EAA® Technical Counselor News

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FEBRUARY/MARCH 1989

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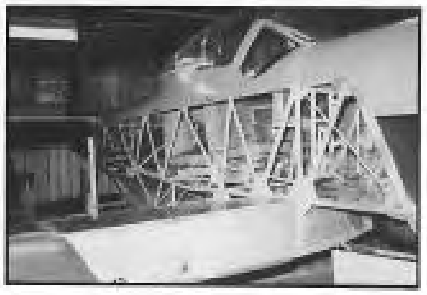
PRINTING: Times Printing

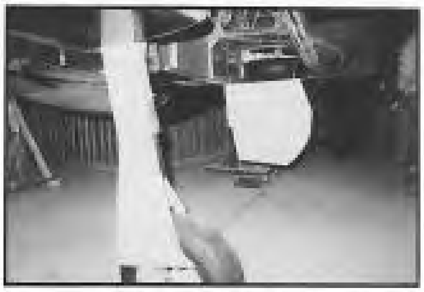
Ed Dyck of Fort Saskatchewan, Alberta, Canada is making progress on his Christavia with two grandsons aboard.

Technical Counselor Bud Shanks reports on Tom Leonhardt and Dick Buck's 3/4 scale Jurca P-51. One of the builders, we don't know which one, shows how the cockpit sits.

Leonhardt and Buck ¾ Scale P-51D



Fuselage from the side, first class workmanship. Tom says it is about 70 percent complete — a ten year project.



This other wing shot in the landing gear area shows one wheel down and one up.

This close-up shot of the landing gear shows it retracted.

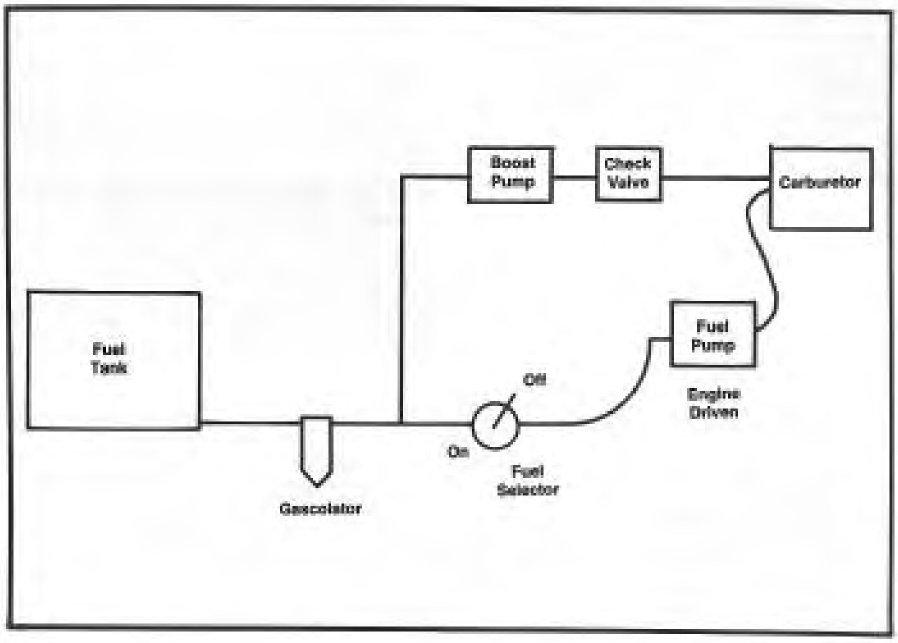
Left. Rear fuselage shots. These fellows had a show winning Fairchild at Oshkosh. George thinks the P-51 will be a winner also.

Right. This shot shows the plywood wing with the aluminum spars in the landing gear area and fiberglass wing skin.

Fuel and Fuel Systems

FUEL SYSTEM

The first instance we have involves a poor builder design. There were two lines from the gascolater, one went to the boost pump, to a check valve and then to the carburetor. The other line from the gascolator went to a fuel selector, then to the engine driven fuel pump and thereby, to the carburetor. The fuel selector handle was mislined. It is actually in the off position so when the pilot turned the boost pump off shortly after takeoff, he shut off the only remaining fuel supply.

