LATE AGAIN

I see I'm still running true to form as far as getting things done on the T-18 newsletter is concerned. The Feb. '85 issue I hoped to get out is now the April issue (if too many other distractions don't show up before I get it completed. Sorry, again, gents. My good wife says I just have too many irons in the fire all the time. She follows that statement by saying, "Yes, and some of them seem to get cold pretty regularly, too.

LAX VISIT

I'll have to confess that my editorial and writing work for Sport Aviation, Lightplane World, and the Antique/ Vintage magazines have kept me far busier than I anticipated. I've been going at it hammer and tongs since a little before Xmas, cranking out around twenty stories since then. Each one requires considerable time spent in research, follow ups, shooting pictures, doing interviews and then transcribing the tapes, etc. and when most of them have to make deadlines I have to rearrange my priororitie- es on an almost daily basis. There are compensations of course. I recently had to make a 4 day trip to the LAX area and did manage to squeeze in a dinner visit with old friends, Dan & Stella Dudash. I also did a story on Ken Brock, his plant, his Avion U/L, got to fly his 2 place gyroglider (was fun !), saw his home workshop (unbelievable) and his new T-18 (it had the most fabulous engine installation I've ever seen on a T-18). I also got a quickie look at his "Sweet Marie" T-18 and his award winning Stinson at Corona Airport. Ken has a hideaway cabin out at El Mirage dry lake, out close to Edwards AFB, where we flew the Avion and the gyroglider and while we were there Bob Hovey came in to Ken's airstrip in his T-18. I'll be going back out soon to do a story on him and to fly Ken Knowles' Super Delta Hawk U/L biplane. Gerri Knowles incanted a voodoo witch's curse on me for getting so close to their home in Corona and not coming by, but I had to hustle and get back to LAX for the trip home.

SUN N FUN

That trip used up four days, plus another week of writing when I got back and then it was time to hit the road again for Sun 'n Fun, which used up another ten days. I had to spend 95% of my time with the ultra lights and new Very light airplanes, new engines, equipment, etc., so I hardly got to look at the T-18s there, much less visit with the builders. I did get to spend an evening with John and Lee Walton over dinner. I've been hot at writing ever since I came back home, along with doing the usual non-aviation chores, like yard work, painting, etc.

HELP WANTED

Well, anyway, amigos, I really haven't been goofing off as you probably thought and I've had the best of intentions about the NL. I hope to get out three more issues this year if you guys will cooperate and send in stories of your labors and experiences building and flying your T-18. If you can type it up so I can simply do a "paste up" on the page, so much the better, as far as my time is concerned. If you can't, just write it out in longhand and I (hopefully) can rewrite it In any case, please keep the accounts coming or our well of information for the NLs will run dry. Plz remem ber, too, that just because someone else has written an account of your subject, don't let that stop you. It's of value to new builders to learn that more than one builder concur with the technique or process and have used it successfully.

PETE WINS RADIO

I was pleased to receive the survey forms that were sent out with NL# 61. You also are interested in who won the drawing for the Narco HT-800 hand held 720. It was won by Pete Gonzalez, of Colorado Springs, CO. We could not have picked a nicer guy if we had tried. Pete has been a NL contributor several times. He has an O-290 G powered T-18 and he has it out of service for awhile as he is installing a turbo in it. A friend with a computer

COMPUTER PROGRAM

is now writing a program on all the material that was covered in the survey forms and once he finishes that we'll publish results of all the categories in the NL. Probably all of us will be surprised on some of the items. I've already noticed a variety of propellors and the different diameters and pitches used. Correlating that with performance in the various flight regimes should be very illuminating.

In fact, there will be a wealth of information in various categories that should be valuable to the beginner, as well as to the one that has flown his airplane quite a number of hours. I am somewhat disappointed that in spite of the fact that filling out the survey form was a required item to be eligible for the HT-800 drawing, that 27 of you failed to send the form in. I would like to encourage you to take a few minutes to fill it out and send it in now. Most all of you at one time or another have said, "I really appreciate the NLs and wish I could send something in, but I can't seem to think of anything, etc". Well, now, here's your chance to do something for the NL.....and it truly is valuable info. So PLEASE send it in....before you forget it again. If you have lost or have misplaced the form let me know and we'll send another.

NEW RADIO !

In case you don't read FLYING or overlooked it the May '85 issue carries a full page ad on page 41 about another hand held 720 t/r that sells for $299.50 postpaid! It carries a 90 day satisfaction guarantee, you can charge it on the Visa & Mastercard, and you can call them on a toll free 1-800-238-2300 no. (800-323-0368) in Ill.) It stores 10 channels and has a 3 year guarantee, with 24 hour service. It appears to do everything the Narco HT-800 does and about the only difference I saw was the buttons and controls were in the top of the unit instead of the bottom. It sure looks like someone is giving the long suffering pilot a break. When I went to buy the Narco for the drawing winner, they had jacked th e price up to $600, instead of the $476. Said that was only a temporary promo price. Maybe so, but it sure smelled of ripoff to me. I had several ham friends look at it and they said it was identical to a hand held ham unit that could be bought for $250 anywhere. Anyway this co. is called STS, Satellite Technology Services and their address is 2310-12 Millpark Drive, St Louis, MO, 63043. Just yesterday a friend of mine got one and let me try it. It worked great. He has used it in his airplane and had no problems working the tower 20 miles out. Now if we could just get a low cost VOR.....

GEOSTAR !

As a matter of fact, I'm in the process of doing some research on an article I'm about to write for Sport Aviation on an all new system that not only will locate you anywhere with a + 1 ft accuracy, but also give you an instantaneous course and distance to the nearest airport or the nearest large flat field...Plus literally dozens of other functions not available today. It will cost about $400 and be about the size of a cigar- ette carton. It's called GEOSTAR. It may be available as early as '86. Mark that name down. You'll be hearing lots more about it soon.

GEAR ALERT

GEAR INSPECTION ALERT!!!!! BRYANT ROWLAND, 1007 Shell, Midland, TX, 79705, 915/683-6617 called me last week to tell me that in the process of doing an annual that he had discovered cracks in the weld where the gusset and the gear leg tube meet. Cracks were about ½" long and were on both the front and back side on one leg and on the front only on the other. He has about 500 hrs on it and has never operated off anything but hard surface. The gear is a long gear. He thinks it came from Ken Knowles, but isn't sure, since he bought the partially finished project from an estate in Las Vegas and some of the documentation was incomplete.

DISCUSSION ON GEAR CRACKS - HEAT TREATING

Bryant's as yet unsolved problem is what to do about it. He can get it re-welded in Midland (Heliarced), no problem. It has to be re-heat treated then and that IS a problem. There is a heat treat co here in Dallas (Dominy) that does work for Bell and others and has an oven large enough to handle the gear in one piece. The cost is around $100. Several years ago (10 or 12) three of us went together and built long gears and had them heat treated at Dominy for $25 for all (the minimum), but we had to have them run the second time, as they were very careless with handling them when they came out of the oven and let them warp. Even after the 2nd go 'round we had to insist they use a large press to get them accurate.

I called Ken Brock about Bryant's problem, asking him what in his opinion is causing cracks. He said possibly we should be asking John Thorp, but of course I am reluctant to do that because of John's health. Ken said as far as he knew that none of the gears his firm made have ever had that problem, but he was inclined to think that the gear might not have been stress relieved (annealed) before it was heat treated. When I visited his plant he took pains to show me that every weldment they made from engine mounts to landing gears went into the annealing oven for stress relief before being heat treated.

It's only a guess, but the cracking problem may be a combination of the locked in welding stress (as above), plus resonance stress, that is concentrated at that point. Also suspect is the tendency for the gear to try to bend spanwise at landing impact. Even slight spanwise movement at a certain vibratory frequency would tend to pull the welded seam apart after a number of cycles. Just like what takes place on a metal prop to cause its failure is Stress x Time, with the nodes of the sine wave crossing at a critical point.

Whatever the cause, if any of you discover landing gear cracks please let us know without delay. If you make such a report it would be of value to know as many of the pertinent facts as possible: aircraft EW and GW, engine and prop used, whether operated off unpaved strips and how much, total airframe time, who mfg. the gear, any problems with wheel and tire balance, whether any previous problems with bolt shear where LG is bolted to the attach beam on the firewall, condition of engine shock mounts...in fact anything that might affect the gear by unusual vibration.

While it seems that these crack problems may well be only isolated incidents, as we have several T-18s that have 2000-3000 hours with no problems, but I think most of these like BILL WARWICK's or DR. COTTINGHAM's have the shorter gear, so the problem may focus only on the longer gear.

A few builders have made their own gear, some of them using gas welding only, but I don't think it would be safe to assume that they would be immune from the problem just because they weren't MIG welded. Altho' you can't easily inspect the back side of the gusset area, you should make regular and careful inspection of the front side, using a bright light and magnifying glass.

If any of you have opinions or suggestions on this subject, I'd appreciate hearing from you and if you don't want your opinions published I'll certainly respect your wishes, or I'll simply say it is an anonymous opinion. The first problem surfaced in New Zealand and was reported on in previous NLs, so you may want to review the information.

