ACRO SPORT Newsletter

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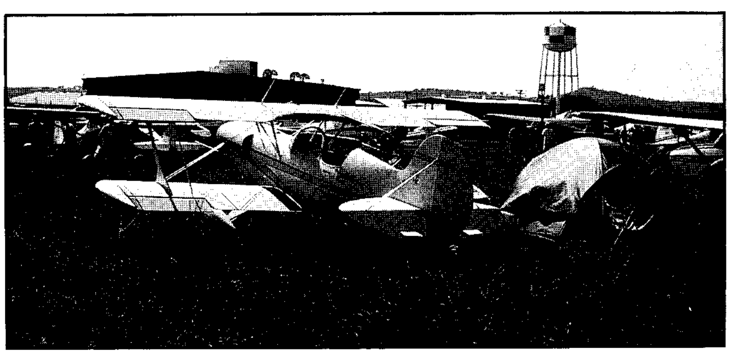
BOB McQUIRK'S ACRO II AT KERRVILLE '93

N790RR has a 17 gallon center section tank, a 23 gallon main, and a 2.5 gallon header tank, plus a seven gallon smoke tank! With his IO-360-1A of 200 H.P., he has quite a long range. The empty weight is 1162 with 45 lbs. on the tail wheel. He used Smith Mini-plane type shock springs in place of the normal Acro Sport landing gear system. He has a lower tail-wheel, about 2½" from stock and a "Cub" tail spring with a five degree forward cant to the axle.

Bob McQuirk
9336 Loma Vista Drive
Dallas, TX 75243-7412

Photos by Ben Owen



HAMMER-HEAD TURNS IN THE ACRO SPORT II

by Don Baker 2733 Whippoorwill Elida, OH 45807

Hammer-head turns in the Acro II are just about the most enjoyable maneuver of all. I did a lot of reading about them, and when I tried the first one, it worked just like it was supposed to. The Acro Sport II was born to hammer! After much practice I have learned a few tidbits which I would like to share with you about hammering the ACRO.

As I have said before, one thing which I really like about the Acro Sport is its ability to do many maneuvers well without being too critical on entry speed. Naturally, a higher entry speed provides more penetration for any vertical maneuver, but the ACRO will do lots of maneuvers with a cruise speed entry, and that's a good starting point for learning the hammer.

The object of the hammer-head is to start from level flight with full power, pull up to a perfectly vertical attitude, then when the speed reaches almost zero, yaw turn over the top, fly a perfectly vertical attitude back down and finally, recover to level flight at the starting altitude, exactly 180 degrees from initial heading.

An entry speed near cruise, (about 130 MPH), with full power applied immediately before pull-up, should result in a total vertical penetration of 600 to 800 feet. The straight line vertical segment should be about 400 to 600 feet. This is what I get with 200 horsepower and a 76x56 inch fixed pitch prop. A constant speed prop would increase the vertical penetration, but the penalty is cost and additional weight. Also, the constant speed prop does not create nearly as much noise. Life is a series of compromises, right?

I have done hammers with entry speeds up to about 180 MPH, but while the total penetration is slightly more, the straight line vertical penetration is not a heck of a lot better than for the 130 MPH entry speeds. This is because the bigger pull-ups radius consumes more of the altitude and it also keeps you in the high Gz mode, (high drag mode), for a longer period of time. Both consume more energy and leave you with not much extra speed for the vertical flight. Although the vertical line segment does not need to be really long for a good competition hammer, it is desirable for vertical rolls, most fun, ego, etc.

Pull-up Gz seem to be the most critical item in maximizing the vertical straight line penetration. Six or more Gz get you minimum turning radius and get you pointed straight up quickly, but it creates too much drag. On the other hand, a two Gz pull-up consumes too much altitude before getting vertical. Three to four Gz seem about right for most entry speeds for the best straight line segment. I like entry speeds about 160 MPH with four Gz initially. This allows enough vertical line for a good, repeatable, half-roll. I have not yet been able to do a GOOD full vertical roll in the ACRO II. A faster roll rate would help a lot.

Be sure to start the pull-up with wings perfectly level and constantly watch both sides, (wing tips), during the pull-up and during the vertical line. Getting and keeping a good vertical attitude is the hardest part of a good hammerhead. Use the ailerons during the pull-up and then use rudder as you get vertical to keep the wing tips equidistant from the horizon.

