be wise for the two fittings to be inspected immediately. The 591 bracket was made of 0.092 as recommended. Bill says that since the brackets are difficult to inspect, you should be on guard for another clue. (An access panel is needed for the last fuselage bay.) He had a loud rumbling noise during taxiing but assumed it to be sloppy tail wheel bushings. After repair, it was gone. Bill beefed up the 591 bracket by making a new one from two layers of 0.063 plus a radiused washer of 0.125 steel. The nutplate was deleted. An 0.063 steel doubler was installed over the 583 bracket. The ends were made long enough to tie into the lower longerons to pick up side loads. 1/4-inch bolts were replaced by 5/16-inch bolts. Total time on the airframe was 220 hours. About 300 landings were made on mostly rough runways.

MORE ON BILL JOHNSON'S RETRACTABLE T-18: Bill has sent me some additional information, for inclusion in the Newsletter, which was not in the article he sent to Sport Aviation. "My first speed check with gear up gave a cruise speed of 190 TAS at 6,500 feet. The center gear doors had not been installed, and the left flap was stuck down 1.24 inches. A considerable amount of cross control was necessary to maintain straight and level flight. After some rework to get the flap to fair, installation of the center gear doors and changing the rigging of the outboard panels to minimize some twist, the second speed check was made. The speed at 73% cruise power and 7,500 feet was 203 mph TAS. Top speed in level flight is about 225 mph TAS (on 160 hp).

The handling of the airplane is greatly improved. Directional stability in flight is noticeably different. The airplane will hold the heading once trimmed out quite well. On a recent 70 mile flight, I made only one heading correction of about five degrees. The main gear tread is about eight inches wider than with the fixed gear. This plus the larger fin and rudder make ground handling very easy.

NACA data indicated that the airfoil change should cause an increase in stall speed of two or three mph. A pleasant surprise was instead a three mph reduction in stall speed with flaps, and no measurable change with no flaps. This effect may be due mainly to the Hoerner tips. However, the aerodynamic twist which was built into the root section

between Buttock Lines 21.0 and 38.5 may also be contributory. An unexpected problem occurred during preliminary flight tests with the gear retracted. Blast from the exhaust pipes pressurized the wheel wells so that the gear stopped eight inches short of the full up position. The problem was isolated by taking some inflight movies. The gear would retract only when the throttle was closed so the exhaust pipes were modified so that the outlets are now about six inches outboard of the original positions. Now, at full power the gear can be completely retracted. Relocation of the exhaust pipes resulted in a 12 mph speed increase with the gear down at 70% power. I do not understand why, but the effect may be due to circulation effects in the wheel wells. It would be interesting to see if the exhaust pipe relocation would have an effect on a fixed gear T-18.

A problem with this very clean configuration is that it exceeds the present red line, so I am conducting a flutter investigation. The analytical characteristics of the wing structure will be calculated using a digital computer. This will be followed by a static shake test and an inflight test with strain gauge instrumentation. Sufficient data will be obtained to determine gust response and damping characteristics of the structure. I hope to establish a red line of at least 250 mph at 2000 feet altitude. If not, the analytical program will show what needs to be done, as well as what the red line IAS should be."

FIRST FLIGHTS: Max Pendergrast, 1611 SW 26th Street, Fort Lauderdale, FL (#419). He made the following modifications: Wet leading edge of the wing, using Fuller O'Brian sloshing material (12.5 gallons per LE section, 50 gallons total), full 74-inch constant speed prop from a Mooney, 2.5 inches longer landing gear, 0.032 in lieu of 0.025 on wing and fuselage. The entire plane was flush riveted or counter sunk. Low profile rivets on 0.032 or counter sunk on anything under 0.032. All riveting was one inch apart. Also, some modifying was done on the cowling. The little jewel flew on April 9, 1974 and about the only statistics I can give you now it that it was light at 60 and airborne at 65 indicated. It is quiet enough to carry on a conversation without raising your voice too much.

He does not say, but it is probably powered by an O-360 engine. Empty weight is probably the highest yet, 1,117 pounds. Forward cg is 68.2 and aft cg is 71. Max sent a list of installed equipment that is just too long to print. No, it does not have a restroom, ladies.

Worthy R. Warnack, 189 Bayshore Drive, Baytown, TX 77520 (SN 772). He flew March 16, 1974. It took him 3 3/4 years to complete and \$4,000+. It has an O-320 swinging a Hartzell HC-C2YK-1 of 70 inches length. Modifications include: Round back, roll bar 3/4-inch higher, canopy 3 inches higher, right

pedal moved to clear tank support, tunnel rounded, dash set back 3 1/2 inches, canopy similar to Derringer, mounted on three arms, moves up and back. The larger headroom is comfortable but the added cross section cancels out cleaner back. It is neither the fastest nor slowest T-18. It has fantastic climb out (2,000 fpm), no upholstery yet so it is loud. I have taped on stall strips and have decided to install them permanently. They do wonders for the stall--give a nice warning. Four inches of 3/4-inch aluminum bent to a sharp angle mounted midway out the center wing on each side works fine.

My goal was to cruise 150 mph in comfort and I think this has been surpassed easily. The plane is a dream to fly (as all T-18s seem to be). I cannot claim any real advantage for the round back other than esthetics. My plane is very stable at high cruise, maybe because of the smooth flow aft of the cockpit--I do not know. I sacrificed a lot of visibility and the construction of the canopy was a major project in itself. Earlier T-18 experience pretty well proved that a constant speed prop adds climb performance, but little speed. My plane is no exception. But I really do enjoy the lower RPM (1900 - 2000) performance--much quieter and vibration free.

This airplane was completed in my garage, which is located in a flood prone area on the coast. During construction, I evacuated N2WW three times due to storm threats. The last time, my shop was flooded with 3 1/2 feet of water during tropical storm Delia. Fortunately my ship was evacuated earlier. I am moving next month.

Ron Kuyoth, Jr., 6128 Secor Road, Toledo, OH 43613 (#716). Finally after four years and two months, #716, N8RK, went to the airport February 25, 1974. The FAA, out of Vandalia, Ohio, made their inspection on the 21st of February. The plane was still in the garage, wings removed, awaiting its trip to the airport. I had called FAA the previous week after being informed that there was at least a three week wait on inspections. When they called and said they would be here on the 21st, I explained to him that the plane was disassembled, but he agreed to inspect it anyway. He was very formal and did his job without much comment. Then he went out to the airport and inspected Max Dauer's Teenie Two which was built in my garage along side the Thorp. The buddy system worked well as we were able to share ideas, help each other, and then there is always someone to praise and encourage you. Both planes were approved!

The trip to the airport was uneventful and after assembly, there in 20-degree weather, taxied it down to the active. I made a few high-speed taxies with it and found that it handled beautifully. After checking things over for the first flight, they changed runways so had to taxi to the new runway. Made a final check of everything, pulled out onto

the runway, gave it full power and after a short roll was off. It climbed right out and I made three trips around the airport. My final approach speed was 110 mph because I was not certain the airspeed was correct. I found after the flare that the airplane floated about half the length of the runway since the speed was so high but proceeded on to make a three-point landing.

The plane had a slight tendency to roll to the left and the pitch trim was not adequate in the forward direction. Bob Dial and Parker Miller advised me to bend the trim arms a bit and this cured the pitch trim problem. Now, for the roll problem, several other owners have had this problem. I went to great lengths to build my wing without twist. I jiggged the center wing onto the fuselage, the main spar bolted to the fuselage, the rear spars bolted to the fuselage and all the ribs on the spars. I put redheads into the concrete floor of my garage, bolted 2 x 4s onto the A frame and bolted the A frame right to the floor using all threaded rods. On the outside of the wing, I riveted an angle on the rib with a hole in the bottom of it and put an all-threaded rod through the angle into the redhead in the floor. I leveled the main spar and rear spars and jam nutted them together with an all-threaded rod. Both main and rear spars were perfectly in line and absolutely could not move. I had the holes in the skins, center lines on the ribs and stretched the skins over the wings while still in the jig and stretched them tight with truck inner tubes. Transferred my holes onto the ribs and clecoed it together. I cannot see how there could possibly be any twist with this method.