COMMENTS

Comments on survey: I received several constructive suggestions on what the survey form should have contained to be very valuable to a new builder. One such was, "It would be most helpful if builders would record what size gas lines are used, the AN no. of fittings, what kind of wheels and brakes used, whether brake cyls. have own reservoir, whether they used Nyloflow brake lines or the older type, what kind oil cooler used, where located, etc." I well understand new builders needing such info desperately as they approach each new area, but I'm not sure if most builders would take the time to fill out the survey. I guess one of the facts of life are that most people strongly dislike filling out forms of any kind and also have an aversion to writing. I had toyed with the idea of another survey this year, using one of the new STS radios in an incentive drawing again, but I rather doubt if the respose would be worth the cost to our treasury. What do you think?

TONY BINGELIS!

Perhaps many of you that are new builders and aren't familiar with all the specific information on such subjects that is contained in the Aircraft Spruce & Specialty catalogue ($4 cost refundable). I'd recommend it. Also TONY BINGELIS' monthly article in SPORT AVIATION is also a veritable gold mine of such info. His two books are also worth their weight in gold to a builder. His monthly articles go back quite a few years. I sure wish he or EAA could put all that info in book form. It'd cost you a small fortune if you had all those articles Xeroxed to put in a handy-dandy shop manual. I just can't say enough in the way of praise for Tony's skill and dedication in writing all those things and for thousands of hours of research he's done on them.

DESIGNEES CHAPTERS

In addition to all the hours above that Tony has spent making life a lot easier for his fellow man, he's also spent a lot of his time making designee inspections and as a chapter officer. I would like to inquire of you as to how many of you are Chapter Designees? I am in the process of preparing a short series of articles for the EAA magazines which will cover the history of the Designee program, its purposes, its deficiencies, its benefits, its total value to EAA members everywhere, and what is in the planning stage for its future. I have a 2 inch high stack of copies of letters sent to HQ in response to a questionaire (there's that word again), and I'll be building the articles around those questionaire replies. Worldwide, EAA has over 800 chapters more or less active. In theory at least, EAA's primary function is education of the new builder, with all other functions secondary, and an old story is a new or prospective builder joining EAA to get help and knowledge from experienced people in the building of his project. Many times he quietly drifts away because he does not find what he came for...and spent his money for. When we join EAA we take on an unwritten contract that says that in exchange for the help and experience we receive now that down the line we"ll agree to repay that debt in kind, willing and not under complusion, so let's not forget we have a debt.

FOR SALE: Pete Bashford, Rt 1, Box 152 E, Morrisville, NC, 27560 put his T-18 over on its back in a sandy field and slightly sprung the fuselage but not much else damaged. Has and IO-360 eng & C/S hartzell (undamaged) and will sell all for $11,550 or might part out. No time to rebuild. his phone is 919/ 467/0725. Give him a call for further info.

DISCLAIMER

STANDARD DISCLAIMER: As always, in past, present, & future newsletters, we would like to make you aware that information presented is only in the light of a clearing house of ideas, opinions, & personal experience acc'ts. Anyone using these ideas, opinions, etc DO SO AT THEIR OWN DISCRETION AND RISK. THEREFORE NO RESPONSIBILITY OR LIABILITY IS EXPRESSED OR IMPLIED AND IS WITHOUT RECOURSE AGAINST ANYONE.

WET WING PLANS READY

WET WING PLANS: Here's some good news that many of you have looked forward to for quite some time.....JOHN WALTON has finally completed the plans and manual for the integral wing fuel tank and it"s GREAT! It has been proof read by several people and now is at the printers and will be available by the time you read this. It's about 25 pages of detailed how to do it, step by step, which includes several sheets of drawings. In case you haven't seen John's airplane at OSH the past couple of years, he has all the extra fuel in the outer wings in the leading edge 'D' section. He has tested it thoroughly for over two years now and has never had any problem with it. He carries an extra 12 gals each wing (24 gal.) and with the normal 28 gal. fuselage tank this gives him a 1000 mi. range with a 3/4 hr. reserve @ 8 gal./hr burn. In fact, John says this is more fuel than you really need, as he can go to either coast with only one fuel stop and 5 3/4 hrs. is longer than most people want to sit without a pit stop. He further says you had better have Temperfoam seat cushions, too. You can order from Ken Knowles or direct from John (5726 Boyce Springs Dr., Houston, TX, 77066) or call him nights at 713/440-8093. The cost is $10 ppd. and John says anything over cost will go into the NL kitty. It would make a good investment to add to your plans even if you never use them. This particular writeup is on the CW. but it could easily be adapted in principle to the st'd T-18.

THANKS, JOHN.

FOR SALE

FOR SALE: John Walton also told me that he still has a near perfect Sensenich metal prop that has been vibration tested by Santa Monica prop shop and has about 100 hrs on it and is in excellent shape. It is just about ideal for a 125-135 hp engine. On his 150 hp eng. it didn't have enough pitch to keep the engine from overturning. It is a 76EM-8-8-72 and is a 68 ½" dia x 72" pitch ($400). John also had a machine shop make up 4 sets of pin extractors that easily remove the main wing attach pins at the dihedral break. He has one set in his airplane and just sold another set, so has two left. It cost him $49 per set and that's what he's asking for them. Has no plans to have more made after these gone. These extractors are not in the CW plans, so first come first served.

TIP

John also told me a little trick he used to make the standard wing tips conform to the NEW airfoil shape. He makes a male plug of balsa (or foam easily shaped) to fit the airfoil at the tip and then puts the tip over the top of it and applies heat to it from a heavy duty hair dryer. This softens the fiberglas so that it can be stretched and reformed to fit the male mold. In case you didn't appreciate this fact before fiberglas is a thermo-plastic and by definition a thermoplastic will soften when it is heated. There is a limit to its movement, tho'. One way to do the above op'n is to protect the mold with Saran wrap and lay a 4" wide strip of glass cloth clear around the outer edge of the mold and wet it out with resin. The two halves of the old tip are split apart and laid on top of the wetted strip and taped in place. After curing the strip, which is now holding the two halves together, more glas and resin are added on the outside at the "Gap' to fill the depression and further bond the halves together, flush sanding the excess after cure. The foam can be left in the tip if desired for additional strength. Care should be taken when you install any wingtip in order to get both tips on at the same angle with the wing or else you will have an airplane that wants to roll.

TIP

Here's a little tip from KEN BROCK that he showed me at his house: He takes a 10 or 12 ft. piece of heavy twine around with him to do a check on how well someone's T-18 flaps are mounted on their wing. Wrapping it around the wing from trailing edge to LE back to the TE, holding it very tightly at the back, a person out at the wing tip can sight the underside and topside (spanwise) and easily see if there is a gap or protrusion. Slick!

THIS AN EXCELLENT WAY TO FIT YOUR FLAPS TO THE WING.

KIRIK

PAUL KIRIK REPORT IN NL #61: Several people have commented on the very excellent and professional report PaulKirik did on his airplane in the last NL. I'd like to encourage you to also submit such a report on YOUR T-18. Incidentally, Paul's T-18 is now out of the test phase and on May 13th will fly into the paint shop at Maquoketa, IA, to get all duded up for its OSH debut. Watch for it.

FOR SALE, TRADE

RUSSELL ROSS, Box 318A, RR 1, Sioux City, IA, 51108, wants to know how many early O-320 Lyc owners are still using 7/16" valves & if so with what results? Wants to use a C/S prop on his T-18, but is concerned about what blade dia. (smallest) that they have used, as he's concerned about ground clearance with the st'd gear. (Gear extensions are a big help). He also has the following FOR SALE:..... Rattray cowl, prop extension, spinner, 2 fiberglas seats, 2 SL4N-20 mags sell of trade He wants 2 SLN-21 mags with gears and an oil cooler.

From HANK STEIGINGA:

SOME FINE TIPS

TAIL WHEEL

Dear Dick,

Good talking to you a week or so ago. Thanks much for sending newsletter #59 so promptly. I am sure I am up to date on the newsletter dues, however, I am enclosing a check to ensure the possibility of winning the Radio. I wouldn't want to miss out on that.

On T-18 tailwheels, some fellows are using a Maule frame and a Lang wheel and tire. A spacer is needed to center the wheel. This lashup is considerably less costly than Scott. Rosenhan master cylinders work beautifully. Many builders use 1/8 inch NYLOflow tubing with Swage loc fittings. Some fellows think 1/8 inch tubing is too small, but believe me, this system works great. This system has proved entirely satisfactory on many T-18's for the past 10 years or more. Completely leak free and trouble free.

ELECTRIC TRIM INFO

As for horizontal trim, I used the 67 Camero Rally Sport headlite motor recommended by Bob Dial. It's a simple bolt on unit, very dependable. Full travel is 15 seconds, which worked out beatifully on N512S. Limit switches were used to control full travel. A "nose up" trim lite was used which illuminated in the landing configuration. After landing, simply hold the trim switch "nose down" 6 or 7 seconds and you were in trim for your next take off. Another preflight trim check on N512S was 2 small gold diamond stick-ons placed on the fuselage skin at the point of full travel of the trim arms on each side. When the arms are nearly centered between the diamonds, take off trim is assured.

Thanks again, Dick, for a great job on the newsletters. We all appreciate them very much.

Sincerely,

Hank Steiginga

Hank Steiginga

THANKS AGAIN, HANK, FOR THOSE FINE TIPS. WE APPRECIATE.