Pitch correction, (elevator), during the vertical segment is more difficult to get right. I have found that either a ground observer with radio communications or reference lines, (taped on the canopy), are needed to properly sort out the pitch angle control.

Keep the throttle fire-walled all the way up. As the speed bleeds off, find a reference point on the horizon which lines up with the left wing tip(s). Use the right wing for a hammer to the right. Concentrate on the wing tip, the aileron deflection and the reference point. You will notice that as the airspeed

EDITORIAL/ by Bill Berrick

I was landing my AcroSport I in a fairly brisk left crosswind one afternoon on a hard surface runway. Immediately after touchdown there was an obvious vibration or drumming feel and sound. My first impression was that I might have blown a tire, but the direction of the roll-out was not all that difficult to control with light touches on the brakes as needed.

The right tailwheel spring had jumped out, allowing the tailwheel to flutter impressively. The tailwheel would have been sharply to the right in the air due to the cross control position of the rudder while I was correcting for the wind with the left wing low. Apparently the tailwheel snapped sharply to the left as it touched the runway, and then the spring popped out after it pulled the wheel back to the right. I taxied off of the runway, walked back out to find the spring, and reinstalled it, although it was now stretched longer than the other spring.

I have now replaced both springs with Maule compression-type springs. These have positive attachment of internal wires to the wheel and rudder post horns by closed loops rather than the hooks of regular springs. These have a better fail-safe design than the tension springs, and might save you a few thrilling moments of doubtful control sometime in the future.

I have an ingrained habit of holding the stick back even after touch-down, and I think this contributes somewhat to the tail wheel flutter; at least it stops as soon as I ease forward on the stick a little. I need to work on this more because the stronger Maule springs mentioned above bent my rudder horns back enough to loosen the springs and increase the flutter! I then replaced the original welded tubing horns with a Cub-type one piece aluminum cast horn. This seems to be working OK, but has not been fully proven due to this winter's cold weather that tends to keep me out of that open cockpit. Please send me your comments and suggestions on tailwheels and landing techniques to share with our readers.

SUN AND FUN ACRO FORUMS **Sunday, April 10th, 2:00 PM Tent #3**
Monday, April 11th, 11:00 AM in Homebuilder's Registration
(Forums moderated by Maynard Engel)

dissipates, you will need more and more right aileron to counteract engine torque to keep the wing tip nailed on that reference point. When about one inch of aileron deflection is observed, you have reached the correct speed to begin the rudder turn. This tip is from Bill Thomas' book "Fly for Fun," and it really works well! Now, feed in the rudder quickly, firmly, and fully, but don't kick it too sharply.

At this point the airplane is not really flying and it is quite responsive to forces you normally don't notice, but you must compensate for them during the turn. At the instant the yaw turn begins, the gyroscopic precession of the propeller will create pitch forces which must be offset by elevator inputs, and the engine torque will create roll forces which must be offset with aileron inputs. I always hammer to the left, (left rudder), and this requires down elevator with right aileron as it comes around. Hammering to the right needs up elevator with right aileron. You must practice to develop the feel and consistency for this over-the-top control. The amount of elevator and aileron deflection required is surprisingly large.

Just before you push rudder to go over the top, note the reference point on the horizon, relative to the wing tip. Keep your eyes on this reference point and try to swing the nose through it, (using elevator), and don't take your eyes off the reference until you are almost pointed down. Use the aileron to keep the wings precisely vertical as the nose passes through the reference point.

Now you are pointed straight down. Neutralizing the rudder or opposite rudder slightly early will make the nose stop crisply on vertical without over-swing. Use rudder, elevator and ailerons as necessary to fly the vertical down attitude. Allow the speed to build and begin recovery, (pull-up), so that you finish with level flight right on the initial altitude. There you have it, and what fun it is!

The hammer-head is a low speed maneuver near the top with full power applied. Therefore, a messed up hammer-head will most likely result in a back flop or belly flop. The natural tendency will be to use elevator to recover from the flop, which could easily cause an inadvertent spin. If you do fall out of a hammer, keep the power on and use the elevator to keep Gz near zero until flying speed is regained, then a stall becomes unlikely. If a spin should develop, remember to close the throttle to avoid a flat spin, and apply normal spin recovery techniques.

Do not close the throttle while still ascending the vertical line on the hammer-head because the prop blast is needed on the rudder for the yaw turn. Also, closing the throttle on the way up could result in a tail slide which will surprise you. Tail slides tend to grab the stick out of your hand and/or slam the rudder. Don't let them slam against their stops because this could damage the mechanisms.