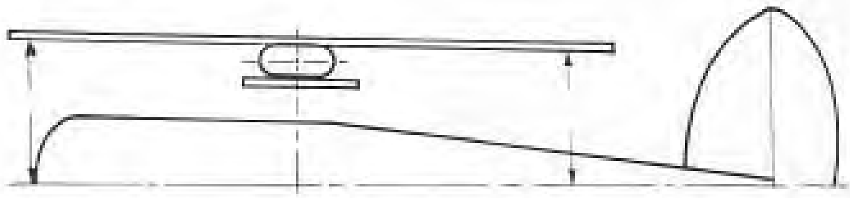


The following incident involved the universal joint. The universal joint was being asked to turn too large a corner and couldn't turn the fuel off/on valve fully on. The solution was eliminating the severe bend and replace the faulty universal.

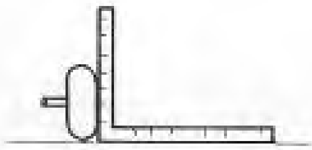
Technical Tips

WHEEL ALIGNMENT
From Technical Counselor Red Beitelshees of Boulder, Colorado

ALIGNMENT—
Landing a tail dragger plane whose wheels do not line up can give you a thrill. Checking wheel alignment can be done in several ways, but the idea is to check the direction of each wheel travel with the center line of the fuselage. One method is to use a long straight edge board or a string stretched tight along the side of the tire back to the horizontal stabilizer, measure the distance to the center line of the fuselage. Then make the same measurement on the opposite side. These distances should be equal and their sum should equal the distance measured to the outside of the main tires and on the forward part of the tires, for zero toe-in. The figure to the right shows the wheel alignment measurement.



X = X for 0-0 Alignment



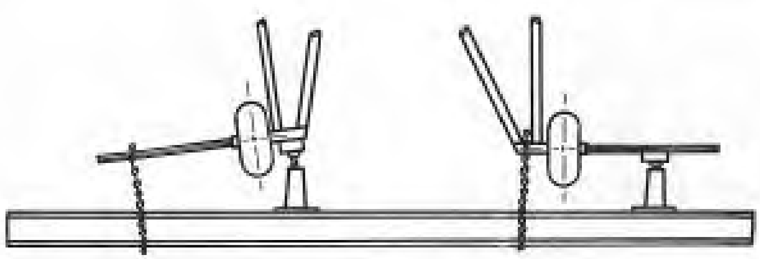
Camber is measured with the use of a 2 foot carpenter's square with the plane sitting on a flat and level floor.

EDITOR'S NOTE:

Here at the EAA, we build homebuilt aircraft with 0 degrees toe-in or toe-out, and 0 degrees camber with normal weight sitting on the wheels.

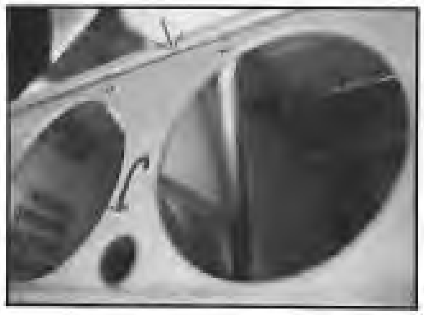
Adjustment for toe-in and camber are made differently on different airplanes. Some have screws, others use washers or shims, while on some of the smaller planes, you must bend the axle. The Champ is an example of one which must be bent to adjust. A suggestion on adjustment by bending is to use a heavy beam, I use a railroad rail, a hydraulic jack, two pieces of chain and some padding, such as old carpet, to protect the axle tubing from the chain. Use a piece of wood to protect from damage by the jack. Also, a heavy metal bar such as an auto axle which will go into the axle tube will be needed. The following diagrams show the use of the bending equipment. Use caution, bend a little at a time, and make frequent measurements.

The manufacturer's manual gives the recommended toe-in, which is usually small if any. Generally, toe-in is measured by comparing the distances measured between corresponding spots on the right and left tires at axle height and at the front and rear of the tires. Toe-in is where the forward measurement is less than the rearward measurement. The tire ribs may be used to measure from if they rotate true. If not, a line may be chalked on each tire as it is rotated. Note that this measurement shows nothing about how well the wheels travel relative to the fuselage center line.