SOME FIRST FLIGHTS AND BUILDER EXPERIENCES:

1 WING STALLS 1ST

Fred Hartman: "My left wing stalls a few mph before the right wing. I'm wondering if my giant "war surplus" heated pitot tube (about 10" long and over an inch in dia.) could trigger the stall earlier. Anyway I put a stall strip on the right wing to balance it out " Fred doesn't say whether or not it worked. Unless he was very lucky, probably not. Finding the exact location for the stall strip location takes a LOT of moving it around an eighth of an inch at a time up and down, as well as spanwise, to find the one and only spot to trigger flow separation at the proper time and rate. If any of you have found such a location plz measure it very accurately and let us know. A piece of alum angle with some pieces of .025 protruding out about an inch from each leg and riveted to each leg of the angle works well. The protruding alum sheet is to have enough area to apply duct tape to secure it to the wing for testing.

DON DERBY FLIES HIS CW: Quite a few of the CWs are now flying.

1ST FLITE

First Flight
T-18-CW

Plans S/N 1423 Registration No N444DD Date 1st Flight 8/14/83

Name Donald F. Deroy Street 300 E. Tropicana Ave #10

City Las Vegas, Nevada 89109 Ph 702/ 736-3726

Engine Make Lycoming Model O-320 D2A Hp 160 Const Cost 30k pluss

Time 3 yrs 8 months Prop Hartzell Lenght 72" Constant Speed

Radios: King Silver Crown Fuel Cap: 30 Gal

Modifications: It was built exactly to plans except for different seats

Wheel pants: Yes Gear Cuffs: Yes

Flush Rivets: Yes

PAINT 1ST OR FLY 1ST?

JIM HOCKENBROCK, in Dec. '84 said, "I now have over 100 trouble free hours on N22JH and have enjoyed every moment of it (isn'tthat what it's all about for all of us, Jim?)....I brought it home last week to paint and upholster it during the winter. I hope to have it finished by spring." Hope to see you at OSH this summer, Jim. When it approaches 1st flight time comes the eternal question, "Shall I fly it awhile before I paint and upholster it?" Most pro painters say you'll get a better paint job with less work in preparation. One can accumulate oil and oil vapor in a lot of places that also attract dirt and are harder to get at for a perfectly oil-free surface. A good scrubbing with Scotchbrite pads will get rid of the surface oxide and give better bonding. It would be interesting to learn how many of you have used what type of primer, whether you used Imron, Acrolyd, or some other of the newer paints, how they came out, how hard to apply, how well they've held up (chalking), what kind of touch up WILL they take without being a 'sore thumb', how much weight the airplane gained after painting...and after upholstery

HOW ABOUT YOUR THOUGHTS ON ABOVE QUESTIONS?

(MY AIRPLANE GAINED 30 LBS WHEN PAINTED WITH S.W. ACROLYD

DICK PENMAN FLIES: (copy of letter from Dick) (12/27/84)

DICK PENMAN 1ST FLITE REPORT

"Dear Dick, I had the pleasure of watching my T-18, serial # 981, fly for the first time in May 15, '84. I have spent the last nine years in building it. The airplane is completely stock, weighing in at 915 lbs. EW. It has a zero time O-320-D 160 hp , a 66 x 76 Sensenich prop , and a Thorp type cowl. The airplane is very clean and has a high cruise of 185 mph. The extra time I spent in wing and tail alignment paid off. The aircraft stalls straight and clean and requires no aileron or rudder tri tab. The only two problems that have showed up after the first flight wer brake pedal and trim tab adjustments. (??)

Gary Copeland, a fe llow T-18 pilot, made the first flight. It was very exciting and Gary made it look very easy. However, after watching Gary fly the aircraft it made me realize that if the builder has the slightes doubt about his flying skills, he should find someone qualified to make the initial flight. Altho' many amateurs get away with it some do not! (AMEN, Dick. They let foolish ego get in the way of good judgement) This absolutely is no time for people to be kidding themselves that they qualify as a test pilot.

I want to give special thanks to Gary Copeland for his time and energy in testing my plane and checking me out in it. Also, a thank you for my good friend, Bob Dial for all his expert help and advice Also, a big thanks to you and Lu for producing the very informative T-18 news-letter... .Sincerely, Dick Penman, 5918 Bordman Rd., Dryden, MI, 48428. P.S...This plane is equipped with Rozenhan brakes and a Ford alternator (60 amps) and has been performing very well."

TEST FLYING COMMENTS

Thank you, Dick, for a fine report and let me commend you for your superb good judgement you displayed. A competent test pilot pre-thinks of his alternatives and emergency procedures to cover every possible contingenc from losing a spinner, an engine fire, a canopy flying off, a rudder pedal breaking in two, etc. ALL OF THOSE THINGS HAVE HAPPENED ON INITIAL TEST FLIGHTS. Here's another bad situation: An airplane with a badly twisted wing, a grossly inaccurate airspeed, and turning from base to fin a poorly prepared test pilot could accidentally stall the airplane, which will begin a spin at an altitude too low to recover. With the same airpl and pilot, visualize an oil line break at the oil cooler, which quickly covers the windscreen with oil. He can't see ahead and knows the engine will soon freeze and in his preoccupation with those problems he forgets to fly the airplane, desperately calls the tower, and the airplane stall with little or no warning (which many do).....Yes, Dick, you did the smart thing.

RATTRAY COWL PROBLEM

DON WARNER, 7 Gaylord Dr., Wilton, CT, 06397 called the turn when he said I was a better aircraft builder than a bookeeper (I'm probably the world's worst, my wife says. I don't like it, don't have time for it, an won't take time for it unless absolutely forced to). Don has a problem with what he says is the combination of a Rattray cowl and a Merle Jenkins horseshoe motor mount ring. He says the combination causes what makes the front end look like a swayback horse, with the firewall being 3/4" lower than a straight line drawn from the bottom of the windshield tothe top of the cowl just behind the prop. He says he either ha s to live with it or buy another motor mount, as he doesn't know who still makes the "flat back" (non-dynafocal) motor mount these days. (Does Leisure Aircraft make them?) Can anybody help him? I know that the Rattra cowl requires considerable blending and fairing in to get the flow lines right, but it seems quite a few come out okay.

A Study Of Cruise Performance Of The T-18

By Howard Henderson (EAA 19060)
14 Byron
Kirkwood, MO 63122
and
Peter Roemer (EAA 26136)
Manitowish Waters, WI 54545

INTRODUCTION

The following article describes some of the testing techniques and problems in determining cruise performance and compares the results obtained on two T-18s. For those readers with a mathematical urge an Appendix is included giving the technique for computing a family of theoretical drag curves on any conventional airplane. These drag curves serve as a reference for comparing data with any other type airplane or airplanes of the same type but with substantial changes in drag configuration.

Everyone talks about performance — but few take time to measure it accurately. This is a shame because developing accurate performance charts is both interesting and educational. And it's not so difficult as one might think.

The writers have been corresponding for about a year, trading cruise performance data on our T-18s. Continuous changes and improvements have been applied to N18TT built by B. C. Roemer, Manitowish Waters, Wisconsin, to the point where its good performance has been questioned by many skeptics. So much data was gathered, it was decided an article on the subject was appropriate, and it is hoped it will be of interest to other than T-18 builders.

Recording full throttle airspeed and RPM is one sensitive way to measure improvements in airplane cleanliness and is probably universally used by racing enthusiasts, however, the alternate methods described in this article have been used by professional flight test engineers for years, and can be used to construct accurate cruise performance charts.

CALIBRATION OF INSTRUMENTATION

Performance figures taken directly from uncalibrated instruments are often badly in error.

Thus it is necessary to calibrate the important instruments before meaningful comparisons can be made. The calibration procedures are not complicated and should be carried out on any airplane for which reliable performance data is desired.

The fundamental sources of error in airspeed reading are: 1) indicator error due to imperfections in the instrument itself, and 2) static pressure errors due to the location of the aircraft static pressure vents (position error). Ordinarily there are negligible errors in the pitot ram probe, as long as it is clear of the propeller stream.

Indicator errors can be determined by "bench checking" the indicator using a homemade water manometer of plastic tubing as a pressure gauge. (Table I gives the IAS to water manometer differential conversion.)

TABLE 1
CALIBRATED AIRSPEED VS. PRESSURE

MPH	ΔP Inches of Water
50	1.2
60	1.77
70	2.42
80	3.16
90	3.98
100	4.93
110	6.00
120	7.10
130	8.35
140	9.68
150	11.15
160	12.73
170	14.4
180	16.1
190	18.02
200	20.05
210	22.1

NOTE: The above data is based on the "Compressible Bernoulli Equations" — there being approximately 1% difference at 200 mph from the normally used calibration assuming adeobatic flow where $\Delta P \cong KV_1^2$

The manometer construction details are not critical. A simple "U" shape segment of clear plastic tubing is partially filled with water (add food coloring for visibility). Pressure is then applied to one end of the "U" and to the pitot input to the indicator through a "T" tube fitting. (The indicator should be left in the airplane — just apply the pressure to the airplane pitot ram probe.) A convenient pressure source is an empty plastic soap bottle connected to a tubing segment and squashed by a "C" clamp. Any leaks in the system must be fixed before taking data. The difference in water heights in the tubing legs should be recorded for each 10 mph airspeed division in the range of expected operation.

Once the instrument is calibrated the static port is the main offender in airspeed errors and it is common for the "commercial boys" to have an instrumented test airplane with holes all over it trying to find a location which will give close to "free stream" pressure under all conditions of flight. Since very few of us care to have holes all over our airplane it is easier to accept what we have and calibrate it. Of all the known methods — trailing cone, ground course, tower fly by, and pacing another airplane — the first one, trailing cone, is preferred for subsonic airplanes.