After the normal hammer-head is mastered, the inverted one is not too difficult. It just feels a lot different and takes some getting used to. Good inverted ones require a lot more concentration and practice. Because the airfoil is not symmetrical in the ACRO II, the drag is worse during high negative Gz, and entry speed and push Gz become more critical.

Practice by getting 160 MPH, roll inverted, then push initially about 3 to 3.5 Gz negative. Crane your neck and watch the horizon as long as you can while you push up to vertical. Use ailerons to keep wings level and rudder as necessary to keep from veering left or right of vertical. Remember, propeller gyroscopic forces require right rudder for forward stick and left rudder for aft stick. (That's why we use right rudder when lifting the tail for takeoff). So right rudder will be required during the inverted pushup to vertical. Once vertical is established proceed with the up line, the yaw turn, etc. as for the normal hammer. Recover upright the first few times until you are confident with the inverted entry. Then try the inverted recovery; it's easier than the inverted pushup. Remember that the negative G limit is 4.5 for the ACRO II. I doubt if you will exceed it because it is fairly painful at first, and takes some getting used to. Also read my article on outside loops, (AcroSport Newsletter #42), for other tidbits concerning inverted pushups.

Now we are really having some fun! And what a confidence builder!! 'Til next time, have fun, keep practicing, and I know you will keep on a grin'n.

CONVERTING POBER PIXIE TO CONTINENTAL POWER

Hart Jewell
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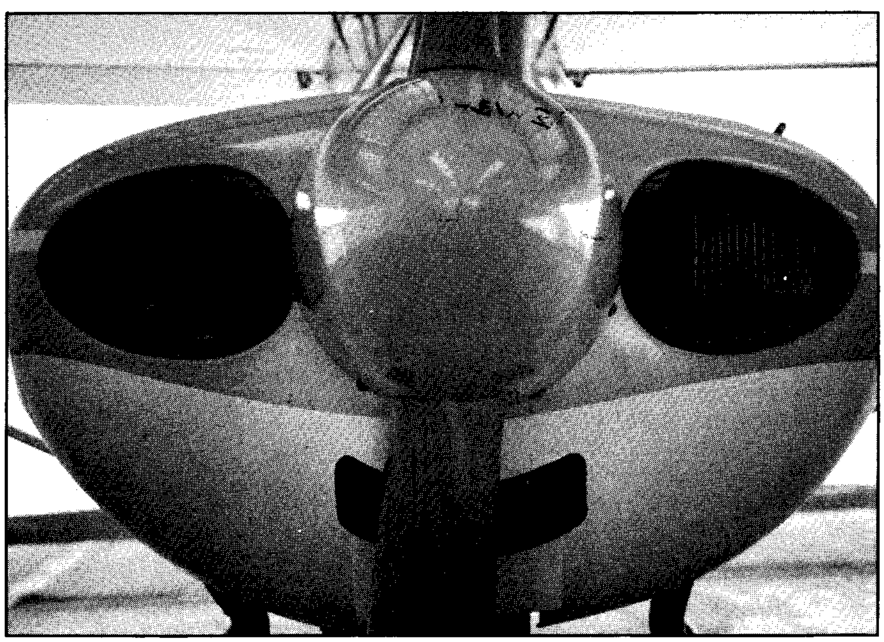
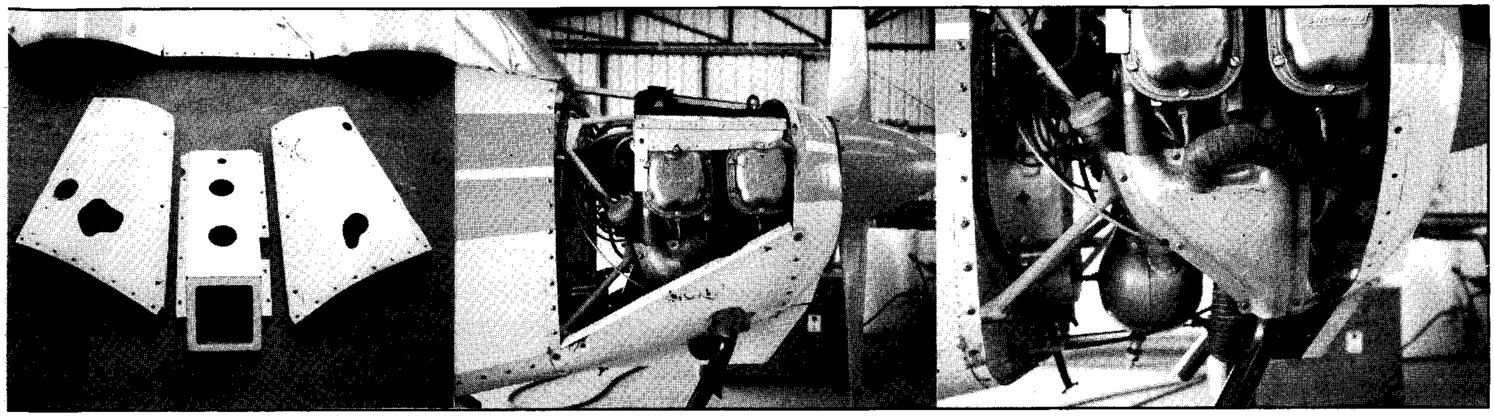
(451) 383-1928