Technical Counselors Rich and Mary Nohr visited Howard Melin's Cloud Dancer in Santa Ynez, California. The aircraft is nearing completion. He uses a Rotac 277 for power.

The wingspar on the Cloud Dancer is a patented design made from extruded aluminum. Its symmetrical when made and then cut diagonally, vertically down the spar to create two exact spars. The thicker width is placed at the wing attach point. The design incorporates a built in lip that the tip skin clips into securely. (See arrow) Mary, by the way, is our first and only female Technical Counselor.



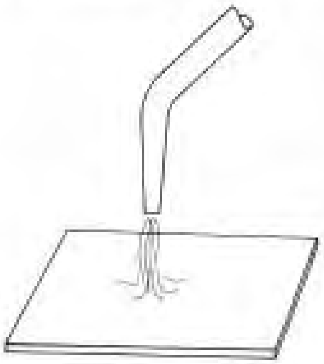
Technical Counselors Mary and Richard Nohr visited fellow chapter 491 EAA member Wayne Millen who is well along on his Glasair I RG.

Wayne is building his fuselage with the front of the fuselage supported by a chain from the ceiling attached to the engine mount and the rear supported by a padded saw horse, this allows all the fuselage seams to be glassed in a horizontal position by simply turning the plane upside down. Wayne also made the instrument panel removable for faster component access when completed.

Technical Counselor Rich Nohr on left with Wayne Millen builder. The workshop is superb and the quality of the fittings, hardware, landing gear is first rate. Wayne was previously in the fiberglass manufacturing business so his lay ups and glass work are really professional.

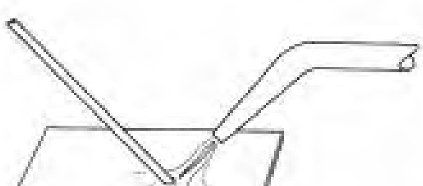
STAINLESS STEEL WELDING PROCEDURE
From the SRA "Outfit" News
By Frank L. Belk

I have successfully used the following procedure for welding stainless steel for 35 years and it works! You may weld cracks in stainless steel exhaust systems with oxy-acetylene. No flux, no heli-arc or cleaning required. Many repairs can be made without removing parts from the engine. I have even used this technique with a cutting torch and won a $10 bet!



WELDING PROCEDURE FOR STAINLESS STEEL

a. Welding Stainless Steel with Oxygen and Acetyline.
b. Heliarc Arc is NOT required in this procedure. No cleaning of the item is required prior to welding. No flux required in welding. It is not necessary to puddle the weld.
Light Torch: make blue flame 1 inch long. Hold flame 90 degrees to work with the tip of the Blue Flame touching the crack in the metal. When metal looks sweaty or moist, place tip 45° to the work and place tip 3/8 to 1/2 inch to crack in metal. Add Stainless Steel Rod No. 308, No. 316 or No. 305 of 1/16 inch to the Blue Flame. Keep welding rod and the melted metal in the Blue Flame.



When the welding is complete remove the flame from the work rapidly.

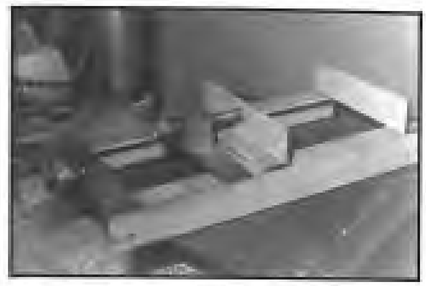
POSSIBLE PROBLEM AREAS

If holes are burned in the metal, the flame is too hot.

If bubbles are formed in the weld it is caused by not keeping the melted metal in the Blue Flame; always keep the melted metal in the Blue Flame.

HOLDING FIXTURE
By Robert Strehlow of Oshkosh, Wisconsin

This holding fixture has an aft movable jaw. Note there is an additional brace under the aft movable jaw to keep it centered side to side. The threaded rod has pins that can be placed on the bed to vary the position for the holding fixture.