TRAILING CONE TESTING

The theory behind the trailing cone test is that "a simple long tube with several holes around it, trailed free from airplane flow interference, will give a perfect static pressure". We have tried two types and got exactly the same results with both of them. The easiest is constructed from fifty feet of soft 3/16" aquarium "Tygon" plastic hose with a 4" plastic funnel safety wired to the end. Shove a tight fitting steel plug (such as a ball bearing) into the end before attaching the funnel. Three to four feet from the funnel about four holes are drilled clear through the tubing, staggering their locations, and any burrs at the surface are cleaned off carefully with a razor blade using a small magnifying glass to get a clean job. In switching static sources a quick acting selector valve is almost a necessity since it is difficult to hold a constant airspeed while screwing in a "water type" valve.

Some people have had success "pinching off" the tubing by kinking and unkinking the appropriate tubes to change static sources. This can become an interesting exercise in manual dexterity.

Tape the tubing to the underpart or side of the fuselage and then to the tail spring. All the remaining tubing including the cone can be carefully coiled in the cockpit and "played out" on the runway before takeoff.

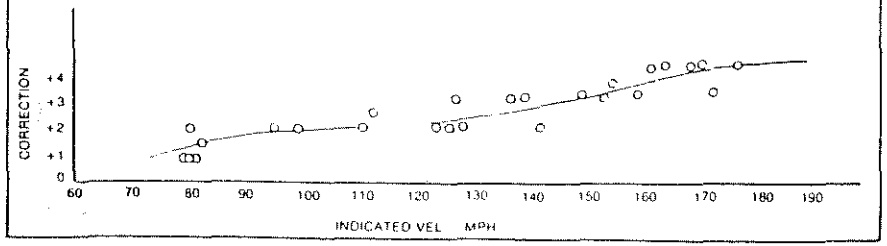
It is naturally better to have the airplane ready to go for a morning flight when the air is smooth. Data is more easily taken with the airplane stabilized "on the cone" first, at zero rate of climb, then quickly switch to the short, low volume, airplane system. The "rate of climb" instrument will require a small volume of air to stabilize but unless very long lines are in the airplane the error will be negligible. The change in indicated airspeed should be recorded at airspeeds throughout the normal operating range of the airplane.

The trailing cone data on N600HH is shown in Figure 1.

FIGURE 1
TRAILING CONE AIRSPEED CALIBRATION
T-18 SN 600

STATIC SOURCE: STA 149, WL 38
(RIGHT SIDE ONLY)

INDICATED	-	81	81	81	82.5	82	96	99	111	112.5
TRUE	-	82	82	83	84	83	98	101	113	115
INDICATED	-	126	127	142	123	126	128	137	139	149
TRUE	-	128	130	144	125	128	130	140	142	152
INDICATED	-	153	153.5	158	161	163	168	170	172	176
TRUE	-	156	157	161	165	157	172	174	175	180



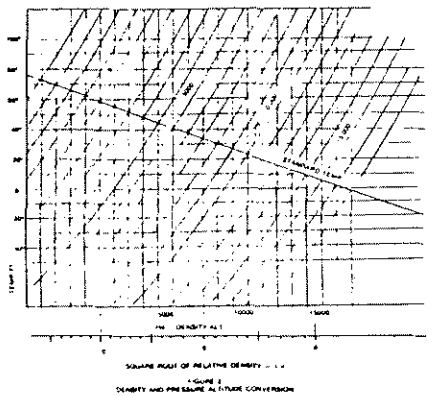
It is often desirable to cross check the calibration procedure to detect mistakes. One alternate calibration method is the two way ground course.

It is possible to average speeds over, say, a six mile course at a constant indicated airspeed, use the average ground speed for true airspeed, and convert back to a calibrated airspeed (multiply TAS by V/σ from Figure 2) which is compared to the observed indicated speed. The problems are: holding a constant IAS, and finding landmarks of known distance. Using an automobile odometer to measure a freeway or measuring landmarks on a sectional chart can involve errors of up to five per cent.

N18TT was cross checked on the surveyed distance between an outer marker antenna and a runway threshold. Careful timing revealed a three mile per hour discrepancy which was finally traced to the pitot ram probe. This is unusual but it is known that some "bulgy" heated probes are more sensitive to angle of attack than a straight tube cut off square. Also rain "bleed" holes may be too large by mistake on some probes.

By all means, don't depend on the indicators in store bought planes for accurate inflight comparison. In our experience, the typical light planes' airspeed indicator should read "slow", "fast", and "Jackpot!". The price and age of the airplane don't seem to be factors in accuracy, either. There are new $400,000 airplanes flying with indicators 5% off in cruise.

Accurate power figures depend critically on observed rpm and manifold pressure. Hence, it is best to have some calibration of the manifold pressure gauge and tachometer. Probably the most accurate calibration can be obtained at an instrument repair shop, but this isn't always convenient. The tachometer can be checked by using a fluorescent light as a poor mans' strobe light during a night "run up". At 1800 rpm the propeller will appear "stopped" since fluorescent lights flicker on and off with the power line frequency. Automobile speedometer shops can also check a tach very



quickly. The manifold pressure gauge can be roughly checked by noting the indicated pressure on the ground with the engine shut down. The reading should be equal to the current altimeter setting, less 1" hg for each 1000 ft. field elevation.

GETTING CRUISE PERFORMANCE DATA POINTS

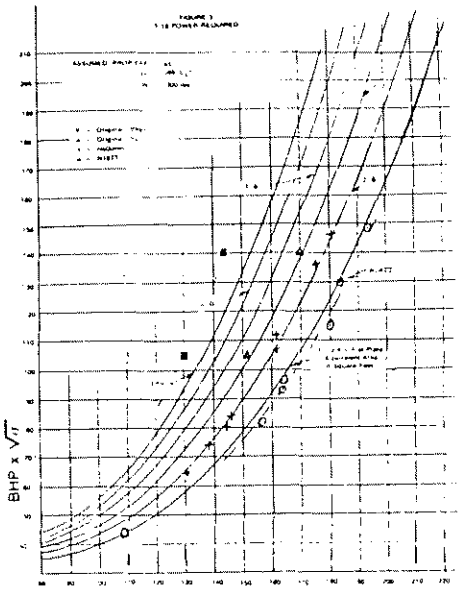
With airplane configuration noted in the log books and the prop and airplane cleaned up we are now ready to collect data. You would think the technique of flying straight and level would not require much discussion for an experienced pilot, but we feel obligated to bore you a little with the minute details in order to give you more confidence in your data. We will list the do's and don'ts in a column to make it easier.

1. Don't try to get data without a rate of climb instrument.
2. Do "tap" the rate of climb **before** flight to determine its **actual** zero point.
3. Do wait until engine is at normal temperature (cold oil consumes extra horsepower).
4. Do get all data in smooth air.
5. Do trim properly (ball centered).
6. Do allow several minutes for airspeed to stabilize at each power setting.
7. Record:
   a. Pressure altitude (set 29.92 on the altimeter)
   b. Outside air temperature
   c. Manifold pressure
   d. RPM
   e. Indicated airspeed (last)
8. Do fly at a wide range of altitudes and power settings.
9. Don't leave test equipment on the airplane for cruise tests.
10. Do lean the engine properly at altitude.

We have found a tendency when trying to get data on an airplane to always be in a rush to get back down on the ground, but a few more minutes and a few more points permits you to "throw away" the real bad ones and gives you more confidence in the data.

T-18 PERFORMANCE COMPARISONS AND PLOTTING THE DATA

To begin, a set of theoretical drag curves on T-18s having equivalent flat plate areas from 2.4 sq. ft. to 4.4 sq. ft. are plotted as a reference for comparison. See figure 3. (NOTE: Multiplying the BHP by $\sqrt{\sigma}$ normalizes the curves for all altitudes).



Determining your own personal airplane drag polar is done by determining the actual true hp being used in stabilized cruise flight, multiplying by $\sqrt{\sigma}$, ($\sqrt{\sigma}$ = density ratio for the altitude and temperature flown which can be obtained from Figure 2), and plotting against the corrected V_I.

Horsepower data can be obtained from the engine manufacturer (tabulated for different altitudes). An example of data on the 180 HP Lycoming is shown in Figure 5. This data can be plotted at various pressure altitudes (example, Figure 6) and the HP selected from the plot.

The "true HP" is the $HP_{chart} \times \sqrt{\frac{460 + T_S}{460 + T_a}}$

where T_S = Standard Temperature for that Altitude and T_a = The Actual "O.A.T.". Incidently, this turns out to be almost a 1% reduction for every 10°F above normal.

The resulting data should give a reasonably smooth plot following one of the calculated lines, regardless of the altitude. Some variation might be attributable to changes in propeller efficiency.

Theoretically there should be a correction to HP and velocity for changes in weight, but this complicates things more than necessary. For airplanes having less than 10% weight change, it is much simpler to neglect it (at the higher cruise speeds the effect is negligible).

Superimposed on Figure 3 are data points of four different T-18s. The first one is the original published estimate of the "basic" T-18, without canopy or pressure cowling. The second "sport" airplane was John Thorp's estimate of the improvements expected by adding canopy and pressure cowl. N600HH and N18TT are also plotted and are described in Table II and the photographs.