The Pober Pixie was designed initially for VW power. I built mine with a Revmaster conversion and flew it 284 hours. Despite the fact that I was fairly well satisfied with the performance, I experienced constant mechanical difficulties including, but not limited to, cracked cylinder, cracked flywheel, cracked crankcase, and two cracked oil coolers — one catastrophic and resulting in a forced landing. In addition, there was constant tinkering with oil leaks, valve clearances, etc.

Although the Revmaster was nominally 75 H.P., there was no comparison with the performance of my Continental A75! Cruise speed has increased from 80 to 87, rate of climb from 400 to 700 fpm. The increase in power is such that I had to raise the leading edge of the



Champ cowl openings and baffles, 12" Rattray spinner.



Left — Three-piece lower cowl. Center — Details of right side cowl. Right — Relocation of outlet from heat muff; Rutan type air-oil separator on firewall is drained by small petcock through bottom of cowling.

horizontal stabilizer .7" to trim the nose down, move the vertical stabilizer to the left, and had to supplement this with a much stronger rudder return spring on the right pedal to correct for the increased torque.

If one has a really good Continental A65, I would use it, but if overhauling an engine, the additional 10 horsepower is easily available. It involves different pistons with a waffle grid in the head for greater heat dispersion, higher temp. valves, and a 1/16" hole drilled in the rod cap for better lubrication. There is no change in compression ratio or carburetion. It simply turns 100 RPM faster to generate the increased power. Sensenich makes a 70-44 prop which is great, favoring climb. Ed Sterba also makes an excellent prop which he will tailor to your needs. Mine favors cruise over climb, but only slightly.

The first order of business is an adequate motor mount. Bobby R. Green, 15947 Fortune Court, Brighton, CO 80601, (303) 659-5829 is a Pixie builder and certified welder with United Airlines. He still has the jig from welding up his mount and mine, and will build others on a time and materials basis. If building your own, the minimum distance from firewall to accessory case is 7½". This distance will necessitate using the shortest Bendix mags or Slick magnetos with modified Eismann gears to obviate use of the spacer which Slick provides to accommodate the (expensive) 3066 gears.

For the nosebowl, I used a generic Piper fiberglass bowl from Aircraft Spruce. This was narrowed 2" horizontally and 1" vertically, the pieces temporarily fastened back together with pop rivets and aluminum strips on the front while the incisions were fiberglassed on the back. This left the openings too low, and they were moved upward by building up below and cutting out above to a pattern which was traced from a Champ nosebowl. The lower opening in the nosebowl is important for crankcase and oil cooling. My oil temperature runs a very satisfactory 100 to 110 degrees above ambient air temperature.

The nosebowl should be fastened to the back side of a large piece of plywood, approximately 2'x3' and bolted to the flange. With the plane chocked and blocked in a level attitude, vertical 2x4's are clamped to each side and extended downward to the floor to prevent rotation. This provides a stable platform on which the rest of the cowling can be constructed.

The secret to easy construction and later maintenance is to build the lower cowl in three pieces as pictured; internal stiffeners are added. The top and side cowlings are built in place, braking the adjoining flanges 90 degrees for the hinges which are then riveted on with countersunk rivets. The blisters for spark plugs were made from fiberglass using Sig model airplane canopies as female molds. Bobby Green used a Piper PA 11 nosebowl from Univair. This would be lighter and much quicker, but more expensive.