There is slight twist in my outer panels but the way it is twisted, I expected the plane to have a tendency to roll to the right, but just the opposite happened. Would like any suggestions on correction of this problem. I have heard of guys lowering their left wing slightly and raising the right at the fitting. (Editor's Note: I am glad to hear that someone else had this problem even when they went to all the trouble to jig up the wing. I just built mine with matched-hole tooling and checked it with a big level before riveting. To cure the left wing heaviness, I just massaged the aileron, as John calls it. That means bending the trailing edge a bit (up on the left aileron and down on the right of course for left wing heavy. This gives the appearance of flying with the left aileron drooped a bit, but it does not seem to slow me down any.)

I have an O-320-D2B, 160 hp engine with a 180 EM hub, which I purchased from Anderson Propeller Company. The prop was never damaged but I had it cut to a 70-inch length. The pitch is 74 inches. Since my landing gear is 2 1/2 inches longer, I still have 9 inches clearance in level attitude. I do not have performance data yet after only three hours. It was a long four years, but in my opinion the wait was worth

it. It think the T-18 is one of the finest homebuilts ever designed. See you at Oshkosh. N8RK's weight is 885 pounds.

DON PHELPS' N8786 Flies in Less Than Six Months: John Thorp reported that on February 10, 1974 he and Kay flew out to Chino airport to see Bill Warwick fly the 110th T-18 to take to the air. It was built by Don Phelps in a time that would almost rival Irvin Faur--less than six months. He bought the plans July 20, 1973! In addition, 10 more T-18s flew in to see the event: (1) Bill Warwick, (2) Ken Knowles, (3) Ollie Smith, (4) George Leider, (5) Earl Odie, (6) Chuck Borden, (7) Lyle Fleming, (8) Don Taylor, (9) Howard Culbertson and John. All 11 ships were lined up for pictures and Kodak rally made out. Now let's see a good shot get sent to Jack Cox for Sport Aviation you guys!

Paul Stanley: 2012 29th Street, Galveston, TX 77550 (#671). Paul flew for the first time September 17, 1973. The only problem after the first three hours was a heavy left wing and a weak mag. (Does everyone have a heavy left wing?) He took 4 1/2 years to build it, has an O-290-G, no electrical system and weighs only 752 pounds. (Wow, that is really light, but I still would not want to hand prop a big Lycoming.)

PAINT AND PRIMER: Several months ago I got to see Bill Lawson's T-18 while in Seattle. His paint job was so outstanding that I asked him to send me information on it. Bill will try to make Oshkosh so you may see for yourself. He used 3815 zinc chromate metal-etching primer. He found that combining one gallon of the primer with two gallons of its catalyst (3816) is enough to do both sides of all the aluminum for the T-18. It is made by Fuller O'Brien Corporation, South San Francisco, CA 94080. Instructions say "mix only as much as can be used in 8 to 12 hours as the mixture will gel after a time." He used DuPont Imron polyurethane enamel for the finish coats. Grumman uses it on the Yankee. Bill lives at 2419 SW 150th, Seattle, WA 98166.

CUTTING PLEXIGLASS: Doug Hilton, 1608 NE 120th, Portland, Oregon. Doug bought an abrasive disk from Gee Bee that cuts plexi like butter with a 3/8-inch variable speed drill.

MATERIALS: Dick Baxter of Spencer Aircraft, 8410 Dallas Avenue South, Seattle, WA 98108 (206)763-0210 says he will send a materials list of homebuilders' supplies to anyone requesting it. He has all sorts of hardware--especially PROP BOLTS for the new wooden props which are 5 3/8 inches thick.

KEN KNOWLES' SPORT AIRCRAFT: 104 East Avenue, K-4 Unit G, Lancaster, CA 93535 (805)949-2312 (1986 address) has just about every raw material for the T-18. Today, I asked him if he was having trouble getting materials and he said he was, but at present he had everything. As mentioned earlier, Ken is putting his 30 years in the aircraft business to good use,

for he has offered to build the prototype T-18 Folding Wing. He will supply a price list upon request. Ken has beautiful Tie Tacs of the T-18.

YOUNGEST T-18 PILOT: I hear that George Leider's 16-year old son soloed his T-18 with only 20 hours total time. Both George and his brother had low time when they first flew the T-18.

FIBERGLAS PARTS: Leopold Perlaky, 6301 Somerset Road, Riverdale, MD 20840. He says he has fabricated a nice set of molds for fiberglas wing tips, nose bowl and tail tips. He is willing to supply a few sets of these parts to other T-18 builders if he does not have to bother with packing and shipping. In other words, they must be picked up in the suburbs of Washington, D.C. He has about 10 years experience in fiberglas fabrication, mainly in boats and associated parts.

T-18 CENTERFOLD FROM PLAY-AVIATION: When I saw the centerfold of John Shinn's beautiful T-18 in the February issue of **Sport Aviation**, I thought it would be nice enough to frame, especially if it did not have the crease down the middle. So I obtained 400 copies of this nice color photograph from the printers of **Sport Aviation**, assuming that many of you would like to have a copy also. They are printed on the same paper stock as the magazine. I have ordered mailing tubes for them so they can be mailed without being creased. You may obtain one by sending me \$2 for the first copy and \$1 for extra copies.

WOODEN PROPELLER TEST PROGRAM: We have tested four different propellers on four T-18s as a part of a formal test program for Sensenich. Each prop was first made with brass leading edge and tipping and then the brass was removed and replaced with a smooth plastic (with the exception of the W66LM76 which had only plastic). Tests were run on my O-290-G, John Shinn's O-290-D2 (135 hp), Bob Daniels' O-320-E2A (150 hp), and Dick Walen's O-360 (180 hp). I do not have all the data collected yet, but here is a brief summary. More later.

PRELIMINARY DATA

Propeller	Tipping	Engine	Max Static rpm	Max rpm at 7,500'
W66LM74	Brass	O-290-G	1975	2550
W66LM74	Plastic	O-290-G	2075	2625
W66LM76	Plastic	O-290-G	2025	2525
W66LM76	Plastic	O-290-D2	2100	2725
W66LM76	Plastic	O-320-E2A	2200 ?	2800
W68LY80	Brass	O-360	2000	2800
W68LY80	Plastic	O-360	2150	2700

W68LY82	Brass	0-360	1950	2700
W68LY82	Plastic	0-360		

The most important piece of information is rpm at 7500 feet at full throttle. Rated rpm for the O-290-G engine is 2600, so the 74-inch pitch in plastic is about right for that engine. Rate of climb is not quite as high as with my metal props. It is about 1,000 instead of 1200 fpm loaded. It is quite noticeable in the 90-degree weather we have been having this week. But I like my cruise at low rpm. The significant thing is that changing to the plastic tipping increased rpm about 100. And if you look at T-18 Airspeed vs RPM Controlled by throttle curves, you will see that a 100 rpm increase gives nearly a 10 mph increase in speed. Dick Walen and I both realized over 5 mph increase in speed when changing from brass to plastic tipping on the same propellers. The only strange thing about it is that on the O-360, the higher-drag brass leading edge and tipping gave a higher rpm, even though the airspeed was lower. The W68LY82 has not been flown with both types of tipping yet so we do not know whether it will do the same. Just talked to John Shinn and found that the 2725 rpm for the O-290-D2 was for 3,000 feet, and at 7,500 feet the maximum rpm was around 2650. His engine is rated for continuous operation at 2600 rpm, however, he thinks he should have a 74-inch pitch. It is strictly a matter of preference. That engine could use either a 74-inch or 76-inch pitch prop. He says he also misses his "show-off" high rate of climb. John has thus ordered a W66LM74 prop. He figures his maximum speed is 184 mph with the 76-inch pitch. This is about four or five mph faster than the metal M74DM-4-68, data taken on the same day within a one-hour period.