TABLE II
COMPARISON OF TWO T-18s

	N600HH	N18TT
ENGINE AND PROPELLER	150 HP Lyc 74OM cut & pitched to 66 76	180 HP Lyc 76EM cut & pitched to 68-81
EXHAUST SYSTEM	Crossover with 2 small mufflers and down facing pipes	Crossover with aft facing pipes
AIR INTAKE SYSTEM	Conventional box & filter inlet	Large carb filter with rebuilt lower cowling
L.G. FAIRINGS	Yes	Yes
PAINT	DuPont Imron	Lacquer
WHEEL PANTS & FAIRINGS	No	Yes
RIVETING	Flush (partially filled)	Flush (epoxy filled)
TOTAL TIME IN SERVICE	100 HRS	600 HRS
FLAT PLATE EQUIVALENT	2.8 sq. ft.	2.35 sq. ft.
AIRSPEED @ FULL THROTTLE AT 9000 FT	177 mph (true)	208 mph (true)
ABSOLUTE CEILING	?	26,100 ft. (See Note 2)
SPEED WITH 100 HP INPUT AT SEA LEVEL	156 mph	168 mph
MILES/GALLON AT 140 m/h INDICATED AIRPSEED	20 m.p. gal	27 m.p. gal
FUEL	28 Gal	34 Gal (See Note 3)

1 Theoretical, only partial throttle is used because of propeller type
2 Actual flight test using recording barograph
3 Roemer has built an enlarged tank which accounts for part of the good range

Figure 3 speaks volumes. Notice for instance, how with 100 HP input the original airplane cruised at 127 mph and N18TT will cruise at 168 mph. John Thorp has redlined the T-18 at 210 mph. As can be seen, a 180 hp T-18, like Roemer's (with a "free breathing" inlet giving the extra ram and possibly "over revving" to 2800 rpm, resulting in 190 HP), can easily fly redline straight and level.

The differences between N600HH and N18TT (both modern versions of the craft) are worth careful scrutiny as a little study in the effects of cleanliness.

Each major improvement in N18TT was carefully flight tested by flying full throttle over a specified course, landing, putting on the new fairing and reflying the identical course within 30 minutes. The observed changes in IAS and RPM thus gave an accurate indication of speed changes, eliminating the effects of atmospheric variation.

Below is a list of improvements on N18TT which are all believed to contribute to the difference. (Note: to the uninitiated the absence of wheel pants on N600HH would appear to be the most obvious and important difference, however, these tests on N18TT have shown only 3 mph difference.)

SPECIAL POINTS OF IMPROVEMENT ON N18TT

a. Canopy and windshield fit (particularly at roll bar)
b. Wheel pants (3-4 mph, 25 rpm increase observed)
c. L.G. Tube fairings (8-10 mph, 75 rpm) (also on 600HH)
d. Tail wheel cover (3-4 mph, 25 rpm)
e. Nose spinner fit
f. Gear tube — wheel pant junction fairings (2 mph, small rpm increase)
g. Air intake
h. Lower aileron gap covers (2 mph, small rpm increases)
i. Flush wing tips
j. Super finish on wing
k. Exhaust stack outlet position and direction
l. No external venturi
m. No draggy ventilating scoops
n. Faired com antenna

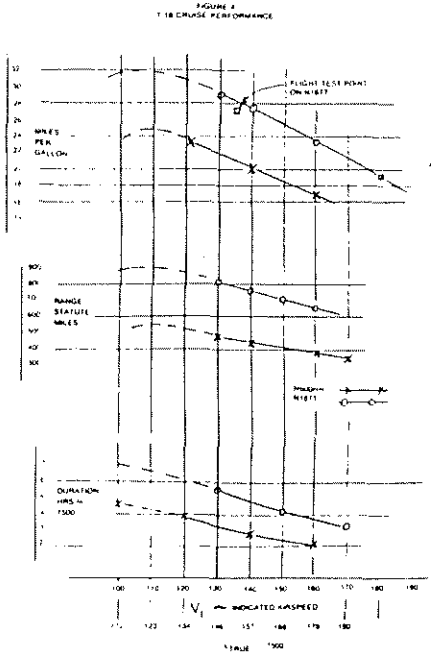
Both airplanes are flush riveted. Both have Henderson designed internal wing tip VOR antennas.

A range performance manual can be constructed from the flight data gathered for Figure 3. See typical curves, Figure 4. Notice MPG and range are constant for a given V_I **regardless** of altitude and can be derived easily from the chart. It is simply

$$MPG = \frac{V_I \times \sqrt{6}}{\text{s.f.c.} \times (BHP \times \sqrt{\sigma})}$$

(V_I from chart (Fig. 3); $\sqrt{\sigma}$ from chart (Fig. 2))

$$\text{Range} = \frac{V_I \times \text{Fuel Available} \times 6}{(BHP \times \sqrt{\sigma}) \times \text{s.f.c.}} = MPG \times \text{Fuel Available}$$



The large variation in MPG between the two airplanes is a direct combination of the 15% improvement in cleanliness plus the 10% improvement in fuel economy of the 180 HP engine; (4.7 lbs/bhphr vs. 5.3 lbs./bhphr in Lycoming tests) The difference in fuel demand is probably mostly attributable to the higher compression ratio of the 180 HP engine.

Specific fuel consumption will vary somewhat with rpm, manifold pressure and altitude, however, as long as the power is reasonably high, this effect is minimal.

In any case, the accuracy of the MPG plots is impressive. N18TT has repeatedly demonstrated 27 MPG on two way trips with legs of 1 hour duration, by maintaining 135 IAS for climb, cruise, and descent. With careful leaning this performance has been remarkably consistent even including climbs to cruise above 12,000 feet.

For those builders with airplanes other than T-18s wishing to compute a family of theoretical curves similar to Figure 3, Appendix A is included at the close of the article giving the basic math and charts for any **standard monoplane**. Airplanes with variable incidence, canards, biplanes, etc., are beyond the scope of the simplified equations.

LIMITATIONS OF DATA

A. There are several pitfalls in trying to gather this type of data, the most important being propeller efficiency. For this article, a cruise propeller efficiency of 85% was assumed and since N600HH and N18TT both have fairly high pitched metal props, of the same diameter, even if the absolute efficiency is not exactly 85% we can guess that their difference is not very great. However, a wooden prop might be a little lower, by say 2-4%. Flight tests on N600HH have verified this flight loss in efficiency (see Figure 7).

B. **Horsepower "Sensitivity" to Exhaust Configuration**

Most Lycoming data is assumed to be taken with a crossover system and a large muffler. Flight tests on 600HH show some HP loss with the small muffler. A test was run comparing straight pipes to the small mufflers. Unfortunately it was a gusty day and the data was skimpy but there is a minimum of 2-3% loss in horsepower (note, Figure 8). If one makes the analogy of a muffler to a simple R-C filter in electronics it would appear one large muffler would be better than 2 small mufflers; i.e., the effective power loss is analogous to the I²R loss in the filters. Of course, a large muffler would be difficult to install in the T-18.

An improvement in effective horsepower can also be achieved by directing the exhaust gases aft, rather than down. This is due to the thrust available in the high velocity exhaust. Hopefully we can get around to modifying 600HH some day and quote some numbers on this.

C. **Engine Condition**

Ignition timing, compression and carburetion must be normal to make comparisons from one airplane to another (maybe not so important for comparisons on the same airplane).

D. **Miscellaneous**

Center of gravity variations can result in 2-6 mph changes in top speed for the T-18 (higher speeds for aft C.G.).

Airvent, oil cooler duct, and cowl flap settings all can change the data.

Bugs on leading edges could destroy any laminar flow present.

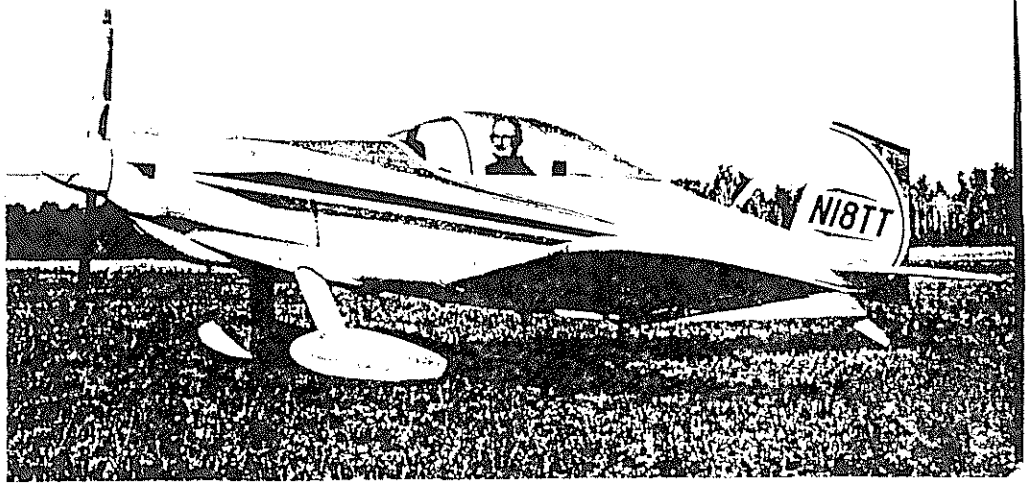
Trim tab settings also affect performance.

Engine accessories (fuel pumps, vac pumps, and generators) all use some engine horsepower.

In spite of the above anomalies the whole data gathering scheme works pretty well and much can be learned about small performance improvements **particularly** changes on the same airplane.