AIRWORTHY PROPELLER?

An investigation of a representative number of propeller blade failures discloses that the majority of failures occur because of fatigue cracks that started at mechanically formed dents, cuts, scars, scratches; nick, or leading edge pits. In most cases, blade material samples did not reveal evidence of failure caused by material defects or surface discontinuities existing before the blades were placed in service. Of course these comments apply to metal propellers.

PREFLIGHT THE PROPELLER

Preflight with the master and mag switches off. It should include running your hand along the exposed surfaces of the blades — front and rear — and along the blade edges. You should be feeling and looking for nicks and scratches, as well as signs of corrosion, because these are the starting points for fatigue cracks.

Safety

CIRCUIT BREAKER RECALL

Most of us are familiar with the circuit breaker recall of a Mechanical Products, Inc. circuit breaker. Over 1/4 million were recalled and these may be used in aircraft from Ultralights to 747's. These are 5 amp and below. They found that an internal shorting bar can rotate within improperly assembled units and allow the line to short to the mounting bushing. This shorted condition will cause a potential "No Trip" situation or a shock hazard.

ACTION - PLEASE RETURN THE FOLLOWING PRODUCTS (5 AMP AND BELOW) WITH THE APPROPRIATE WEEK DATE CODES:

MP SERIES NO./ MS NO.	AMP RATING	WEEK DATE CODES, START/END
4001/22073 V, L, VL	1 to 5 Amp	8501 thru 8636
85001/None	1 to 5 Amp	8514 thru 8636
4200/26574 V, L, VL	1/2 to 5 Amp	8430 thru 8636
4310/3320, V	1 to 5 Amp	8630 thru 8636

SEAT CUSHION

A report of an accident in Australia with a Pitts Special in 1986 brought to light a construction defect which is pretty prevalent in many homebuilts. This accident occurred when the aircraft spun to a low level and, during recovery, was over pitched and mushed into the ground.The impact was moderate, the cockpit area remained intact, and clearly, the accident was survivable, but the pilot suffered fatal spinal injuries due largely to the use of a resilient seat cushion, according to the official report.

A resilient seat cushion can have three adverse effects. It can delay the onset of deceleration: the pilot continues downward after the aircraft has started to slow down, until he stops abruptly as he hits the seat pan. Second, it can store energy so that, as it rebounds, the pilot may experience much more rebound than experienced by the aircraft. And third, at the time of peak loading, when the cushion is most compressed, the pilot's harness will have been slackened by the amount of compression, and his spine will be flexed, greatly increasing the risk of spinal injury.

The report states that seat cushion should compress 83 percent under 1g, or be of a crushable material that will not store energy.

In the old days, a commercial material by the name of ensolite was used for seat cushions. However, ensolite was found to be flammable under certain conditions and the usual product today is similar to "Temperfoam". Check under miscellaneous in the SPORT AVIATION classifieds for suppliers of this material. Anyone who has any questions, can write to Information Services for a report on this material.

SIDEWINDER ACCIDENT IN CANADA

Witnesses reported that the aircraft performed two chandelle maneuvers, and while diving to perform a third sequence, both wings folded up and back. The stabilator tube end fitting was forwarded for inspection. A total time of 50 hours since new was recorded on this part. The stabilator tube end fitting that failed was attached to the cross tube which interconnected the dual control stick system. It was found that the stabilator assembly received was one size smaller than that specified. The steel alloy tube measured 3/4 inch in diameter as opposed to a 7/8 inch diameter specified. Similarly, the threaded rod had a 1/4 inch diameter versus 5/16 inch diameter specified, so that the rod end bearing did not meet the dimensional requirements.

Microscopic examination of the fracture surface disclosed a bending overload mode of failure. The angle of bend was approximately 55 degrees. The material used for the two bend fitting was found to be of substantially lower quality than specified. The conclusions were:

1. The stabilator tube end fitting failed in bending overload mode.

2. The size of the stabilator tube end fitting components were both smaller than the minumum specified.

3. The ultimate tensile strength of the material was significantly lower than that specified.

4. The actual breaking load was found to be 58 percent lower than the minimum breaking load calculated from specifications.