Bob Daniels from way out in Oregon, does high altitude photography work. He tested the same W66LM76 on his 150 hp T-18 and reported a 5 mph increase over the metal prop he had been using, (195 mph vs 190 for the metal). He checked this out over a 7.5-mile measured course. The metal prop is 68 inches long x 75 inches pitch. The wood prop is also much smoother but will not climb quite as fast as the metal one.

Dick Walen favors the 80-inch pitch on his 180 hp T-18. He really raves about the wood props and gets around 210 to 213 mph with them. Maybe the plastic will help the 82-inch.

I did not list true airspeeds in the table because no direct comparison has been made of the various test aircrafts' airspeed systems. About the only way meaningful data can be deduced from airspeed readings is for readings to be made on the same system within a few minutes of one another. I developed a leak in my pitot line between tests of the 76-inch pitch and 74-inch pitch props and had to recalibrate the system. Both of them were checked against the metal prop on

the same day and both were faster than the metal one. At 5,000 feet altitude, full throttle, I can cover my six-mile measured course in two minutes average with the 74-inch pitch plastic-tipped prop.

Conclusions: Use of the plastic tipping gives a 5 to 10 mph increase, so I would recommend ordering it unless you expect rough service in rain. Sensenich has been quite cautious about converting to plastic because of the durability question. Ray Hegy and Ted Hendricks used nothing but the plastic and report that it is very durable and easy to repair. John Shinn flew through some rain with the W66LM76 and the clear polyurethane peeled off the plastic, but it did not hurt the plastic. Sensenich had failed to use the proper primer on the plastic. Since then it has been recoated and has held up OK although it probably has not had a good rain test yet. Those of you who purchased props with the brass tipping can change it over very easily. Just remove the brass, remove 3/8 inch from the leading edge of the wood, remove 1/16-inch layer of wood under area where brass covered, apply Sears Roebuck boat two-part polyester to the leading edge and tip filling in all rivet holes and sand down. Then apply a polyurethane finish. Balance on knife edges by adding or removing plastic before coating, then check again after finish coat is applied. I discovered how Sensenich gets such a fantastic finish on their propellers. They soak the bare birch propeller in the polyurethane (which has been thinned down well) for about 20 minutes. Then they just spray on the polyurethane and air dry. (1986 Note: After extensive tests of many plastics, they dropped the boat polyester and now use a more flexible material for the leading edge, which resists rain erosion.)

BOB DIAL GETS INSTRUMENT APPROVAL: Bob had been unable to get his T-18 approved for instrument flight, so he decided to bring the matter to a head. He obtained a copy of Dick Walen's instrument waiver and sent it to Washington. Dick figured he would be up the creek and probably lose his approval in the process. But, Bob got a favorable ruling from the FAA in Washington, saying that his aircraft simply had to comply with FAR Part 91 to obtain the instrument waiver. So, if anyone has trouble with their local FAA, you can write to Washington for help. But just make sure you have an aircraft which is worthy of the waiver. There are now so many T-18s with this waiver that I have lost track of the number, far more than any other type homebuilt.

TRIM SYSTEM FLEX COUPLING: John Thorp says that Aeroquip 601 fuel line hose works very well as a replacement for the flexible steel cable in the trim system.

WING ATTACH BOLT ACCESS: Recently John had occasion to remove his center section (after a connecting rod bolt broke) and he discovered what a number of people have been saying

for some time, namely, that you have to be double jointed to get the wing attachment bolts removed. So, John is changing the plans to show an access hole for a socket wrench behind each main spar attach bolt in the 592 bulkhead.

PREPARING SHEET METAL: Robert Clayton, 1783 Harvard Avenue, Salt Lake City, Utah 84108. As a new builder, I have more questions than helpful hints, but I do have one thing that might be of help regarding washing down sheet metal to get rid of the coating. Basic H from the Shaklee people is a terrific organic cleaner, highly concentrated, that will do a better job safer than any soap or detergent. It has anti-magnetic properties in that it reduces the tendency for a surface to build a static charge and attract more dirt. It is fantastic for washing planes. It was the only cleaner to go to the moon on all Apollo flights. There will be no residue.

MATERIALS: Received a listing from Airparts Inc., 1143 South 33rd Street, Kansas City, Kansas 66106 which shows they carry all thicknesses of 2024-T3 sheet, rivets, bolts and all sorts of other goodies.

TUNED EXHAUST: Rick Keller, #332 has written an article on calculating the length of tuned exhaust stacks, but it is too long to print here. For anyone interested in picking up some extra power in this manner, it may interest you to know the required length--10' 6" stacks, two side by side. It will be interesting to see if the pluses win over the minuses in this setup. Rick lives at 3284 Bayside, San Diego, CA 92109.

FLIGHT RECORD: If anyone knows of a T-18 which has flown but has not been listed in the Newsletters, please have the owner notify John Thorp, for he keeps the master list of first flights and assigns numbers. John just notified me that the third Eckel brother has bought a set of T-18 plans, SN1000. Gene Eckel had his T-18 at Oshkosh last year. In total number of plans sold, the T-18 has not broken any records. Some homebuilts have had plans sales in the tens of thousands. There are few which can rival the T-18 in total number of aircraft completed and flown, however. The BD-5 has been threatening to eclipse the T-18 by the thousands since 1968, but it still has a long way to go to even catch up. (I hear the BD-5 with a Japanese water cooled snowmobile engine and a flexidyne coupling to the prop shaft has been virtually free of burnt pistons, drive shaft problems and mixture problems which have plagued the Hirth engine model.)

SN374 FLIES: Carl Hoots' flight report. I started building in January, 1966 and my first flight for N18CH was May 18, 1974. No mods except flush gas cap. 180 hp engine with a light-weight Hartzell constant speed prop. Empty weight is 951 pounds. Performance is spectacular. By the time you get the throttle back you are at pattern altitude, over 2000 fpm.

My exhaust system is made from old aircraft pipes with two-inch tail pipes. I anchored my crossover exhaust with a triangle of braces down from the back of the engine to each pipe and joined them together. This combination is guaranteed to break a pipe every hour. (Editor's Note: Amen! See back Newsletters for a description of ball joints and a flexible attachment clamp which is guaranteed to not crack.)



Luther D. Sunderland

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 does not 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 have not had much time to put out a Newsletter.

If you have not noticed the ad in *Sport Aviation*, the price of the plans is \$35 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 redrawn. 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 0.032 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 0.032-thick web and the extrusions are 1.25 x 1.25 x 0.125 angle with a short piece of 1.125 x 1.125 x 0.125 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 cannot 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 cannot 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 detented 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 is not 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 a 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 1480 pounds as the design gross weight. The wing was designed for the same design load factors (6 and 9 gs positive) 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.

LANDING LIGHT INSTALLATION: Norm Buehler, Route 3, Box 106, Scott City, Kansas 67871. Norm 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 fitting, 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 is not too large and if you reinforce the cutout with a doubler of at least 0.040 x 1.5, the structure will be OK. Functionally, the landing light in the outer position has been a notable success."

TEMPLATES: The T-18 skin templates have finally worn out. There has not 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 will have to make your own.

WING PROFILE LAYOUT: by Luther D. Sunderland. 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 lines. Positive distances (to the upper surface) are above the 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 0.1685. Draw the line through the intersection of the reference lines which we will call point two, and a second point, which we will call point C located 10 inches to the right and 1.685 inches above the horizontal reference line.

The leading edge radius is given as 0.5435 inches. 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. (1986 Note: The new GAW series of NASA airfoils, including my LDS-4-212, have all leading edge coordinates defined and use no L.E. radius since the curve is actually

exponential there.)

