As part of this newsletter you will note an enclosed letter from Mr. VERN PEPPARD, in which he details the plan for a most important addition to T-18 Newsletter, a "Safety Manual", for want of a better term at the moment. This will be similar to the Owner's and Operators manual that factory built aircraft have and will be a very valuable and necessary guide to safe operation of the T-18.....Please note, tho', that this is something that YOU and YOU and YOU must be a part of. It's not something that you can let George do. Most of you are properly motivated when it comes to helping your fellow T-18ers, but some of you are a little on the shy side...or maybe you are a little like I am most of the time, in the finding of time to pass on some of these gems of wisdom. Some experience you've had, some small bit of knowledge you've uncovered, might just be the means of saving someone's skin...and airplane. Just remember...the safer ALL T-18s are-the more your T-18 is worth and the more it will be held in high regard in the market place.....and now on to other things:

NEW MANUAL

TEMPLE, TEXAS, OCT. 15-16: Back before the OSH fly-in began, the EAA national convention was held at Rockford, IL, and those were indeed the fun days for EAA people. Many of us look back on those days with great fondness, that's perhaps tinged with a certain wistful sadness.

1ST ANN T-18 CONCLAVE FOR S.W. REGION

As the fly-in became too big for RFD and moved to OSH it lost most of the warm camaraderie and close friendships that were part and parcel of RFD. While most of us really enjoy OSH and marvel at the international spectacle it has become, we still long for the perhaps indefinable missing ingredients that stamped RFD so indelibly on our hearts and memories.

I've tried to analyze what made RFD so much more enjoyable and it all comes out PEOPLE. We got to know EVERYONE that brought in an airplane and a considerable number of those that just brought a dream of owning their own airplane someday. While we jawed on the pros and cons of our favorite airplane, our wives met their wives, we ate together, and really got to know each other to a degree that it became almost like a family relationship. Each year it became almost like a family reunion.

Another big plus for RFD was the simple fact that most of us were able to stay in the same motels or hotels, where we could gather in large groups for after-hour informal functions, an utter impossibility at OSH today. Unless one brings in a warbird, or are an aerobatic performer, or a VIP, one doesn't "qualify" to rent a decent motel room there anymore....and this has angered a lot of people for several years.

Still another BIG factor in the RFD success was that the airplanes flew, and flew, and flew after they got there. There were buddy rides for just about everyone. We flew when we wanted to and the fly-by pattern was always in full swing. As it all mushroomed in size, safety considerations greatly restricted such activities.

Boil it all down and we can see that it was a fly-in for US and by US. It was for OUR enjoyment-and not a 6 ring circus to attract thousands of ground-pounder type spectators.

Anyway, the essence of all the above was what made our 1st annual "conclave" and social weekend at Temple such an overwhelming success. We couldn't call it a fly-in, as an invitation to such an event with the fly-in label could possibly incur liability. Ours was a simple invitation to join us for dinner, like inviting someone to your home for dinner. How you

get there and what you do with your vehicle after you get there is your own business.

Our weather on the Oct. 15 weekend was typical fall Texas WX. There was early morning stratus, but by mid-morning it burned off and by noon it was beautiful. Our winds were southerly, 15 to 20, which made the 85 afternoon high seem quite pleasant (or was it the euphoria from just being around the T-18s?).

Numbers-wise, we did pretty good for our very first annual event. By 2pm we had 12 pretty T-18s lined up along the edge of the closed runway 12-30. The Houston area fielded 4 T-18s: BILL COX and guest: PARKER MILLER; STEVE HOLBERT and guest; and JOHN and LEE WALTON.... The Dallas contingent was VERN PEPPARD, with T-18 builder, RON BOSTIC, as his co-pilot; DAVID MANN and son; and myself, with T-18 builder JOHN HARAST, riding shotgun with me. LEE REILLY and wife came in from Wagner, OK; TONY RUSSELL came charging in from New Orleans; and ol' JOHN HARDY made it over from Natchitoches, LA. JOHN PHILLIPS zoomed in from McAllen, TX (which was about as far away as New Orleans and Wagner) with guest RICHARD STAKES. GARY and MAXINE GREEN of San Antonio had the shortest distance to fly.

We had hoped that Houston's WORTHY WARNACK, BILL McKISSACK, and PAUL STANLEY would join us with their T-18s, but other things interfered it seems. We also looked for JERRY STALLINGS, of Ferriday. LA, to be there, along with HOWARD HENDERSON (St. Louis); SYLVAN KEEBLER (Jackson, MS); LOYD TOLL (Hazen, AR); RANDLE WOOLAWAY (Cassville, MO); NATE EASTMAN (Kimbal NB); DON LANKFORD (Sherman, TX); BRYANT ROWLAND (Midland, TX); BOB MILLER (Ft. Worth, TX); PETE GONZALES (Colorado Springs, CO); DEAN COCHRAN AND GALE ABLES (Denver, CO area); DOUG FRANTZ (Okla. City, OK); LOU FALCONI (Roswell, NM); and TOM KERNS (Arlington, TX); and JIM LANEY (Springfield, MO). If all those had made it we would have had about 30 T-18s there, which would have been pretty close to the number that were at OSH! Maybe next year, huh, amigos???

BOB SLAGLE and wife (Clute, TX) had to make it to Temple this year via the family Cherokee, as did Robert and Dean Sanderson (Graham, TX). STEVE RIFFE (Amarillo, TX) came to Dallas via airline, then rode with ROBERT CLARK (Dallas, TX). Others that arrived by auto were BILL GARDNER and wife (Alice, TX) and LEROY and MARY HOLT (McAlester, OK). JOHN AUSTIN and wife, MARY, (Dallas, TX) had to also come by car, as John has been having oil temp problems on his T-18. NORM BUEHLER and wife (Scott City, KS) would have like to have brought their T-18, but they wre in the middle of a long planned auto trip and would have to drive back home some 500 miles to get the T-18, so they came via car.

GEORGE COPLAND (Duncan, OK) and daughter, DR. ANN COPLAND (Wichita Falls, TX) had to settle for the family Cessna 180 this time, but Ann hopes her T-18 project will be there next year. She'll have no trouble flying it either, as she's a pretty sharp 180 pilot and has flown it to Alaska a time or so to visit her sister in Fairbanks.

Our little clambake so fired up ROBERT CLARK that he went all the way up to Ames, IA, a couple of weeks later and bought an almost-ready to fly T-18 and trailered it home. He also has a wide body fuselage up on the gear in his garage, so now he can feast his eyes each evening on one of each kind. I can think of another half dozen T-18s in this area that might possibly fly before this time next year.

SANTA PAULA BUZZ-IN: Last March I flew out to Long Beach to do a mag story on events and activities preceding the opening ceremonies for the public debut of the HFB-1 (Spruce Goose) and I had called STEVE HAWLEY a few days earlier to tell him I would drive up to Santa Paula and visit him on Saturday after wrapping up the HFB story on Friday. Southern Cal wx had been miserable for several days with very rare thunderstorms and even a couple of waterspouts that moved ashore and turned into twisters. Saturday was only a little better, with light rainshowers and low scud hanging over the basin for most of the day, but SouthernCal T-18ers are not easily deterred when the call goes out for assembling the troops on the flimsiest of pretexts. The occasion was a cover dish luncheon in Steve's hangar. The wx around Torrance kept that T-18 squadron on the ground,or we would have probably had 25 T-18s there. As it was, we had 10 of the little beauties there. (With the world's largest concentration of the world's best sport plane, It's no trick at all to get a group of 25 of 'em together on mighty short notice, it seems).

SANTA PAULA BUZZ-IN

I got to see KEN BROCK's new "Sweet Marie" for the first time and it's a beauty, as you might suspect. (Did you see the cover photo ot it & the feature story about it in the Dec. '83 issue of HOMEBUILT AIRCRAFT mag ?) One of the first to greet me was DAN DUDASH, an old, old friend we called "Tex" when he lived in Dallas. Also saw PAUL CARABELLI's almost new T-18 for the first time and it's a beauty, too. I always admire the sharp job of flying that ELAINE GINN does with the family T-18. Husband HOWARD says it's no secret, since she has flown it some 450 hrs. to his 150. (There's a great human interest story in that family...if I could just get 'em to put the stats, etc. down in writing).Also on deck were DON FRAZIER , LYLE FLEMING, LYLE TRUSTY, AL CHIVERS,H. *CULB'T'Nten really first class examples of sportplanes to delight the most jaundiced eye. *HOWARD CULBERTSON

Back in Palos Verdes that night I heard about a pilot doing low level aerobatics under a low ceiling that augered into a schoolyard in what was probably a T-18. He had just bought the airplane, was around 20 yrs.old. Probably was teaching himself aerobatics, too. PLEASE, gents, let's do everything we can to make personal flying safer and specifically T-18 flying as safe as possible. Talk like a Dutch uncle to the new ones that come along and buy T-18s. There's simply no excuse for accidents such as this one. I feel we should strongly discourage aerobatics in a T-18, unless the pilot is ex-military, with a LOT of experience doing aerobatics in clean, fast airplanes. With a Vne (NEVER EXCEED SPEED) of 210 mph IAS and a spar that is good for +6Gs...IF..the gross weight doesn't exceed 1750 lbs. what kind of sense does it make to get into a position to exceed one or both of these limits in the flick of an eye????? Have you ever considered that differential aileron throw ACCENTUATES adverse yaw inverted? Airplanes may have docile stall characteristics normally, but that does NOT mean they won't be really nasty inverted, especially if the stall is accelerated. Let's again note that you CANNOT open a T-18 canopy in flight! Also, again, why not go rent a Pitts if you're wormy to do aerobatics?

All of the above is to say that T-18 fly-ins are real fun for all and I just wish we will have more and bigger ones. Thanks again to Steve and the rest of the So Cal guys for all the hospitality! I'm beginning to feel that So Cal is my second home. Just wish I could take my T-18 out there more often and join the fun.

This ends the "social" side of this newsletter. Many of you have encouraged me to make social news a regular part of the newsletters. I hope you agree.

NOTE FROM LU SUNDERLAND ABOUT SENSENICH PROPS: "Sensenich corporation has appointed a distributor for all their experimental propellors. He is JOHN W. BENJAMIN, 973 NISSLEY ROAD, LANCASTER, PA, 17601. He not only handles all W66LM (125 hp thru 160 hp Lyc.) and W68 LY (180 hp) props, but also wood models for the Varieze, Longeze, Tailwind, Sidewinder, RV-4, and Mustang II.

PROPS

Sensenich is in the process of applying for type certification for the T-18 props, so this may help to reduce the required flight test period for the T-18 in the U.S. and shorten the landing gear legs on Australian T-18s, which must now use standard length certificated propellors.

Also, Sensenich just confirmed my contention that the brass leading edge took about 5 mph off top speed. On a Cassutt racer with test runs the same day, they got an 8% increase in power and the same % decrease in fuel consumption with a PLASTIC leading edge prop, in comparison with an identical prop with the brass leading edge! They now offer an improved plastic material, which is less prone to rain erosion. "

Sincerely,

Lu

Thanks, Lu, for the info. I assume they now have the type certificate on the props, since several months have now elapsed in the interim. I know the reduced flight test time will be appreciated by new builders. It not only is quite tiresome to spend so may hours just boring holes in the sky to fly the time off, but nowdays it's also pretty expensive. After a certain point it's unproductive, too. In most cases one knows what they need to know about a new airplane (of a proven type) in ten to fifteen hours. I'm sure the Australians will also appreciate the removal of one more bit of red tape, too. I rather doubt that many will opt for the shorter gear, as it is now well established that the longer gear greatly improves the actual landing speed, as well as ground handling on the takeoff and roll-out, primarily due to the increased angle of attack in the normal 3 point position. It also puts more pressure on the tail wheel and helps to stabilize the airplane directionally.

An improved plastic leading edge will indeed be a step forward. LEE REILLY (Wagner, OK) flew a few minutes in what he called light rain a year ago and he nearly had a heart attack after he saw what it did to his Cassidy prop. It not only ate up the fiberglas on the tips, but also ate into the leading edge wood. This was in spite of reducing airspeed and rpm! Since then I've flown a lot of extra miles to stay out of even the lightest of precip. I suppose this isn't all bad, as it's probably kept me from pushing weather, and I've done the old 180 for an overnite of comfort at the motel, where we spent the time congratulating ourselves for such a sensible decision (as we forced down a bit of prime steak). I've found that in circumstance such as this, that it's nice to have such decisions automatically made for you.

PROP LEADING EDGES

LYLE TRUSTY's NEW WING: I don't know how many of you subscribe to Jack Cox' SPORTSMAN PILOT magazine, but you're missing out on some excellent flying stories if you don't. The current issue (Fall 1983) has a two page article on Lyle's new wing. (If you send $2 and ask for Vol. 3, No. 3 you can get one of these issues if you hurry.)Jack tape recorded Lyle's account of the exciting performance gain that has been documented with the new wing.

A NEW WING !

Lyle's wing retains the standard, non-folding planform, with integral aux

tanks in the leading edge of the center wing.This gives him an extra 13.7 gals. of fuel, the total usable fuel now about 42 gals. he formerly had a 10 gal. aux tank behind the seat, which he has now removed.He now has a 650 mile reserve,(an increase of 100 mi,)with a 45 minute reserve with the 3.7 gal. increase in fuel. There's much more than the increase in fuel capacity and range tho':

A big plus is the effect it had on both the CG and baggage capacity. The old baggage capacity limit was 35 lbs. Now it's 195 lbs!He says he very likely won't go beyond 100#, tho', as he now has doubts about the tail wheel's ability to take the extra weight.The wing tank moment arm is just about an inch aft of the Forward CG limit, so if you have an aft CG and put fuel in the wing aux tanks it moves the CG forward. If you have a forward CG and add aux fuel you move the CG aft, so this location ensures that you do the right thing no matter what the original CG position is.Fuel in the wings reduces the bending load on the spar, whereas any added weight in the fuselage increases spar bending load. Of course a landing with full wing fuel would increase negative spar bending, but that's one of those improbable things.He is also aerobatic at 1500 lbs. (which is unimportant to him, but it's there anyway).

You might think all the above was enough to justify all the time and trouble to build a new wing, but not so. That's really just the icing on the cake. The real bottom line is what it does to performance and flight characteristics. Read on: His new stall speed was 6 mph less, he gained 10 to 12 mph in CRUISE (depending on altitude), and he picked up 130 rpm, so now he's needing to raise his prop pitch to 85 or 86 inches. His present prop is a 68" x 84" metal prop. What's more, his head temp dropped about 40°, with a corresponding drop in oil temp. In other words he can get the equivalent speed with less power, less fuel, less heat, if you think of it that way...or he can use the 25 hp he has gained from the 130 rpm increase to go faster, etc. Or you can also say that the decrease in drag was the equivalent of gaining 25 hp. (using the formula that says horsepower is the cube root of the difference in rpm the gain in hp was 25 hp).

Why would "just" a new wing do all that for you. Lyle's explanation goes like this:"People sometimes lose sight of the fact that the T-18 was originally designed around a 125 hp Lyc, as an open cockpit, non-cowled and unfaired airplane, whose max speed would be under 150 mph. For these conditions a 63_1-412 airfoil was chosen, with a 1^o angle of incidence. (The last three numbers in the airfoil are the key. The 4 means the design lift coefficient is .4, which is what the airplane and its gross weight required at 160 mph and 1^o of incidence, meaning the wing would be flying at a plus 1^o angle of attack at some chosen altitude. The 12 designation refers to the airfoil thickness in percent of chord, 12%).

When one puts 180 hp in it and are going 195 mph there's quite a change. Long ago John Thorp announced such T-18s didn't need that 1^o of incidence, that the fuselage was flying at quite a negative angle at those speeds, where you only need a 1.7 C_l, instead of .4...All adding up to the fact that you are generating a lot of induced drag by pushing the wing through the air at half a degree of negative incidence.

In addition, the tail is up another degree than it needs to be, perhaps 3.5" on the end of a long moment arm of 214", so you are now 2.5^o off the optimum cruise angle for the fuselage, plus 1.5^o off on the wing.The sum of all this is a lot of useless drag, which requires hp and fuel.

(CONT'D)

My wing has a 63_1- 212 airfoil tha's modified forward of the spar. It also has a 50% increase in the leading edge radius, which greatly gentles the stall. I also built in a strake by increasing the chord of the inboard rib by 5 inches and the aux tanks went into the bay this triangle made. I also inverted the inboard ribs and if you'll notice a 727 or L-1011 has the same thing. The reason is that this points the inboard portion of the wing up into the induced downflow around the cowl, which reduces induced drag. The oil streaks on the cowling definitely show that they all come down where the air comes around the side of the cowl. This shows that on a stock T-18 the wing root area is sitting there in a negative angle of attack in that downflow. Also the additional 5" in the root rib strake increases the Reynolds number significantly, so you get more lift out of the center section. The change in the stall characteristics is tremendous. The old wing stalls from 12 to 14 degrees angle of attack, whereas the new airfoil will get up in the 18 to 20 degree range before flow separates.

The max lift coefficient with flaps down is about 2, and with no flap it is about 1.6 and that's a change of about .4 from the old one.With the increased leading edge radius the new one doesn't have the secondary break characteristics , either. Coming down the back side of a loop with the old airfoil and you pull it tighter until you get the first buzz of an accelerated stall and back off a little . Just barely touch it again and you'll get a secondary stall pronto, but the new one doesn't do that.It also has a nice stall buffet, but the downwash doesn't stall the tail,too. It doesn't tuck or suddenly bunt and it's a totally new feeling to fly the airplane.

I also believe the wing is much more stable in roll and is a much better IFR platform as a result.The harmony between pitch and roll is an even better match with the new wing (?). With the new wing you can take your hands off the stick for a longer time. Some might not find it quite as delightful to fly with the heavier ailerons, but after a few hours you get used to it and soon forget the other.You just know it has greater stabilit These changes are due to the change in the wing camber, including the reflex in the trailing edge, in addition to the higher speed.

All in all, I'm tickled to death with the resultand if someone else wants to go this way I'll help.I don't have the time, or the desire, to publish plans and sell them. I haven't talked to John Thorp about my wing yet, but I'm sure I will soon. Of course I want to acknowledge the work of Bill Johnston, Lu Sunderland, and Kenny Knowles, as they have designed or built different wings for the T-18 and I borrowed heavily from them.(Bill was the first to design a wing with the inverted rib strake and a new airfoil, which he outlined in N.L. #50-Ed.) I'm having Pete Beck back in VA design a new prop for me that promises fantastic performance, so if that also works out I can do something about that 130 rpm."

Thanks a million,Lyle, for that great wealth of info.We truly appreciate it. The late Bill Johnston was another that generously gave us a lot of information on his experiments and you might want to go back and review his work, too. Bill was an engineer for Boeing-Seattle and he would use his computer to design a new airfoil and then go out and modify the wing o his T-18 with microballoons and resin and go fly it. Of course you well know the story of how Lu and his friend at NASA developed the LDS-2 airfoi that Ken Knowles has on his airplane.

Lyle carefully flew baseline tests with the old wing at 3, 6, and 9 thousa

feet with max power to determine airspeed, rpm, and manifold pressure, stall speeds, clean and dirty and all the other items of impostance on baseline testing. After he installed the new wing he left the old pitot system intact, using the same prop, too, so he could accurately compare the results, which really startled him (and us, too, I might add!).

Okay now gents, before you drive Lyle up the wall crying for more info, hang loose until next N.L. issue please and we'll get more of the details that you may want to start such a wing on your own. Before you make such a decision, tho', be sure you will wind up with a 180 hp airplane. If you will be in the 125-150 hp range the results might be less spectacular on the high end.

NEWS FROM JAVELIN AIRCRAFT: I just got an advance copy of Dave Blanton's latest newsletter for the Ford-Javelin aircraft engine conversions and there is GOOD NEWS from him for T-18 builders. The 1.9 liter engine that Javelin called the 110T put out 100 hp unaspirated, but it turned out to be 70 lbs heavier than an O-200 Cont., but they flew 20 hrs. in their old Cessna 150 test bed, but the noise from the four tuned stacks was unbearable, he said. The bottom line is that this engine CAN be pumped up to put out 180 hp in the TURBO version, but now Ford has quit making it. Dave says okay to use it in other airplanes from Pietenpols up to Longezes, but for T-18 class airplanes he does NOT recommend it. The limitations of the engine surfaced in the test flite program, so he accelerated development of the conversion of the V-6 engine (known as the Windsor engine, as it is built in the Ford Windsor, Ont. plant) which is now used extensively in cars and trucks. They got an engine out of a Ranger for $900, which had 22,000 mi.on it.

I've added on some of the excerpts from Dave's newsletter, for your info and I think you will find them interesting. It appears that this greatly de-rated engine turning out 200 hp for T/O will come out even in wt. with a Lyc. 150 hp O-360 and constant speed prop. Take note that this is NOT an aspirated engine and can use automotive regular. At a 100 hp cruise it only burns 6.2 GPH (.37 SFC). The only engine changes required in the conversion is another camshaft and the gear on it. This raises the max torque rpm from 2200 to 3600 (cruise rpm). If we can live with no more weight than an O-360 plus C/S prop it certainly appears we may truly be on the threshold of a cheap, high powered engine for the T-18 at last. Javelin currently is preparing price lists for four conversion kits, which will range from raw material only to a complete, assembled conversion.

Right now, while I was just in the middle of writing this about Javelin, I got a call from Dave to further bring me up to date. He said Ford had quit building the 1.9 liter engine and they had no intermediate engine between it and the 230 V-6 (which could put out as much as 370 hp!) They have the 230 running on the dynomometer and are very pleased with it. The reduction system turns the prop at only 1800 rpm, which will really make it quiet. He also is working on a ground adjustable prop with Kevlar-reinforced blades and are now testing their 4th model, which may be the final product. He also said there will be a turbo model of the 230 out in a very few months. I asked him about the size of the 230 and he said it's a 24" cube. That means it should fit in the present cowl, too. The present cowl could easily be modified to close off the cheeks and take what little air is needed via a small opening below or around the spinner, possibly like the Doerr cowl.

The 230 engine will be flying in a short time, using an old Cessna 175 for a test bed, so we'll report on developments very soon.