(Courtesy B. C. Roemer)

B. C. Roemer in N18TT. One of the most proven and high performance homebuilts in existence.



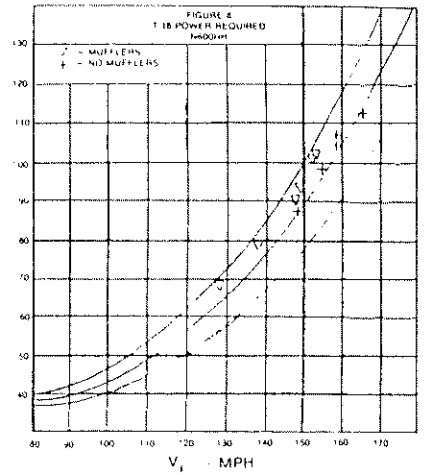
CONCLUSIONS

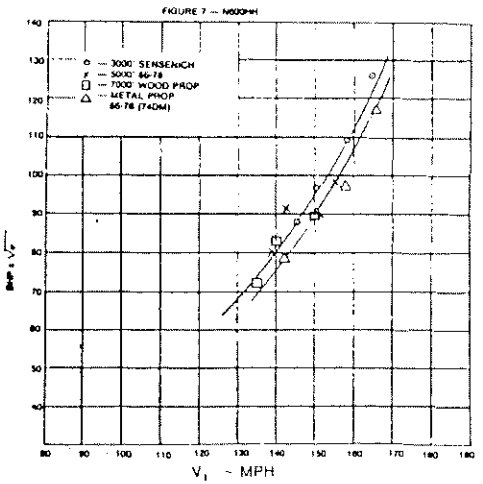
Relatively clean, modern versions of the T-18, such as Roemer's N18TT, will indicate better than 210 mph at sea level with 180 horsepower, while a good T-18 less some fairings, such as Henderson's N600HH, will indicate more than 195 mph. Under the same conditions, the original "basic" T-18 without pressure cowl or canopy would indicate 155 mph and the "intermediate sport" would indicate 188.

Our tests show that these performance differences can be accounted for by both streamlining and engine details. The canopy and pressure cowl add about 33 mph. Landing gear tube fairings raise the speed by 8-10 mph, and wheel pants, gear tube-wheel pant junction fairings, and the tail wheel spring fairing each account for 2-4 mph. The use of lower aileron gap covers adds about 3 mph and down pointing exhaust pipes cost 3 mph. The use of a wooden propeller also costs 3 or 4 mph.

Together the stated differences in 600HH and 18TT account for about 10-13 mph of a 15 mph plus difference in sea level top speed with 180 HP input. The remainder can be attributed to smaller details such as the canopy-windshield junction, epoxy filled rivets, etc.

In closing, we should point out that any small improvements in air frame streamlining have pronounced effects in fuel economy, and operating costs as well as on cruise speed. For the T-18 an increase of only 10 mph in top speed is the equivalent of nearly 25 extra horsepower — which doesn't have to be purchased, maintained, overhauled, carried by the airplane or fed 80¢ per gallon gasoline. Not a bad reward for investing in a few fairings and keeping it clean — or don't you think flying 1 hour free in every 10 is a good deal?





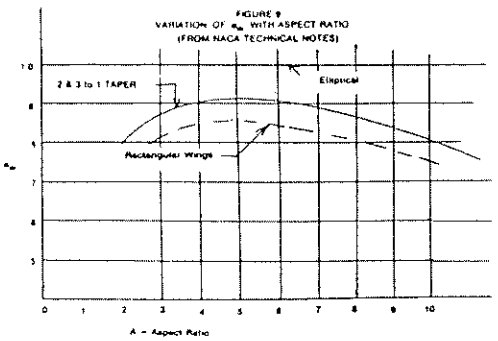


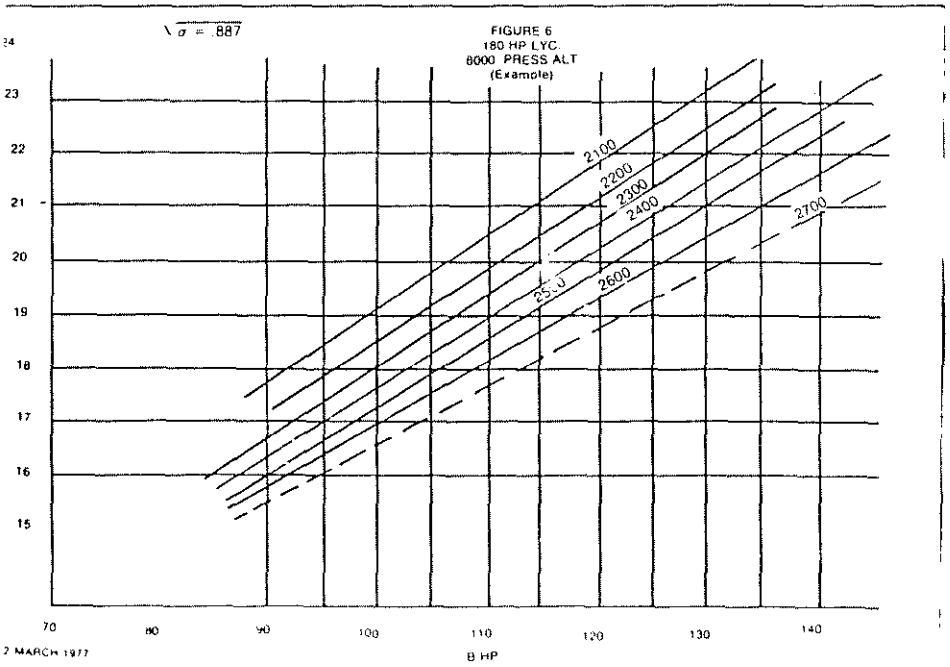
FIGURE 5
FUEL AND POWER CHART — LYCOMING O-360-A SERIES

PRESS ALT. 1000 FEET	STD. ALT. TEMP. °F	.47 LBS/BPH/HR 100 HP - 55% RATED APPROX. FUEL 7.8 GAL/HR RPM & MAN. PRESS. 2100	2200	2300	2400	.46 LBS/BHP/HR 117 HP - 65% RATED APPROX. FUEL 9 GAL/HR RPM & MAN. PRESS 2100	2200	2300	2400	.47 LBS/BHP/HR 135 HP - 75% RATED APPROX. FUEL 10.6 GAL/HR RPM & MAN. PRESS 2200	2300	2400
SL	59	20.9	20.3	19.8	19.3	23.3	22.7	22.1	21.5	25.1	24.4	23.9
1	55	20.7	20.1	19.6	19.1	23.1	22.4	21.8	21.3	24.8	24.2	23.6
2	52	20.4	19.8	19.3	18.8	22.8	22.1	21.6	21.0	24.6	24.0	23.4
3	48	20.2	19.6	19.1	18.6	22.5	21.9	21.3	20.8	24.3	23.7	23.2
4	45	19.9	19.3	18.9	18.4	22.3	21.6	21.1	20.6	24.0	23.5	22.9
5	41	19.7	19.1	18.7	18.2	22.0	21.4	20.9	20.3	23.8	23.2	22.7
6	38	19.5	18.9	18.4	18.0	21.8	21.1	20.6	20.1	FT	23.0	22.5
7	34	19.3	18.7	18.2	17.8	21.5	20.9	20.4	19.9	--	FT	22.2
8	31	19.0	18.4	18.0	17.6	21.3	20.7	20.2	19.7	--	--	FT
9	27	18.8	18.2	17.8	17.4	FT	20.4	20.0	19.5			
10	23	18.6	18.0	17.6	17.2	--	FT	19.8	19.3			
11	19	18.4	17.8	17.4	17.0	--	--	19.6	19.1			
12	16	18.2	17.6	17.2	16.8	--	--	19.4	18.9			
13	12	FT	17.4	17.0	16.7							
14	9	--	FT	16.8	16.5							
15	5	--	--	FT	16.3							

TRUE H.P. = HP at std temp x $\sqrt{\frac{460 + T_S}{460 + T}}$

T_S = Std temp

T = Act temp



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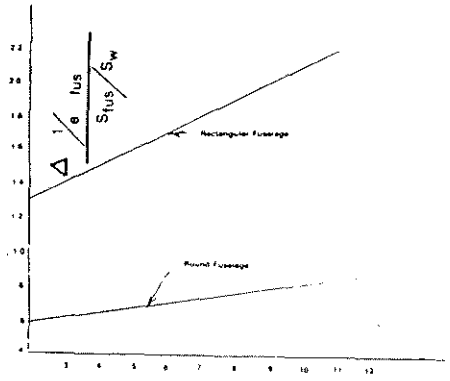
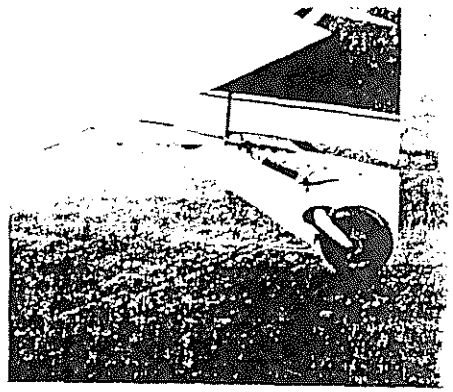
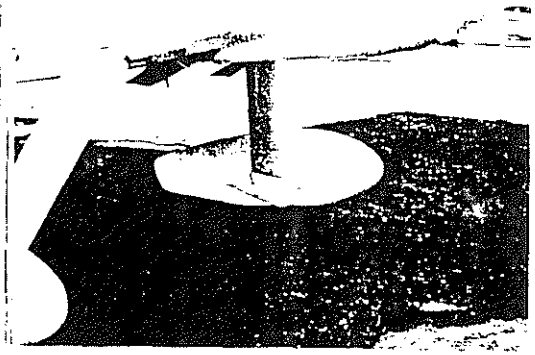


FIGURE 10
CHART FOR ESTIMATING EFFECT OF FUSELAGE ON e_w



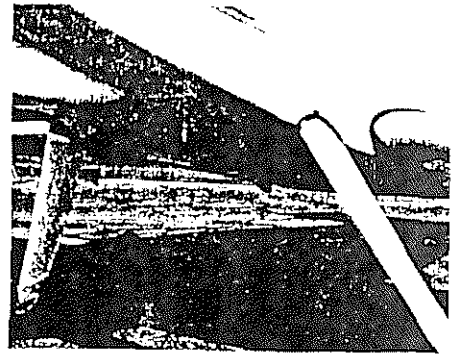
(Courtesy B. C. Roemer)

Tailwheel fairing of N18TT. An example of the extreme effort by B. C. Roemer to lower the total drag coefficient of his T-18



(Courtesy B. C. Roemer)

Close-up showing the many fairings, backward slanting exhaust stacks, etc. that contribute to the high speed of B. C. Roemer's N18TT.