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 five 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 0.020-inch minimum increments. (Drafting supply stores have them.) The wing profile laid out according to drawing 547 (and 108 for S-18) is for the outside of the skin. So, to make everything come out right, you should make the master rib form block smaller by the thickness of the skin and the tooling rib, (0.025 top 0.025 bottom). Center rib form blocks for 0.032 and 0.040 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 0.060 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, Vice President 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 that 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 inches, 150 hp - 76 inches, 135 hp - 74 inches, 125 hp - 72 inches or 74 inches. I have a 74-inch pitch prop with plastic tipping and like it fine for a good low rpm-cruise, but it does not climb too well, that is, it will not do over 1000 fpm with a full load. Someone operating from a small field would probably prefer a 72-inch pitch.

I really have not 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 did not 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 this 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 degrees F for eight hours. Room temperature-aged 6061-T4 has a yield strength of about 22,000 psi. After eight hours at 350 degrees 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.

BAND SAW: James Borg, 1332 Jersey Avenue South, St. Louis Park, Minnesota 55426. James says he built the band saw shown in September 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, TN 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 North Gillan Avenue, Lancaster, CA 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 flight 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 degrees F. Construction cost was \$4000. Empty weight is 894. Most forward cg is STA 63.7, gross cg is 68.4, empty cg is 62.7 and most aft cg is 70.7. "Since the first flight on June 22, 1974, 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!"

(Editor's Note: 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 will not 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. (1986: They now charge \$7 per check.) I can usually get currency changed OK. Money orders are OK, as are checks for US funds. If you buy someone's plans and do not know the number, look on a copy of an old T-18 Newsletter and the plans number will appear before the name on the label.

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

ALTITUDE RECORD? Pete Roemer flew his dad's 180 hp T-18 to what may be a altitude record for a non-turbo powered T-18. He went to an absolute ceiling of 26,100 feet in one hour and twenty-five minutes. 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 minutes 48 seconds to climb to 20,000 feet.

BELT SANDER: Roger Weselmann, 4054 Suburban Drive, Waterloo, IA 50702. My favorite tool is a one-inch belt sander from Wards. Cost \$18 plus motor. Absolutely indispensable because I hate filing. It is 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 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 is not necessary, except for highly accurate locations.

Also, I have added a 0.025 bent-up angle down top centerline of the fuselage from the canopy to the fin. Reason: Other T-18s really vibrate in this area. (Editor's 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. This will not work because AN fittings are 37 degrees and automotive are 45 degrees. 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. (Editor's Note: This will just add a third to help confuse us for the next hundred years!)

A. O. CHELLIS FLIES: 12 Henry Street, Bridgeport, 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 February 21, 1972 and was the fourth T-18 to fly in Australia.

O-290-G WITH WOODEN PROP: William Oliver, 2369 Phillips, Beakley, Michigan 48072 has a Sensenich W66LM74 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 degrees F. Empty weight is 928. No flush rivets. Most forward 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, Michigan to Salina, Utah and back--the longest and best trip I have ever made in an airplane. Averaged over 160 mph and 20 miles per gallon. At 14,000 it will turn 2450, indicating 125 to 128 mph."

TAIL SPRINGS: 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 inch since February 22, 1969 (A-590). I have not been told of a 3/8-inch 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-inch front bolt and I have not 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, Michigan 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 steel utility building. His son received a broken nose and few cuts and he got away with two broken ankles and broken wrist. Following this accident, two of his friends who were quite far along building wooden airplanes switched to T-18s.

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 gs. 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 web (0.040) became wrinkled. Thus, we have added 3/4 x 3/4 x 0.062 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-inch 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 SN600 October 21 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 first 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, 68 x 68 purchased before the prop requirements were well understood. Ground vibration tests (suspended on shock cord) showed a first mode resonance of 2750 rpm so am placarding the tach at 2600. I will get another prop after my test period. The gear is double tapered, both inner and outer tubing and two inches 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 degrees 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 Electrofilm. I have specified Moly-Kote on the T-18C wing. It is also a dry lube. After 1000 hours, John disassembled N299V 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 Street, 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-inch 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-inch plate, hollowed out. Anyone else have a good solution with available parts?

T-18 NEWSLETTER #43 07-06-75

Luther D. Sunderland

REGIONAL T-18 COORDINATORS: A good response was received to the request for regional coordinators. The latest list of T-18 plans' owners will be mailed to each coordinator, except of course for the many blanks representing persons who moved without sending in a change of address. Builders can contact the nearest coordinator for information on other nearby builders and on local material sources. Most coordinators have sufficient experience to assist new builders with answer to their questions. This initial listing reveals areas not covered, so if your area needs a coordinator, why not volunteer? If I have missed listing anyone who wrote in, please write again for it is easy to place letters in the wrong file.

No.	Region	Name	Address
1	NJ	Elmer Hyman,	36 Center Street, Midland Park, NJ 07432
2	PA	Grover Rahiser, Jr.,	517 Van Buren Street, Evans City, PA 16033
3	GA	Conrad H. Hagle,	90 Martin Point Court, Roswell, GA 30075
4	FL	Tom Daniels,	335 Okaloosa Drive, Winter Haven, FL 33880
5	OH	Lewis Cunningham,	8180 Deepwood Boulevard, Building H, Apartment 12, Mentor, OH 44060
6	MI	William Beswick, Jr.,	7144 Heatherwood Drive, Jenison, MI 49428
7	WI	B. C. Roemer,	Manitowish Waters, WI 54545
8	MN	James A. Borg,	2451 115th Avenue NW, Coon Rapids, MN 55433
9	AR	Lloyd Toll,	Box 303, Hazen, Arkansas 72064
10	NE	N. L. Nate Eastman,	Box 83, Kimball, NE 69145
11	TX	Richard Cavin,	10529 Somerton, Dallas, TX 75229
12	NM	Vic J. Plath,	6109 Natalie NE, Albuquerque, NM 87110
13	WA	Cecil Hendricks,	Seattle, WA 98188
14	CA	Paul A. Harris,	P.O. Box 7304, Menlo Park, CA 94025

#844 FLIES: M. B. Mantooth, 4109 Barnsley Lane, Olney, MD 20832. First flight was June 7, 1975 but do not have any data since the canopy is off. No problems as far as I know except the oil temperature went up too much. Airspeed indicator really goes to pot about 85 just above stall. Hope it does better with the canopy on.

#200 FLIES: Jerry Ewing, Box 307 East Jordan, MI 49828. After three and a half years, serial number 200 took to the sky on May 11, Mother's Day. I had read in the past

Newsletters about first flights, how to taxi and how to fly. I taxied for about an hour and it felt so good on the ground that I knew it would fly. I used an airport 35 miles away with 7500-foot long runways made of blacktop. I took off, climbed to 3000 feet and leveled off. It handled just like an old airplane, for everything was perfect. Did slow flight and came back to the airport and landed. By that time all of Chapter 510 was there. I told them I was going back to East Jordan with a 3000-foot long sod strip. Am flying almost every day trying to get 50 hours before Oshkosh. Weight empty - 894 pounds. Engine - 320 150 hp. Prop - 68-63 metal. I will be going to a wood propeller. Static - 2200 rpm. Max level is 2750 rpm at 2000 feet. Max indicated is 165. Have gear fairings and pants. I am using a Corvair oil cooler and oil temperature never gets over 180 degrees F. Cost to build was \$5700 with full panel and 360 channel radio. Thanks a lot for a very fine job on the Newsletters. It was a great help.

WOODEN PROPS: Lloyd Toll just reported that after some recent flying in 90-degree temperature weather, he is convinced he needs less pitch in his wooden prop. He has a metal tipped Sensenich with 78-inch pitch and is going to replace it with a 76-inch pitch prop. His engine is the 150 hp O-320. For some reason, Sensenich is still sending out pitch information based on their early estimates before any tests were flown. The 150 hp engines need 76 inches pitch and the 160 hp engines need 78-inch. Lloyd will sell his 78-inch pitch W68LM-68 prop for 10% off original price.