EXCERPTS FROM THE JAVELIN FORD NEWSLETTER #7, DATED DECEMBER 1983
JAVELIN AIRCRAFT CO., 1982 EASY ST., WICHITA, KS, 67230. (316/733-1011)

JAVELIN FORD MODEL 230 V6 (231 cubic inch, 3.8 liter). With starter, alternator, carburetor, oil filter, fuel pump, 6 1/4 pound flywheel and 2 to 1 reduction drive, no oil, 387 pounds. Reduction drive alone is 59 pounds, bare engine 328 pounds. This engine is 50 pounds lighter than the Javelin Ford 140T (four cylinder Mustang engine 2.3 liter), and is 90 cubic inches more displacement. Only 62 pounds more than the 98T but 2.35 times the displacement, only 14 pounds heavier than the O-360 Lycoming of 180 to 200 h.p. which weighs 373 pounds. 101 pounds lighter than the O-470 Continental which weighs 488 pounds. The weights we give on air cooled engines are with exhaust system, carburetor air box and baffels. An air cooled engine can not be operated without these components. With the 2 to 1 reduction drive the swept volume per propeller rotation is 462 cubic inches. The compression ratio is 8.8 to 1 and due to liquid cooling, automotive regular can be used. The cylinder heads and accessaries covers are aluminum. The thin wall steel block is lighter than an aluminum block. The steel block is 3/16 thick as compared to 5/8 thickness of an aluminum block. This engine is known as a Windsor engine, since it is manufactured in the Ford plant at Windsor, Ontario, Canada. The production rate is 2500 per day and they are used in many models of Ford cars and trucks. Low mileage engines are available from wrecked cars and trucks.

HORSE POWER: If you turn up a liquid cooled engine to around 5000 r.p.m. with high compression pistons and the correct camshaft you can get 1.3 h.p. per cubic inch. With this engine that would be 300 h.p. The specific fuel consumption (S.F.C.) would be .54. An air cooled engine at rated power requires .7 for cooling and .78 with a turbocharger. With a small amount of supercharging and the right camshaft, the liquid cooled engine will produce 1.6 h.p. per cubic inch. For this engine that will be 370 h.p. but at a S.F.C. of .7 in order to cool the dome of the pistons. To get minimum fuel consumption we will operate the model 230 at low power and unsupercharged. We have arbitrarily picked 200 h.p. for rated, this is .86 h.p. per cubic inch. At 75% maximum continuous cruise this is 150 h.p. and at an S.F.C. of .37 this is 9.25 G.P.H. with the right prop, a T-18, Mustang II or simular airplane will cruise very well on 100 h.p. and if we can do this at 6.2 gallons per hour on automotive gasoline we have accomplished something.

We encounter people that think F.A.A. requires two spark plugs per cylinders, there is no such requirement on a homebuilt, but even a certificated engine can now be approved with a single spark plug. We are going to use the stock ignition system on the Model 98T and the 230 V6 but with two modules which we will call, left and right. Spark plugs and the distributor never fail but the ignition module can fail. All it takes is a 4 pole-double throw switch. We do want a stand-by battery for the second module. We use a little motorcycle battery and keep it charged with a diode from the main battery.

All of our flight testing with the 98T engine has been with the flywheel ignition system and it has worked perfect. But the cost of the system is $480 and we think the homebuilders will have better success with the stock ignition system. With the stock system you can get parts and service. We will add the second module and selector switch. The distributor on the Escort is on the end where our prop shaft goes, we will provide a drawing to show how to install it on the other end of the camshaft.

— END —

LETTER FROM A T-18 OWNER

Dick Cavin
T-18 Mutual Aid Society
10529 Somerton
Dallas, Texas 75229

Dear Dick,

You asked for it so here's from a buyer, rather than a builder. I bought Serial No. 279 w/ O-360 Lyc. and fixed pitch prop. From back issues of the newsletter and extremely limited information from the guy I bought N3WB from I deduce that I am her fourth owner. Number three owner had installed a placard listing himself as the builder and the logs for the engine and airframe reflected same. In fact it appears that my Thorp was built by Bill Hart and first flown in 1971.

It is a basically well built aircraft but had been messed up with tons of Bondo, foam and fiberglass. My wife, Kathy, and I spent nearly 500 (inexperienced) hours replacing wheels, brakes, windshield, gear and wheel fairings, etc, and on fiberglass cowling, wing tips, etc. Then to the paint shop and upholstery shop for professional finishing touches. We had upgraded 3WB from a flying pile of junk to a third place custom trophy winner at the Northwest EAA fly in at Arlington, Washington last fall.

During the restoration period (with the exception of the painting and upholstering periods) we had to have everything reassembled by Monday mornings as I used the plane daily to commute to and from work. I now have over 400 hours in my T-18 and each flight has been more fun than the last. It is a fantastic plane and I am indebted for life to Jonh Thorp, to everyone involved with the newsletter, to Ken Knowles, Merrill Jenkins and many others for making possible an airplane beyond the dreams of a Cessna jockey.

Some observations:(keeping in mind that I haven't the foggiest idea how many hours total my Thorp has spent in the air). My throttle and mixture controls are routed under the fuel tank. They had worn half way through the tank wall and I corrected this with felt pads cemented to the tank.

My canopy had two latches,one on either side. In flight the canopy lifted 3/4" or more and directed an unbelievable amount of rain into the cockpit. A new seal and a Ken Knowles latch top dead center was the cure.

The forward canopy frame wheel tangs were worn over half way through from contact with the rail. I made stainless shims and attached them to top and bottom wheel bolts. This restored the structural integrity and provides a buffer between the steel rail and the aluminum canopy frame.

As I continue to pile up the hours and as other items come up I will send them along.

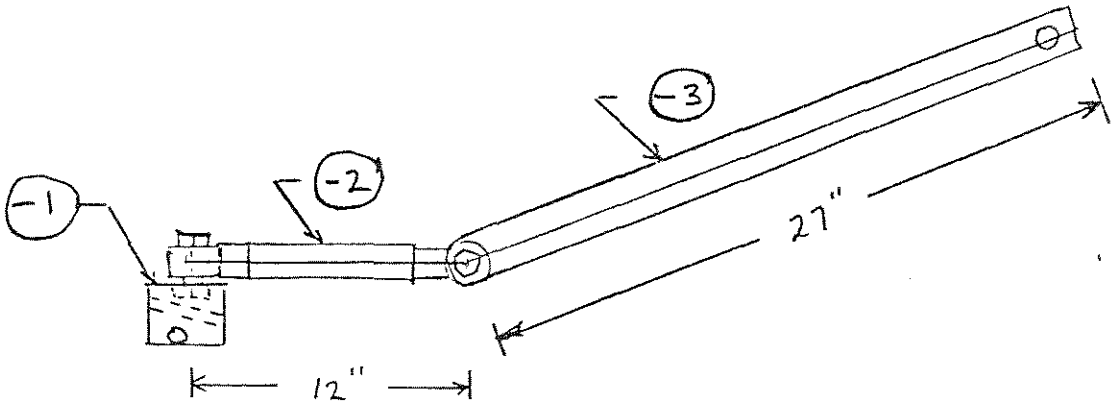
Arch

Arch Maxwell
1845 Mesa St.
Redding, Ca. 96001

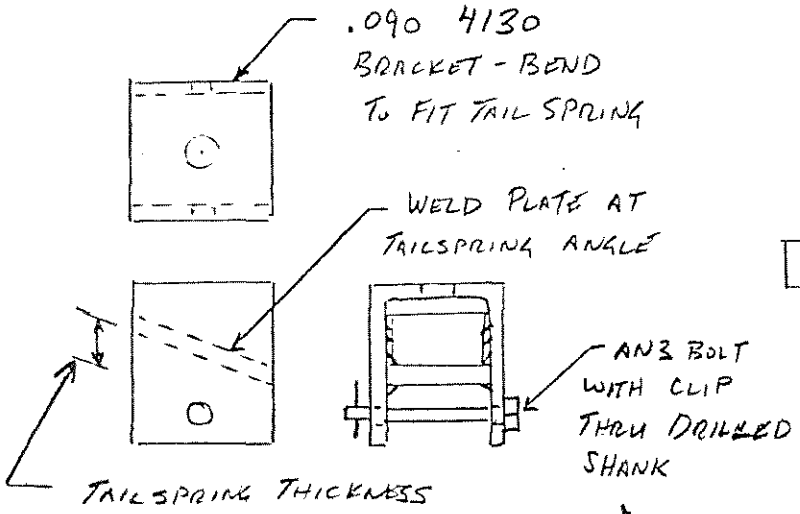
THANKS, ARCH, FOR AN EXCELLENT LETTER & A COUPLE OF GOOD TIPS

T-18 TOWBAR

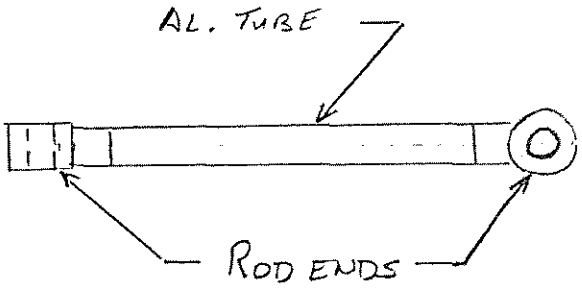
FROM — WALT GIFFIN - N78WG



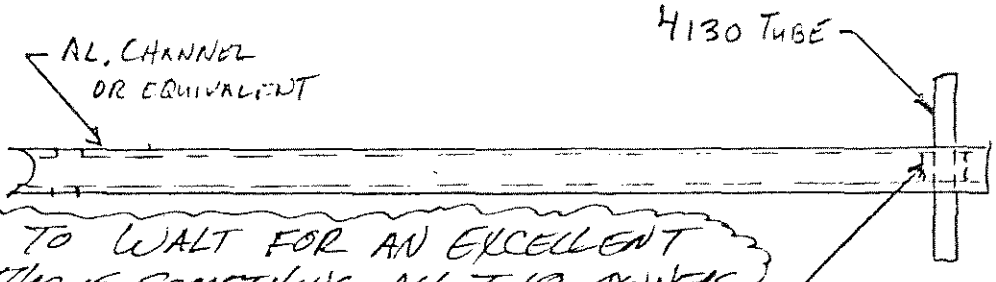
NOT TO SCALE



(-1) TAIL SPRING FITTING



(-2) HORIZONTAL SWIVEL



"THANKS TO WALT FOR AN EXCELLENT DRAWING. THIS IS SOMETHING ALL T-18 OWNERS NEED."
DICK

(-3) HANDLE

(ALSO SEE PHOTO PAGE)

Nothing quite gets your attention like a sputtering engine just after lift off on your first flight or on go-around the first time you've stretched it and your'e down to two gallons remaining..... Yes, that's happened many times to an unsuspecting homebuilder because he neglected a fuel flow check prior to first flight. I consider it an afternoon well spent for the peace of mind you get.

First, some light exercises on your calculator using the following conversion factors:

Fuel weight	5.87 pounds per gallon.
" volume	128 Liquid oz. per gallon.
" "	3.785 Liter per gallon
" "	3,785 cubic centimeters per gal.

Fuel flow requirements for a couple of popular engines will be used as examples.

The 100 H.P. Continental will burn slightly more than eleven gallons per hour at takeoff power setting at sea level. (Because of an enriched fuel schedule which is to cool the valves in this growth version of the old 65 horse Cub engine) 125 % of that fuel flow, as a safety measure, amounts to 13 ¾ gallons per hour. This figures out to .23 gallons per minute or 29 oz., or 867 cc's per minute.

The 150 horsepower Lycoming burns a little more than 14 gallons per hour under the same conditions. 125 % of that is 17.5 gallons per hour. That equals .29 gallons per minute or 37 oz. or 1,100 cc's per minute.

These figures are far above the normal ones your'e used to seeing at cruise. Like 5.6 G.P.H. for the Continental and 9.4 G.P.H. for the Lycoming and illustrate how the trap gets set and why you need to do the flow check under worst case conditions.

So....set your tail in a ditch, hoist your nose in the air or do whatever you have to in order to get the aircraft setting at the stall angle of attack. Now drain all the fuel out, put two gallons back in (to simulate that go-around with only 2 gallons remaining we mentioned earlier) shut off the fuel valve and disconnect the fuel line at the carburettor inlet. Using any convenient measuring container, like a 32 oz fruit jar or a cc beaker time your flow rate. Normalize the time to fit the container if you like:

$$\frac{29 \text{ oz.}}{60 \text{ sec.}} \text{ as } \frac{32 \text{ oz.}}{T}, \quad T = \frac{(60 \times 32)}{29}, \quad T = 66.2 \text{ seconds}$$

32 oz should take 66.2 seconds then.

If you have installed 3/8 inch fuel lines, as you should have, and have number 6 fittings all the way from the fuel tank to the carburettor, and you have a high wing airplane .....fuel will squirt all over and your jar will runneth over. However, a low wing airplane is another matter since it doesn't have the static head pressure the high wing had. This amounts to about 1 psi for each 35 inches of fuel tank elevation above the carburettor. Now couple this with the Marvel-Schebler float type carburettor specification of 0.5 psi minimum fuel pressure required and you've got a fuel flow problem.

(CONT'D)
The Designee File: by Lyle Trusty, Designee #52 (cont)

The reason most low wingers have two fuel pumps, one electric and the other engine driven becomes obvious. Either one will provide takeoff fuel flow.

You can give up here and put on two fuel pumps or do a little more work and have a more reliable system at lower cost.

FUEL FLOW INFO

Pressurize your fuel tank through the vent line, which should be about 3/8 inch diameter and be facing forward, to about 120 % of stall speed on an airspeed indicator tee'd into the line your'e blowing in and again measure your fuel flow. If it squirts the required amount into the container you know it would do that in flight too and you've got a good system. This is how the Thorps get by without fuel pumps, even with 180 horse engines installed.

Put a screen on your vent line though or a mud dauber can ruin your whole day! (It's happened)

A word of caution about gravity feed systems,. put in check valves, cut down the tubing size, use smaller than #6 fittings or install a super dooper fuel filter and you lose fuel flow. A gravity feed system has to be simple and tested for flow after it's all together the last time.

It's worth the extra effort because something thats not there can't fail and the reliability of a piece of tubing is fantastic compared to two fuel pumps. So, keep it simple and reliable by the check we've described and eliminate one more first flight worry.

This is another excellent report by Lyle and we really appreciate this sort of article. It's hard for the builder to dig out this sort of info, yet it's something each and every one need. So again, Lyle, our heartfelt thanks from all of us for two very timely and excellent technical articles.

Here's a short note from Walt Giffin about the T-18 towbar that I didn't have room to put on page 10 with his drawing:

T-18 Towbar

My T-18 towbar was fabricated from assorted scrap material laying around my shop. The basic idea stems from a design by Pete Gonzalez which appeared in Newsletter #53 p. 17A. I modified his design by constructing a simpler tail spring fitting and providing two swivel joints for easy maneuvering and easy storage in my baggage compartment. The towbar works beautifully and makes it a cinch to pull the T-18 into the hangar or a tie-down space without stressing the tail surfaces.

The next two pages also contain some pertinent words of wisdom from our good friend, John Walton, of Houston, TX. I would like to encourage all of you to submit this sort of article for our upcoming Safety Manual. What pre-flight items should we especially watch for, etc.

April 22, 1983

WATCH THAT PREFLIGHT ! by JOHN WALTON

The experience described herein occurred recently on T-18 N51863 and points out once again the importance of a thorough preflight, including inside the cowling.

On a recent flight a faint fuel odor was noted on initial climb out. Later, when landing, slightly rough and irregular engine operation threatened peace of mind. At the time, a mental note was made that maybe we better check the plugs and engine timing.

Before the next flight that mental note escalated into a special thorough preflight. Both of the Thorp cowl checks were pulled. Before pulling the plugs and checking timing, a meticulous preflight was made of the engine and accessories. The Marvel-Schebler carburetor was fully inspected and everything appeared normal. But when the carburetor bowl was taken in a hand and twisted, it was found that the whole assembly, along with the induction system, was sloppy loose. (see diagram)

The fuel trace noted on the previous flight's climb-out was the result of fuel spilling out of the bowl at its gasket and sloshing over into the engine compartment. The entire carburetor and induction system, along with their respective control cables, were suspended below the throttle body assembly by four precarious 12-24 machine screws.

The carburetor in question is an MA-4SPA installed on a Lyc O-320. It had 150 hours on it since being overhauled and yellow tagged by a certified shop. The 12-24 screws bowl attach screws had tab locks installed and the screws apparently were locked against turning.

The entire carburetor and induction system was removed from the engine for inspection. Upon disassembly, it was found that the gasket was intact and that the screw locks were behaving properly. Parenthetically, it was also noted that these four attach screws, when shouldered on their lock tabs and extending through their holes in the throttle body assembly, extend only ¼" into their bowl tapping. (5 to 6 threads).

The looseness of the screws seems to have occurred due to a shrinking of the gasket under attach screws which (possibly) were lightly torqued to begin with. The resultant loosening caused some thread marks to occur in the attach screw holes in the throttle body, but appeared to have done no permanent damage to the parts.

It was noted above that the subject 12-24 attach screws extended only ¼" into the 9/16" deep tappings in the bowl. Disassembly of two other carburetors, and a check with the overhaul shop confirmed that the short screw is "standard".

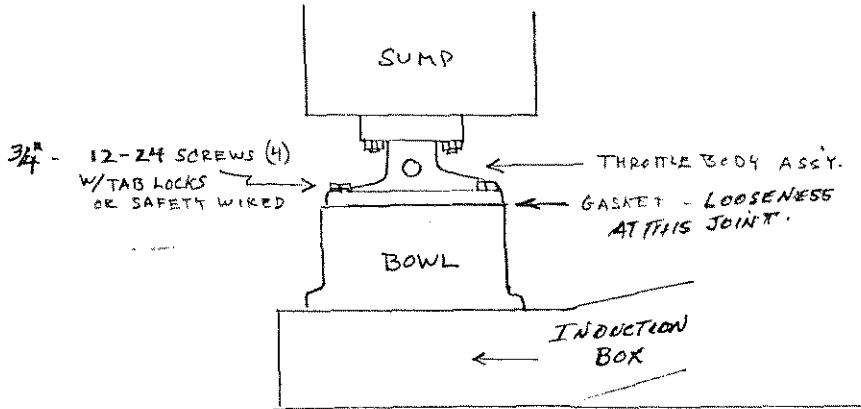
Pre-flight article by JOHN WALTON (cont'd)

page 2

Although the carburetor was reassembled tight with these 3/4" screws; 1" screws have since been located to replace them, and utilize another ¼" of the available thread (due to some possible wear in the first ⅜" of thread length, this seemed to be a reasonable precaution).

The aircraft has flown 3 hours on its retightened screws without any apparent signs of loosening. All signs of fuel odor and roughness are gone.

The hazards coincident with a continued wearing or possible detachment of the carburetor bowl need not be recited, and it is suggested that all owners check for this looseness on their next preflight.



Here's another excellent article that certainly deserves our thanks to John. Again, I would encourage ALL of you to contribute ANY sort of article, but especially ones of such general interest. Such sage words could well contribute to one's well being and prevent sudden stoppage, with resultant bent or broken body parts.

Jwalton
T-18 N51863

-NOTICE-

AVISO - NOTICE

As always, in past, present, and future newsletters, we would like for you to be aware that this newsletter is presented as a clearing house for ideas and opinions only and anyone using these ideas or opinions does so at their own risk and discretion. No responsibility or liability is expressed or implied and is without recourse against anyone.

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N.L. #59 Soon

NEWSLETTER #59: I plan to publish #59 very shortly after the first of the year and I have quite a number of letters and articles from T-18 builders AND owners to pass on to you, but it won't take too many issues for my well of articles and letters to run dry. We need more articles on any and all aspects and areas of building. With so many of you building the wide body and folding wing, we especially need your report on wing build'g, canopy fitting, control rigging, etc. As for owners, we need to know who owns what airplane, who built it, any problems, improvements, experiences flying it, etc. Our roster in #59 will have several letters from overseas builders, more Designee articles, a 1st flite report, ultra-sophisticated propellor balancing, a pitot drain tip, an article on auto vs A/C alternators, cutting and drilling your canopy, checking the A/S indicator on the ground, a Canadian accident from their DOT, a rivet gun tip, and more.

Please remember that your contributions of articles..and money..are the lifeblood of the newsletter. Most of you have sent in your $10 dues which covers increased costs of first class mailings, but some of you are a bit forgetful, as most of us are, at least part of the time .

We continue to publish For Sale items for our current members at no cost, as long as we have space available. This issue contains for sale notices from several builders for complete standard wings, as they now have, or will have, changed over to the folding wing.

JOHN WALTON, 5726 Boyce Springs Dr. Houston, TX, 77066. 713/440-8093, is asking $3300 for wing. Is complete, painted white, perfect shape. Peter Beck, 8712 Queen Elizabeth Blvd, Annadale, VA, 22003. 703/323-7132, is asking $2500 for the wing now on his airplane, but will be available as soon as his other wing has been completed.

There will be others availble next year, no doubt. This is an excellent way to get airborne many months sooner. At today's prices both are really "steals". If you want a CW you could fly one of these awhile while you are building and then resell it.

Frank Seats, 111 Chapel Hills Dr., Fredricksburg, VA, 22401, has an M-76 Sensenich metal prop, prop extentsion, and matching spinner for sale and is asking $800 for all. Prop is vibration tested by Santa Monica and is polished. He also would like to hire an experienced builder to update his airplane with a new canopy, add flaps, cut down the deck, etc., or he would consider buying or trading for a later model T-18 (Has no time to do work himself). PROP IS 68" X 76" FOR 160 HP LYC.

Parker Miller, 15535 Edendale, Friendswood, TX, 77546. 713/482-1732 is starting a new business, so must sell his prized T-18 to help finance. He is asking $23,000. Call after 7 in evening.