5. The material of the threaded rod was not considered to be representative of good aircraft quality material.

LINCOLN SPORT PLANE

Don Walter, a Technical Counselor from Santa Ana, California reports that builder John Krug of Orange, California started construction of his Lincoln Sportplane in January 1985. He found the plans in a 1930 copy of the *Flying and Glider Manual*. John plans on using a VW engine of 36 HP. The structure is 3/4 to 1/2 inch aluminum tube with aluminum gussets pop riveted over each joint. The wings have two 1-1/2 inch diameter aluminum tubes for the main spars and 1/2 inch foam and wood ribs. The Sportplane replica will exceed the ultralight weight limit and will be registered as an experimental homebuilt. Don says he is impressed with the quality of the work and ingenuity shown in his construction techniques. The entire Chapter is looking forward to the first flight!

Composite Corner

LANCAIR COMMENTS

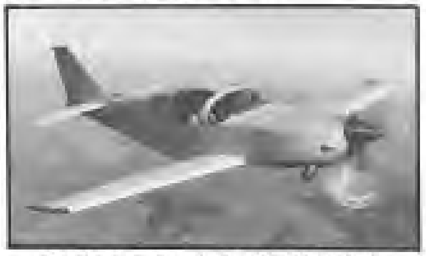
The Lancair is built of epoxy pre-preg glass cloth with Dupont's Nomex Honeycomb cores throughout. All parts are vacuum bagged and oven-cured to 250 degrees F plus or minus 10 degrees. Nomex Honeycomb, although many times more costly than typical foam cores, is far superior. The Honeycomb is roughly 4 times stronger in both shear and compression than most foam cores and much less susceptible to break down due to aging, temperature cycling, etc. (Pre-preg) alludes to the fact that the glass cloth used had been previously impregnated with epoxy resin.

The following comes for EAA Chapter 478 Newsletter "Cockpit Chatter":

Dick Gibbons presented some of his experiences with epoxy work on the Lancair 235 he is building. He has not been able to get 100 percent epoxy bonding on the single-ply, pre-preg for the wing spars. The two ply pre-preg works fine. Dick has cleaned the surfaces with any and all solvents and cleaners, and sanded in every manner. The Saf-t-poxy will not wet the surfaces and beads up, or fish-eyes. Dick consulted the Lancair factory for help. At first they indicated this was the first such problem they had news of, and offered workmanship advice on cleaning and surface preparation. Dick had done all this, but did it again with no better success. On the second inquiry, they admitted many Lancair builders were experiencing the same single ply pre-preg bonding problems. No solution has been found yet. Wax in the pre-preg Saf-t-poxy might be the culprit.

Sid Wood demonstrated the vinylester fiber glass wing skin construction system for his KR-2. The wing skins are made in a female mold by Diehl Aeronautical, Jenks, OK as a kit for the KR-2 using vinylester epoxy. Saf-t-poxy will not bond to the cured vinylester. Vinylester epoxy must be used. According to manufacturers literature, vinylester epoxy is 35 percent stronger than Saf-t-poxy, and has a 55 degree F higher temperature index, i.e. 235 degrees F versus 180 degrees F for Saf-t-poxy. Diehl Aeronautical estimates a 45 pound weight saving using their wing skin system. That's about an 8 percent savings on the empty weight for the KR-2.

As an experiment, two test samples of the one-ply pre-preg were laminated to samples of two-ply pre-preg using some vinylester resin. The samples had been thoroughly cleaned by Dick. The surfaces appeared to wet well. After a seven day cure at 72 degrees F, the clamps were removed, and the samples were easily split with a pocket knife. The cured surfaces appeared to be extremely starved for epoxy.



GLASAIR III SETS NEW N.A.A. CITY TO CITY WORLD SPEED RECORD

First Flight Airport
Kittyhawk, North Carolina
December 16, 1988

Marking the 85th anniversary of the Wright Brothers' first flight U.S. Air Captain Bob Olszewski piloted the prototype Glasair III, N540RG, to a new C1c class world speed record. The 1,057 mile flight from Kansas City, MO to Kittyhawk, NC took just 3 hours and 37 minutes setting a new city to city speed record of 292.87 mph (recently approved by the National Aeronautic Association).