At the last report, Sensenich had sold 80 wooden props of which about 30 had been ordered with plastic tipping. Just talked to Henry Rose and he reports that the only cases where the plastic tipping eroded involved aircraft which were being flown in IFR conditions of heavy rain. He said that Sensenich has now changed their literature on pitch recommendations and it is consistent with what I have been suggesting. Here it is:

O-290-G	W66LM72	125 hp
O-290-D2	W66LM74	135 hp
O-320	W66LM76	150 hp
O-320	W66LM78	160 hp
O-360	W68LY80	180 hp

Dick Walen had used both an 80 and 82-inch pitch wood prop on his O-360 and he has now switched back to the 80-inch pitch, preferring the higher rate of climb in hot weather.

George Rattray finally sold all of his super expensive prop extensions which Sensenich had designed for the W68LY wooden props. (This is the only wooden prop which takes the larger than standard SAE four size flange.) Now he is making and selling the spool type prop extension which I designed and

which John Thorp now will sell you on request (\$2 I believe, for Drawing A-126). Do not have the exact price, but I hear it is less than \$100 from Rattray.

METAL PROP SURVEY: I am happy to report that there have been no further incidents with cut-down metal props since the Hartzell in-flight vibrations tests. Since a large percentage of T-18 builders already have metal propellers and do not want to incur the expense of another propeller, it would be of special interest and value if we could obtain service information on the cut-down metal props that are now or have been in service. If you have used a cut-down metal prop on a T-18, please fill out the questionnaire at the end of this Newsletter. Results of the survey will be published in the next issue and also sent to Sensenich.

The value of metal in a propeller became evident recently when my W66LM74 began to run a bit rough. I took it off and checked the balance, finding that it was 1.75 grams out of balance. No wonder it felt rough! There must be a quarter of a cup of water running around in there. Otherwise, I am quite happy with it.

BALANCING A PROPELLER: To balance a propeller, it is necessary to get a good tight mandrel through the hub and level parallel bars. The mandrel can be made in the form of two aluminum plugs inserted from either side. Or it can be made of a wooden plug with a 1/2-inch or larger pin through the center to provide a good smooth rolling surface. To obtain best results, the parallel bars should be mounted on two long pedestals to permit the prop to be rotated to any position, but it will suffice if they are just high enough to permit the prop to be oriented horizontally. I use my table saw top which I level up by placing shims under the legs and checking with a good carpenter's level. Then I place two 3-inch long pieces of scrap main spar extruded angle on two one-inch high steel blocks. I cleaned off the edge of the extrusion with a file to get a smooth straight surface. To compensate for a slight non-level condition of the parallel bars, always check balance with the prop pointed in first one direction and then the other. Happiness if very definitely a smooth running propeller.

MY J-3 FLIES AGAIN: Happiness is also flying a Cub low and slow. After spending 10 years standing on its nose beside my T-18, my J-3 just took to the air last weekend with a shiny new rebuild job and overhauled engine. After three or four evenings of flying, I filled it up with a whole eight gallons of gas. With a 34-inch pitch climb prop, that 65 hp Lycoming engine really stands it on its tail on climbout. The only problem was a rough running prop, but after I took it off and balanced it, now it runs as smooth as a sewing machine, instead of a threshing machine. But after getting used to the T-18, the J-3's ability to roll seems infinitely slow.

One thing I can say for sure, if you learn to land a T-18, landing a Cub is a snap!

198 MPH ON 135 HP: John Shinn just received the results of last year's efficiency contest at Oshkosh. His maximum speed was 198 mph and minimum speed was 68 mph. He has great hopes for this year because they only clocked him on one of the three high speed passes because on the first two he was a bit too high for their viewing mechanism. He had the lowest IAS on the pass which they clocked. Now perhaps people will believe my 180 mph on 125 hp.

This year, let us get more T-18s in the efficiency contest. The rating formula appears to be designed to favor airplanes with low minimum speeds, so do not expect to win first place. It is an excellent way to get comparative performance data with other T-18s to point up which design modifications or construction details produce the best results. Those of you still pondering the selection of a powerplant should note the very narrow speed differential between the 180 hp models and the 135 hp on John Shinn's beauty.

NEWSLETTER POLICY: For you new members of the club, you may obtain copies of back issues of the previous 42 Newsletters plus future issues by sending me a donation of \$12. The T-18 Newsletter is financed by donations from builders and by donation of my time.

OSHKOSH FORUMS: Two forums of interest to T-18 builders will be presented. On Friday morning, 9:00 to 10:15 in forums tent #2 I will give a paper on the application of propellers which Henry Rose, chief engineer at Sensenich is helping to prepare. Then on Saturday morning from 10:30 to 12:00 in forums tent #2-A we will conduct the T-18 Forum. This year we have been given prime time, so a good number of people should be able to attend. See you there.

T-18 INFORMATION STAND: Benjie Roemer is making good progress on plans to maintain a T-18 information stand and have all the T-18s parked in one area. Pilots should contact him upon arrival to donate some time.

CONVERTIBLE T-18C WING PLANS: A total of 36 sets of T-18C wing plans have been shipped to builders around the world. I will have a few sets along at Oshkosh if you have not obtained a set and will be there. The price is \$35 for 38 drawings. To avoid some of the liability problems which have plagued John Thorp, all purchasers must sign a purchase agreement somewhat similar to that used by Pitts.

Ken Knowles will have his T-18C there again but I doubt if anyone else will have one completed. If anyone has parts completed, why not bring them to display?

WATCH OUT FOR 4130, CONDITION A: Some suppliers are substitution 4130 Condition A for Condition N plate stock. Unless it is to be heat treated, it is only 2/3 as strong.

BENDING SHEET METAL: Bob Clayton, 1783 Harvard Avenue, Salt Lake City, UT 84108 writes that he would like to see a rather detailed explanation and procedure for making proper bends in sheet metal correlating with reference points and dimensions on the drawings--something like John Shinn's articles on ribs and riveting. Until someone comes up with such an article, perhaps the following comments will be of some help:

If the novice needs advice in the area of bending sheet aluminum, he probably also does not have access to a sheet metal bending brake. Without such a brake, it is almost useless to accurately compute setback, which is the distance from the vertex of the mold lines intersection to the point where the bend begins. Even with a commercial brake found in the average heating and plumbing sheet metal shop, there is usually no selection of bend radius shoes. so again, it is not a simple matter to theoretically figure setback. If you wish to take that route, get a good sheet metal book and use the tables in it to determine setback. Otherwise, here is a simple and foolproof way to make your bends:

Figure bend allowances for making templates according to the example and equations found in Part IX of Building the T-18 by John Thorp. Now cut out some two-inch square pieces of scrap aluminum of the same thickness as the part being formed. Bend samples in whatever brake you are using, make adjustments and add shoes until the proper bend radius is obtained. Remember, if the bend is too sharp, the material may form cracks. Now, experiment with the samples until a flange of 0.625 inches is obtained (or whatever the flange should be). Observe the amount of setback used and use this for all bends with this thickness material with this set of shoes and with the brake adjusted in this manner. My experience is that if you do it any other way, you will end up scrapping some parts and doing it this way anyway.

If you cannot locate a bending brake, contact your local high school and see if night classes are available in sheet metal. Many builders have been allowed to make their T-18 parts in such classes and in some cases they were permitted to use the T-18 as an instructional project.

If builders need more help in this area of forming straight bends, let me know. Also, if you have found some tricks which might help others, let me know.

CADMIUM PLATING SOURCES: The main spar joint fittings in the T-18C wing are made of 4130 which is heat treated to 150,000 psi and cad plated for corrosion resistance. Bill Huff who is now on assignment in Iran writes that his home town of

Amarillo, Texas does not have a plating facility, and he wants to know where he can find one when he returns home. This is where the regional coordinators can be of assistance. For instance, Dick Cavin can give you the name and address of shops in Dallas. But, from what I remember about distances in Texas, Dallas is only a little bit closer to Amarillo than Iran.