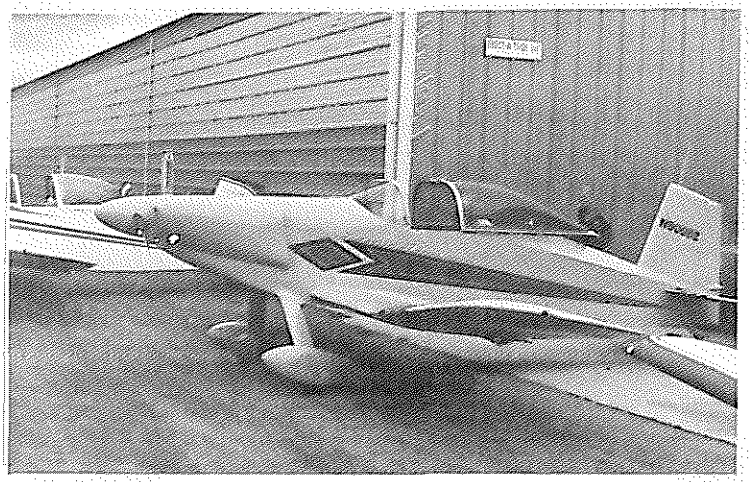
Ted Jarosak, 2501 Sand St., Portage, IN, 46368. 219/762-7038 says: "Havea ~~Dynafocal~~ type II Mount, large rings, for Lyc 160 B1A 0-320 $300, set 2½" Westach Fuel, Quantity, Fuel press. Ammeter, dual oil press./temp sender & lites. $225 for complete set. (CONTACT HIM FOR FURTHER SPECIFICS)

UNTIL #59 — ENJOY.

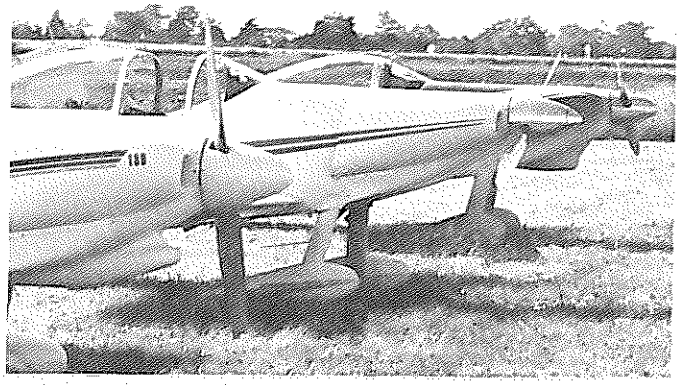
Dick Cavin

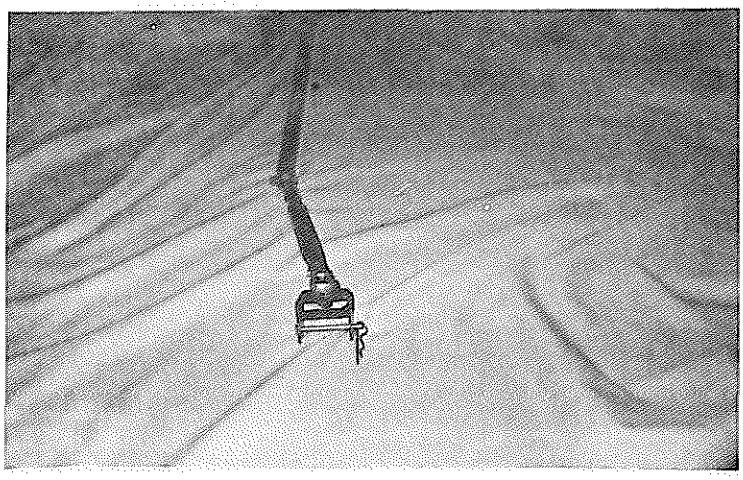
SCENES FROM THE OCTOBER 15th T-18 CLAMBAKE AND CONCLAVE AT TEMPLE, TEXAS

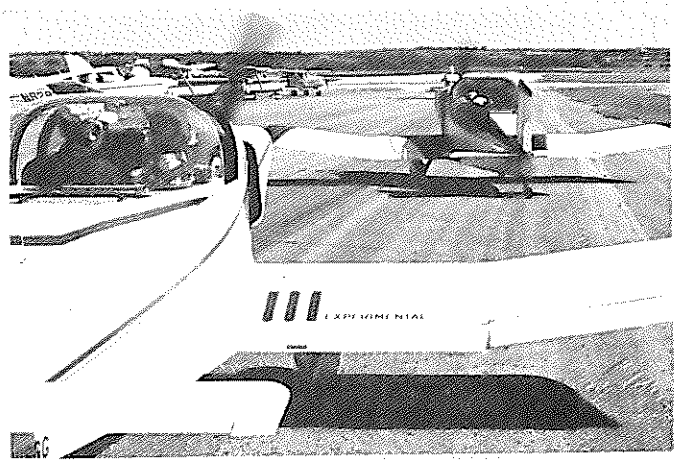
SCENES FROM EARLY SPRING T-18 "BUZZ-IN" AT SANTA PAULA, CA, AIRPORT

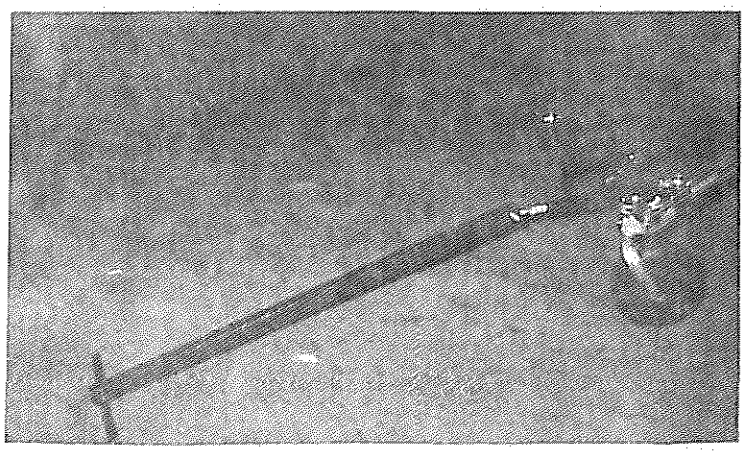


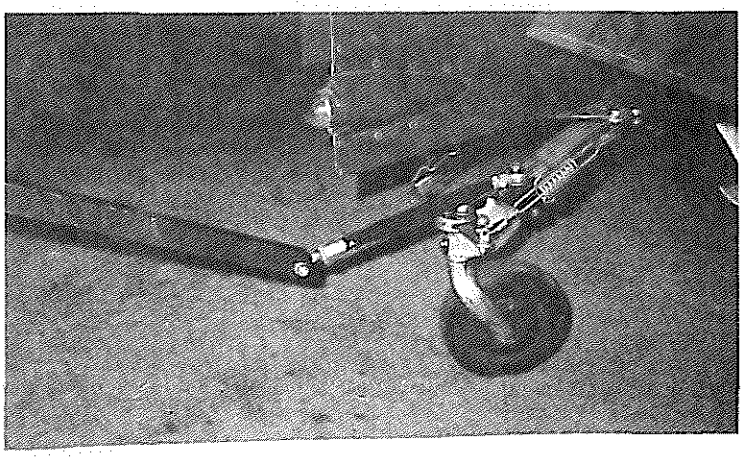
SCENES FROM THE TEMPLE TEXAS T-18 FLIGHT LINE AND WALT GIFFIN's TOWBAR





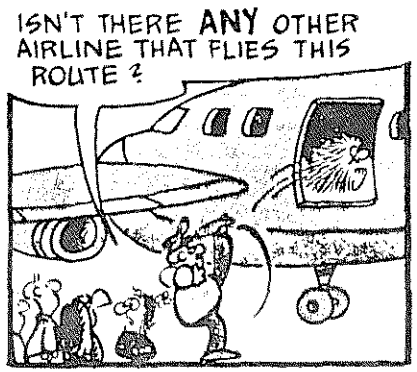


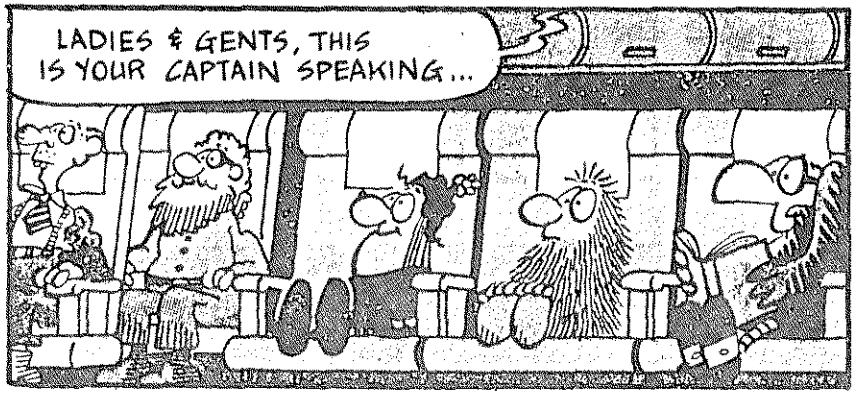


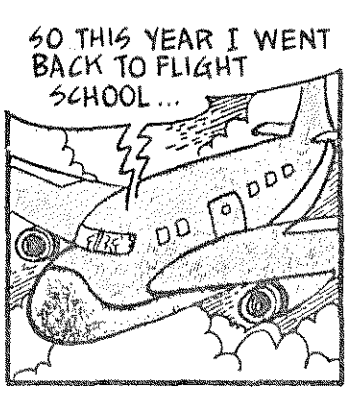


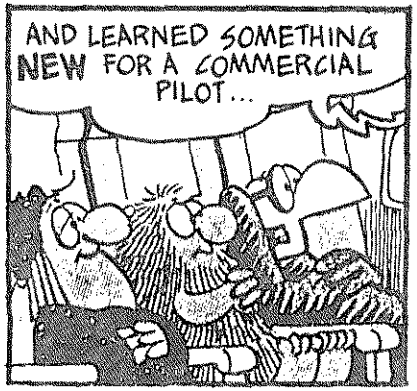
BROOM HILDA

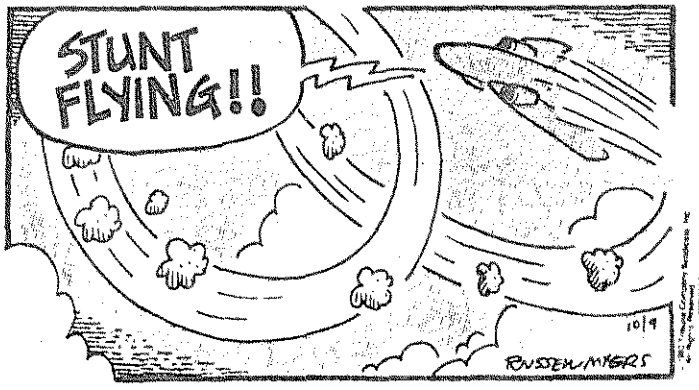
by RUSSELL MYERS











To All T-18 Owners and Builders: **October 18, 1983**

I am enclosing for you the rough draft of what we hope will someday become a safety manual for people who own and fly the T-18. This first draft is nothing more than an extraction and rearrangement of data just as it has appeared in the newsletters. For anyone reading this information for the first time, let me reemphasize that you must rely on it at your own risk. All of it is well meaning but **you must not accept it as authoritative. You, the pilot, are the only authority when you fly your T-18.**

The material was arranged into eight groups: **(1) Accidents and incidents; (2) C.G.; (3) Check List for the Annual (nothing appears here yet); (4) Danger Directives; (5) Flying the T-18; (6) Maintenance; (7) Miscellaneous; and (8) Propellors.** We hope the final product will have as many sections relating to safety as each of you want. The enclosed draft is only the starting point.

Now let me discuss my role in doing this manual. Typists, word processors, typesetting equipment, as well as all paper and printing, will be furnished at my expense, so that each owner and builder will receive a copy of the final product free of any cost. Dick Cavin and I have said in jest that those who make no contribution whatsoever to the booklet should be charged between $500 and $1,000 for their copy.

What would we like for you to do?

(1) **Read this data immediately** and write out any contribution in the form of information which will be useful. For example: a description of any accident or incident in a T-18 is valuable information and can potentially save someone's life. You do not have to type it, just make it legible. Rack your brain for anything meaningful you can add to any section and send it in now!

(2) **Volunteer to be a coordinator** for one section of the booklet. Each coordinator will be sent the typed information which has been contributed concerning their section. For instance, if you are the C.G. section coordinator, this is the only section you will receive. You will not have to type anything!! Legible handwriting for a typist is all that is required. If there are no volunteers, this is the last you will hear from me, because I do not have the time to do it all myself.

(3) If you think such a project is worthwhile, **let me have your contribution** immediately. If there is no substantial response in a relatively short period of time, the project will be abandoned.

(4) If you will serve as the coordinator of a section, **let us hear from you.** The responsibility of the section coordinators will be to review the rough draft of the entire booklet before it is printed, as well as be responsible for their sections.

(5) Once we have some coordinators, **you may send suggestions** on how the material should be arranged or what information should be added directly to them. We will let you know their names and addresses in the newsletter.

(6) **Mail any information** you wish to contribute to:

Vern Peppard
Attention: T-18
1100 Geomap Lane
Plano, TX 75074

Please realize that I will not be able to read all of the letters should there be a large number of them. I will have them opened, typed and mailed to the section coordinators.

The data I have enclosed was done on the word processor and has been reduced in size for economy in printing. The final copy will be professionally typeset and printed in the same type style as this letter. Although it will be expensive, I assure you that it will be a first class job. **It cannot be done unless a lot of you contribute to the text or volunteer as a section coordinator now.** If the response from you is not great enough and we decide to abandon the project, you will be notified in the next newsletter.

Sincerely,

Vern

Vern Peppard

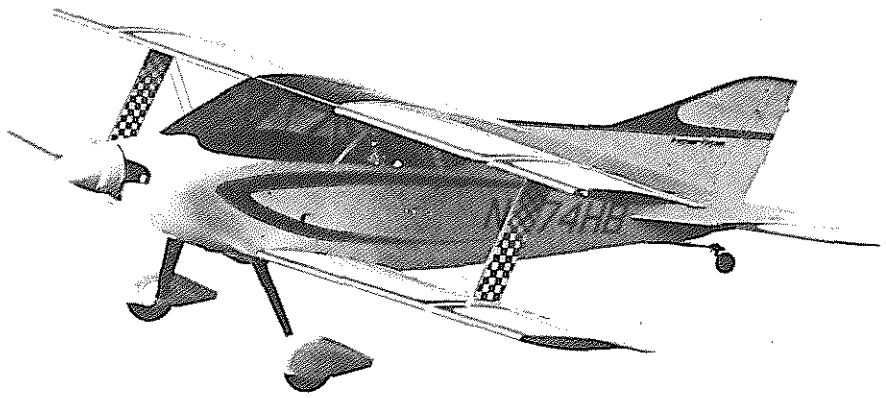
Goodbye Homebuilt, Hello, Your Honor

The legal travails of the Hiperbipe builders after an insistent buyer crashed and sued.

by Ralph Seeley

Remember those "You Be The Judge" features in the old *Saturday Evening Post*? Try this one: You build an airplane, fly it to Oshkosh, and win Outstanding New Design. A few months later, you sell it to someone who seeks you out; you don't advertise it for sale. A month after that, the man you sold it to has an engine failure; he's on downwind pattern leg, not yet opposite the numbers. This is considered by most pilots to be the ideal place for an engine failure, but our pilot "panics" (in his own words), and the airplane comes to rest amid a jumble of boulders on a river's edge, only 30 feet from the point of impact, facing back toward the flight path. It is a quarter of a mile, maybe a half-mile from the runway. But it is a strong airplane, designed for aerobatics; the pilot lives. He sues you, the builder, for a million dollars. Can he collect?

It's almost a moot point. If our hypothetical case runs the same course as *Saulie vs. Sorrell*, you, the builder, will live under that million-dollar cloud for five years, and you'll spend thousands of dollars defending yourself, which can also be defined as constantly educating legal officials on the fundamental laws of aerodynamics, such as the fact that airplanes have been known to glide when engines quit.



Sorrell Hiperbipe seats along *at a 160-mph cruise behind a 180-hp engine. Though the cabin looks big, it seats only two. The aircraft is fully aerobatic.*

Cost of Characters

Meet, then, our cast of characters in a bizarre story which affects anyone who ever built, modified, or even maintained an airplane, then sold it:

• **The Airplane:** The Sorrell SNS-6 Hiperbipe (for High Performance biplane); a two-place, negative-stagger cabin bipe begun in the late 'sixties by brothers John, Mark, and Tim Sorrell, with advice and assistance from father Hobie; finished in late 1972. It won Outstanding New Design at the EAA's Oshkosh, '73.

• **The Defendants:** John, Mark, and Tim Sorrell (pronounced sor-rel') who, by the time the lawsuit was brought against them—two years after the crash—had all quit various higher-paying jobs to form Sorrell Aviation. The original purpose of the company was antique restorations, but the followup to the SNS-6, also called the Hiperbipe (SNS-7) was an even better machine than the -6, so they decided to market a kit. It is important to note that the plane that crashed was built by three brothers, *not* by a company.

Though none of the brothers had a college degree or any real business experience, each brought something special to the effort: John the woodworker, Tim the draftsman, Mark the welder. Each was—and is—a perfectionist. Hobie, father of the brothers and Guru to the entire Pacific Northwest home-building movement, acted as both mentor and laborer for the fledgling company.

• **The Plaintiff:** Grant Saulie (pronounced solly), Attorney at Law. In September of 1973, after repeated refusals by the Sorrell brothers to sell the Hiperbipe, Mr. Saulie walked into their shop and commenced laying hundred-dollar bills on the desk. When 180 of them—that's $18,000 in 1973 currency, lying there in front of three high-school graduates, all recently out of work, so to speak—were lying there, damn near *pulsating*, the brothers gave in and sold Saulie the airplane . . . to their eternal regret.

Saulie took delivery of the airplane and flew it for a month. From here, the only undisputed facts seem to be that the engine quit on close-in downwind pattern leg, Saulie flew away from the runway while hitting the starter (with a windmilling prop) and the primer (on a hot engine), the airplane crashed, and Saulie was injured seriously. After that, there are only allegations.

When you wade into the two-foot-high stack of papers which comprise the legal history of this case, one thing becomes clear in a big hurry: a lot of people changed their stories over the years. Thus, I am unable to determine whether Saulie's accusations include one that the fuel gauges were defective (perhaps meaning he took off with less fuel than he thought, and ran out?) or that the fuel system was defective (meaning fuel was present, as indicated, but it was "unusable"). But that is the nature of this entire case; like so many adventures in our legal system, it is a very expensive and time-consuming way of using polysyllables to say "Did!" "Did not!" "Did so!" And like so many arguments, it soon degenerated into an argument about who said what at the beginning of the argument.

Moral of the Story

It is not my purpose to try the case on these pages; indeed, I purposely waited until it became legal history. My purpose is this: to point out that, through a series of legal maneuvers, someone

might convince a judge that you should be in court defending yourself (with the assistance of an expensive lawyer) if you so much as polished the windshield of the airplane you sold him.

It all hinges around a legal doctrine called *res pisa loquitur* ("The Thing speaks for Itself") which can be illustrated this way: You're walking down a sidewalk and a bale of hay falls out of an upper-story window, injuring you. To collect damages from the owner/operator of the building, you *don't* have to prove that the window was defectively designed, the bales were negligently stacked, and so forth. To invoke *res ipsa loquitur*, the event must be "one which does not ordinarily occur unless someone is negligent." Being struck by a flying hay bale on a public sidewalk is such an event. So, Grant Saulie alleges, is an engine failure in an experimental airplane.

Design Error?

So Mr. Saulie's argument about the fuel system went something like this: I can't point to anything specific, but the engine quit, so there must have been something wrong with the design.

A similar argument attaches itself to Saulie's argument concerning the "defectively designed" shoulder harness: I was injured, therefore the shoulder harness must have been defective. That a shoulder harness wasn't even legally required to be installed has no bearing, evidently. (Eventually, at the trial, Saulie's own witness testified that the shoulder harness installation resulted in less injury to Saulie than if none had been installed.)

To any unschooled in the workings of The Law, Saulie's accusations may seem a bit far-fetched, but the point is that they were *not* seen as such by various judges, and the Sorrells could not get the case dismissed. The years dragged by as the case inched its way toward a courtroom showdown. Meanwhile, there were multiplying briefs, motions, "interrogatories," depositions, "authorities," and statements, all swearing, moving, stating, iterating, reiterating, setting forth and making manifest various disputed facts, accusations, and allegations. The stack of papers grew at a rate of about a half-inch per month for *five years*, at a cost (to the Sorrells) of around $500 per inch.

More than a cost in dollars, the Sorrell brothers payed a cost in what we might call "stress" or "mental anguish." These are religious men, perhaps more concerned with morality than with legal technicalities. (John Sorrell recently quit the company for a full-time Christian ministry.) Not only were they upset and confused about Grant Saulie, whom they had considered to be a friend, but they were confronted with the ethical dilemma of selling plans and kits for the Hiperbipe, knowing that if a million-dollar judgment went against them, they would be bankrupt. They decided on a no-credit, cash-on-the-barrelhead policy with suppliers, and a token-deposit policy with customers. Thus, if bankruptcy were to ensue, neither creditors nor customers would be affected.

The Trial

Almost six years from the crash, the case came to trial. Present in the courtroom were Grant Saulie, Attorney at Law, represented by his lawyer. Then, there were the Sorrell brothers, who were represented by their attorney. Hearing the case was a judge—another attorney. The Sorrells felt—shall we say—outnumbered.

For days, the trial dragged on, in the manner of trials everywhere. Witnesses gave sworn testimony which contradicted their sworn depositions. Some gave testimony that contradicted their statements of a few minutes previous. Some were concise, informative, and helpful. One "expert witness" became so confused that he withdrew into a nearly-incoherent monolog for several minutes, reminiscent of Captain Queeg in *The Cain Mutiny*.

The Winners

Eventually, justice was done. The judge ruled in favor of the Sorrells on all counts.

How can we protect ourselves against this sort of situation? The sad fact is, if you so much as alter the upholstery of your airplane, then sell it, you might face the same kind of lawsuit.

One way is to carry lots of insurance, and let your insurance company worry about it when it happens. Another is to get a signed and notarized waiver from your buyer. (One of the Sorrell brothers suggested still another way: never sell *anything* to a lawyer.)

The law presumes that we all have the duty to treat each other "reasonably," and we can't waive that duty. Thus, if I knowingly sell you a car with a leaking gas tank, and the car burns up, the fact that you signed a waiver accepting the car "as is" is not going to do me much good in avoiding your lawsuit. But a properly worded waiver—assuming you are acting in good faith, meaning not covering up any known defects—might help get a case thrown out of court without the wasted years and dollars involved in Saulie versus Sorrell.