To the greatest extent possible, I used stock components for other items. Baffles were stock Aeronca stainless steel from Aircraft Spruce, as was the heat muff. The latter was modified by closing the original cold air inlet and moving it to a higher spot to clear the cowling edge which still had to be inletted slightly. Carburetor airbox is a stock J3 item with Brackett foam filter. Most old engines have the Stromberg NS3A1 carburetor, but if you can find a Marvel Schebler MA3SPA, it is much superior. It has a genuine mixture control, and an accelerator pump. Two strokes with the throttle obviates the need for a primer system.

Letters To The Editor

WHERE INDEED!

One day when driving home from the day care center with Becky, who was about four years old at the time, I noticed a more inquisitive than normal look on her face. She finally said, "Daddy, Amanda says they don't have a big red barn in their back yard."

So I told her, "Well Becky, not everyone has a big red barn in the back yard; it's O.K."

After a couple of minutes of heavy thinking, she said, "Well if they don't have a barn, where do they work on their airplane?!"

Neil Sidders
235 Rowland Rd.
Monroe, LA 71203-8502

UPDATE ON TONY HOHENWALDE'S ACRO II
December 21, 1993

Dear Bill,

As Sandra Hohenwalde told you, I purchased Tony's AcroSport II project from her in May of this year.

After seven months of almost every evening work, here is the current status of the airplane.

WINGS: Finished. Covered, painted, trimmed, striped, and sitting, (leaning actually), in my hangar at the local airport wishing they were hanging on the rest of the airplane!

AILERONS: Same as the wings.

FUSELAGE: From here on the completion status gets a little less definite. The fuselage is completely painted and striped, including all of the side panels and the engine cowling. Avionics now include a KX-170B and transponder with Mode-C. Engine is mounted, wired, plumbed, and had its first run in several years yesterday.

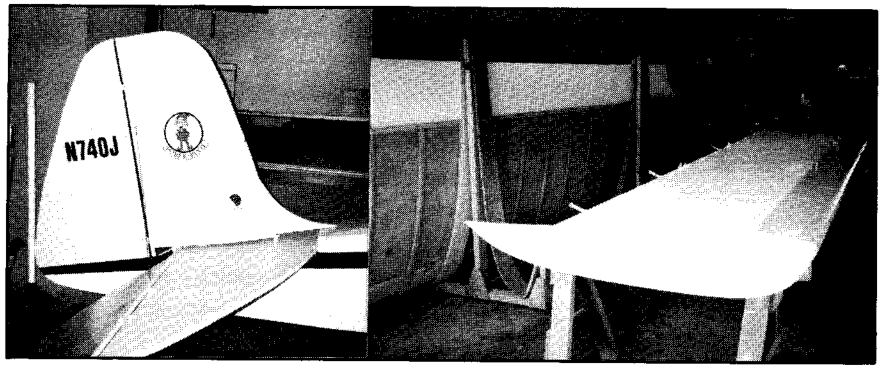
TAIL FEATHERS: Same as the wings

except that they are bolted to where they are supposed to be.

I anticipate having the airplane "in one piece" by the end of this year. If my luck will hold out, the FAA inspection should be sometime in February 94. Just in time for the first flights in my first open cockpit biplane to be done in about 45 degree weather!

When you see me and the AcroSport II at the fly-ins next summer, (N114DJ), come on up, introduce yourself, and let's talk airplanes.