HYDROGEN EMBRITTLEMENT RELIEF AFTER CADMIUM PLATING: Bob Todd, 427 NW Overlook Drive, Vancouver, WN 98665 heard about hydrogen embrittlement in 4130 cad plated parts so he wrote to the FAA office in Seattle and asked them some questions about it. Here is a portion of their answer:

...essentially, hydrogen embrittlement is a phenomena where free hydrogen in metal draws to it, from the atmosphere, other hydrogen molecules. This action results in cracking of the part as the atmospheric hydrogen "elbows" its way into the microstructure of the metal and forces the structure apart. To preclude this occurrence, it is common to bake parts after cad plating or other types of plating to ensure that all hydrogen in the metal is removed. The Federal Specification regarding cadmium plating is QQ-P-416C. Note in paragraph 3.2.8 that it is appropriate to bake a part for three hours or more after plating.

The following is a quote from paragraph 3.2.8:

Embrittlement relief. Unless otherwise specified or stated in the end product specifications, all steel parts having a hardness of Rockwell C40 and higher shall be baked at a minimum of 375 plus or minus 25 degrees F (191 + - 14 C) for three hours or more, within four hours after plating to provide hydrogen embrittlement relief.

The above note is included on T-18C Drawing #231. Any plating shop worth their salt will be quite familiar with this procedure.

DRILLING HOLES IN PLEXIGLASS: Elmer Hymen, 36 Center Street, Midland Park, NJ 0732. I have tried lots of ways to drill large holes in plexiglass and had lots of cracks. Now what I do is drill a small hole 1/8-inch diameter using a standard 1850 rpm electric drill. Use a rate that lets the bit do the work. Then I have a reamer that is tapered from 1/8-inch to 1/2-inch. I feed this in the hole with a slow speed drill stopping at the right size and that is it. I find that this method works quite well with no cracks so far. I tried it on some scrap pieces first to see how rough I could get and it works real good! The same procedure works for making large

holes in aluminum sheet also.

BATTERY CABLE ROUTING: Elmer Hymen asked how he might route the cables forward from the battery. It is probably possible to run them through an aluminum tube mounted in the tunnel in such a way that it does not interfere with push-tube or cables, but I ran mine up the side of the fuselage over the wing cut-out. I simply drilled holes in frames and put in grommets. One which I saw that routed cables through the tunnel had them rubbing the tube.

FUEL TANK CONSTRUCTION: Bill Johnson warns that builders who make fiberglass ends for fuel tanks and join them to an aluminum sheet center portion with Pop rivets might be asking for trouble. Even though one uses epoxy tank sealant, a reliable bond cannot be achieved unless the metal is chromic acid or phosphoric acid anodized. All of the other surface prep systems break down in the presence of water. It is my personal opinion that the entire tank should be made of fiberglass as described in previous Newsletters. So far, mine constructed in this fashion has not leaked a drop.

Luther D. Sunderland

T-18 NEWSLETTER POLICY: No, we have not gone out of existence, even though the Newsletters are few and far between. The existing back issues seem to contain about everything a builder needs to know to build a T-18, so there is not a pressing need for more. If anything, there is already too much material for builders to read and remember because most of the questions I get in almost every mail have been adequately answered in the Newsletter. We will publish future issues only when something comes up which needs publishing.

On the subject of mail, my wife Marilyn has been taking most of the load and it uses up much of the morning every day. This seems to be an endless job, so please try to follow these rules when you have questions or need back issues:

1. Always include a stamped, self-addressed envelope (Unless you are from outside the United States). About one out of 10 now do this.
2. List all questions on a separate sheet of paper with space for answers.
3. Your best chance of reaching me by phone is between 10:00 PM and 11:00 PM (607)625-3084.
4. Read your back Newsletters first to try to get answers.
5. Contact your nearest Regional Coordinator (Newsletter #43) or other experienced builders whose addresses are listed in other Newsletters. The builders who have flown are a bunch of nice guys who do not mind helping others.

MOST FREQUENTLY ASKED QUESTIONS:

1. Are Pop rivets satisfactory, safe, and approved?

Answer: Yes. They have stood up for about 10 years now with no more problems than AN rivets.

2. Should flush rivets be used?

Answer: On the wings and tail surfaces, yes. It is just a matter of appearance on the fuselage, for little performance improvement will be realized with flush rivets there.

3. Should rivets be filled with body putty?

Answer: Yes, on the wings and tail. The two-part putty

sold in auto supply stores has worked out well. It seems unavoidable to get little circular cracks around some rivet heads on the main wing spar but they never seem to become a problem.

4. Where can I obtain materials?

Answer: Write to Ken Knowles' Sport Aircraft Inc., 104 E. Avenue, K-4 Unit G, Lancaster, CA 93535 or Merrill Jenkins, 2413 Moreton Street, Torrance, CA 90505 for catalogs. They have about everything except canopies which can be obtained from GB. All-Aircraft Parts sells cowlings made to the shape on my T-18, Ken Knowles' Sport Aircraft and Rattray both have nice cowlings also. Dewberry makes machined parts.

5. Where can I get prop bolts?

Answer: Spencer Aircraft, Dallas Avenue, Seattle has any length AN bolt. See my May 1975 Sport Aviation article to figure dash numbers.

6. Which propeller do you recommend?

Answer: The Sensenich wooden props listed in Newsletter 43 have been performing and holding up well. For best performance, get the plastic tipping, but if you expect to fly in much rain, get the brass tipping. My W66DM74 makes me awfully happy during cruise, but I miss those skyrocket climbs. Wouldn't want to try to get out of real short strips with it. (1986 Note: Only plastic tipping is available today.)

7. How can I get more width in the cockpit?

Answer: I have drawn up the necessary changes to add two inches more width to the fuselage. Several fuselages are being constructed to this configuration. Drawings will be for sale for \$10 consisting of one new drawing and a list of changes to 29 others. We are looking for someone who could assemble a fuselage in rather short order to check everything out first. The wing has remained unchanged except for fittings. In order to keep the same fuselage side curves which John carefully had designed to minimize drag, the side skins were simply moved apart two inches and the tail extended five inches. The extra length was added between the canopy and fin. Everything aft of the fin leading edge was unchanged except the bottom trim line on two frames. How much the performance will be affected, we have not been able to estimate, but it should be minimal. John Shinn and I do not go any slower with our 3/4-inch higher canopies, so maybe the same thing will happen here. One thing is certain, we of bigger stature will have plenty of

shoulder room. (1986 Note: The S-18 plans contain these features.)

EXHAUST SYSTEM BALL AND SLIP JOINTS: As you know, it is necessary to install both slip joints and ball joints in an exhaust system to prevent cracking. If you are building your own, I still have these available to fit 1.75-inch tubing. Two ball joints and two slip joints are \$18. This also includes detailed instructions on how to make perfect wrinkleless bends in stainless tubing.

EXHAUST SYSTEM PARTS: Dean Cockran, 255 Hemlock Street, Broomfield, CO 80020 supplies all the bends and parts cut ready to weld for T-18 exhaust systems. He found it uneconomical to supply welded systems. Write for latest prices.

T-18 COFFEE CUPS: Ken Knowles sells nice coffee cups with a picture of his T-18 glazed on the side. A good conversation piece, but you had better get two for your helper will want one also. I see the picture has the "new look" wing. Looks sharp. Ken also has nice three-dimensional T-18 tie tacs.