Suggested Waiver

A waiver might read like this:

"Buyer realizes that this is an isolated sale of seller's personal airplane, and that the seller is not a manufacturer or dealer engaged in the business of selling aircraft to the public. Buyer accepts the aircraft as is, and recognizes that there are no expressed or implied warranties as to merchantability or fitness for any particular purpose, in particular, no warranties expressed or implied with regard to airworthiness, materials, design, performance specifications, or intended use. Purchaser acknowledges he has made full inspection prior to purchase, and waives any claim against seller as a result of any defect in design, materials, or workmanship."

If you think a potential buyer might balk after reading such a waiver, I have a suggestion: Save this article. Show it to your buyer. If he won't sign it after reading this, you don't want to sell him the airplane anyway.

Your other hope is that when the engine quits on close-in downwind pattern leg, your buyer has enough sense to land the airplane on the runway. □

Postscript: This article is written from the point of view of the Sorrells, obviously, and their lesson could apply to any homebuilder who ends up selling his aircraft. But a lot of attorneys reading this story might be moved to cry, "Foul!" and point to their role on the other side of the courtroom in helping innocent aircraft buyers get satisfaction from manufacturers who build a defective product that ends up causing them grief.

In the case of the Sorrells, part of the court's decision relating to product liability hinged around the decision that a manufacturer owes a higher degree of care to the purchaser than someone who built an aircraft for himself, basically. And the Sorrells were not at that time considered manufacturers.

Also, no one should assume that a signed waiver is going to offer protection against negligence by the builder, since that can't be contracted away.

—Ed.

T-18 NEWSLETTER - ACCIDENTS & INCIDENTS

Newsletter #22 - 6/67

OOPS - WATCH THAT LINE BOY - Herman Rassler, 98 Constitution, Henderson, NV.

I don't know just how to start this letter, but May 21st, I added another chapter to T-18 history. Returning from a trip to Lake Tahoe, I stopped at Bishop to refuel and the attendant left the oil plug off after checking the oil supply without my notice. I made an emergency landing at Lone Pine, CA, and overshot on the rather short runway. I applied power to make a go around and got no response from the throttle. As there was a new ditch across the end of the runway, I tried to save as much speed as possible to jump the ditch. The gear hit the top of the far bank and this started the disintegration of #24. About twenty feet beyond, the right wing hit a mound of earth and she started cart-wheeling and tumbling from tip to tip. After the dust settled, my wife and I crawled out of the wreckage with only minor scratches and bruises (for the damage done). The engine, gear, fuel tank, instrument panel, and floor boards were laying inverted about twenty feet beyond the mound and the tail cone, with the wing attached by one rear spar bolt, was another twenty feet away, inverted and reversed. The roll bar with one attached channel still on it and the canopy were between the main parts. Both the shoulder belts and the high back on the tail cone share the credit for the minor injuries in this case. None of the panels survived with no damage, but most of the tail cone and one horizontal tail panel are repairable. On any other bird it would be declared a total loss, but to a homebuilder I can see plenty of fitting which can be salvaged by carefully removing rivets. The engine appears OK, except for the crank and the engine mounts. Not a fin broke. That marvelous prop is just scratched and repairable. John Thorp called the next day to find out what happened and made the generous offer of any tooling I need to get her flying again, and Lee Hamlin has offered me another set of glass to help. Sure makes me proud to associate with people like that, although I always have been one to go it alone. This time I think I'll accept all the help I can get. Even the wife says she will help more this time. I don't think she ever really comprehended what I was building until it was nearly done. A few trips over areas where we had spent days driving, convinced her we really had something that would go for us. Hope this hasn't spoiled your day, but be assured she will be rebuilt better than before.

Newsletter #24 - 4/68

Ron Zimmerman, 1915 McKinley St. NE, Minneapolis, MN 55418

Last October, my T-18 was damaged while attempting an unscheduled landing on a road. The cause developed from poor judgment by the pilot, followed by an electrical equipment failure. I was demonstrating the gliding characteristics to my passenger. An attempt was made to restart the engine with the starter. It turned through two compression strokes and ceased responding. When I realized the starter was hopeless (later found a poor connection inside the non-aircraft battery), I dropped the nose to gain speed for an airstart. I was a little shy of enough speed when I ran out of sky.

I lined up with a road below without any traffic. Just before touching down, the landing gear caught some unseen power lines. The contact with the wires was very gentle and I didn't feel any stall.

The plane hit the ground just off the road with the wings level and about some 5 degrees nose down. I estimate the speed at 50 mph. The main gear spring steel legs (tailwind type) bent back to where the wheels dented the wing skin and bent one nose rib. The tail came up as the plane bounded once, overturned, and came to a stop. Personal injury was taken care of with one Band-Aid - thanks to luck and SHOULDER HARNESSES.

Most of the damage (and expense) was done from stopping bottom side up. The windshield, canopy and frame, fin, rudder were totaled. The fiberglass cowl and wing tips were broken. The wing now has two new spars, three nose and one center rib, all new skin, and a repair on one outer main spar. The damage to the fuselage can be described as "widely scattered minor damage".

Newsletter #26 - 10/68

ACCIDENT REPORT - As was announced in the Nov. issue of Sport Aviation, a second fatal accident has occurred involving 180 hp T-18's. During the Southwest EAA Fly-In at Georgetown, Texas, a T-18 experienced what is believed to be flutter of the horizontal tail, followed by failure of the spar at the 510 fitting. During the Fly-In, the pilot-builder was observed to make high speed passes across the field followed by abrupt pull-ups and zooms at extremely steep angles. The day before, a passenger reported seeing between 210 and 220 on the indicator. A credible witness said that during the final pass, the tail was observed to flutter before it failed. The wing was bent down and separated and the fuselage struck the ground under full power, killing the pilot.

Prior to the Fly-In, the builder had parked his airplane in his driveway and it had rolled down a hill tearing off the horizontal tail and associated fittings. Repairs were made and a new tail built, including the doubler tube. Three deviations from the plans were made. The ribs were not riveted to the spar, because he didn't think it was necessary. The 509 fitting was attached to the spar with a 1/4" bolt instead of rivets. 5/32 rivet holes were also drilled, but not used because the fitting has been positioned wrong. This is where the failure occurred. It is evident this accident would no doubt have been prevented if the red line speed had been observed. Just had a talk with John Thorp on the phone to get the latest progress report on the testing program. He thinks they have identified the problem as being related to the bending frequency of balance weight arm. Everyone will be notified when tests are completed.

John expects that the program will allow the establishment of a red line speed of 200 mph or slightly higher. He expects, however, to recommend that all horizontal tails be modified to the new configuration. If you haven't built your horizontal tail, I would recommend holding up until we receive word from John on any modification that might result from the test program. In the meantime, be sure to adhere to the present 180 red line, which has been verified through tests as being safe.

Newsletter #28 - 9/69

CAUTION: A forced landing has been reported caused by throttle cable failure. After two hours on a new T-18, the pilot was unable to reduce power, so he came over the field and cut the engine with mixture control. On final, a Cessna got in his way, so he elected to turn and re-apply power with mixture

control. However, the engine would produce no more than 1000 rpm, so he turned back to the field. Unable to reach the runway, he landed in trees, fortunately without major damage or serious injury. Probable cause - loose throttle cable clamp.

Don't depend on the FAA inspector to catch everying. Get one or more designees or chapter members to thoroughly go over everything before you fly. You'll be surprised at the things they find.

While we are on the subject, do you have a fancy push button throttle control that you can twist for fine control? If it is like mine, there is no provision to safety the end which screws into the fork at the carburetor. I drilled and safety wired mine to the fork.

Now we should never again have forced landings or close calls due to the following reasons, right?

1. Loose throttle linkage.
2. Loose oil filler cap.
3. Loose crankshaft seal.
4. Bad motorcycle battery.
5. Injested nut through intake system.
6. Bad airspeed indicator.
7. Lost canopy.
8. Ground loops.
9. Broken non-standard tail spring.
10. Loose bolt in brake.
11. Fuel system failure or obstruction.
12. Clogged fuel tank vent tube.
13. Out of fuel.

All of these have caused accidents or near misses. Can you find any that could not have been prevented? Very likely, the next one will fall into the same category. Better make this list part of your check list.

Newsletter #30 - 5/70

Burst an oil line from firewall to pressure gauge on third flight. Had small orifice in firewall fittings, so was able to get back before any damage was done. Advise builders to make sure of quality when installing hose and fittings. I took someone's word and it could have been disasterous. More later, as soon as I have the information.

Newsletter #34 - 11/71

NO NO'S - Now we have two more items to add to the list of things NOT to do with your airplane. One is, don't do a slow roll on take-off, even over a beach. Second, don't buzz a lake, for there might be power lines stretched across it. Two T-18's just ended up "in the drink" because of the above. Fortunately, all four occupants got out.

Newsletter #40 - 1/74

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

Newsletter #42 - 4/75

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

Newsletter #42 - 4/75

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

Newsletter #46 - 5/79

ACCIDENT REPORT:
Space this month doesn't permit full coverage, but I'll go into greater detail in a later N.L. The other day, I got a letter from an old friend, John Foy (3801 127th N.E., Bellevue, WA. 98005), one of the original T-18 builders. He told how the T-18 he had built (and donated to the museum) years ago was destroyed in an accident, caused by still another in-flight failure to a cut-down and re-pitched metal prop! This one was a Sensenich from a Cherokee, reportedly. The engine was a 150 hp O-320 Lyc. and there was about 100 hours on the prop since installation. This could have easily resulted in a double fatality, but pure luck and the rugged T-18 airframe enabled the pilot and his wife to survive.

Newsletter #56 - 10/82

BAD NEWS DEPARTMENT: FRANCIS RICHARDSON, one of my long time very good friends and a very enthusiastic T-18'er from its pin feather days in '62, died in a stall/spin accident in his T-18 on the first leg of his trip to Oshkosh. His oldest son, Danny, also died in the accident. He is survived by his wife and another son.

Circumstances of the accident, as related by an eyewitness (a pilot and the son of the airport manager) at the Neosho, MO, airport: Francis had called in on Unicom and advised his intention of landing there for fuel. Weather was not a factor, nor was fuel or engine stoppage. He entered a close left hand downwind at fairly high speed, but somewhat lower than normal pattern altitude

(estimated 500' AGL). On his base leg turn, he overshot the runway centerline (extended). To correct back to the proper approach line, he made a very steep bank (in excess of 60°) at an altitude of not more than 200-300 ft. The airplane stalled in the turn and spun over the top, making two complete turns. Spin rotation was stopped just a few feet before it impacted in an almost vertical attitude. There was no fire. There was no fuselage damage aft of the cockpit.

His airplane (plan serial #1) had a standard fuselage, except for a modified canopy, with forward opening doors. The wing had the standard airfoil, but was the folding wing configuration. He had about 75 hours on the airplane and the engine and had had no engine or flight problems. This was Francis' 2nd T-18 and he had flown the first one over 300 hrs. when he lost it in what was either a departure stall or a violent little dust devil. Francis went with me when I flew my T-18 out to Calif. a couple of years back and I had him fly every other leg. On each one of his approachs and landings, he had a pattern of overshooting final approach, at too low an altitude, with incorrect rudder and aileron inputs. I talked the matter over with him on the ground after each landing, pointing out the potential lethal results of even a slightly accelerated stall in the turn from base to final, as verified by hundreds of such fatal accidents in nearly every type of airplane ever made. His main problem was that he couldn't accurately project ahead in computing the angle of bank that was required and when to start turning base to final, to accommodate to the conditions of wind, altitude, drift, and speed. I suspect this was very probably the reason that he made this final turn so low, that possibly he felt he could better judge the situation at a lower altitude and closer in. This is a judgement decision that all of us have to learn by experience, and really cannot be taught by an instructor. I always use to teach a new student to start the turn when the landing target spot was midway between the nose and wing tip (an angle of about 45°, more or less) and to start with a steeper bank angle, shallowing it out as required. This was a very mechanical method and in the beginning, I even suggested a pre-selected bank angle to correspond to surface wind velocity. Most people rapidly learned to visualize the invisible track of the airplane ahead and their "computer" soon stored the necessary information for future decision making and most of them soon learned what adjustments to the bank angle were necessary to fit the real time situation....But I also found that perhaps 10% of these people took much, much longer to really project ahead and a few of them were extremely deficient. I also noticed that these same sub-standard ones badly mishandled rudder, aileron, and speed coordination in this final turn, even tho' their coordination was acceptable in level flight turns. To me, this indicated they had one too many "balls to be juggled" at that time, thus overloading their computer. What has really surprised me over the years is that many experienced pilots carry those same bad habits right on. I've had experienced co-pilots on the airline that show a sub-standard ability to project ahead on entering the final approach course from base or downwind (in the airline business it's REALLY a no-no to overshoot final and have to make a bank in excess of 20°). In such cases, I've often wondered whether the fault lies with incompetent or sloppy primary instructors or whether a certain percent of pilots are genetically unable to handle multiple judgement calls in that segment of flight.

In any case, the purpose of this discussion is not to be critical of Francis or anyone else, but to call attention to a potentially lethal situation for new pilots on the T-18 (and also for those that might tend to get a little careless, too). This can and does happen in any other type of airplanes, but high peformance airplanes like the T-18 have different characteristics than the run of the mill factory built. First of all, the pre-stall buffet is either minimal or practically minimal in most of the T-18's I've flown and that's why John Thorp has recommended the installation of stall strips on the wing leading edge....to induce a more complete stall at the wing root before it spreads out towards the tips, thus sending more rough air back to hit the stabilator and warn the pilot. I've talked to builders that have tried them with widely varying results. Admittedly, it takes trial and error to get them located perfectly, but don't get discouraged. Let's be aware that there is only one thing that ever stalls an airplane.... excessive angle of attack ... pulling the stick back too much for the conditions of the moment. Very rarely will we ever stall an airplane straight ahead on the final approach (unless it is flared too high). It's the accidental stall in a turn....the accelerated stall....that's the killer. If the rudder or aileron control is being misused when the airplane is stalled in a turn, the airplane will spin. The direction of the spin will depend on which wing stalls first. To avoid a spin, it follows that we should not stall the airplane, but in order to have a trained reaction to avoid a spin out of the stall, it follows that we should really know what causes one wing to stall first and trigger the autorotation. Give yourself an honest little quiz and see if you really know - or are you just guessing?

Let's take a hypothetical case: The airplane is in a steep left bank, turning from base to final. The pilot has let his speed decay in the turn and now he attempts to unbank, using aileron alone (or mostly aileron alone) and he has applied the opposite aileron control rapidly and very strongly. Since the airplane is now very close to the critical (stalling) angle of attack, which wing will now stall and which way will the airplane spin? What will his ball/bank indicator be telling him when he has applied full opposite aileron? I'm sure that 99% of you know the correct answers, but how many of you had to stop and think about it a few moments? Any one of us can get rusty, but that's one situation we should stay super-sharp on. In the case of the T-18, 697 remembered that there is a differential throw built in that causes the up aileron to move more than the down one, but with full deflection the down aileron will cause more drag than it increases lift. The increased effective camber will trigger flow separation and the aileron drag will tend to slow that wing up and speed up the high wing. Result? Left wing stalls and it will autorotate to the left. As that wing (1) moved backward, the ball bank would show you the same thing as if you were holding left rudder...it would be on the far right side of the cage. In other words, a skid, which in itself is a speed losing maneuver.

Now, ask yourself what else might have happened as the airplane began to unbank? Remember when you were practicing steep turns and as you rolled out what happened to the nose? Unless you applied forward stick, the nose would pitch up sharply as the wings shed their G load. If the airplane was already close to the stall angle of attack, that little extra pitch up could do it. Right?

Now, suppose a pilot is making a perfectly coordinated turn and the skid ball is in the center, but his entry airspeed for the turn was too low for his weight, the degree of bank, and the number of G's he has pulled for the particular angle of bank. In order to pull X no. of G's, he has had to pull back on the stick and increase the angle of attack. If he exceeds the critical angle of attack, the airplane will enter an accelerated stall (trying to force the wing to carry more load than it is capable of at that moment). Now... which way will the airplane spin?.. Clue: Go out and stall your airplane with one wing say 10° higher than the other and see which wing will fall at the moment of stall. If there is no yaw at that moment, it will fall off toward the high wing. Try it with 20°, then 30°, then 40° bank and see how much more rapidly it will roll as the bank increases. The answer to the above question is that, yes, the airplane will spin over the tip in the direction of the high wing. Of course, if you experiment with any of the above (which you probably did during your test period), common sense would dictate you be well above 3000 ft. AGL, be prepared to spin and recover promptly with throttle closed. Don't let your speed get out of hand on recovery, but be very gentle and don't horse out of the spin recovery into a high speed stall or bend the wings, etc. Also avoid the tendency to pick up the low wing with aileron.

One other thought on the subject: The SPAN loading of the T-18 is on the high side. This isn't too worthy of consideration until you increase the angle of attack, such as in a climb, a glide, or a turn, and then it hurts. As this angle of attack increases, more and more lifting energy is siphoned off by the wing tip vortex. More of the high pressure air on the underside of the wing escapes towards the wing tips and the result is the same as if some giant had taken a pair of scissors and clipped off the outer few feet of each wing, and it loses a large amount of its potential lift. To compensate for the suddenly increased sink rate from this loss of lift, the pilot either has to increase his speed (thus generating more new lift) or increase his angle of attack. Well, you know what also happens when you increase the angle of attack to get more lift. The drag also increases, so you are in an ever increasing condition where the airplane looses speed at a rapid rate.

I've heard new T-18 pilots comment on how puzzled they were that the T-18 would lose speed so rapidly in a steep turn, mentally comparing it to other airplanes they had flown.....particularly those with a much lower span loading. The subject of span loading doesn't often come up in the average bull session, so many pilots aren't really too well versed on the if's and and's I guess. At any rate, be aware of the limitations as you start to enter a steep turn. If you don't have the airspeed you need for a comfortable safety margin, don't be timid about getting the power in firmly. If you've waited a little too long to start you base/final turn and it's apparent you'll have to do something drastic to get back in the approach slot, why that's an excellent time to roll out and go around the pattern and do it right the next time. Besides, that's good PR if you give the ground bound troops a good low level fly-by in the process!

Newsletter #56 - 10/82

FUEL PUMP PROBLEMS ON INJECTED ENGINE: From EARL ODY, 28903 Gunter Rd., San Pedro, CA 90732 - Dear Dick: I remember that you were particularly interested in the fuel problems in my T-18 that led to my engine out landing at Gary, IN airport. Since several people have expressed an interest, I have written a commentary on the incident, had it duplicated, and am mailing a copy to you.

I really do appreciate your interest and concern, Dick - not only the incident in which I was involved in, but over all T-18's and all pilots.

I am enclosing a contribution to the T-18 Newsletter fund. Keep up the good work, Dick! Best wishes, Earl Ody. Commentary follows:

Thorp T-18, N8952 has been flying for 11 years and 1500 hours and is equipped with TWO Weldon Electric Fuel Pumps in parallel with each other and both in series with the engine driven fuel pump. The engine is a 10-320, which requires 16-26 lbs./in. sq. fuel pressure. Ideally, it should be 21-25 lbs./sq. in. (the engine will stall at 13 lbs./sq. in.). I have always flown the airplane with one of the electric pumps on AT ALL TIMES, since the engine driven pump would NOT maintain sufficient fuel pressure.

It should be noted that the Weldon Electric fuel pumps are approved for continuous duty and whether or not they are free flow by-pass pumps is optional. BOTH of my pumps were of the by-pass type.

During our trip East in July - August, 1982, electric pumps gave out at different times. On Sunday, July 25, we replaced the two pumps with a rebuild Weldon electric pump in Cedar Rapids, IA. This electric pump was placed in series with the engine driven pump. Five days later, we suffered a loss of fuel pressure over Lake Michigan, the engine stopped, and we glided to a landing at Gary, IN, airport. (Whew!) While in Gary, we had a new engine driven fuel pump installed and a rebuilt Weldon electric fuel pump installed. At this point, we installed the single electric pump in PARALLEL with the engine pump and found that the engine driven pump would maintain sufficient pressure for flight and the electric pump would be needed only for starting, take-offs, and landing.

We departed Gary on Thurs., Aug. 12, for Bartlesville, OK, with a fuel stop in St. Louis, MO. Upon arrival in Bartlesville, we found that our electric pump was pulling 15-17 amps and popping fuses as fast as replaced.

Between Friday, Aug. 13, and Mon., Aug. 16, numerous corrections were discussed, but the decision was made NOT to fly until a satisfactory electric fuel pump was functioning. Since I had a collection of electric fuel pumps by this time, I matched a functional pump with a functional motor and had a system that worked. I flew to Calif. on Tues., Aug. 10, using only the engine driven pump in flight and the electric pump for starting, take-off, and landing.

An analysis and some conclusions:

I believe I could have flown for the first eleven years with only the engine driven pump IF the fuel was not passing through one of the elect. pumps, although both electric pumps were the by-pass type. I believe enough resistance was offered to the flow of fuel, that it affected the supply to the engine driven pump.

On our trip East, both electric pumps simply wore out. Upon returning home, I found the motor on one pump was good (that is the motor that brought me home from Okla.), but the pump section failed. The mechanic in Cedar Rapids took my other pump as a core. I am trying to get the pump back, as well as the $290 that I spent for a rebuilt pump that lasted only five days.

I believe our engine failure over Lake Michigan was caused by the motor quitting on the electric pump installed at Cedar Rapids, that it was NOT a by-pass pump, so the fuel supply to the engine pump and to the engine was terminated. We put 12 volts to this pump in Gary and it did not work. I learned several things about the Cedar Rapids pump while in Gary. Weldon has not made this style pump for 11 years, parts are no longer available, and that particular pump was rebuilt on 7/2/75. I did not disassemble this pump to determine why it failed, as I have since returned it to Cedar Rapids.

I disassembled the rebuilt electric pump installed in Gary upon my return home and found that the motor had a frozen bearing; hence the high current draw and popped fuses.

Altho' it's probably too early to tell, I believe that I now have a workable system with the engine driven pump and the electric pump in parallel with each other. I believe that the solution to the problem is one where there MUST be an adequate supply of fuel flowing freely to the engine driven pump. At this point, I do not know why Lycoming 10-320 engines (that were supplied to Wing Aircraft where Earl got his) have customarily had these problems.

P.S. Since writing this commentary I have received a check for $290 from the FBO in Cedar Rapids, the electric fuel pump which they kept, and an apology for their contributions to subsequent problems.