Danny Johnson
Rt. 8, Box 301
Joplin, MO 64801
(417) 623-8255

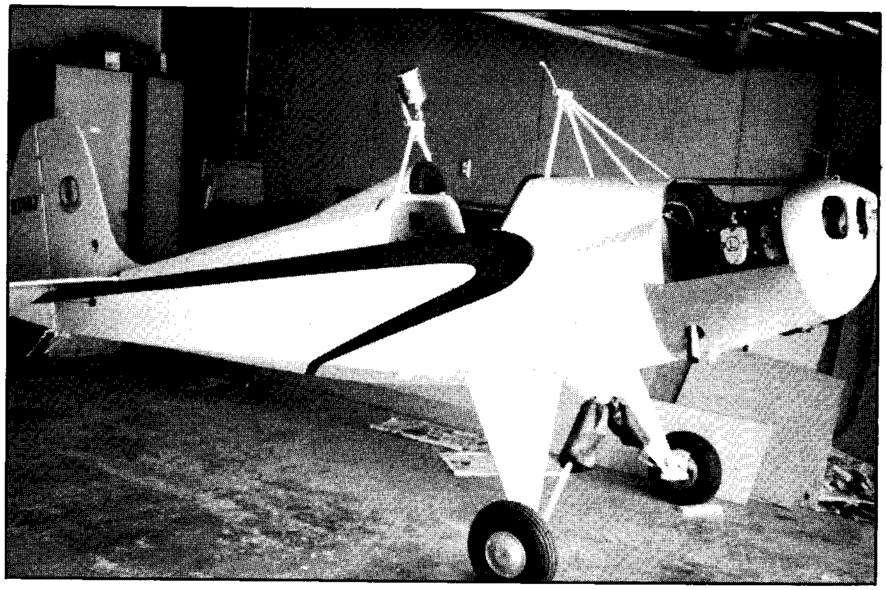


Dear Ben,

I am enclosing pictures of my Pixie project. It has taken me about three and a half years to construct it. The engine is a sixty-five H.P. Lycoming, and the covering and paint are Stits. In building the fuselage, I welded in fittings for floats. My next project may be to build the floats. The wing struts and fuel tank are all that remain to be finished. I carved my own propeller from laminated maple.

Thanks again for the information on wing strut thickness.

Sincerely,
Walter Johnston,
EAA 345818
949 Bethany Road
Burbank, CA 91504



PolyFiber covering and paint on Walter Johnson's beautiful Pixie.

Dear Ben,

Enclosed are a few pictures of the Pixie under construction and a written review of the construction period. I hope the info will be informative and maybe help someone else.

The decision to build the Pober Pixie was an easy one for me as I have had previous building experience. Another reason was the flight characteristics being low and slow. The last reason was cost as I had a low time VW engine from my Sonerai and all the instruments.

The construction was very staightforward. Starting with the wings and ailerons, because then I could get a perfect match to the fuselage down the road. I used Douglas Fir exclusively for all cap strips, spars, nose blocks; and felt the weight penalty more than offset the cost of Spruce. Clear Douglas Fir is available locally and is a fraction of the cost, though it is a little harder to work with. Aircraft birch was used for gussets, and I used both Weldwood Plastic Resin Glue and T-88. I made two deviations from the plans, one was to use .020 aluminum for the aileron leading edges, (with many lighting holes), and .063 chrome moly for the jury strut attach fittings on the spars. The lift struts are

The result of 4½ years of Doug's time and Carolyn's understanding; well worth it! First flight was September 30, 1993. Construction of this attractive Pixie began in March of 1989.

made with 4130 round tubing 1⅛ by .058 and I streamlined them with foam and fiberglass. The streamlining added one pound per strut. The fuselage and tail and all fittings, landing gear and cabanes were made of 4130 chrome moly steel.

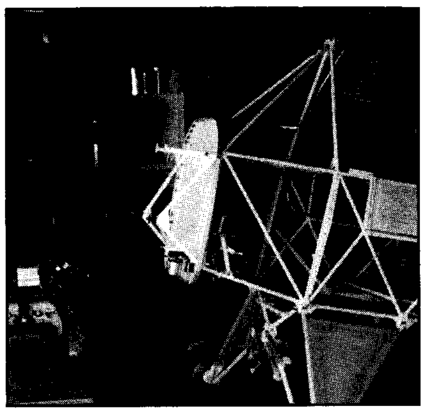
I used Stits covering materials for the fabric work. I consider the Stits process to be excellent. They are easy to work with, and all components are compatible with each other as well as being a cinch to repair. A word of caution when covering the wings: use plenty of slack in the fabric as the new P-103 fabric has a higher shrink percentage. The bays between compression members are pretty wide, and I buckled a couple of ribs slightly on one wing. The finish paint was Polytone white #105 with yellow trim. My thanks to Dr. Hart Jewell for sending me a picture of the Pixie which my granddaughter used as a model to paint the Pixie on my vertical fin.

I opted to put the door on the left side for two reasons. I could hand prop from the rear and reach the throttle if necessary. Secondly, I am slightly handicapped and figured it would be easier for me to get in and out. I also welded two loops on the lower longeron so I could fit a boarding ladder which I could use to get in, and once in, I could haul it into the cockpit with me and put it back down after landing. It really works good for my old frame!

Everything else was exactly according to the plans. My empty weight came out at 505 pounds, and with my weight, (210), the CG came out perfect.