DIMPLE CRACK QUESTION: John Walton, 5726 Boyce Springs Drive, Houston, TX 77066. In my test piece, it appears that I am getting small cracks adjacent to the rivet after it is upset. These are mentioned a lot in the Newsletters, with various polishing ideas to smooth the hole prior to setting the dimple (and/or rivet?). I have tried several of these, but the small cracks are still there--(they are not there before the rivet is upset.) Answer: The best way to prevent cracks around dimples is to deburr before riveting and then use new soft rivets. Rivets harden with age. Once before, I recommended solution annealing of hard rivets to make them soft again. This means heat treating them to the original 17S state, which is not dead soft. Nearly every T-18 has some tiny cracks around dimples. They have been flying for years with no problems!

Question Two: How do you bend the joggle in 580-3 3/4-inch angle longeron at the horizontal tail fitting? Answer: With great difficulty. After you have tried to make the joggle as best you can, just forget it even if the fitting is not completely recessed. The slight bulge in the side skin is not noticeable. I have been getting most of my materials from Ken Knowles. He deserves some notice for being prompt on deliveries--even for the little orders. J.W.

SUN 'N FUN FLY-IN: Bill Satler won the best metal aircraft award with his beautiful T-18. Bill says that the secret of making a nice airplane is practice. This was his third T-18. One of the novel features incorporated in this aircraft is the electric trim. He uses a headlight door motor from a 1967 Camaro. It is a standard GM-Delco part. The motor is

mounted with the output shaft pointed aft on the frame at Station 191.75. The motor is on the forward side of the frame. Two universal joints and a short piece of tubing connect the motor with the trim screw. The nylon universal joints fit 1/4-inch tubing and are available from any radio supply house. He installed limit switches to prevent a stuck trim switch from applying continuous current to the motor. Bill reports ideal operation, 15 seconds for full travel. The limit switches are actuated by a hose clamp that is clamped to the 1/2-inch 703 trim torque tube. This system appears to be an ideal arrangement with little if any complexity.

DRILLING HOLES IN PLEXIGLASS: E. S. Arvidson, 8918 Birch Avenue, Morton Grove, IL 60053. I just received your Newsletter and see there are still problems with drilling holes in plastic. I have not had any problem with cracking. I use a solid shank wood spade, for the small holes a 1/4-inch solid shank wood spade. Do not use changeable heads. I would never use a twist drill, they heat and build up material and crack one in ten times, but wood spade and 1/4-inch high speed drill motor, full bore will give you a clean hole without cracking. Try it on scrap, it really works. On cutting my canopy, being one of the older ones, I trimmed on the band saw and finished with 1/4-inch drill motor and two-inch sanding disc. Do not be afraid to cut it, just do not twist it. Do everything high speed.

HOWARD HENDERSON FLIES SN600: 444 Bryon, Kirkwood, MO 63122. Enclosed is a copy of my summary of the performance of SN600. The equivalent flat plate area is 2.8 square feet as compared to approximately 2.4 to 2.5 for Roemer's or Thorp's. The data assumes a propeller efficiency of 85% and a gross weight of 1300 pounds. My static source is located on the fuselage side at STA 149 and WL 38 and produces only a 3-mph error at cruise. Possibly locating it four or five inches more to the front would produce even less error.

I am using a M74DM 68-76 propeller and do not have wheel pants. If any ham operators would like to talk to me join in on the EAA net (WQZJR).

(Editor's Note: Howard sent graphs of airplane performance that will not be reproduced here. The range curve at 7500 feet shows a maximum at 123 mph TAS. Maximum duration is under 100 mph. Range computation assumes six gallons reserve. He obtains 190 mph TAS.)

NOISE REDUCTION KIT: Ken Knowles has just arranged with a professional noise reduction expert to obtain ready-made noise reduction kits for the T-18. There are two separate kits, one which makes a complete liner for the cockpit forward of the seat back and the second just for the baggage compartment. The liner is composed of a fiberglass mat sewed

inside a fiber glass screen. It is cemented inside the fuselage skin including the floor. Weight of kit #1 is 16 pounds which seems a bit heavy, but acoustic engineers claim that it takes mass to make effective sound insulation. Price of Kit #1 is \$69.95 and Kit #2 is \$25.20.

OTHER MATERIALS: Ken Knowles presently sells T-18C steel main spar fittings only in prefabricated form. They are already heat treated and plated. The complete set is \$160. For those builders who have machining facilities, Ken will make 4130 plate stock available from his next wholesale purchase. I have not checked with Merle Jenkins but I assume he also supplies plate stock. Builders report that they have been unsuccessful in locating 3/8-inch 4130 plate from other suppliers. Price of the T-18 coffee cups is \$3 each. Either a gold or silver tie tac is \$.95. each.

ALLAN CHIVERS FLIES SN287: 45108 11 Street West, Lancaster, CA 93534. The following data applies to T-18 N18AL: Engine O-320-E2D 150 hp, propeller M76EM-8-76, max rpm static 2050, OAT 70 degree F at 2785 feet altitude, max level flight at 5000 feet 178 mph IAS at 2700 rpm, OAT 5 degrees C, max ground speed 190 mph at 1300 pounds weight. Airspeed was calibrated over measured course. Oil temperature 83 degrees C at 70 degrees OAT. Oil cooler is a Corvair type mounted forward of the left front cylinder. Max rate of climb is 1250 fpm. Construction cost is \$4000 in eight years. First flight 21 December 1975. Empty weight 947 pounds. Most forward cg at STA 63.0. Most aft cg 69.96. Empty cg 60.32. Gross weight cg 67.3.

C-GRAF #644 FLIES: R. A. Froebel, 54 Cumber Avenue, West Hill, Ontario, M1E1T3. I first flew my Thorp on September 28, 1975. That day was also my oldest son's birthday and my youngest son won \$100 in the Olympic Lottery. Good things seem to happen in bunches. There is really no way to describe a first flight on an aircraft that you have constructed yourself so I will not try. I purchased the plans from John late in the fall of 1968 and then working on and off again, my three sons (Eric 14, Mike 15, and Peter 17) and I finished it late in August. I estimate that it required about 4 1/2 years of steady part-time work since there were several long periods when we did not even look at it. As far as cost goes I do not know. I have yet to add up all the bills. It has got to be more than \$6000. If we had some spare money we would spend it on parts. If we did not have it we did not spend. It is essentially a stock Thorp with a good smattering of stock 1966 Mooney Mark 21. We bought a wreck and salvaged many, many parts from it including a full panel, radio and engine.

Basic Details of T-18 #644: Engine: Lycoming O-360-A1D 180 hp (carb: MA4-S); Propeller: Sensenich wood 68LY82. More on this later; landing gear: Jenkins, 2 1/2 inches longer;

tail gear: Thorp steel spring made by local auto spring shop, \$8; cowl: John Thorp. All snap-locked together and to the fuselage; engine mount: Dynafocal, John Thorp. Mounts: Lord from the Mooney, reversed; canopy: Gee Bee, clear; spinner, tips and wheel pants: Rattray; radio: Narco Mk 12A 90 channel plus 100 nav channels; panel: full, vac. & elec. driven, plus fuel press, man, press, g-meter, vac gauge and volt meter. Also cylinder head temperature; miscellaneous: remote ELT with panel switch, rotating beacon, Alumigrip paint done by my sons and I; mufflers both sides with muffs for cabin heat; carb heat off cross-over exhaust pipes; air intake highly modified Thorp with 360 cubic-inch 300 hp auto air filter. Hot air also filtered; small access door right center fuselage for battery and ground-power plug, snap-lock fastened (booster battery a must below -10 degrees); pitot-static right wing 18 inches ahead of leading edge; VOR antenna inside canopy works well saves eyes; fully upholstered including indoor-outdoor rug on the floor, all panels including floor and firewall deadened with sticky lead tape (8-10 pounds) before upholstering. All AN flush riveted except key structural elements front sides of fuselage.