*** That was a superb and well written report, Earl, and one that could certainly save someone from grief. I well remember your telling me of the dead stick landing when you got to OSH and how close you came to not making it back to the field. I meant to ask you at the time what airspeed you used and what your sink rate was at that speed, but it slipped my mind at the time, I guess. I can't remember whether or not your airplane has a constant speed prop or not, but I think it does. It would be interesting to know what the comparative sink rates would be for one with a constant speed prop vs. one with a fixed pitch prop with the engine completely dead. I seem to remember a fatal accident that followed an engine failure (Burbank, I think), in which the airplane went into the approach lights and it was equipped with a constant speed prop. I remember discussing this with John and speculating on the possibility of using a prop that could be feathered for minimum drag. Do any of you with constant speed props have any figures on sink rates with the engine at idle? Or better yet, have any of you switched from a fixed pitch to a constant speed and had a chance to record the two different sink rates? It's a pretty good idea to know how far your airplane will glide, what airspeed is optimum, etc. Have you ever given serious thought to whether you would choose a road vs. a field for a forced landing? One of our local T-18'ers says he will opt for a road, everything else being equal. With the 21 ft. span, you could fit in most roads in pretty good shape and probably would have a better chance of staying right side up with the small wheels we have. I've flown coast to coast via T-18 and I find one of those big interstate highways to stay above when I can, even it it is a few miles farther. Giving yourself an extra break now and then makes the trip more enjoyable and just might pay off someday.

T-18 NEWSLETTER - C.G.

Newsletter #23 - 8/67

CG LIMITS - Don't get the forward cg ahead of station 61. Most have been over 62. The limiting consideration is not elevator effectiveness, but rather possibility of nosing over on the ground - especially with a full tank and no passengers sitting on the ramp with gusts. Aft limit is 31% or station 70.5. Empty weights vary from 750 to 1050 lbs. Keep that weight down if you want performance.

Newsletter #26 - 10/68

CG MEASUREMENTS - One of the toughest problems in getting ready for a first flight is weighing the airplane and determining the cg. First is the matter of finding accurate scales with sufficient range. The airplane should have the tail raised to level the fuselage reference line and scales should be placed under all three wheels at the same time. It is nearly impossible to get consistent readings if the airplane must be moved to place scales under different wheels. The reaction at the main wheels will be about 400 lbs, so single bathroom scales won't do the job. If anyone knows a good source to rent or borrow platform scales, let me know. A poor substitute is two bathroom scales under each main wheel with a plank across them.

With aircraft in a level attitude on the three scales, remove all extra articles and close canopy. The fuel tank should be empty and oil should be full. Now, read all three scales. Drop a plumb bob from the leading edge of the wing and measure the distance from it to the center of each axle. This is extremely important in order to find the empty cg. The angle location may vary from sta 53 to 55, depending on the length and amount of deflection of your gear. If the 2 axles are not at exactly the same station, just split the difference. Locations for the various reaction points are: oil sta 28, fuel 48, main wheels 53 to 55, wind leading edge 55, passengers 87.6, baggage 111, tail wheel 214. Next issue I'll put in a set of sample cg calculations for my ship.

Newsletter #27 - ?/69

CG CALCULATIONS - In Newsletter No. 26 I made some comments about cg calculations and promised to include data for my T-18 in this issue. In order to assure accuracy, I reweighed my ship -- this time with platform scales under both main wheels at the same time and a bathroom scale under the tail. Was I surprised at the difference over the previous measurements taken by first weighing one wheel and then the other with pairs of bathroom scales! Instead of getting an empty weight of 826 lbs. without fuel or oil, it turned out to be 881. I knew the use of bathroom scales wasn't good, but I had no idea how bad. It turned out that our local airport had two pairs of ordinary platform scales like we used to use on the farm to weigh grain. If you aren't so fortunate, why not talk your EAA chapter into buying scales?

Be sure to accurately measure the stations for the main gear and tail wheel as referenced to the leading edge of the win (sta. 55). Use a plumb bob for these measurements.

The cg of a full tank is sta 50. When there is only a small amount in the tank, the cg is forward of this.

The following calculations are for my T-18. The table lists data on some others which have flown. Notice that I can take only 75 lbs. in the baggage compartment with empty tank and not exceed the aft cg limit of station 71. I've verified in flight that station 71 is the neutral point, so don't plan to exceed it. If I could find room, I'd move my battery from the baggage compartment to the firewall. John Shinn has located his battery under the right front seat.

CG CALCULATIONS FOR N4782G

	Weight		Station		Moment	%C	%C
Main Wheel	1019	x	54	=	55,026		
Tail Wheel	43	x	214	=	9,202		
	1062		60.4		64,228		
Fuel (27.5 Gal.)	165	x	50	=	-8,250		
Oil	16	x	28	=	- 448		
	181				-8,698		
Empty cg	881	x	63	=	55,530		
1 passenger	+170	x	85.5	=	+14,535		
Oil	+ 16	x	28	=	+ 448		
Fuel	+165	x	50	=	+ 8,250		
Most Forward cg	1232	x	63.93	=	78,763		17.8
2nd passenger	170	x	85.5	=	+14,535		
Baggage	75	x	109	=	+ 8,175		
Gross Wt. cg	1477	x	68.7	=	101,473		27.4
Fuel	- 135	x	50	=	8,250		
Most aft cg	1312		71		93,223		32

T-18 WEIGHT AND BALANCE DATA

SN	OWNER	MAIN WHEELS	TAIL	OIL	FUEL	In. a	In. b	EMPTY	cg AFT	(sta) FWD	Wt. GROSS
37	Thenhaus	817	36	16	0	1.25	160	60.5	68.7	62.6	1450
37	Hamlyn	866	45	16	0	1.25	160	61.65	69.7	63.2	1475
41	Hansen	951	43	16	0	1.13	160.25	60.8	69.8	62.5	1600
62	Ferko	815	43	8	0	1.75	161	61.32	70.2	62.9	1450
68	Schureman	767	29	16	0	1.5	161	59.6	70	62.1	1350
77	Sunderland	1019	43	16	165	1.0	160	63	71	63.9	1477
79	Kaergaard	672	42	16	0	1.75	160.75	62.7	71.7	62.9	1300
196	Anderson	990	55	16	42	1.38	161	62.6	70	62.9	1600
328	Martens	1051	48	16	0	1.38	161	60.65	69	62.3	1700
390	Grammer	940	43	16	0	1.75	162	60.34	69.2	62.25	1575

Comments:

37 - Thenhaus - no canopy, O-290-G
37 - Hamlyn - Canopy, Pants, New Cowl
41 - Hansen - Const Speed Prop 180 Lyc.
77 - Sunderland - O-290-G
79 - Kaergaard - No canopy - O-290-G
196 - Anderson - 180 Lyc
328 - Martens - 180 Lyc

a is distance in inches from wing leading dege to main wheel station.
b is distance from main wheel station to tail wheel station with fuselage level

T-18 NEWSLETTER - DANGER DIRECTIVES

Newsletter #27 - ?/69

TAIL MODIFICATIONS - The flight test and shake test programs are now completed and new prints are being mailed out as fast as possible. Four modifications are involved:

1. The tail spar is changed to include an outer full length tube of .049 and a shorter double tube inside.
2. Two of the balance weights are removed and new bullet shaped weights are added externally to the tail tips.
3. A little .015 stainless stiffener is wrapped around the inside front corner of the tail tabs.
4. A stiffener is added to the balance weight arm.

BULLETIN - John Thorp urges all T-18 owners to make the No. 3 modification immediately. It had the most significant effect in raising the flutter speed. It simply stiffens the tab by tying in the inside rib with the leading edge and hinge. Note that it does not wrap around from top to bottom, but rather from front to side. This is such a simple modification and so important that it should be done immediately.

John is recommending that all four modifications be made to all T-18's, even the 125 hp models, just in case someone forgets the 180 red line for unmodified models. The new red line for modified models is 210 mph.

TEST PROGRAM - John will probably be documenting the test program in a future article, but I know you are anxious to hear about it, so here are a few details.

All tests were conducted on Dick Hansen's T-18, N299V. Shake tests, flight test instrumentation, and consulting engineering were subcontracted to Specialty Testing Services, who drew upon some of the most expert talent available in the field of flutter analysis. Sensors were placed on the horizontal tail and balance arm and outputs were recorded in flight.

The procedure used was to make a modification and perform shake tests on the ground which identified the bending frequencies of the various parts. Then flight tests were conducted by John Thorp to verify the predicted in-flight characteristics.

First, a new horizontal tail was built with the new two-piece spar. Tests showed that, at about 195 mph, the horizontal tail experienced a bending oscillation at 31 cycles per second with zero damping. This means that the oscillation reached a certain amplitude and got no larger. It was not actual flutter because flutter is defined as a divergent oscillation. That means it gets progressively larger until something gives. The condition was not detectable by the pilot, but showed up on the instrumentation.

The balance weight arm vibrated with a 16 cps frequency. Figuring that this was coupling with the tail bending at twice the frequency, they added a stiffner to the balance weight arm. But tests revealed that this lowered the speed at which oscillations occurred.

Next, the three lead weights were removed completely and John flew up to 200 mph with no problems. Now, a word of explanation about the purpose of these weights. They were not intended to give static balance to the horizontal tail to raise the flutter speed. Instead, they serve only to provide dynamic stability augmentation, or damping, to smooth out the ride in rough

air. You have all observed how an arrow oscillates back and forth in its flight after being released. The bigger the feathers, the quicker the oscillations will damp out. An airplane acts the very same way with its "tail feathers" providing the damping when gusts disturb it. Now, without a balance weight the horizontal tail would fall down at the trailing edge indicating that the cg is aft of the hinge line. When a disturbance swings the tail of the aircraft down in flight, this mass unbalance causes the trailing edge of the tail to swing up. This created downlift on the tail, which rotates the tail end of the airplane down even more. This effect decreases the dynamic stability compared to the conditions with the horizontal tail held fixed. As weight is added to the balance arm, the damping is improved. With the specified amount of lead the tail is nearly statically balanced and the damping is very good, giving a smooth ride in rough air. With the weights all removed, the T-18 flies fine in smooth air, but in rough air the ride is not so nice because the damping is poor.

There is another type of stability called static longitudinal stability. This relates to the ability of an airplane to fly hands off. If it gets disturbed and later, on its own, returns to trim conditions it is said to be statically stable. But, when disturbed upward, for instance, if it continues to pitch up until it does a loop or stalls, it is statically unstable. That is, if the cg is forward of the neutral, it has positive stability and if it is aft of the neutral point, it is unstable. The balance weight affects static stability also. More weight decreases static stability and less weight increases it (moves the neutral point aft). This has nothing to do with flutter, but is only noted for your information.

Back to the flight tests. Since John felt that the balance weight was needed for a good ride in rough air, he had to put the weights back on. The tests indicated that the weight was causing a flutter problem since there was considerable flexure between it and the tail tips. So, to get the weight more rigidly connected to the tail tips, the two side weights were removed from the balance arm and streamlined weights were added ahead of the tail leading edge at the outboard ribs. Flight tests were run up to 220 mph with this configuration, but they still weren't out of the woods. A tail oscillation would still occur at 25 to 30 cps.

Next, the little stainless steel stiffeners were added to the corners of the tail tabs and the frequency went way up giving the biggest single improvement. Flight tests were then run up to 231 mph with perfect results. The damping from stick bumps was just as good at that speed as at 150 mph. John now thinks the tail would go all the way up to near sonic speed without flutter. However, his experts would not let him fly any faster, because other surfaces like fin, rudder and ailerons were not instrumented and there was no way to tell whether they were approaching flutter conditions. Since the FAA requires flight demonstration tests to be run at 10% above red line, that sets the red line at 210 mph. This is valid only for the flight tested configuration, which included all of the above listed four modifications.

Some people have asked whether a slab tail is more susceptible to flutter than a conventional tail. This is a fair question for the layman and let's face it, almost everybody is a layman when it comes to flutter. The answer is a definite 'NO'. Conventional tails have the same problems as slab tails and one can be made just as safe as the other. If you don't believe this, just take a look at all of the supersonic airplanes. Nearly all have slab tails.

So what conclusions can be drawn? What caused the two accidents? There has been no official announcement and we do not know for certain, however, there is evidence that they were caused by flutter of the horizontal tail. In one case, there was strong evidence that the aircraft had flown much in excess of the 210 mph redline. In the other case, there was evidence that not only had the aircraft been flown at high speed, but that the tail had not been built in compliance with the plans.

T-18 owners can now have the confidence that their airplane has been through perhaps the most extensive flutter test program of any homebuilt.

Newsletter #28 - 9/69

STALL SPOILERS - John recommends that everybody now flying re-read my article in Sport Aviation on tuft testing and then add the spoilers. A recent stall spin accident, after an apparent engine failure, emphasizes the need for these. They don't hurt the speed any and are mighty good insurance. I still haven't permanently attached mine, but plan to just bond them on.

Newsletter #30 - 5/70

BULLETIN - John reminds all T-18 builders to complete the tail modification per the plans. When disassembling one tail to make the mod, they found loose rivets in the fittings. They were 1/8" pop rivets. Of course, some weren't long enough, since it is not possible to get them long enough for this application. John says the following is mandatory: Use only the AN 5/32 rivets specified for attaching the 510 horizontal tail fitting. Use no pop rivets for this fitting. To buck them, use a seven foot long steel bar 1" or larger. It is also possible to use a shorter large diameter bar with a handle taped to it. Gravity does the job of holding it against the rivet. John is very concerned about the tail modifications and wants everybody to make them immediately.

Newsletter #34 - 11/71

FLAP BULLETIN - John says that on T-18's with a foward cg loading, it is possible to get a phenomenon he calls "bunt" at a 40° flap setting and at speeds between 100 and 120 mph. He thinks this is caused by a horizontal tail stall, due to high tail loading and bad airflow due to the tail getting into the wing wake. He says that while flying solo, he can nearly always cause a pitch over in N299V and occasionally when dual. I've never experienced this, and can't imagine what it is like, but then, my cg is pretty far back. John says that the solution is for all T-18's to have the flap travel limited to 30°. Consider this a mandatory bulletin. John says this is a problem for T-18's with the cg far forward and probably explains why no one else has reported experiencing this phenomenon.

Newsletter #36 - 3/72

FUEL SYSTEM - L. D. Sunderland - After Jack Park and several others reported that they got power interruptions with several gallons of fuel in the tank, John recommended that a fuel pump be put on all T-18's. However, many of us don't use pumps and have no problems, even with 180 hp engines. Before Bill Warwick flew the first T-18, he ran a full power test with the nose elevated and there was no problem using up all fuel in the tank.

So, what could cause fuel flow problems in some T-18's? Three possibilities - vent clogged or creating negative pressure, clogged fuel strainer or wrong carburetor float valve. If the vent tube faces forward into the wind getting full ram air, the pressure increase is equivalent to that if the fuel level in the tank were 7.2 inches higher. On the other hand, if the vent tube faces aft pulling a suction, it will be like lowering the fuel level. Depending on the amount of negative pressure differential, it could prevent fuel flow. What is wrong with facing the vent forward? It collects dirt. So it should have a screen to keep out contamination and perhaps more importantly, mud wasps. An alternate inlet should be made inside the fuselage just in case the main inlet becomes clogged. Drill a 1/16" hole in the tube for the alternate inlet.

My vent tube is made of 3/8" aluminum. It comes through the .040 floor board near the fuselage centerline and extends out about ½". The end is cut off at a 45° angle, with the opening facing fwd. Preen the tip forward making a small pocket to insure getting positive ram pressure. Air in the vent tube is virtually stagnant, except between the end and the alternate hole where water or dust will be purged by the airflow. I've purposely run my tank very low (it's fiberglas, so I can observe the fuel level in flight) and I've been unable to cause the engine to even hesitate in a steep climb.

If a filter or tank strainer is clogged, the solution is obvious. Someone has already had engine failure because of NOT having a screen finger strainer in the outlet of the tank. If your airplane doesn't have one, ground it until you install one. If you can't find a shutoff valve with a finger strainer, you can make one easily as shown in the sketch. The fitting, which screws into the tank, should be made of brass. Drill out the center hole about .080 oversize. Then make a 2" long sleeve from brass or copper screen. The sleeve ID should be at least as large as the original ID of the fitting. To secure the screen until it can be soldered, bend several wires into hooks. Tin the end of the sleeve with solder, tin the fitting, insert the sleeve and solder in place. Inspect to ascertain that the sleeve ID is as large as the original fitting ID so there is no restriction, crimp the sleeve and solder. If all homebuilders had done the above, there would be a lot more nice shiny airplanes around.

I've been told that carburetors have different float valves when designed for use with a fuel pump. Still haven't been able to verify that, but John Thorp tells me that there were some surplus carburetors available after the war which didn't cause a problem because the engine wouldn't even run without a fuel pump.

What are the disadvantages of a fuel pump? If your fuel system configuration is such that a pump is not required, then its use decreases powerplant reliability. (Al Neuntaffel says his fuel pump failed on takeoff on his first flight. Luckily, he made a safe landing back at the airport.) A pump by-pass with check valves can and should be added when a pump is used, but it all adds up to more things which can go wrong. A part can have no higher reliability than when it is not used.

While on the subject of fuel systems, I've heard of two T-18's that have run out of fuel, one in rugged terrain resulted in a fatal accident. We don't need anymore of those, so why not try making an extra fuel stop, if you don't have a one hour reserve?

Newsletter #37 - 10/72

Before the author installed both slip joints and ball joints in the crossover exhaust system of his T-18, during the first one hundred hours, the exhaust tubes and various supports cracked at least a half dozen times. This experience has been repeated several times by others. Several times builders have proudly opened their cowlings to show how they succeeded in keeping their crossover system together with various supports made of brake lining or tubes, but had to turn away with a red face when they found them broken loose. Without a large dose of luck, both ball joints and slip joints are an absolute necessity in crossover systems.

Newsletter #46 - 5/79

TAIL MOD THOUGHTS: It shouldn't be necessary to repeat this, but there are still some T-18s flying without the tail mods called out. The builders are likely telling themselves that, "I'm safe, as long as I don't go over 180 mph." NOT TRUE! Thorp says you are riding a bomb with a lighted fuse if you do. Altho' he had previously pushed N299V up much faster, he once got a "buzz" out of it at 165 mph! (Before the mods were done.) He now feels the stab is good up to 'sonic' speed, but has redlined it at 210, because other components of the airplane (rudder, ailerons, etc.) could enter destructive resonance regimes at speeds above those tested. Why gamble your life or your passenger's life - or those on the ground? An accident would give the T-18, EAA, Thorp, and yourself an undeserved black eye. Last year, I heard that one T-18 builder was cited by the FAA for "Operating his aircraft in a reckless manner", a careless act under F.A.R.'s, because he refused to make the mod when the inspector brought it to his attention. As you may know, the FAA recently boosted the minimum dollar penalty for violations, as an aftermath of the San Diego fiasco, so give it a serious think, huh? You can well imagine what a field day a lawyer would have in such a situation. I have been told that liability does not end if one sold the airplane.

Newsletter #48 - 11/79

DANGER ITEM - A local Starduster builder has a power failure on 1st takeoff, due to blockage of Aeroquip fuel line. In installing the fittings of the hose ends it's very easy to cut off a little rubber "doughnut" that remains in the line and will block it if allowed to remain. Blow the line out, look thru it, etc. but make sure it's not there. The builder also inspected oil lines to the cooler and found them blocked as well. A local Buecker builder flamed out on his first t/o for the same reason a couple years back, so don't overlook this item!

Newsletter #50 - 4/80

From JIM ROBERTS - To start at the beginning of my love affair with the aircraft, another man that worked for me (Earl Love) and I started construction and flying of N299V which was built for Dick Hanson, of Volpar.

During the early days of testing and Earl Love was flying it, the flutter problem surfaced. Earl was (prematurely) doing a high speed run when he encountered a severe vibration. Fortunately, he reduced power soon enough and by having a constant speed prop, he was able to come back in one piece. The

only casualties were a bent stabilizer and a badly blistered hand caused by the rapid stick movements.

The spar was reinforced and the problem studied while John put a 180 mph temporary red line in effect. The flutter problem came to a head when a Texas builder lost his life diving in on an airport at far over 200 mph and encountered tail flutter. (Documented facts later showed the builder had not complied with recommended changes on the stabilator in several areas, i.e. ribs were not even riveted to the spar - Ed.)

At this point, a full blown flutter investigation was initiated by John Thorp. Stan Rosmussen and Sandy Freznar (vibration experts) were summoned to do the testing. Strain gauges were mounted on the spar tube and the tape readout unit strapped in the right seat. I performed the first series of flight tests, which were done off the coast at Malibu.

My instructions were to set the speed, tap the stick sharply, and flip the switch to "record" increasing the speed in 5 mph increments. Before I started the actual tests, I searched out the highest speed that I could still open the canopy to get out in case of an emergency.

John indicated that there is an aerodynamic forward reaction on the canopy. I found I could not move it back above 120 mph, so I took along a big steel wrench for breaking out the canopy -- just in case.

My three trips up expanded the speed up to 180 mph, where John took over. He wanted to take the risk himself above 180, as he felt responsible. The rest is history, as you know. The results showed a definite flutter at the higher speeds.

Two fixes were called for -- one by moving lead weights to the outer forward surface of the spar from the center (or embedded into the leading edge). We chose the L.E. The other was a beef up of the tab rib.

The second precarious incident in N299V occurred after I installed the flaps and was making an approach to Whiteman Airpark at 90 mph IAS. I set flaps to 40° (30° wasn't in the system then) when suddenly the nose tucked down steeply, narrowly missing obstructions. Only by dumping flaps did it recover to normal attitude. After this incident, John suggested the approach speed of 90 mph was too high for the 40° position. (In short, I ran out of elevator effectiveness.)

(This subject discussed at length elsewhere in this months N.L. We might note that a maximum of 30° flap extension is now recommended. Again, take note that the nose down pitch is a combination of too much speed and a far forward CG that overpowers the horizontal tail - Ed.)

Dick, I did a serious study of a few things as I was planning my T-18, so will briefly outline them. Above all I would express that these changes do not reflect any criticism of the standard T-18 aircraft.