Amongst the multitude of city to city world speed records, the Galsair III has the distinction of holding the fastest city to city non-turbocharged speed in **any class.** The Glasair III also holds several closed circuit world speed records in the C1b and C1c class.

In addition to his 30 year commercial airline career and an earlier tour with the U.S. Air Force, Bob Olszewski is an enthusiastic promoter of general aviation. He currently holds 64 national and world speed records in various commercial and general aviation aircraft.

Four different models of the popular Glasair design are available in kit form with cruise speeds ranging from 200-285 MPH.

AT—9 TURBOPROP SETS NEW TIME—TO—CLIMB—WORLD SPEED RECORD

December 14, 1988
Arlington, Washington

The AT—9, the world's first all fiberglass composite turboprop trainer, recently demonstrated its impressive performance capabilitites by easily setting a new time—to—climb world record in class C1b group II (turboprop).

The two place aerobatic trainer flew from runway brake release to 3,000 meters (9,843 feet) in a time of 3:07.

The AT—9 was piloted by U.S. Air Captain Bob Olszewski and Robert Gavinsky, Vice President of Engineering of Aerocet, Inc. Olszewski currently holds over 64 national and world speed records in various commercial and general aviation aircraft.

Powered with an Allison model 250 B17-D 420 hp engine and three blade McCauley reversing propeller, the AT—9 is designed to be a low cost trainer/reconnaissance/light aggressor multi—purpose aircraft. First introduced in July of 1988, flight testing to date has confirmed performance expectations of a top speed of nearly 300 knots. Its uniquely premolded all—composite airframe can be easily assembled, resists corrosion, and offers many other advantages over existing aluminum airframes.

The developers are currently seeking a third party interested in marketing and manufacturing the AT—9.

CORRECTIONS TO LAST ISSUE

Dec 88/Jan 89 issue, page 3, HOLLOW SHAFT ENGINES AND AEROBATICS, the last sentence stated "For smaller, lighter aerobatic aircraft, the hollow shaft engine is the best way to go for crankshaft longevity." That is incorrect. It should have stated that SOLID SHAFT engines are best.

Also in the Dec 88/Jan 89 issue, page 7, WING TIP VORTICES, in the Editor's Note we stated that when landing you should land before the point at which a heavy aircraft touched down. We should have said to land AFTER THE POINT at which they touched down.

Technical Tips

GRAHAM KING ON PLYWOOD

I had the occasion recently to talk to Graham King who is well known as a builder of plywood racing shells. He uses aircraft techniques and frequently comes to EAA workshops to pick up new ideas on woodworking. Some of the things we discussed were these: although the military specifications on spruce and aircraft plywood are still available (contact EAA Heaquarters Information Services for details) no one enforces the military specifications, it is up to the manufacturer's who build plywood to supply wood that meets the mil spec. Just because it is stamped mil spec does not neccesarily mean it meets the specification. Graham recently bought some plywood from a New York light plane supplier and he found that what they sold him as a 5/32 inch is actually .072 inches thick. You will recognize that 5/32 inch translates to .1532 inch thick. What he bought is actually closer to 1/16 as the fraction 1/16 corresponds to .0625 inches. The plywood was U.S. built and it had this stamp but the manufacturer is not known. Many times Graham has found that plywood advertised as aircraft plywood does not meet mil specifications and this is not the first time he has noticed this. Due to the very high cost of thinner plywood, he feels this should be right. On the so called aircraft plywood, 3/16 inch thick, 60 to 70 percent of it has a very thick inner core and thin skins and this is easily damaged in shipping. To get proper plywood, Graham makes up his own plywood in many cases. You would think with racing shells, he would mold it over a form but he does not. He builds it on a very flat table and he obtains veneers that are supplied from Canada occasionally using something known as McCaray or "African Cherry". This glues together flat and he uses epoxy to make up his plywood. He would not use rescourcinal formaldehyde because he feels it would probably dry by the time he gets the sheets together.