Weight and Balance Data from C-GRAF #644: Empty weight: 950 pounds; empty cg STA 63.52; most forward cg pilot, full fuel STA 64.68; most rearward cg pilot, pass, zero fuel plus 64 pounds of baggage STA 71.00. Now to bring things up to date. We finished the thing late in August, had big launching party on September 13 and hauled it out to the airport the next day. (Oshawa Airport, 20 miles east of Toronto.) We assembled it, checked everything over for the third time, did some taxiing and waited for the MOT inspector to come and give us the go ahead. He came finally, pointed out a few little things he did not like which we were able to correct in an hour or so and then we got our flight permit for the first 50 hours: no passengers, no aerobatics, day VFR only and 25 nm radius from the airport. Next I had to wait for the proper day. Oshawa is a controlled and rather busy place most of the time. I did not want to have to talk to the tower or look out for Cessna 150s so that meant an early morning flight. Meanwhile we did some more high speed taxiing. Bad shimmy in the tail wheel. Tightening up the friction screw fixed that. Finally got up at 0500 hours on September 28 and looked outside. It was clear, temperature 10 C and you could see a million miles--the sun was just coming up to the horizon and not a breath of wind. Told my wife that this was the morning she went back to sleep and I went to the airport. We did not tell the boys. Got to the airport and it was just me, C-GRAF and a bunch of seagulls (just a couple of miles north of Lake Ontario). Just looking at her for the umpteenth time I knew she would fly. Another couple of high speed runs, lifted it off a couple of times and it did not seem to have any bad tricks. One more run to clean off the seagulls from Oshawa's (3500') runway and away we went. Absolutely indescribable--we were at circuit

altitude before we were ready to turn downwind. Kept climbing to 4000' still directly over the airport. At 4000' we very carefully turned off the electric fuel boost pump and the engine pump carried the fuel just fine, though at 3.8 instead of 6.0 psi. All the temperatures and pressures were just fine and she was flying at about 125 indicated at about 2000 rpm and 19 inches. Next for some slow flight and stalls. Stalls in an exceedingly nose-high attitude at about 60 indicated without flaps, rapid right wing drop and fall through recovered in about 400' that first time. G-meter tell tale read -0.5. Did a couple more stalls, no flaps and same results but recovered in about 300'. Now it was time to land it. I figured that if anyone ever stalls this airplane below 500' he has had it so I decided to approach at 90 mph with power about 1300-1400 rpm. (Editor's Note: To cure the right wing drop off he simply needed to add a four-inch stall spoiler three feet out each center section.) No problems, crossed the button at 85 indicated, power off and eventually hit tail first. No problem controlling it. I stopped and took off again more to convince myself that I had really built an airplane and that it was flying than for any other reason. Landed again uneventfully but not well, tied it down and went home for breakfast. It was 0730.

Later the whole family came out and we flew it again with many witnesses. We had 50 hours on it by November 29, 1975 including a climb test which the MOT requires before they will give you the final flight permit. The climb test has to be at full gross with the density altitude reduced to standard day conditions. I decided to make this a careful full load handling check as well as the climb test so we started out by loading in 50 pounds of scrap iron, flying it and then 50 more pounds of scrap and so on up to 225 pounds. No problems at all though she handles somewhat differently. Finally the climb test at full gross. According to the MOT requirements I had to be able to climb at least 1210 feet in three minutes. My measured climb in three minutes was 3800 feet. Took all the paper work into the MOT last week and got my final flight permit without restrictions. I can now go anywhere in Canada, VFR and no aerobatics, and carry passengers. The test period was completely uneventful except for a sheared vacuum pump drive (new pump required).

The longer gear makes the airplanes a little softer on the ground and gives more prop clearance. The steel tail gear makes all the difference in the world. I have flown Fred Kracht's Thorp CF-YEI a lot and early on we had the aluminum tail spring on it. When I got my steel one made up we got two and changed Fred's as well. That aluminum one should be banned. In my opinion it is part of the problem why people have trouble on roll out in the Thorp. I have the large Maule tail wheel on mine and that helps too as the tire is pneumatic and quite soft. I went to the large tail wheel because of the large engine. However I did not need it for

that reason. I have only one complaint about the plane and I am not sure if it is my piloting or the plane itself. I find it very hard to three-point land well. The tail wheel almost hits first with a resounding thump of the front wheels shortly thereafter. I have pretty well given up three-point landings and now do almost all wheel landings which are relatively easy. If I can ever find a really good tail wheel instructor I am going to ask him to come up with me and we will try some three pointers. (Editor's Note: Try using full flaps. Makes a world of difference.)

I do not have much performance data yet. Partly because I have not had the time yet to lay out a really good measured course and partly because I am not sure how good my airspeed indicator is particularly at the top end. I compared it with the local Citabria one day and it appeared to be about 7 or 8 mph low but that is not much of a check. The maximum speed that I have been able to get on the deck (500' indicated) is about 180. At this speed the control forces are exceedingly high (much higher than in CF-YEI) so I think that I might be going a little faster. I have not taken it faster than 195 in a dive for this reason. I did one altitude cruise check on a leg about 125 miles long. For this leg, which I flew at 10,500 indicated, I had an IAS of 137 which gave me a TAS of 176 mph at 2300 rpm and 18 inches. At this power setting I was fully leaned out and my fuel consumption was 6.5 gallons (imperial) per hour.

Now for that propeller. It is the standard Sensenich with metal edges 68LY82. I believe it is slightly too much prop for this engine. At a density altitude of 50 feet, 29 inches (on my manifold pressure gauge) the max rpm that I can get static is 1950-2000. This is less than 50% power. I believe this checks out because it takes me about 700 to 800' to get airborne, paved runway, zero wind. By lift off 75-80 mph the rpm is up to about 2250. I get max rate of climb at about 110 indicated (1600-1700 fpm with just me) but the rpm will not go above 2350. I have to get above 6000 feet to get 2700 rpm at full throttle. On the deck full power the best rpm is about 2550-2600. At 1000' my best climb would appear to be about 105 indicated and the rate of climb is just over 900 fpm. I am in a bit of a quandary as to what to do about this propeller. As a cruise machine it has got to be the cats whiskers. However, she is not going to be much good for short field work or high altitude fields especially at full gross.

The engine came from the wrecked Mooney. It had only 1100 hours total time on it so I thought that I would simply pull it out, check the crank and stick it in the Thorp. One of the cylinders had some broken fins which I thought I could get welded. Oh how wrong one can be. I put a dial indicator on the front flange of the crank it was off about 13 thou, not bad considering that the Mooney went through a ditch and

live at Stellar Airpark, a community of houses on a private airport. We have taxi ways to the back of our houses and most have planeports or hangers on our own lots. I started the T-18 December 1966 and it took nine years. I worked pretty fast the first two years or so. Then I got involved in building houses (after my normal working hours). I am on my fifth house now. I do not think I would have finished it at all without the Newsletters. It seems someone already solved all my problems before I got to them. I have read them probably twenty times over.

S-18 MATERIALS LIST: by L. D. Sunderland (Nov. 1986)

I have just begun construction of an S-18 fuselage and have made a rough layout of all sheet metal parts to determine the amount of each type of aluminum sheet required for the entire airframe. The following list of sheet metal materials should be of assistance to those just getting started on an S-18 project. It should be noted that this list is preliminary and it requires some overlapping of parts to conserve material. For example, if one side skin is laid out with WL42 parallel to the long sheet edge and with the top of the skin against the sheet edge, then a second side skin can also be cut out of the first 19 feet of a four-foot wide roll of 0.025 2024-T3 alclad sheet. Air-Parts from Kansas City sells sheet in any length rolls, so the side skins won't have to be spliced. I bought rolls of 0.025 in 40-foot lengths for convenience in shipping. To get the bend out of the sheet material, just roll it up in the opposite direction and squeeze tightly.

S-18 Sheet Aluminum Material List for Complete S-18

0.025 2024-T3	95 feet x 4 feet wide roll
0.025 6061-T4	10 feet x 4 feet wide
0.032 2024-T3	26 feet x 4 feet wide
0.032 6061-T4	2.5 feet x 4 feet