In my calculations I discovered I could increase elevator effectiveness from 10 to 12% by just lengthening the fuselage 12". With this change I could have more baggage area, or 2 extra (limited weight) jump seats - up to 170# within the CG range. Also, I would be able to eliminate the need for lead weight in the tail to static balance (common on A/C with constant speed props and big engines).

During the ground vibratory tests on N299V, data revealed in the natural frequency mode that longer fuselages could produce more flexing, but 12" was acceptable (with proper reinforcement).

Newsletter #50 - 4/80

From JOHN G. WALTON, 5726 Boyce Springs Dr., Houston, TX 77066 - A few months ago you wrote in the M.A.S. NL regarding the 1978 accident at Oshkosh in which a T-18 stalled on downwind base in a low, slow turn to a landing. It consequently impacted inverted on the runway. A fire resulted after impact and this was, I believe, considered the cause of both fatalities. In the NL write-up you mentioned that the fire probably would not have occurred if the gasoline tankcap had not released (i.e., come out on impact).

I have been giving this event a lot of thought as I've been completing my T-18. I do not know what type of gas cap was involved in the above failure. I do know that a lot of them are like the one supplied in my aluminum tank from Ken Knowles. A picture of this is attached as shown on the copy of a page from the Aircraft Spruce Catalog. The cap in question depends on a to compress outward a rubber inner cap. The compression action is achieved by the squared cam-shape of the locking tab on the cap. This is adjustable by an internal AN 365 nut. There is no detent or lock for this tab such as is present on many military-type caps (e.g., T-33 wings and tip tanks) and others.

I have found that this cap will pop out simply by dropping my gas tank from a height of 3' on my lawn. I should mention that the adjusting cap nut was set for maximum compression in the lock-position while still allowing room to remove it when in the relaxed position. I do not know whether the subject aircraft in the accident has this same type of cap, but if it did, the release on the cap is not a great surprise based on the casual tests I made on my own tank.

In order to improve this situation, I have designed a restrictive "stop" on my flush cover over the cap in the cowl skin which rests against the top of the tank cap when in the locked position. The only way the cap could come loose with this top in the cover would be as a result of a combination of the necessary impact force vectors and significant skin distortion. The enclosed sketch might help to illustrate this description.

It is my feelings that this style of fuel tank cap is vulnerable to this type of release.

A positive lock on the cap itself might be preferred to my modification to my cover for the ultimate in corrective action. It is felt that the simple stop, as shown on the cover, will greatly reduce the potential of this type of release in almost all circumstances.

Newsletter #50 - 4/80

From BRYANT ROWLAND, 1007 Shell, Midland, TX -

The subject of my letter is the use of full flaps on the T-18. Please pass on the following in the newsletter as it well could save someone a very bad experience.

Some T-18's, mine included, have a very violent downward pitch, when full flaps are applied, or when speed is increased while full flaps are applied in a forward CG condition. The airplane is of course at it's most forward CG with one pilot aboard, full fuel and no baggage (such as would be for test flight) the downward pitch is very rapid and is totaly un-controllable, not something that you would want to happen down close to the ground.

My airplane reacts this way:

1) With one 170# pilot aboard, no bags and more than half fuel which gives me a total weight of 1351 and CG of 63.2 In. Rapid downward pitch upon application of full flaps (30°).
2) With two people on board, less than half fuel (and some baggage preferred) no problem with full flaps, meek as a lamb. This loading gives me 1397 total weight and a CG locaton of 66.1 In.
3) When the CG is something between the two above conditions, full flaps may be applied at a slow speed (80 mph or slower) but will pitch down if the speed is increased. Stick buffet is the clue. If the stick buffet's with a forward tug, better get the flaps up or have a very tight seat belt and be ready to ride through the first half of an outside loop.

By the way, my empty CG is 61.6 In. and empty weight is 1013 #. For flight I call 1500 # max. with 62 In. forward limit and 70 In. aft limit. My weight and balance is good, I have double checked it on freshly calibrated aircraft scales. What I am suggesting to new T-18 pilots is, to explore the full flap and CG locations at altitude before any landings are attempted.

All of this has proved to be no problem to me, it's just a limitation that I have learned to respect. As you know, I fly airplanes for a living and have for most of my life. I fully agree with all the good things that are said about the T-18 and wouldn't part with mine for anything.

Newsletter #51 - 7/80

From BILL WARWICK: The boys in the PRPA came up with this a few years ago and it's mandatory on all the formula one's and Biplane racers. (He is discussing an Engine Restrainer, drawings for it are in the above mentioned newsletter.)

The main idea is to give the engine room to thrash about until it croaks without breaking the cable, so don't snug it up too tight. All it has to do is keep the engine from falling out.

Be sure the lugs are bolted to the landing gear attach and not the engine mount.

I've had mine in for years now. Gives wonderful peace of mind & cheap insurance.

**Thanks Bill, for some very important advice. I lost a good friend from this very cause several years ago. He "planned" to put the restrainer on when he got back from the XC and had more time. He never made it. When the prop let go it shook engine, prop, and cown completely out of the airplane and it pitched up into a stall and augered in. It also shook one aileron off and the windshield as well.

Newsletter #53 -4/81

From JOHN WALTON, 5726 Boyce Springs Dr., Houston, TX 77066 - The newsletters are full of comments warning of the tendency for the Thorp to be squirrelly in slow taxi. This is especially true with power off. The controlability in this situation is to a considerable degree, affected by the amount of tension put on the tail wheel springs. Don't leave them sloppy - they should be compressed about 1/2 of their original length.

Newsletter #53 - 4/81

From LYLE TRUSTY, 7500 N. Ave. A Lancaster, CA 93534 - Some fuel system basics: Here is a helpful hint concerning a gravity feed fuel system like most of us use.

When you get ready to run your engine up before going to the airport, block up the main gear, lower the tailwheel into a ditch or whatever you have to do to get the airplane into a 12 to 14 degree approach attitude. Put a gallon of fuel into the tank, put a container under the carburetor, disconnect the fuel line at the carburetor and see how long it takes for that gallon to run out.

$$\frac{14}{60} \text{ as } \frac{1}{N} \text{ , Therefore } N = \frac{1 \times 60}{14} = 4.28 \text{ minutes}$$

or 4 minutes and 17 seconds per gallon.

That's what it takes for a 150 horsepower Lycoming at sea level, full throttle. In order to avoid problems you really should flow about 150% of that required to run full throttle.

Newsletter #54 - 10/81

From HARVERY MICKELSON, 486 Novato Sunnyvale, CA - Remember BILL WARWICK'S tip about the safety cable, tying the engine to the frame, that was in a previous NL? Harvery writes about his recent trip to the Reno Air Races, where one of the racers almost lost his prop/engine in a race, but the safety cable kept the engine in, altho' it was hanging down 45 degrees and as a result, there was no fatal stall/spin, just a forced landing! 'Nuff said'.

T-18 NEWSLETTER - FLYING

Newsletter #23 - 8/67

TRIM INDICATOR - John says there is absolutely no need for a trim indicator since the stick force needed to overcome full trim is very light. It is safe to take off with trim in any position. He convinced the FAA to license the Sky Shooter without an indicator. As a matter of interest, one of the Blue Angels told me they fly all their performances with full nose down, trim cranked in. If anything happens this causes them to dive away from formation. This means they must constantly fight a 60 lb. force. The T-18 trim force is about 10 times less than this.

Newsletter #24 - 4/68

Bill (Johnson) had given me some good advice about handling the T-18. He said, "Don't try to pick the tail up until it is ready to fly. Use 1/2 flap on the first landing and 3-point it. This keeps the tail on the ground the maximum amount of time and thus gives better control."

But I wasn't ready to fly yet. I wanted to take it easy and not repeat some of the near catastrophies most of the other T-18'ers have had on first flight. John said that close calls are the rule rather than the exception and recommended a couple of hours in a T-6 or, as second choice, a Swift. Since we have no T-6's around, I got several hours in Paul Schriebmaier's Swift, shooting landings during the previous several weeks. Even with this experience and most of my recent flying done in tailwheel airplanes while towing gliders, I was still a bit apprehensive after hearing about how tricky a high performance plane like the T-18 was on ground handling. So I taxied out, resolved to spend a lot of time doing taxi tests before trying a flight.

Newsletter #24 - 4/68

THE FIRST 20 HOURS - LDS - ... As I mentioned before, for the first few landings I did only three-point landings to get my tail wheel on early for good ground control. I found, however, that these were not complete stall landings. When I got the feel of it a little more so I could hold it off until it started to shudder, the tail would hit first even with half flaps. One sunny day, when a nice thermal was coming off the center of the runway, if I would make a perfect three-point landing, it would roll awhile in that attitude and then balloon back up a few feet. So, under those conditions, I found it best to take wheel landings. There is no problem of directional control if you keep on your toes and don't start waving at spectators or enjoying the scenery until it stops rolling. But then what conventional gear airplane doesn't fall into that category. (Or should we tail draggers call ourselves "unconventional" now that we are probably outnumbered?)

Newsletter #27 - ?/69

AEROBATICS IN MY T-18 - BY DON CARTER - Vestal, NY - The keynote of this article is "Be Prepared." It is important that both pilot and aircraft are properly readied for aerobatics. Another important consideration is that just as no two pilots have the same experience and capability, there are no two T-18's exactly alike. This is especially true of power plants and CG locations, both of which are significant factors in aerobatic performance. The

reader, therefore, should understand that the aerobatic performance to be discussed is not for all T-18's, but only for Serial Number 96 with the conditions as specified. It is powered with a 125 hp O-290-G engine.

Is The Aircraft Prepared? - The red line restriction should be considered in detail. The first question to be asked is, "What is the accuracy of my airspeed systems?" John Thorp advises that the red line has a known 10% margin of safety. From what I've seen and heard about pitot-static systems of homebuilts, errors greater than 10% are not uncommon. Serial #96 was checked on a ground course and verified against a factory job that had a high confidence level.

The red line has additional significance because, with a cruise CAS in the neighborhood of 150 mph, the red line represents only a small percentage increase. Since these T-18's are clean ships, that increase would invite exceeding the red line. That maneuver is conspicuous in its absence from those which #96 has performed.

Is The Pilot Prepared? - It is never wise for a pilot inexperienced in aerobatics to experiment on his own. This is especially true in the "Tiger" for reasons outlined above. Therefore, if the T-18 pilot is not an experienced aerobatic pilot, he should buy himself some insurance in the form of a good course in aerobatics. Such courses are offered by many local flying schools.

Aerobatics In Number 96 - Although I handled a number of T-18's in flight and Lu Sunderland generously let me do some airwork and make four circuits around the field as preparation for my first flight, I did not appreciate the beautiful handling characteristics of the T-18 until I was on my own in #96. Although I've flown a number of aircraft from the WACO to F-51's and F-80's, I have never flown a sweeter handling aircraft than the T-18. This statement comes from a pilot who prefers a very responsive aircraft.

Number 96 began aerobatics with an empty weight of 730 lbs. (bathroom scale accuracy) and a pilot weighing 175 lbs with chute. Depending on fuel, cg would vary between 20% and 22%. A GPU was up front. There is no tendency for either wing to consistently drop off in stall maneuvers.

Number 96's pilot has been through the formal aerobatic programs of CPT and Aviation Cadet training. In recent months, he had made a number of aerobatic flights in an EAA Bipe. Therefore, both pilot and aircraft were reasonably prepared for aerobatics.

I will discuss the aerobatic maneuvers in the order that I progressed through them. In general, I started with the positive "G" maneuver first. I would like to point out that my interest in aerobatics is generated by the desire to increase my skill in controlling my airplane and the pure enjoyment derived from them. I am not a contest pilot, nor am I even familiar with current standard techniques.

Barrel Rolls - I dive to 160 mph and pull the nose up 5-10° above the horizon at the same time banking about 20° opposite to direction of roll. Then almost full aileron with lots of rudder with the roll and a little back pressure to keep you comfortably in your seat and hopefully, the ball in the center. If the roll rate is relatively high, the nose won't deviate more than about 5° during the roll. With full aileron, #96 will roll 180° per second. I have done double and triple rolls by raising the nose proportionately higher at entry. I like this maneuver because it's comfortable, fast, and presents a real challenge in keeping it coordinated through recovery. One word of caution: start with nose high, up to 30°, on first attempts to avoid excessive speed in event you dish out. This roll could be entered at a slower speed, but it would not be nearly as tight.

Loops - I enter my loops at 160 mph, with full throttle. Because of the wide range of speed in this clean aircraft, back pressure will vary considerably if the loop is to be round. Use lots of it in the first quarter, gradually letting off to a very light pressure as you go over the top. Remember that red line and throttle back in the third quarter. Biggest problems will probably be not enough back pressure in the beginning and too much going over the top. There is a natural tendency to pull too much back pressure at the top of the loop to hurry it up, but this is at the point where the aircraft is going the slowest and a stall or even a snap roll can be induced. Remember to pull those g's (2.5-3) in the beginning.

Immelmanns - Enter a tight loop at 170 mph using even more back pressure in the beginning so that enough speed to roll will be available at the top. Roll out at the top can be either barrel roll type or slow roll. For maximum comfort I like to barrel roll, which should be started just before going over the top. Full aileron and lots of rudder for the roll with back pressure gradually increasing. Perhaps the more proper method is the half roll at the top. When reaching the top apply forward stick to keep the nose on the horizon. Immediately start the roll with aileron and rudder and add lots of top rudder as the wings go vertical, decreasing as they approach level.

Spins - Spin entry is normal and recovery occurs immediately upon releasing back pressure and neutralizing rudder. No. 96's roll slows slightly about every half turn with forward cg. No difference in right and left spins.

Snap Rolls - As a precautionary measure to keep stick forces light, I have only performed snap rolls at 80 and 90 mph. I use stick full back and full rudder (no aileron). There is a slight hesitation as in a spin and roll rate is average (whatever that means). Recovery is instant with forward stick and opposite rudder.

Snap on Top of Loop - Enter at 170 mph and start snap about 10° before reaching the top. Nose should be about 10° down at recovery after 360° of roll. Complete loop normally. Keep first half of loop tight as in an Immelmann.

Slow Rolls and Half Rolls - Start by vacuum cleaning the office. A tight seat belt and shoulder harness will also help keep you from standing on your head on the canopy. Start your slow roll, after a shallow dive to 160 mph, with your nose slightly above the horizon. Begin your roll with stick and rudder together. From then on you're completely uncoordinated trying to keep your nose on a point. Top rudder is maximum when the wings are vertical and forward stick maximum when on your back. I find that I need all the rudder I have and then some to keep the nose up. Except for lacking rudder, the Tiger rolls nicely. The only difference in the half roll is that all action is stopped on your back and then you go back to the way you came. If you get into trouble, just apply full aileron and you'll be right side up in jig time. Avoid recovering in a split S.

I wanted an inverted fuel system so I could keep the engine going when I roll slowly. Number 96 has a poor man's inverted carburetor system and so I have to adjust the mixture when I go inverted. This makes things a little busy at this point.

Hammerhead Stall - If physical sensation is what you like, this is the maneuver for you. Dive to 160 mph, pull nose up as in a loop to vertical and hold her there until the airspeed approaches stall. Then apply full rudder and fall away. Your airplane will weather vane around to nose down vertically. Then quickly reduce power and recover to level flight.

Conclusion - The high performance and superb handling characteristics of the Tiger make it a fine aircraft for aerobatic flight. The light control pressures also reduce the fatigue factor. However, I am sure some of the pro's would have some recommendations if the Tiger was to be used competitively. To date, I've only tested the inverted capability in slow rolls and sustained inverted flight. Inverted snaps and spins are yet to be explored. I've already messed up my Tiger by leaking a couple of quarts of oil while on my back. I'll probably modify my lubrication system for inverted flight before pulling many more negative g's.

I would like to conclude with the keynote "Be Prepared". I should not have to emphasize the significance of the red line. All Tiger pilots should observe it religiously. Below is a list of "Be Prepared" considerations.

1. Pilot should be experienced in aerobatics.
2. Aircraft should have accurate airspeed system.
3. C.G. should be forward for first flights.
4. Vacuum office for inverted flight.
5. Wear chute.
6. Practice opening canopy in flight to be prepred for emergency egress.
7. Have lots of air beneath you.....like 7000 ft.
8. Get off airways to keep it legal.
9. Clear the area before each maneuver.
10. WATCH THAT RED LINE.

Newsletter #27 - ?/69

HOW TO TAXI - So you think this is a pretty silly subject. I assure you that you won't think so the first time you notice a gravel dent in the leading edge of your nice shiny new propeller. The fact of the matter is that practically nobody is using a 63 inch propeller. Mine, for instance, is 67 inches long and with a 68 inch pitch, is just perfect for the O-200-G engine. It turns up 2750 max. at 172 indicated. With a standard length gear, this puts the prop close enough to the ground to pick up loose gravel if you don't use some discretion in ground handling. Of course, it isn't as bad as a typical tri-gear airplane, but it will still pick up gravel. Here are some suggestions which could save your prop.

1. Never apply high power while standing still or moving at low speed over gravel. If you have to taxi over loose gravel, get speed up before reaching it and either coast over it or hold reduced power. Don't stop and proceed slowly thinking this will be easy on the prop.
2. Choose run-up areas carefully. Even pavement usually has some loose gravel laying around, so avoid it. Try to find a patch of grass for run-ups on unpaved fields.
3. When stopping for parking, such as at the gas pump, try to avoid gravel also.

If you want to see how a propeller picks up debris, just watch an airplane running up over a dusty area. The swirl under the prop picks up debris just like a tornado. So, take heed.

Newsletter #27 - ?/69

Ron Zimmerman, 1915 McKinley St., NE, Minneapolis, Minn. 55418 -

Back in October, 1964, I rode with Bill Hansen in his (N152A) new Trigear Tailwind to Mississippi State University. We spent a week there while Sean Roberts ran some tests on the Tailwind. They recommended nylon yarn for tufting. The tufts need only be 2½ - 3" long. They should be taped on in a staggered pattern -- this reduces the possibility of the slight turbulence of one tuft affecting the ones downstream of it.

On the subject of stall characteristics of the T-18, I experience a slight left wing heaviness both before and in a stall. The break was pretty much straight ahead. There was little or no warning (buffet) before the stall. I tufted and experimented with stall strips to get more warning before the break. I tried to get the wing to stall sooner in the area of the wing walk so the tail would pick up the buffet for a warning. I got the warning I wanted, but the whole center wing broke at the same time. I didn't think trading warning for a gentle stall was worth it, so I threw the stall strips away.

After re-building my T-18 and re-skinning the whole wing, my T-18 now stalls 10 mph (indicated) lower with the same indicator (calibrated) and pitot-static. At first, I wouldn't believe it, but the ailerons are not as responsive as before (in a stall), so it must be going slower.

Originally, I flush riveted only the nose ribs and main beam. When I re-skinned, I used flush rivets back to, but not including, the rear beam. Also, originally, I bent the wing skin L. E. around a radiused piece of 3/4" plywood. This required much sweat, 4-letter words (Darn, etc.), and an extra set of hands. The second time around, I used the method described in Newsletter #23, pg. 8 (1.7 dim). With this method, it can be done alone in ½ the time, during a church service. (Amen! Ed).

I don't think the extra flush rivets did much to reduce the stall speed, but I do think I got a better L. E. contour on the airfoil, which might be a big factor in the lower stall speed. I am not sure how close the airspeed indicator was calibrated before the crash, but it checked out very close after.

It is my personal opinion that the L. E. contour and uniformity has as much to do with stall habits as unwanted wing twist does. A little extra attention to these factors should be worthwhile. I have my horizontal tail off now to be updated.

Newsletter #28 - 9/69

Are flaps worthwhile? Absolutely yes. Not only do full flaps reduce stall speed about 5 mph, but they also greatly increase the glide angle. This significantly cuts the landing roll and makes getting into small fields much easier. If you are in a big hurry to fly, you can skip the flaps and then add them later. But I believe it is much easier to install them when building the structure, especially the fuselage parts. You'll probably just let them go and never get around to installing them.

Newsletter #29 - 12/69

TAXI TESTS ON 336 BY DICK WALEN - I have started taxi tests on No. 336 and have found that it's about more than I can handle right now. I'm not familiar with the tailwheel, so I'm checking out on a 125 hp Pacer. When I get her up to about 40 to 50 MPH and reduce power, I have fishtail problems. I'm just not proficient enough to handle it yet.

The noise level is surprisingly low. The cockpit is fitted with styrofoam 1" all around, with rolled and pleated upholstering. With the styrofoam filling the cavity between the angles, the upholstery is flush from the seats to the firewall. Here is some data on construction and equipment: 3 years, 2 months to build; $5000 total investment; O-290-D2, zero time certified engine; full IFR instruments; Alfa 200 Genave Radio; Prop from a 180 Cherokee, adapted to fit extension, 68" dia., 70" pitch; weight - 950 lbs. Engine will turn 2200 static, 29" MP, with the tail tied down.

Newsletter #29 - 12/69

EDITOR'S NOTE: The foregoing comments about Dick's taxi tests are not surprising for two reasons. First, the difficulty in maintaining directional control, when the throttle is cut under 40 mph is typical. It is the only time a T-18 could be said to be even slightly hard to handle. Second, all his experience has been in mosegear airplanes. For this reason, I recommend that he find an experienced tail gear pilot to make the test flight. For making a first test flight in a new airplane, it isn't good enough to just be able to handle an airplane. The pilot should be able to handle all the unexpected things which can occur without worrying about normal control of the aircraft.

Newsletter #35 - 3/72

MANEUVERING SPEED - L. D. Sunderland - Don Carter finally got his T-18 approved for instrument flying. He needed to know the maneuvering speed for the T-18. John says it is 172 mph, with 1500 lbs. gross weight. It is the speed where you can't exceed 6g. CL max is 1.48.

Newsletter #38 - 2/73

SPEED INFO - B. C. ROEMER, Manitowish Watters, Wis 54545. We flew without pants at 3500 feet wide open down a road, noted RPM and air speed, landed, put on pants and re-flew the same area. We gained about 4 mph and around 25 to 35 rpm. Tested the same as above with and without gear fairings and gained 10 mph and around 100 rpm. Very surprising.