Some of our other discussions included the use of strong lights under thin plywood to see if the plywood had voids although voids have not been a big problem with the thin plywood he has purchased. The problem simply has been . . . it doesn't meet military specifications. Again, copies of these specifications are free to any reader of the Technical Counselor Newsletter.

PILOT INDUCED G-LOADS

A serious problem with airplane strength is pilot induced g-loads. High speed ratio airplanes may be dangerous when flown by "heavy-handed" pilots.

$$\text{Pilot induced "g's"} = [L_x/L_s]$$

$$= \frac{[\text{Lift capability at speed x, } V_x]}{[\text{Lift capability at stall speed, } V_s]}$$

$$= \frac{[0.00256\ C_{L\ max} V_x^2]}{[0.00256\ C_{L\ max} V_s^2]}$$

$$= [V_x/V_s]^2$$

Some examples are listed in the table below:

	V_s	V_{cr}	g_i	V_{max}	g_{lo}
Pixie	40	80	4.0	120	9.0
RV-3, -4	50	150	9.0	200	16.0
T-18	65	150	5.32	200	9.5
Squadron	22	50	5.2	80	13.2

V_s = Stall Speed
V_{cr} = Cruise Speed
$g_i = [V_{cr}/V_s]$
V_{max} = Do Not Exceed Speed
$g_{lo} = [V_{max}/V_s]$

To keep from overstressing an airplane at higher speed ratios, it is necessary to design elevator stick forces to increase with g's and/or surface deflection.

ACRODUSTER II

Technical Counselor Robert Caravas of San Carlos, California sent this photo of Mike Mattel's Acroduster II. Workmanship is very good, wings were inspected on this date. Mike built the lower wings and Stolp Starduster is building the top wings. The fuselage was welded professionally by the Stolp Starduster Corporation.

CLARIFYING THE N NUMBER SIZE

The following comes from FAR 45.22 and copies of this are available to any Technical Counselor who is interested.

Exhibition, antique and other aircraft built at least 30 years ago or an experimental exhibition aircraft which has the same external configuration as an aircraft built at least 30 years ago may display 2 inch marks on the fuselage or vertical tail surface consisting of the Roman capital N followed by the U.S. registration number of the aircraft or the symbol appropriate to the airworthiness certification of the aircraft C—standard, R—restricted, L—limited or X—experimental followed by the U.S. registration number, i.e. NC123 or N123, etc.

FAR 45.25 — Location of marks: 2 inch marks may be displayed horizontally on both surfaces of a single vertical tail or the outer surfaces of a multivertical tail. If displayed on the fuselage surfaces, horizontally on both sides of the fuselage between the trailing edge of the wing and leading edge of the horizontal stabilizer. 3 inch marks may also be displayed vertically on the vertical tail, or horizontally if preferred.

FAR 45.29. This FAR discusses the size of marks for experimental amateur built aircraft which can be 3 inches high as long as the maximum cruise speed of the aircraft doesn't exceed 180 knots calibrated airspeed. The location of the marks is the same as the 2 inch marks on exhibition, antique and other aircraft.

If you have 2 inch numbers on your exhibition antique or other aircraft, or 3 inch numbers on your experimental amateur built aircraft, you must temporarily put 12 inch numbers on if you fly through an ADIZ. The above applies to fixed wing aircraft and as stated, a copy of the FAR is available from Information Services free of charge.

CLEANING PLEXIGLASS WINDSHIELDS

From an unidentified newsletter source, they found that Pledge Furniture Polish (not lemon) will clean plexiglass and has no apparent effect on it. It apparently has a better effect than the commercial plexiglass sheet cleaners.

Technical Counselor Harold Haughton of Niles, Ohio reports on a one-of-a-kind Webber BFW-1, built in 1936 through 1938. First flown in January 1939.

This photo shows the elliptical wing as the project is being rebuilt. It uses a Velie-5 of 65 hp.

EAA® TECHNICAL COUNSELOR NEWS

WITTMAN AIRFIELD *OSHKOSH, WISCONSIN 54903-3086*

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