The engine is an 1835 CC VW which I had in my Sonerai; it utilizes a Posa Carb with mixture, Bosch distributor, electric starter, HAPI case with alternator, and a Sears motorcycle battery mounted on the firewall. I made a rather large heat box for the carb as these carburetors WILL ICE! The instruments include: air speed, altimeter, oil pressure, oil temperature, cylinder head temp., exhaust temp., and compass, plus tach. My wheels and brakes are Cleveland 500X5 with Matco toe master cylinders. This combination works very well for the Pixie. I used 1280HD shock rings one on each side, and I'm going to add another one soon. I also plan to add another leaf to the tail wheel spring.

The way she flies is almost unbelievable! She flew hands off the first time, and the control inputs on take-off are very slight; she lifts off by herself at around 40 MPH. So far, I only have three hours on it, so I can't give much on best climb or glide speed. I would guess the rate of climb at about 400 to 500 feet per minute, and I've been cruising at 2800 RPM, indicating 70 MPH. At 3000 RPM she comes close to 80. Landings are remarkable. I hold about 1000 RPM and she settles down very close to 35 or 40 MPH with a three point, and tracks like an arrow. Construction time was 4½ years, from March 1989 to 9/18/93, with a cost of under $4000 as I had the engine and instruments already.



Motor mount for Hagerman's UW engine.

It is a well known fact that no one can build an airplane alone. I would like to acknowledge the many fine people who helped me on the way. First to my wife Carolyn, without whose patience and understanding, I could never have built the Pixie, let alone the two former planes I built! The other Pixie builders who helped a bunch are: Randy Smith in Houston, Dr. Hart Jewell, (California), John Mitchell of Illinois, John Leitis of Pennsylvania, and the local EAAers Bob Kennedy, Russ May, Marc Nassie, and Steve Hagerman, (my son).

I would also like to thank Mr. Ben Owen for his help and many letters, and especially to our founder, Mr. Paul Poberezny who started it all.

To all of you I shall be forever grateful!

Douglas W. Hagerman
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Chico, CA 95926

WIRE SIZING FOR HOMEBUILT AIRCRAFT

by Lee H. Thomas, Technical Counselor/A&P, EAA Chapter 240
29 Stevens Ave., New Castle, DE 19720

I am a technical counsellor in Chapter 240. A member experienced a burning smell in the cockpit while in the landing pattern at the end of his first night flight in his recently completed homebuilt. The aircraft has a 12 volt electrical system.

After an otherwise uneventful landing, the problem was found to be the main battery feed wire to the battery buss behind the instrument panel. A 10 gauge wire was used with a 60 amp. alternator and a 50 amp. main circuit breaker. This size wire is only capable of carrying 33 amps in a wire bundle without overheating! (The actual total current draw was tested afterwards and found to be 47 amps).

The correct wire size for this application would be 6 gauge. (Reference AC 43.13-1A Chapter 11). The current draw to operate radios and strobes during daytime flights did not draw enough current to cause overheating of the wire. Only when all of the lights were turned on, including panel lights, dual landing lights, and dual taxi light did the current reach 47 amps.

Do not expect the ammeter in the panel to warn you of the pending fire; it will show a normal charge, as the alternator is still providing enough current to meet the demand. You can do a full power current draw test with all of your systems turned on at once, including transmitting on the radio. The engine should be running for this test to keep the voltage at 14 volts. You could calculate the same thing if you know the current draw of every light and component in the aircraft.

Be certain the voltage regulator you choose can handle the current that the alternator will produce. The main breaker size must NOT be greater than the alternator output current!

Use caution when selecting automotive components, as they often have existing leads already attached that are a smaller wire size than the circuit breaker you have chosen for the circuit can protect. For instance, if you are using a 10 amp. breaker in a lighting circuit, no portion of wire anywhere in the circuit can be smaller than 18 gauge. Numerous small lamp sockets are available with 20 or 22 gauge leads.

Use the enclosed chart reprinted from AC 43.13-1A to determine the correct wire sizes for your applications. Ask your local technical counselor or A&P mechanic if you need help to read the chart.

444. INSTRUCTIONS FOR USE OF ELECTRIC WIRE CHART. The chart is based on copper conductor wire meeting Specification MIL-W-5086. Curves 1, 2, and 3 are plotted to show the maximum ampere rating for the specified wire in size and under specified conditions shown.

a. In order to select the correct size of electric wire for equipment, two major requirements must be met:

(1) The size must be sufficient to prevent an excessive voltage drop while

carrying the required current over the required distance.