(Courtesy Howard Henderson)

Close-up of landing gear leg fairings and exhaust pipe ends on Howard Henderson's N600HH.

APPENDIX A
DEFINITIONS

A	= Aspect Ratio = b^2/S	BHP	= Brake Horsepower
b	= Wing Span	MPG	= Miles per gallon
C_L	= Lift Coefficient = L/qS	S_w	= Area of wing
C_{Dp}	= Parasite drag coefficient = $\frac{f}{S}$	S_{fus}	= (for this article) fuselage frontal area
e	= Induced drag efficiency factor for whole airplane	μ	= Efficiency (for this article propeller efficiency)
e_w	= Induced drag efficiency factor for wing	σ	= Air-density ratio
D	= Airplane drag	W	= Aircraft weight = Lift
f	= Flat plate area equivalent to minimum drag of airplane	V_t	= Velocity, true = $V_i \sqrt{\sigma}$
HP	= Horsepower		

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V_i = Indicated velocity (corrected airspeed reading)

s.f.c = Specific fuel consumption
= .47 lbs BHP/HR for 180 HP LYC
= .53 lbs.BHP/HR for 150 HP LYC

$$BHP_{(reqd)} = \frac{V_{mph} \times 88 \times D}{550 \times 60 \times \mu}$$

$$D = C_{D_t} \times S \times .00256\ V^2_{mph}$$

$$C_{D_t} = C_{D_p} + C_{D_i}$$

$$C_{D_i} = \frac{1}{\pi Ae} C^2_L$$

$$C_L = \frac{L}{.00256\ V^2 S}$$

$$L \cong W$$

$$C_{D_p} = \frac{f}{s}$$

CALCULATION OF $\frac{1}{\pi Ae}$ FOR T-18 from K.D. Woods. Airplane Design, Vol. I, Page A119

Wing aspect ratio = $\frac{(20.8)^2}{86} = 5.$

From Figure 9, $e_w = .85$ for rectangular wings

$$\therefore \frac{1}{e_w} = \frac{1}{.85} = 1.176$$

For the contribution of fuselage to induced drag, from Figure 10

$$\Delta \left(\frac{1}{e}\right)_{fus} \Big/ \frac{S_{fus}}{S_w} = 1.6$$

$$S_{fus} = 3 \times 3 = 9 \text{ sq ft}$$

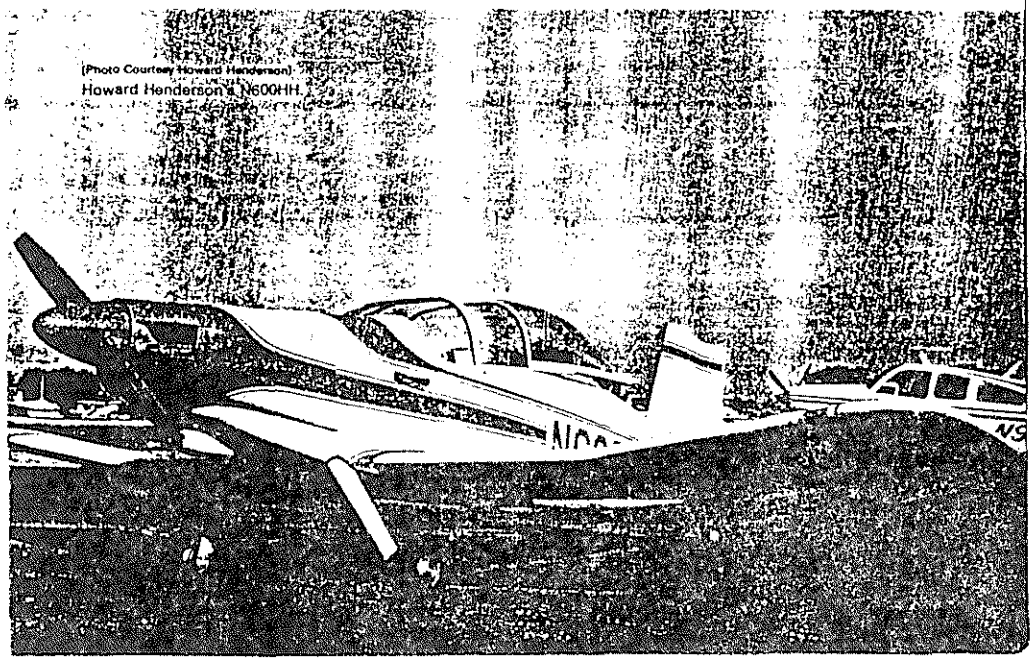
$$\Delta \left(\frac{1}{e}\right)_{fus} = 1.6 \times \frac{9}{86} = .167$$

$$\text{total } \frac{1}{e} = 1.176 + .167 = 1.343$$

$$e = \frac{1}{1.343} = .744$$

$$\frac{1}{\pi Ae} = \frac{1}{\pi \times 5 \times .744} = .0855$$

From the above basic equations it is possible to substitute your own parameters of S, A, etc. and crank out a set of curves for values of f which you think might bracket your airplane.



T-18 PERFORMANCE

The preceding 9 pages were from the March '77 issue of Sport Aviation and were a result of the joint efforts of two highly regarded T-18 builders. I think you will agree that this was an outstanding piece of work.

The past year I have had several new builders and owners of recently purchased T-18s ask me if there were any guidelines available to properly evaluate the T-18 performance with accuracy. This article is one you may want to seperate from the rest of the NL and insert with other such articles in the operations manual. (Hopefully I'll be able to find time to get it together in the next few months).

FLIGHT TEST PROGRAM

One T-18 builder I talked with some time ago made a good suggestion about one of the things that would be most helpful to those just about to fly their airplane and that was to have a SPECIFIC program to follow in the required test period, with all data to be carefully recorded. When most are asked what all they did in their test period they'll give you a silly grin, which says they didn't do much except bore holes in the sky until they flew their time off. Maybe that's okay, as most T-18s won't have too many surprises, but just remember there's a good reason that factories pay good money for production test pilots, so don't assume every T-18 is just like the next one. Not so. Every T-18 is different from every other. Every T-18 will fly just a little differently from the rest and some will fly a whole lot differently. Just because the FAA has given you the final sign off, don't relax finding out all about your bird and say, "Well, now I'm gonna just enjoy what I've spent all those hours of labor on."

PROJECT FOR SALE

Another FOR SALE: One of our local builders, Ken Hamilton, died last fall and his only heir, his mother, asked me to be a go-between in disposing of his project. Ken's aim was to build the fines T-18 that had ever been built and had he lived he might have done just that. The fuselage is all riveted and on the gear. His stepfather, who worked for Douglas 30 years helped him rivet and I'll say I've never seen a more perfect job. All his parts came from Ken Knowles and everything is there to finish the airplane from the firewall aft. The main spar caps have been machined, but that is all that has been done on the wing. Everything has been inventoried and the cost was $7100, which included plans (st'd, WB, & CW), dynafocal eng. mount, canopy & windshield, seats, controls, tank, Cleveland wheels and brakes, all controls, a transponder, in fact, just about everything except upholstery, engine, and cowling. They will consider any reasonable offer and might consider selling parts. If you are serious about it give me a call at 214/351-4604 and I"ll fill you in on details and pass on your bid.

T-18 BUILDER/OWNER LIST

T-18 BUILDER'S LISTS: From time to time we get requests from builders for addresses of builders close to them, as some of them have never seen a T-18 in the flesh, a real live flying one that is. Also, some of them need alittle hands on help getting started, so a kindred soul is greatly appreciated in those cases. Starting with this issue (NL #62) we are publishing a complete list of paid up T-18 Builders and Owners Association members that are computer sorted as to zip code. We are printing these pages full size for better readability. We do not have phone numbers for but a fraction of the membership, but later this year when you renew your membership it would be a kindness if you furnish your phone number for the 1985-86 listing. We will publish a supplement in the next NL of new members and later we'll publish a list of former members that have not renewed for one reason or another. I wish we could somehow get a complete list of all the FAA registered T-18s. Can any of you help????

(See pg. 21.) SOMEBODY DID HELP!