Newsletter #42 - 4/75

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

Newsletter #46 - 5/79

AEROBATICS IN A T-18: Before you go out and do aerobatics in your T-18,

consider this point: A 6 G capability is ordinarily considered as the MINIMUM in strength capability for doing aerobatics...safely. Had you ever wondered why truly aerobatic airplanes can take up to 12G's? If your T-18 weighs over 850# empty, do you know how much fuel and pilot weight can be added before your G tolerance becomes LESS than the 6 G Minimum? Do you KNOW how many G's your engine mount can take safely? And how about your prop blades? Are you a smooth, competent aerobatic pilot? Are you REALLY competent to do aerobatics in a very clean and responsive airplane? Or has your experience been in slow, high drag airplanes, like a Citabria? Are you aware of the possible consequences if you exceed V-e if you fell out of a 'busted' maneuver? Have you considered the effect of G's on your gyro instruments? Do you think you could open the canopy at 200+ MPH? Inverted? After you've considered all these points, what do you think about the logic of flying your beautiful T-18 into a nearby airport where there is no FBO with a 2 place Pitts for rent to those wishing to stretch their neck a little?

A smoothly done barrel roll normally isn't considered an acrobatic maneuver (from a practical standpoint only), but letting the nose down while inverted could result (and already has) in excessive airspeed on pull out and G's sufficient to bend the main wing beam. Let's not clutter up the landscape with pieces of smashed tin and bloody hunks of meat. It makes the environmentalists furious.

Newsletter #49 - 12/79

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

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

FLIGHT TECHNIQUES: First of all, I would recommend using full flaps for landings in all conditions. We have always used full flaps for all landings in airline work and the very same reasons hold true for the T-18. Like the jets, the T-18 has a relatively high span loading. As the angle of attack is increased, the wing tip lift loss increases drastically. The shorter the span, the higher the span loading and percentage-wise the greater lift loss. In the high angle of attack position on a typical final approach with no flaps, it's analogous to having a giant pair of scissors clip off most of your outer wing panels. Thus the "remaining" wing has to "work" much harder. The only way the wing can compensate for the loss is to go faster or go to a higher angle of attack. If the angle of attack is already close to the stalling angle that door may be nearly closed. If the wind cannot compensate for the loss of lift via wing tip vortex, the result is an excessively high sink

rate. If flare height is approached in a super high sink rate condition, it might take full power to acheive an adequate flare cushion.

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

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

Many T-18's have little or no pre-stall buffet warning, so it makes sense to maintain an adequate speed margin above stall. Approaching in turbulent or gusty conditions, you should tack on just a little bit more. Standard practice is to add the minimum of 30% of stall speed for approach.

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

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

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

One other bit of advice to the new T-18 pilot: Don't flare the airplane until you are within a couple of feet of the runway. We've had several "incidents" and accidents that began with a too high flare. Most T-18's will pitch the nose down briskly at stall. Even at 10 mph above stall the stabilator begins to loose power to raise the nose (without power) at the same time the very high sink begins. If this high sink is allowed to start and the nose is falling thru rapidly at the same time, a hard bounce, or

series of bounces, leads to big problems. If you make your flare and aren't on the ground in a second or two, play it safe and go around.

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

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

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

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

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

"WE NEVER GET TOO OLD TO LEARN" DEPARTMENT

Recently, I was demonstrating my T-18 to a new builder and on landing roll out, he commented what great rudder control it had. I enthusiastically agreed and vigorously yawed it back and forth at 15-20 mph to demonstrate. After 3 or 4 of these, it surprised me and took off for the boonies and despite full right rudder and brake (?), I couldn't stop it. It didn't go all the way around, due to our low speed, but it got my attention, as I could have dinged it some if there had been a runway light there.

I later simulated this in an open area and sure enough, it did it again. I first suspected my Maule tail wheel had sheared the locking pin (as Dan Dadash's T-18 had done when I was riding with him once. He came very close to losing it then). The Maule checked out.

I had first thought I'd lost my right brake, but what I found was that it was very nearly impossible to suddenly get any brake application with full right rudder applied. It has been known for years that the brake pedal will hit the tank cradle under those conditions and can be corrected by notching the right brake pedal. Let me strongly recommend you do this, even if you move rudder pedals back an inch or more! When taxiing in close quarters, to make a sharp right turn, I've always had to apply a little left rudder in order to get the right pedal back far enough to use right brake. Needless to say, my right brake pedal now is notched. Now, before you say to yourself, "I'll just move the tank cradle," take note that it affects the channel over the top of the tank, the skin it attaches to, etc. Don't do it. The notched

rudder pedal isn't unsightly and it gives plenty of room for even a big foot like mine.

Incidentally, Dan Dudash was so upset at the Maule that he took it off and replaced it with a non-full swiveling Lang. It takes a little more planning to maneuver in close quarters and to push in and out of the hangar, but he feels it's worth the extra peace of mind. The Scott seems to be the best and perhaps the extra cost is justified.

One other very important item: Tail Wheel Steering Springs:
Use only the so-called compression springs! These are double action and have one inside the other, acting like a solid link when stretched so far.

On my recent trip to Chino, I let Francis Richardson fly the leg into Pecos, Texas, where the wind was west at 30K. We landed on the West runway no sweat, but when he turned up the North runway to get to the gas pit, he couldn't hold it and it would weather-cock into the wind and go on around in a super low speed ground loop. This took place 6 times before we got to the gas pit. The culprit was the single action tail wheel springs. They had stretched and had caused my problem the week before.

I had an extra set of double action springs with me, so we pushed it behind a hangar out of the wind and changed them. Boy, what a difference! When I taxied out to the runway, I had perfect rudder control and never had to even touch the downwind brake, even with that 30K crosswind.

I talked to several T-18 owners about this at Chino and found they had all changed over for similar reasons, so, amigos, if you have single action springs, throw them away and write Ken Knowles for a set of compression springs.

Newsletter #50 - 4/80

Not many airplanes have encountered this problem, but please note that the two conditions necessary to overpower the horizontal tail are a nearly full forward CG and excess air speed. I've known of one T-18 builder that always kept a 75# tool box in his baggage compartment, primarily because of the forward CG he had as a result of the heavy C/S prop he had and a battery located under the seat.

It should be emphasized that every airplane is different and just because you have a GPU and wood prop doesn't automatically guarantee that there won't be such a problem arise. Check it out at altitude several times, verifying the speed.

From GLENN YOUNG - The only bad habit that we have found with the Thorp is, that when flying solo, the CG is more forward than with two persons. It is within limits, but it causes a pitch forward and a buffet on the elevator when two notches of flaps are extended above 80-85 indicated. Below this speed, the buffet disappears. A call to John Thorp on this confirmed that others have had this same problem when the CG is forward. John assured me that this would probably disappear when I put two persons in it. With two aboard, there is no buffet below 100 indicated. Both Ethel and I usually use 1 notch of flaps when flying solo, as there is no buffet or pitch down in that configuration.

Newsletter #51 -7/80

ANGLE OF ATTACK INDICATOR - Glenn and Ethel Young

An angle of attack indicator can be a very valuable instrument for precisely controlling minimum safe speed on final approach. Several T-18's that I've flown have practically zero stall warning buffet... especially if you gradually "sneak" into one as you might on final and were a little careless about getting too slow. We have had a number of incidents and some accidents when some of the low time pilots flared too high or flared too rapidly. Some lean too far the other way and come in with much too excess speed and float so far down the runway that they use up all the runway and hang their neck on brakes at the last minute.

Such an A of A indicator is also valuable for selecting the proper climb angle and for speed control in turns. It might even save your life if you had a power failure and needed to maintain the best L/D without approaching an inadvertant stall, which is almost 100% fatal at low speed altitude. It might well be the best $25 any of us ever spent, especially if your T-18 is one of those with zero stall warning. I plan to put one on mine, not only for the above reasons, but also for what it might teach me in cruising flight.

If you don't have a copy of the Sept '75 S.A. and can't get one from EAA HQ, I understand John Bergeson will photocopy specific articles for 20¢ per page. He's the one who puts out indexes for Sport Aviation and advertises in S. A.

Newsletter #52 - 10/80

From B. C. Roemer - A lot of the builders probably have the same feelings that I had when building -- that perhaps I was building an airplane that I couldn't handle -- just too much for my experience level and that I'd never be able to hack it. My advice -- forget that line of thought. This doesn't mean to go out, hop in, fire up and off you go when it's time. No. 1: Have someone experienced test fly the airplane. Then, get yourself checked out in it before you solo. I did this and it sure beats the high pucker factor -- wet palm route. T-18's are very easy to fly -- when you know how. Anything that goes 200 MPH sure is going to fly different than a J3 that goes 80 MPH. And another thing -- after you had your dual in your T-18 and you make your first solo takeoff -- concentrate on only one thing, -- flying the airplane away from the earth, period. Get altitude and then feel it out and play around a bit -- I definitely wouldn't advise take off, getting 15 to 30 feet high and landing again. Pulling the power creates a vast control feeling change, and gets you slow, sloppy and settling all at the same time. This is not the place to be learning how to fly a T-18. Try this in the airplane you are used to flying and see how you like it. Sure, some people may disagree, but it just ain't the place to be learning about anything. Add to this the unknown of a new machine (and anything can go wrong -- I had the elevator control jam at 20 feet on take off, because a mike fell in between and blocked it, it was flying with cover plates off) and you really have to do a lot of sorting out in quick time to save everything.

How hot is the T-18 landing?

Let's take some cases. Landing normally full stall is no sweat. Wheel landing are fine -- they burn up a lot more runway and you got to be more

precise as to feeling for the ground or you get bouncing expecially with hard tires, but works well when you get it down pat.

How about landing with only one brake? A number of people have done this -- most times there was not a problem. Of course, landing with no brakes will use a lot of runway, but should give no unusual problem.

What's the worst condition possible to land a T-18?

How about one wheel locked dead and one wheel zero brake? Want to ride through that condition? First you're probably saying, how could that condition ever exist in real life? Rest assured, it can and did.

I landed with zero brake on the left and locked brake on the right on bare blacktop. The result was one worn out tire, a mild ground loop and the tying up of the main runway at downtown St. Paul, (a jet port) in Minnesota.

Our home port is grass and is not plowed for snow. We had about 5" on the ground and normally, this is no problem, however, the snow gets in the drum brakes we have and the water soaked linings give no braking.

I knew the wheels were full and figured they would freeze in the air. (Temperature was below freezing), but they always broke loose upon landing in the past, but not this time. The left wheel broke as expected, but was iced up and the zero brake. The right never broke and created a nice curved black skid mark until we ground looped. Not violent, but mild (1¼ turns). The wing didn't even come up. I had to find some heat to warm up the brake drum to unfreeze it before I could move off the runway. When I did, the locked wheel was worn through 3 plys of the 4 ply tire.

So now, no one has to be afraid of the "hot landing" T-18. There's not a lot you can do in this situation, except opposite rudder and wait for the ride.

Newsletter #53 - 4/81

ELECTRONICS INTERNATIONAL: EC-1 Operating Instructions - During descents to the traffic pattern, it is recommended maintaining the mixture at the leaned cruise condition with a gradual richening of the mixture, carrying some power and at a sensible airspeed to maintain the most efficient engine temperatures possible. Avoid low power--high speed descents which may cause sudden cooling, severe lead fouling, cracked cylinder heads, and warped exhaust valves.

Newsletter #54 - 10/81

ANGLE OF ATTACK INDICATOR: Thanks again, Glenn and Ethel, for the info. It's greatly appreciated. An Angle of Attack indicator would seem to be a very useful item. There are times when we might want to fly a little slower than Vs + 30% on approach, but with the rather poor pre-stall buffet that most T-18's have, most all of us usually pad that figure a little, too. My T-18 indicates 58-60 at stall with two people and I normally approach at 90 until about 200 ft. and then I may work it back to cross the fence at 80 if I am

going into a short field. Incidentally, I feel that to go in and out of any field less than 2000 ft., with two people aboard and an average 10 mph wind is using up most of our normal safety reserve (and that's a field with no obstructions on either end). With 180 hp and a constant speed prop, you might safely knock a couple of hundred feet off that figure and the new airfoil might trim another hundred more off. In very hot weather, light or no wind, and a turf field, a 2100 ft. field is my personal minimum, unless it's a case of "have to". I'd be interested in hearing how other T-18 owners feel on the above. I also wonder how many of you make a practice of using a forward slip on approach, with flaps extended? My airplane slips very well with full (30) flaps. John Thorp doesn't recommend (or approve) of this, but I've done it hundreds of times and some so steep I've had to use full rudder and MY airplane lets me know when I am close to the max control limit. (I'm not advocating it for anyone else. Just curious).

Newsletter #55 - 4/82

From DON THOMSEN 112 Station Ave. North Hills, PA 19039 - I fly from a 2100 foot strip and would like to offer my solution to short field landings. I have found a high, slow approach with full flaps works best for me. A 90 to 95 mph final, decreasing to 80 to 85 mph over the fence, seems about right. The rate of descent is controlled with power. At light weight, there is a little float, at heavy weight almost no float. Three point landings are used exclusively. Flaps are retracted at touchdown and very little braking is needed.

FLIGHT TIPS - I heartily agree with your technique for short field landings. To my way of thinking, that's the only safe way to do it. I've always been opposed to dragging a T-18 (or any other airplane) in a very flat glide path. First of all, if you have any sort of power loss you're in deep, deep trouble. Most T-18's have minimal stall warning buffet and flying the airplane close to the ground and the stall at the same time is a form of gambling that's in the same category as passing cars at the top of a hill. With a steep approach, you can precisely control your airspeed, sink rate, and glide path with a degree of accuracy that's simply not attainable with the other method.

FLAP USE - I give a considerable number of BFRs and if there is any one thing that is common in many private pilots, it is a reluctance, or timidity, to use flaps. If you will pay close attention to the way highly experienced pilots fly an approach, you'll see full flaps extended on all landings and you'll see landings with minimum float. When the pilot knows exactly where his aircraft will touch down and he has the airplane centerlined on the runway, he then only has two simple problems to solve for a safe and smooth landing: What altitude to start his flare and how rapidly to make it. If we analyze the difference between a no flap landing and a max flap landing, it's nothing more than the time factor. Speed will decay more rapidly with flaps extended, hence the flare must be executed in a shorter interval.

LANDING TIPS - When I check a new pilot out on the T-18, the first thing I show them (before we even start the engine) is where the horizon is in the 3 point position (which is fairly close to the stalling angle of the wing). On most T-18's it will be pretty close to the front and top of the nose cowl. I point out that if they don't quite raise the nose that high on landings, that they won't drop it in and 95% of their landings will be good ones, and

at the most they might get a little skip. I go on to say that as one feels the mains first roll, to bring the stick all the way back. I also have them record that horizon position in their minds for use as a quick guide for a safe climb angle for takeoffs and waveoffs.

I'll also pass on a little tip I used to use on pilots that seem to have a problem in focusing their eyes the proper distance ahead of the ship (which usually is the primary reason he'll flare too high). On takeoffs, I try to get them to notice how far ahead that marks on the runway, or blades of grass, stop blurring from our speed and come into sharp focus and I try to get them to zero in on this at what they think is 2 or 3 ft of altitude. I also usually have them fly 6 or 7 approaches down to 3 feet without landing and then fly most of the way down the runway at that altitude before climbing out. The T-18 would never be flared above that altitude and if you will take care to do these things when you first fly your airplane (including the series of approaches without landing), you shouldn't get into trouble. Until you get very used to the airplane and get a bounce of a couple of feet or more, don't hesitate and try to save it, get full power in and go around and do it again. This time try to improve your airspeed control on final and concentrate on your flare height and rate.

OTHER FIRST FLIGHT TIPS: At any time you do any fast taxiing be absolutely sure THAT BOTH YOU AND THE AIRPLANE ARE READY TO FLY AROUND THE FIELD! I know of three accidents and one hair-raising incident that happened when the airplane got airborne when the pilot was not expecting it and when insufficient runway length remained for landing and stopping. In one of these cases the airplane ran out of gas just as it was crossing the field boundary on takeoff, causing major damage to the airplane. The pilot said his throttle stuck open and it rattled him so that he forgot the switch and mixture. A couple of years back, a T-18 pilot found himself 10 ft. high, the airspeed indicator not hooked up, the stick only stuck in the socket and he had drifted off the runway to the side... AND it looked like he didn't have enough runway left to get back on and stopped!!! Guess he had no choice but to try, and somehow or other he did get back on and stopped, altho' it ended up in a hair-raising, tire-screeching ground loop out in the grass at the end and nothing got bent except his ego.

TAXI EXERCISES: I have mixed feelings about the worth of doing high speed taxi runs, and most of those feelings are negative. If the pilot is not CURRENTLY a PROFICIENT tail dragger pilot, he should make every effort to put in 3 or 4 hours minimum of takeoffs and landings (not touch and go wheel landings). The T-18 is quick on the rudder and that takes a little getting used to. If you have only flown tri-gears, it might take a lot of getting used to. One thing I always advocate ANY new T-18 pilot to do is to get on a wide, unused runway or taxi strip and starting out at VERY slow speed (5 mph) make precision taxi turns of say 30° on each side of the center line. Do this upwind, downwind, crosswind for perhaps a half hour...at least until you are truly proficient with stopping the turn EXACTLY the same amount on each side of center. I have noticed new T-18 pilots doing this with me while riding shotgun with them: they inevitably sight the turn to the right, only going about 20°. I found out the reason was that they were using the spinner to sight the turn, not an invisible sighting line parallel to the C/L of the airplane. When I stuck a piece of tape on the nose cowl directly in front of them and had them use that for their front'gunsight, that ended that problem. As you become proficient doing this at 5 mph, you can gradually increase your

taxi speed in 5 mph increments, but as your speed increases to a maximum of 25-30 mph, it is advisable to cut down the angular deviations from the center line to perhaps no more than 10° at the high speed end. While this exercise is best done using no brakes, you certainly should have your foot in such a position that you can immediately use brake if the occasion demands it.

T-18 TAKEOFFS: The T-18 has a marked tendency to turn left as the tail comes up on T/O, due to P effect. This usually starts the pilot to overcontrolling the rudder and getting one oscillation, out of phase with the nose swinging. Fortunately, the airplane is ready to fly at this time before the pilot embarrasses himself too badly. The airplane is accelerating so rapidly and the rudder is becoming so sensitive with full power slipstream, that there is a very natural tendency to overcontrol on the rudder and even experienced T-18 pilots will also do it if they haven't flown a T-18 for awhile.

The cure for all this is simple: Just let it fly off in the 3 point position unless you are very heavy and on a very short runway. In my airplane, flying solo, I can't tell the difference in the length of the takeoff roll. On a very hot day and with a load, I have found that if I raise the tailwheel no more than an inch or so after I am about 3 seconds into the takeoff roll, that takeoff roll distance and acceleration after lift off is about optimum. In this way I can take full advantage of the available tail wheel steering, which is much less sensitive than the rudder alone.

If you are inclined to be offended by such elementary advice as above, it isn't intended to offend. While building one's own airplane is a noteworthy accomplishment, it's wise to be aware that our ability to properly and safely fly our creation is completely UNrelated to the building process and the first flight should be approached with an attitude of humility. Tempering that attitude with a little bit of knowledge coming from practical experience will help to reduce the number of surprises.

Newsletter #55 - 4/82

MORE ON FLUTTER: Thanks again, Bob, for all your words of wisdom on the flutter speed's fixed relationship to the TRUE AIRSPEED. I sincerely hope one and all clearly understand the inherent danger associated with foolishly pushing the airplane's speed up to or beyond what is known to be safe. The T-18's speed and control response makes it an exhilerating airplane to fly and in some people, this also generates an overwhelming surge of "Look at me, Mom-itis".... the show-off urge, to be plain about it. Most of us can resist that urge at low altitude, but be alert about VNE at altitude. Don't ever assume you could react fast enough to stop flutter after it began. You can't. I interviewed two eyewitnesses within 15 minutes after they saw the start of the tail flutter until the airplane self-destructed in mid-air and they both agreed the total time interval was considerably LESS than 2 seconds!

If you don't have an OAT gauge in your airplane, perhaps you ought to sit down and figure how much less your airspeed indicator will read for each thousand feet of altitude you go up and make a little chart to keep in the airplane and refer to. You can use standard temp dropoff figures and be pretty close. Right now, you should also be asking yourself "I wonder how accurate MY indicated airspeed is?????" That's a pretty good argument for finding out just how accurate your airspeed is. Right?

T-18 NEWSLETTER - MAINTENANCE

Newsletter #19 - 11/66

OIL PRESSURE - Some GPU engines will provide too low a value of oil pressure even though all bearings, etc., are within tolerance. This is probably because the pressure relief mechanism is set too low. This cannot be corrected by replacing the spring with a stronger one. The problem lies in the cage that the pressure relief ball sets in. In some of these cages, the holes are larger than standard for aircraft. Remove the cage and replace it and the pressure should fall in the correct range.

Newsletter #27 - ?/69

HOMEBUILT MAINTENANCE - Now that you've got your homebuilt aircraft flying after those seemingly endless months of toil and sacrifice, you can finally relax and enjoy flying again on all those nice sunny days, instead of being cooped up in the workshop. Also, you can do some of those odd jobs around the house which you've been promising your wife you'd do "just as soon as I get 'er flying". Wow, what a great feeling! You can even take a little snooze after supper without feeling guilty. No longer do you go to work the next day with zinc chromate stains on your hands, cut fingers, or burns from a hot welding rod. Yep, you can just fly to your heart's content or until the gas bill gets too big.

And just think how much money you are going to save on maintenance and annual inspections. Isn't it silly all the rules the FAA has about maintenance on type certificated airplanes? Sure hope they don't get any idea like that about homebuilts. That would be ridiculous, since anyone who can build an entire airplane can surely keep it running. Besides, you are going to stay on the safe side and check it over good once in a while.

Up to this point, the picture is all roses, but it is all too easy to let human nature take over and give that ball-of-fire homebuilder a case of the "put offs." Since there is no absolute deadline on maintenance, it is easy to just relax and enjoy life and wait a little longer to do that preventative maintenance.

The disciplines and skills learned by the homebuilder are not necessarily those required by a good aircraft mechanic. Before a person can make a part from new materials, he is forced to learn how to go about it, otherwise he will end up with scrap. Building an airplane is thus a mandatory learning process for the novice. He has nothing to lose but his time and money if he goofs -- and even that is a very effective learning process. Maintenance, however, is another story. There is considerably more at stake than time and money if maintenance is not performed until it is forced upon us by a failure of some part. Much as we dislike being policed by the FAA, that is really the reason for all the emphasis on maintenance and inspections.