(2) The size must be sufficient to prevent overheating of the wire while carrying the required current.

b. To simplify these determinations an electric wire chart (figure 11.7) may be used. In order to use this chart properly for the selection of wire we must know:

(1) the length in feet of the actual wire "run" from the bus to the equipment;

(2) the number of amperes of current it must carry;

(3) the amount of voltage drop permitted (see tabulation, paragraph 442a); and

(4) whether the current carried will be intermittent (maximum 2 minutes) or continuous, and if continuous, whether it is a single wire in free air, in a conduit, or in a bundle.

c. Assume that we wish to install a 50-foot length of wire from the bus to the equipment in a 28-volt system. By referring to the "allowable voltage drop table" (paragraph 442a), we find that we are permitted a 1-volt drop for continuous operation. Now referring to the "electrical wire chart" (figure 11.7), we find along the left side values numbered 5 to 200 showing the number of feet a wire may be run while carrying a given current, with a 1-volt loss or drop. Place a pointer on the horizontal line shown opposite the number 50.

d. Assuming that the current required by the equipment is 20 amperes, place another pointer at the top of the table on the diagonal line numbered 20 amperes. Now follow this diagonal line downward until it intersects the horizontal line number 50. From this point, drop straight downward to the bottom of the chart and we find that a wire size between a No. 8 and a No. 10 is required to prevent a greater drop than 1 volt. Since we are between these two numbers, select the larger size, No. 8. This is the smallest size which should be used to meet requirement a (1).

e. For requirement a (2) : (1) Disregard the length of the wire, the numbers along the left side of the chart, and the horizontal lines for this determination; (2) Assume that the wire is to be a single wire in free air carrying continuous current; (3) Place a pointer at the top of the table on the diagonal line which is numbered 20 amperes; (4) Follow this line until the pointer intersects the diagonal line marked "curve 2;" and (5) Drop pointer straight downward to the bottom of the chart and we are between the number 16 and 18. As the results are again between sizes, select the larger No. 16 wire. This is the smallest size wire acceptable to carrying 20-ampere current in a single wire in free air without overheating.

f. Compare the wire sizes selected. Use a cable no smaller than No. 8 in order to satisfy requirement (a) and no smaller than a No. 16 in order to satisfy requirement (b). Since we must meet both requirements, select the larger No. 8.

g. In this particular instance, the voltage-drop requirement was more critical because it required a larger size than the heat-dissipation requirement. This is usually true when a relatively light current is carried over a relatively long distance. However, when a short wire and/or a heavy current is required, the heat-dissipation capabilities of the wire may become the critical factor and may dictate the size of the wire to be used.

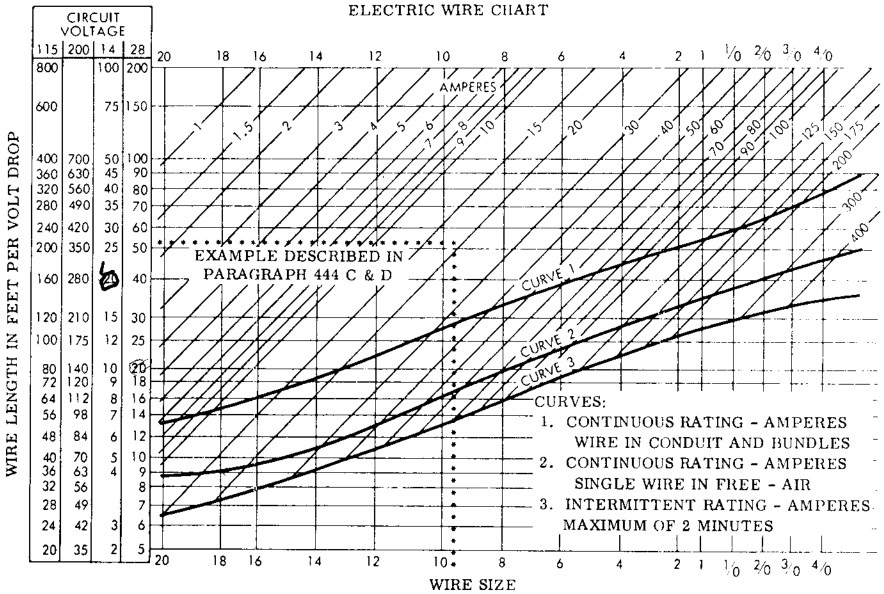

Figure 11.7. — Electric wire chart.

Plans now available for the two-place, side-by-side Pober Junior Ace — $125.00 plus $4.50 postage.

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