Another Interruption: Since writing page #18 nearly two weeks has zipped by. I had to take time out to do two big articles for the July issue of Sport Aviation, a short article for Sport Aviation, and a couple for Lightplane World and make a May 10 deadline, so when I get these assignments I have to drop everything and go like gangbusters.

FOR SALE: Another local T-18 project just came open and it's such a good buy that it'll probably go locally before this gets to any of you. This (standard) T-18 is a complete airframe for all practical purposes. It was started by a Bell Helicopter employee and he has done professional type work. He has an unassembled, but overhauled, O-290G engine with it and a metal prop. There is an engine mount, too, [redacted] cowling. It has a tank (in), windshield (in), instrument panel with engine instruments and basic VFR flite inst'ts, seats (in) not upholstered, all flite controls (in), no upholstery or soundproofing, ~~Canopy is fitted. [redacted] is older 3 piece~~ type, landing gear standard length, wheels, brakes, tires, Maule tailwheel and steel spring, horizontal tail (modified per ADs), fin, rudder, electric flaps (partially installed). Aircraft was started here in late '60s, using my templates copied from Thorp's. Original builder went thru divorce which tied project up about 6 or 7 years. Later got Alzheimer's disease and sold locally a year ago. Present owner's business commitments too much to have time to complete (has another airplane and only flew it 12 hrs. last year). His asking price is $5495. Wife threatening bodily harm if he doesn't sell. He's out of town much of time, so call me anytime after 9 amCST and I'll answer any other q's you might have, as I know it well. (214/351-4604).

NEWSLETTERS 1thru 44: For newsletters in this range you need to send to LU SUNDERLAND, 5 Griffin Dr., Apalachin, NY, 13732 for them. He has a condensed package of them for $15 ppd. Many of the new ones joining the T-18 Builders and Owners Association write about these and sometimes I don't seem to be able to find time to answer.

While in the LAX area in March a friend of Ollie Smith came by Ken Brock's house and said Ollie had decided to sell his T-18. I think his health was the reason. He has a fine T-18 that's well known there for several years. Don't know the price or other details. No address, either, as Ollie has never joined our group. Ken could probably tell you how to reach him.

Ken Brock was supposed to send me a really good method of very accurately aligning the main gear wheels, using a cord, a couple of chairs, protractor, and a hand held computer. Most everyone these days say that you should set your wheels with no toe in or out on a T-18. A little bit of misalignment will soon show up in tire wear. It will also tend to make the T-18 a little bit too frisky on the ground. CG will also play a part.

The following pages dealing with the bending of leading edge radius in wing skins and other brake bending of sheet metal is from DON WINCHESTER, who lives here in the Dallas area and is *foreman of the biggest manufact'r of stainless steel food machinery in the area. Don holds patents on a number of food machinery items and is an artist when it comes to metal. He is an A & P, a long time EAAer, and built an excellent T-18. I have learned a lot of little tricks with metal from him and the wing skin bit is one of them that's invaluable to know.

*(DON IS SR. VICE PRES. IN CHARGE OF PRODUCTION, NOT FOREMAN).

BENDING THE LEADING EDGE RADIUS IN WING SKINS: This is one of the most important things the builder can do that will determine how well the airplane flies. Make that radius too tight and the wing will not only stall at a higher speed, but also the stall onset will be sudden...even vicious. Quite a few builders report one wing stalling ahead of the other. The most likely answer is one of the wing skins has a slightly tighter LE. Bend the radius too softly and up goes the drag, altho' it will have a gentler stall on THAT wing. You should take the time to do it as perfect as you can. The LE radius MUST fit the airfoil contour. You may have purchased a pre-punched skin from a supplier or perhaps you've laid it out yourself, carefully trammelling it in all directions for squareness, but you still must take extreme care to make the bend of the LE fall in the right place with just the right amount of radius. Each of the 4 skins (6 on the CW) will require probably as many as five or six of the gradual crushing type bends as you progressively move the pressure point forward, dis-assemble and re-check the radius, re-assemble, bend, etc

When you are doing it all yourself, there are a couple of ways to go. We'll look at the easiest way first. FIRST, assemble the ribs and spars. Then shear out several pieces of scrap metal about 3-4" wide x about 5-6" longer than the wing chord. With small clamps clamp tightly to the upper flange of the rib. Let the forward end project out in front of the most forward part of the rib LE. The idea is to be able to locate the point where the strip is no longer in tangency with the rib flange, where it projects forward as a straight line . Where this begins is the AFT END OF THE L.E. RADIUS. Making the strip out of heavier gauge material (i. e. .040) makes it easier to determine this point. Mark this point carefully on both the strip and rib. Now mark the point where each spanwise rows of rivets will fall on the front and rear spars.

BENDING WING SKINS

Now on the bottom side of the ribs you want to basically do the same thing, but now the airfoil shape must be temporarily changed to a SYMETRICAL airfoil in order to get the LE radius bent in the exact point. Since it is flatter on the bottom than the top we have to add X amount to make the distances the same, top and bottom. This time we have to start at the front, at the AFT END OF THE LE RADIUS. Using the template for the top flange to get the proper distance from the LE radius point to the rear spar rivet line we find the point to locate a New line of spanwise rivet holes. This involves adding some extra length to the wing skins, with the excess later trimmed back to the typical .25" ED from the rear spar rivet line After the skin is bent. This NEW line of rivet holes will match the ones above, so that when the two rows are clecoed together the LE radius will be in the proper place when the sheets are squeezed together in the classic method via 2 x 4 spanwise pressure.

To see this a little clearer, look at Dwg. #547 (Wing Profile). At the bottom of the ordinate table you'll see a figure for the LE radius, plus a 50% figure You'll also see a # for the slope, which locates the center of a circle. Now take a compass or divider and set at this radius. Draw a circle and notice where the circle line intersects the wing profile lines and these are the points we need for using the above procedure.

Using still another piece of scrap(that will be about a 6" wide segment of a complete wing skin) lay out about 4 holes top and bottom and cleco together Now gradually make the squeeze bend and test it for fit at the LE, using a strong light behind the rib as you eyeball it. A 6" wide strip will only offer a fraction of the restistance to bending a complete skin will, so GO EASY on the bend.

CONT'D ON PG. 21

(cont'd)

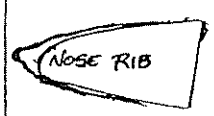
WING SKIN BENDING

You will find in bending a 4 ft. wide section of skin that the edges offer less resistance to bending than the central part. Some have found that adding a 1½ or 2 ft long 1 x 4 to the bottom of the 5 ft long 2 x 4 you use for bending will add enough extra pressure to the central part to make the bend more uniform along the entire 4 ft section. It's a good idea to add "stop" blocks on each end of the 2 x 4 to prevent accidental overbending.

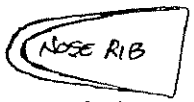
IF YOU OVERBEND THE LEADING EDGE YOU HAVE JUST CREATED AN EXPENSIVE PIECE OF SCRAP....YOU CANNOT UN-BEND THE RADIUS AND SAVE IT, SO GO SLOW. TAKE TIME TO TAKE IT APART AND CHECK HOW MUCH YOU HAVE FORMED IT AT EACH RIB STATION.

The following illustrations may help to visualize the results of either overbending or underbending:

(exaggerated for clarity)



overbent



underbent

In both cases the skin doesn't fit the contour of the rib's nose. Try this for yourself with a narrow strip of scrap. Overbent it will result in skin being too short to reach rear spar rivet line

The above series by Don to be continued in NL #63. We are out of space for this issue and also out of time (now in late May).

T-18 OWNER LISTS, ACC. R'PTS

GLEN DAIL, a builder who is also an accident investigator for the DOT Nat'l Safety Board, just sent me a computer print out on all accidents that a T-18 was involved in and also a print out of the FAA list of all civil aircraft that have the name Thorp as all or part of their identity. We'll start publishing these lists as space permits. I notice that quite a few of you have NOT updated your address as req'd by regs. Could cause you big trouble if you had a violation filed on you for some minor reason. Thanks, Glen, for the list. Now maybe we'll be able to contact some of the T-18 owners that apparently haven't heard of our Association.

S-18 PLANS

LU SUNDERLAND was here last week. Now has all 177 drawings for the S-18 completed ($185). Part no.s remain the same. S-18 is the WB & CW version of the T-18. Lu & I agreed we should reprint and update NLs 1-44, as the print quality is poor. We plan to make a book of ALL back NLs. Some of you could help if you would TYPE an index page of contents of ea. NL.

DAVE BLANTON is moving to new quarters at Augusta, KS. He will have one or two versions of his Ford engine Cessnas at OSH '85 and will be doing demos. Maybe he will let you fly one if you are seriously interested. NO definite info at the moment on that. Hard to really evaluate the V-6 eng, as he has too much pitch in prop and it doesn't get up to power until you hit 100-110 mph with it. I've tried several times to get him to try another prop with less pitch. STEVE HAWLEY has one of the "Almost constant speed" props on his T-18 now (story on that in #63) and maybe he ought to take a look at one of those. STEVE LIKES IT (SEE PIX)

Again, gents, sorry to be so late getting this out. Will try my best to get #63 out before OSH '85. Have to go to Houston to cover USA '85 next wk, then to Merced, then to LA again, plus a half dozen more stories to cover within 100 miles from DAL. I'm busy, yes, but it's a lot better than a rockin' chair, so I'm not complaining. (A DIRTY JOB, BUT SOMEONE HAS TO DO IT)

Rev ya,

Dick