Currently, all preventative and actual maintenance on homebuilt aircraft can be performed by the owner with an annual re-certification inspection performed by the FAA at least once a year. Our FAA office does a good job on these inspections, but they emphasize that they are not meant to be a substitute for good periodic inspections. Just what should periodic inspections consist of and how often should they be made? This is where the average homebuilder should resume the learning process. To know when and what to do he should, by all means, study a book such as one which is intended to prepare a person for the A&P mechanics test. An example is the Zweng manual on this subject. If you can't answer the sample questions that apply to your type of airplane, then you should do some studying.

Regarding inspections, the homebuilder should discipline himself to stick to a rigid, preplanned program. EAA chapters can help by devising such a program and take positive action to see that it is enforced. For insurance, ask each aircraft owner to voluntarily submit his log books to a designated chapter representative once per year and thus show evidence that inspections are being performed.

Here are a few suggestions which might be of help in establishing your maintenance program:

1. Enter all maintenance actions in a log book.
2. During the first 25 hours, remove all cowling every 5 hours and thoroughly inspect the powerplant. If your cowling can't easily be removed this often, including the nosepiece, without removing the propeller, then it isn't designed right.
3. Every 25 hours thereafter, remove cowling, wash down compartment, and inspect engine mount for cracks, baffles, exhaust system, tightness of fittings and nuts, jugs, and check oil screen for metal particles.
4. Repack wheels every 100 hours and check plugs and points.

Newsletter #27 - ?/69

VALVE PROBLEM - If you haven't had a stuck valve on takeoff, you really haven't lived. This happened to me during climb out recently. Fortunately, I was at 600 ft. altitude and about at the end of the runway. I was able to just make it back and land across the other runway, with only minor damage when I ran through the snow at the edge of the runway. Inspection of the engine revealed nothing wrong, except that a piece of carbon had gotten under an exhaust valve. This kept the valve from seating properly, and, with no heat sink for cooling, the valve got overheated and expanded in the guide. Even though the valve stem to guide clearance was within tolerances, the valve stuck open. This not only caused a power loss, due to one less cylinder, but it also caused severe backfiring. This must happen when burning exhaust gas from the other cylinder is sucked in through the open exhaust valve at the same time the intake valve is open. Believe it or not, this makes a very noisy glider out of an airplane. John tells me that Bill Warwick had a similar close call when his 180 Lycomiing powered T-18 injested a nut from the induction system and this got lodged, jamming a valve open.

Changing Spark Plugs - John Thorp says that it is very common for carbon to get lodged under a valve when spark plugs are changed. Removal of the top plug can break loose chips of carbon, which fall down past the valves. If a valve is open slightly, the chips will collect around the seat and when the valve closes, it will smash and sometimes stick fast. Since the valve can't touch the seat, it becomes very hot and may either stick or start to burn. John said this happened to him on three different types of engines, until he figured out what was causing it. He thinks that 90% of the pitting of both exhaust and intake valves is caused by this.

First, he removes the bottom plugs. Then, before removing each top plug, he brings the piston up on compression, thus insuring that the valves are closed. For added safety, blow air through both spark plug holes. John says he has never had any burnt valves over the years since he began following this procedure. He has written to both Lycoming and Continental to bring this situation to their attention. I don't know whether my valve problem was caused by changing plugs since I haven't had them out top recently, but you can be sure that I will remove the bottom plugs first now that I'm aware of this situation.

T-18 NEWSLETTER - MISCELLANEOUS

Newsletter #19 - 11/66

WHAT RPM IS RED LINE? John Thorp tells an interesting story about how the 2600 rpm red line got established for light aircraft. After WW II, an SAE committee meeting was called to set standards for engines and propellers for light aircraft. Representatives from the various air frame, engine and propeller manufacturing companies were present, including John Thorp and Fred Weik. Mr. Weik stated that it looked like the propellers in post war airplanes would be in the 72 to 78 inch length range and that for the wooden props then in use, 2600 rpm would be a good maximum. So, since that time most of the airplane manufacturers have specified 2600 rpm as the maximum. But this is not necessarily hard and fast limit, based upon engine or propeller design considerations.

The Hughes helicopter uses an O-360 Lycoming engine, which cruises at 2950 rpm. John was involved in its design. The only problem which arose was that the valve mechanism had a shorter life, so they had specially hardened cam shafts and lifters installed. John thinks the O-290 series engines can be turned at cruise speeds up to 2800 rpm without adverse effects.

You have heard that propeller tip speeds cannot exceed the speed of sound and that this limits maximum rpm. The speed of sound at sea level is 1100 feet per second, but you shouldn't attain tip speeds this high. A wooden propeller turning 3100 rpm has a tip speed of 1000 fps. The best maximum tip speed depends somewhat on blade pitch. So, for T-18 length propellers you can cruise at up to 2800 rpm.

How do you determine the 75% power point for your airplane? Power varies roughly as the cube root of rpm. So, to determine the 75% power point, first determine the maximum level flight rpm for a given temperature and altitude. Your engine is delivering its maximum horsepower for that set of conditions, but you don't know what it is (or don't need to know). Now, reduce rpm by 10% and you are obtaining 75% of the original maximum power. If you assume a maximum of 2900, the 75% point is 2610 rpm.

Newsletter #19 - 11/66

COWLING - Be sure to have enough outlet area for best climb speed. Since the best climb for the T-18 is greater than 100 mph, an ejector type cooling system will give no advantages and is more complex. (At 100 mph at sea level the ram air provides about 5" of pressure.)

Newsletter #28 - 9/69

MANDATORY BULLETIN - If you sell your T-18, give the owner the plans and notify John Thorp of the change of ownership. Why is this so important? We very nearly had a serious accident in a case where a T-18 was sold, but the new owner did not get the plans and knew nothing of the tail modification. One tail tab became fatigued at the root rib attachment rivets and the rib became detached in flight. The tab fluttered at 155 mph, but the pilot got down safely. He knew nothing of the tail mod because he didn't get the plans or T-18 Newsletters. The purchase of a set of plans licenses the owner to build one T-18, so, legally, you can't keep the plans and build a second one anyway. And since an owner of a homebuilt needs the plans to make repairs, they should form a permanent part of the aircraft records.

Newsletter #29 - 12/69

TAILWHEEL STEERING SPRINGS - During the first 150 hours on my T-18, the springs on the tailgear became uncoupled at least a half dozen times. I tried several different weight springs and bent the ends in more, but still they became unhooked. I finally found a fix that really works, and makes ground handling much easier. I simply restricted the amount of stretch of each spring with an extension of the connecting chain. New chains were made about 6" longer than normal. The first link of a chain was hooked to one end of a spring in a link, which permits the spring to stretch about an inch before taking up the slack in the chain. The chain then continues on to be hooked to rudder horn. Since making this change, I have never had an unhooked spring, and directional control is much improved. This, along with the longer, softer main gear legs, has really made a world of difference in my T-18. I strongly recommend both.

(Most people refuse to take my advice. You really should try it!)

Newsletter #44 - 4/77

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.

Newsletter #45 - 1/79

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

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

With the gear acting as a "pylon", with the engine hanging from one side and the rest of the structure from the other, very high G forces on the airframe are greatly softened and slowed up, thus allowing gradual deformation of the structure, the key to survival of high G impact. The A frame gear's ability to soak up huge amounts of energy before failure also validates its unique role as an effective barrier to prevent the engine from smashing thru the firewall and crushing the cockpit occupants. I know of no other single engine design that has this very valuable safety feature.

Newsletter #28 - 9/69

OUNCE OF PREVENTION - Lyle Fleming just had a spectrographic oil analysis run and discovered warning signs. Disassembly of the engine revealed three broken rings. Ads for this type of service appear in the Aviation Magazines. Sounds like a good idea.

Newsletter #28 - 9/69

OIL SEAL RETAINERS - If you want to buy some real cheap insurance, just add a retainer to your crankshaft oil seal. Several T-18 owners have had problems with blown-out oil seals. You will recall Lyle Fleming's forced landing in the middle of nowhere and Bill Warwick had two blown seals before he discovered a washer installed wrong in the breather. Lycoming now uses as standard equipment, on all engines, a split retainer ring, which attaches to the front flange on the crankcase with four number 8 screws. It would be very easy to make such a retainer if you can't locate one. I strongly recommend that one be installed on all Lycoming engines. The flange on the O-290-G case isn't any too wide, but there is ample material to drill and tap for four number 6 screws.

Newsletter #30 - 5/70

MAINTENANCE TIP * For 180 hours, I've been plagued by a problem which I've finally solved. When at full throttle, occasionally the engine would give a little jerk like it missed once. Thought it had to be carb, but it was bad mag. Hooray!

Newsletter #31 - 9/70

Never remove top spark plugs, unless the piston is at top dead center, on the compression stroke. Cracked loose carbon may otherwise get under a valve seat, later burn itself fast and bye-bye valve. This advice was learned the hard way, through experience, so take all of it seriously.

Newsletter #35 - 3/72

Oil Consumption is a very important trend to monitor in an engine. The operator and maintenance people should know the general history of oil consumption during the life of the engine. It is typical of an engine during seating of new piston rings that oil consumption may be erratic or high, but after the rings are seated, generally within the first 25 to 50 hours, oil consumption should level off below the maximum limits established by the manufacturer. Later, during the life of the engine, if there is a noticeable increase of oil consumption within a 25 hour period, this could be a possible danger signal and calls for an investigation. The oil screens and filter should be carefully observed for signs of metal. Maintenance personnel should take a compression check of the cylinders, preferably using differential pressure equipment, and also look inside the cylinders with a boroscope or gooseneck light to detect any unusual conditions.

Newsletter #41 - 7/74

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. 2½" 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, they 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. (Ed Note: This is a very important point and relates to the flutter modification. My observation is that an .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 nosepiece be easily removable.

Newsletter #41 - 7/74

There is a slight twist in my outer panels, but the way it is twisted, I expected the plane to have a tendancy 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. (Ed. Note: I'm 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 called 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 doesn't seem to slow me down any.

Newsletter #45 - 1/79

TCP: I regularly add TCP to the 100 LL fuel as a bulwark against valve and plug troubles that plague so many nowadays.

I'm pretty interested in preventing troubles in that area, as last year, after my return from OSH, my GPU swallowed a valve (on the left rear cyl.) on my 1st takeoff after returning. Luckily, I had another airport 2 miles straight ahead and had just enough power left to stagger in. The fuel was 100 LL and I had run out of TCP.

You may have heard that the Embry-Riddle flight school in Florida put TCP in half of their trainers and that half had no problems, but the other half had valve and plug troubles galore on the 100 LL. Results were definitely conclusive.

More on seats: In the area of survivability, don't overlook the importance of the seat. Several years ago, a T-18 pilot suffered a broken back when his seat collapsed on impact. A dust devil got him a few moments after t/o. His daughter was uninjured, except for bruises made by shoulder straps, but his seat failed downward. His additional body weight failed bulkhead #592 in compression. His fix on his next T-18 was to add short pieces of vertical angle on #592, just below the 2 hinge points (that allow his seat to be tilted forward for baggage comp't access). You might want to take a long hard look at this item.

To that seat, I would add a woven barrier below the seat for crash-worthiness. The seat sling would normally never touch the ¼" wide woven strips of aluminum pop riveted to a tube or extrusion frame. Its only function would be to stop the vertical movement of the body, if impact forces were high enough to fail like the sling and lacings. I, too, would add vertical support legs for the barrier frame.

An outstanding feature of that seat design was the tubes at the juncture of the bottom and back were not a single, common tube, as is normally used. The bottom tube of the back was well below the level of the bottom tube frame and also the rear tube of the bottom was well aft of the back frame plane. Thus one's sensitive tail bone area never came into contact with a hard point and the effect was like being suspended in a hammock.

Newsletter #31 - 9/70

Jim Reed had pictures of the propeller blade failure, which caused the accident in Maryland. He said that the prop had been sent back to Sensenich once for straightening and, then, after being bent a second time, had been straightened over a car bumper. For this reason, it would be difficult to draw meaningful conclusions from the incident.

Newsletter #31 - 9/70

The O-290-G crankshaft is the standard O-235 shaft. It differs from the O-290-D shaft in two ways: the sludge tube passages are larger and the propeller flange is not as thick. Although the sludge tube passages are larger and this does give somewhat less strength in that area, it is not known to be a problem. The O-235 shaft has a propeller flange of 0.190 inch thickness. Starting with the O-290-D and going up to the O-360 180 hp engine, the flange is 0.260 inch thick. Although there have been few problems with the G flange over the years, within the last year there have been four cases reported of either cracks or complete flange failure when metal propellers were used. Two of these involved 4" shaft extensions. For this reason, the propeller and ring gear should be removed periodically, at least at annual inspection, for a close examination of the flange for cracks. The cracks start at the jagged edges of the two 1032 tapped holes. These holes should be deburred and the screws should not be used. BULLETIN: Take off ring gear and inspect flange before flying again. It is evident that the G shaft flange should be reinforced (especially since mine was one of the four). Figure 1 shows a flange support, which can be installed without disassembly of the engine. This not only will sufficiently stiffen the flange so it will be kept below the fatigue limit of the flange material, but even in the event of complete flange failure, it will prevent the propeller from separating from the airplane. Due to tolerance considerations, it is not possible to tightly clamp the split ring to the shaft. The epoxy is used only as a shim. Holes for the lugs must be precision bored for a press fit. The flange is counterbored because the lugs are only at maximum diameter for .25" and they need to be a press fit in both flanges. I'm running a test on this reinforcement with frequent inspections. John concurs with this mod, but feels it wouldn't need to be quite as heavy, but then he never had one fail. This may be a belt and suspenders situation, but then sometimes it's necessary if we don't have big enough hips.

A bigger problem to the homebuilder appears to be with propeller blade failures on metal propellers. Recently, two cases have been reported when homebuilts have lost about 16 inches from metal propeller blades. This, of course, is not exclusively a homebuilder's problem, for the factory jobs have their share of blade failures. Blade fatigue is less of a problem with lower compression engines like the O-290-G, but the only way to be sure that a propeller installation is safe is to run an in-flight vibration survey test for each different propeller length and pitch, engine horsepower, and engine mount combination. It is very expensive and complicated and can be run only by someone in this type of business who has all the necessary equipment. Arrangements are being made to run such tests on a T-18. (More on this later.)

Newsletter #34 - 11/71

Depending upon a propeller's geometry (thickness, width, length, pitch, and shape) at certain rpm's, the blade stresses will be higher than at others. This is basically because the propeller is like a very stiff spring, and, when it is excited, it will vibrate at a certain fundamental frequency like a tuning fork. If the firing and compression impulses occur at the same frequency that the prop wants to normally vibrate, then the size, or amplitude, of the vibration will be much larger. Just like on a playground swing: if you lean forward and backward at the right rate, you will make it swing, but if you move at the wrong frequency or rhythm, it won't go.

On certificated aircraft, there must be a placard against operation at rpm's where propeller blade stresses are too high, if indeed there is such an rpm within the operation range of a particular installation. But with homebuilts with unknown propeller, engine, and engine mount characteristics, it is difficult to determine the rpm's to avoid. Two propeller blade failures have now occurred on T-18's, both with 68 inch long 74-DM propellers. Both were on 160 hp engines. Consequently, John Thorp is getting very concerned about the need for a vibration survey. According to John, all propeller manufacturers have Dave Bierman, Vice President and Chief Engineer at Hartzel do all their vibration surveys and he is the only one in the US which the FAA recognizes as qualified to do this type of work. He has quoted a price to John of $10,000 for each combination tested. A survey involves instrumenting a propeller with strain gages and recording their outputs during actual flight.

Newsletter #34 - 11/71

Since writing the above, I discovered that Bob Dial, who nearly lost 19 in. of his 74 DM cut down to 68 in. on his O-320, is already making arrangements with Hartzel to start the tests on his airplane, a T-18. Bob now has an M 76 and it will be tested with two different prop extensions. Then Parker Miller will have his T-18 tested with a 74 DM. So, the machinery is all set up. Let's do our part.

Newsletter #35 - 3/72

May I give a few observations about props? An incident prop failure (due to vibration fatigue) cannot be detected by any inspection method prior to flight. Stone nicks, gouges, etc., are obvious causes for not flying, but a prop can be in perfect visual condition and still fail.

The vibration modes which will fail a prop cannot be felt in flight.

Injected engines place less stress on props than carburetor engines.

High compression engines place higher stresses on prop than low compression engines.

The elastic stress failure on 2025 forged aluminum props is at about 100 million cycles. This is about 2400 RPM x 2 x 350 flight hours. The moment of truth on a new prop would then be about 300 - 500 hours.

The most critical parameters are engine, prop extension, and propeller. The engine mount, compression ratio, airframe, aerodynamic exhaust system, cowling, etc., all have some bearing on the stresses on the prop, but the big items are the ones mentioned.

All prop extensions, no matter how well designed or built, increase the stresses on the prop and the engine.

Prop extensions decrease the natural frequency of a crankshaft and the natural frequency of the prop. (That's what all the tests are about -- how much?)

Clipping the prop increases the natural frequency of the prop.

Newsletter #36 - 3/72

PROPELLER BULLETIN - The propeller in-flight vibration survey has been concluded at Hartzell. Bob Dial's 160 hp T-18 was used for all of the tests. Twenty-three flights were made with three different props (M74 cut to 68", M74 cut to 69", and M76 cut to 70"), and three different propeller hub extensions (1070, 1072, Thorp spool extensior and a Sensenich type bolt-through barrel extension). Hartzell is still writing the test report, but several conclusions have already become evident and should be brought to the attention of anyone using a cut-down Sensenich propeller. Cut-down M74 Sensenich propellers and light 1070 extensions, should not be used on 160 hp Lycoming engines. They probably should not be used on the 150 hp O-320 engine either.

A full report on the tests with information extrapolated for the smaller engines and on the effect, can be obtained from Editor, T-18 Newsletter, 5 Griffin Drive, Apalachin, NY., 13732, by sending a donation of $5.00 or more to help pay for these tests. Twenty-seven persons have donated $575 to date to help pay for them, but we need to raise about an additional $1500. The report will reveal some surprising things about propeller extensions, engine timing, and cut-down props, which should be of interest to all home-builders. A Tailwind with an O-290-D2 engine was recently found to have a bad resonance point right in the middle of his operating range.

Newsletter #46 - 5/79

Your choice of a prop is one of the most important decisions you'll make in building your T-18. Previous newsletters have spelled out what you should and should not do about selecting a prop and John and Lu's article on prop failures in Sport Aviation is worth re-reading. Perhaps we ought to reproduce it in its entirety. Above all, don't blindly buy a prop. If you don't really know, don't be afraid to ask. The M-76 is ok apparently.

If you lose part of a prop in flight, you might shake the engine out before you could get it shut down. If that happens, about your only hope of keeping it from stalling would be to quickly roll it into a steep turn. I lost a prop on an old biplane in 1937 and I can promise you that you'll never have a more exciting time in your life. The M-74 is not!

Newsletter #47 - 8/79

We're including Chris Fast's prop test sheet in this newsletter and I think you will find it educational. I would suggest you drag out a copy of the article about propeller fatigue, written by Lu Sunderland in the Nov. issue of Sport ('78) Aviation, pg. 23, and carefully review the subject, if you are using, or thinking of using a cut-down metal prop. Your choice of a prop is one of the most important decisions you'll make in your life! Your very life can depend on it! Don't blindly buy a metal prop.

Newsletter #47 - 8/79

Note that page 11 is the chart on Chris Fast's prop vibration survey, as done by Specialized Testing Service, 10758 Burbank Blvd., North Hollywood,CA. 91601, phones: Office 213/877-7317, res. 344-1851.

Note that the chart is a plot of Cycles per minute vs. RPM or FO vs. N., as they denote it.) Modes 1, 2, & 3 refer to where the modes (nonvibrating points) are located with relation to the tip. Again referring to Lu's article, you can decipher the chart quite easily when you learn the meaning of the various symbols in the equations. If any of you do not have the Nov. 1972 Sport Aviation, send me a dollar to cover the costs of postage and Xeroxing and I'll send you a copy -- or if enough of you request it, I'll reproduce all 4 pages of Sport Aviation and run it in a future N.L. On second thought, I'll do that, as that article should be a vital part of your reference file on the T-18, so scratch the Xerox offer.

You may note that due to less damping at higher altitudes where the air is thinner, stresses on a prop can be as much as 75% higher above 10,000 ft. than those below 5000 feet. Be aware that on the "bad" M-74 prop, cut down to 68", that the allowable stress of 4800 lbs. per sq. inch was exceeded by another 2000 lbs/sq.", when the prop was turning 2630 rpm.

These danger area rpms spread out to 50 rpms each side of the critical rpm, so it is absolutely essential that you have an accurate tach! To verify tach accuracy easily, run the engine at night with a fluorescent light near the prop. At multiples of 600 rpm, the strobe effect from the 60 cycle current will cause the prop to appear to be stopped.

It's too bad the owners of the T-18 that crashed in Washington a few months ago weren't aware that this information was available. John Foy originally built the airplane, powered with a GPU, and he donated it to the EAA Museum several years ago. The museum sold it to Wag-Aero, who in turn sold it to a Mr. Christian in California. It has been re-engined with a 150 Lyc and a cut-down and re-pitched prop from a Cherokee was installed.

When the prop failed over Uakima, with a loud explosion, the vibration shattered the left side of the windshield and unlatched the canopy, sliding it back. Mr. Hallstrom, the pilot was practically unable to see because of air blast and vibration and most of his vision was only a blur until he touched down. He cut the throttle and mixture and stalled the aircraft in an effort to stop the prop, and this almost succeeded after two attempts, that also resulted in short spins. He spotted a plowed field and attempted to land there over a grove of cherry trees. He went through a couple of small cherry trees and then over on his back. They later found he had hooked a steel cable on short final (a 3/8" thick braided power cable).

He and his wife had some difficulty getting out of the inverted ship, but he got out and tried to lift the wing to free his wife. By this time a fire had started and passerbys helped him get her out, altho' she suffered burns on her legs in the process.

John visited the accident site and inspected the wreckage in detail and he and the Hallstroms are convinced that only the rugged construction of the T-18 kept this from becoming a real tragedy and they all thanked John Thorp for such an excellent design.

I think this story should make one and all realize the seriousness of selecting a prop for an airplane. As we pitch props more and more to reach higher cruising speeds, we are indeed tickling the tail of a roaring dragon,