EAA® Technical Counselor News

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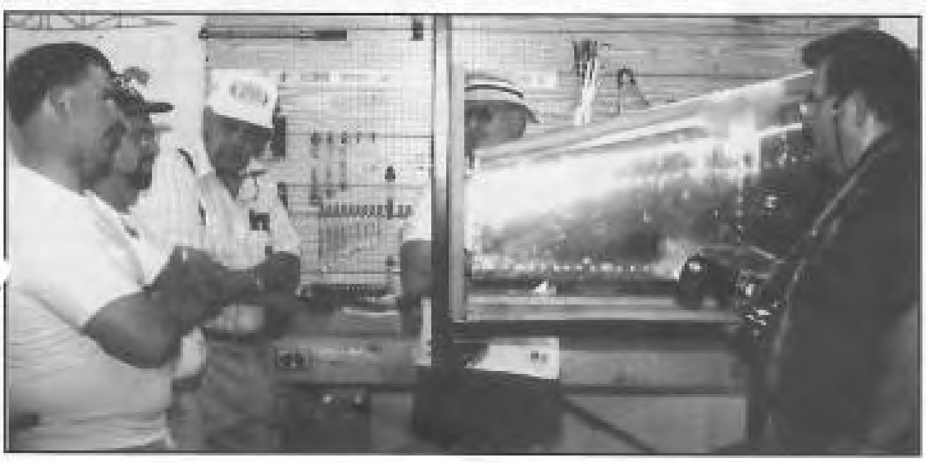
MAY • JUNE • JULY • AUGUST

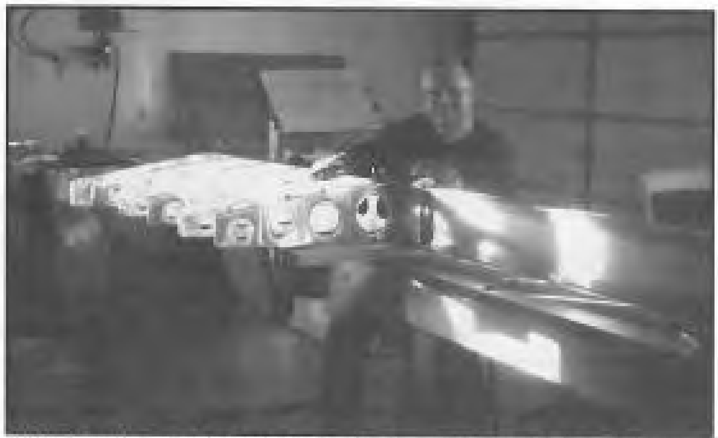
EDITOR: BEN OWEN

Chapter 563 Annual Project Tour

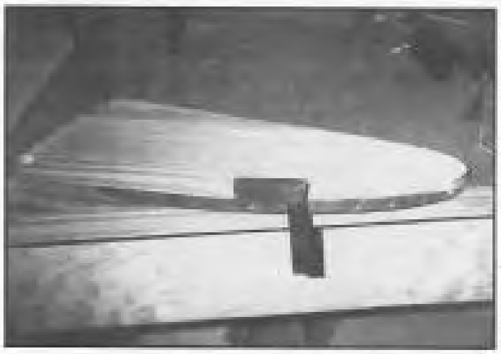
Technical Counselor Al Leery of Peoria, Illinois reports on the EAA Chapter #563 second annual project tour. First stop - Delbert Dester's VariEze. Stop 2 - Chuck Watson's KR-2. Stop 3 - Jim Hull's RV-6 parts and pieces. Stop 4 - Lou Carr's KR-2. Looks like a nice job. Stop 5 - Joe Rex on the left, Guy Snider on the far right and Eric Manual with the chapter cap on the RV-4 project. Stop 6 - Carl's Homolka Kitfox project.



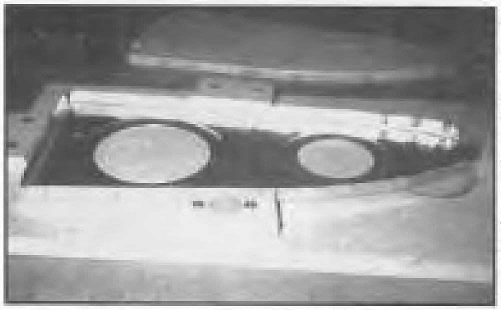
Dick Guenther's RV-6A



Dick Guenther, Technical Counselor from Prescott Valley, Arizona is working on his RV-6A wing.



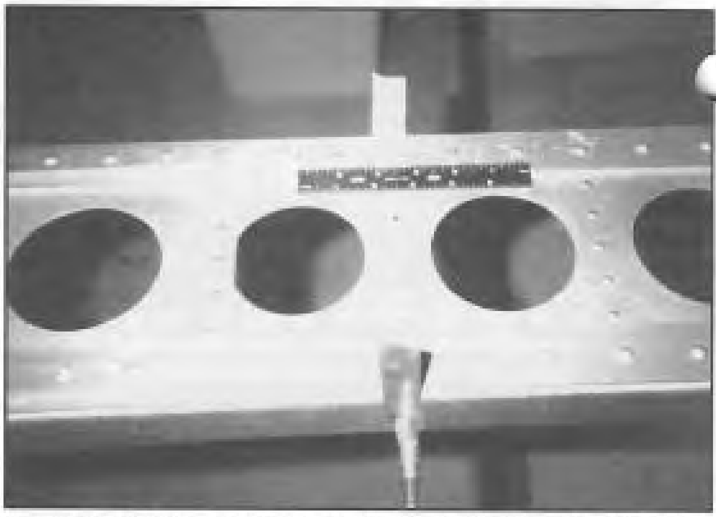
Making a pattern to fit inside a hydroform rib and marking the rivet placement with a small square and a pilot felt tip is much faster than using a ruler on each rib. This gives you the rivet interval and you can flute in between rivets to straighten the rib.



The rib holding board is clamped to the drill press table and the member is clamped to the board before the reinforcement holes are cut out. A hole saw or a fly cutter is used. He relieved all of his wing ribs in less than four hours.

The fence clamped to a drill press table enables you to drill holes parallel to a given edge to make a good looking line of rivets with a proper edge spacing.

Use the jig and clamping the drill enables you to drill holes in line in the middle of the web. The auxiliary table top is shimmed with the bit on the center of the web.



Centering the ribs on the spar makes for a smooth skin. Note how easily a white on black rule reads.

Threaded bar really holds the ribs in alignment for blind drilling. Dick has the following suggestions on AN rivets:

AN Rivets: Drilling and Fitting

An AN 4 rivet has a 1/8" shaft but will not fit properly into a 1/8" hole. Likewise an AN 3 rivet has a 3/16" shaft but will not fit properly into a 3/16" hole. All AN rivets should have their positions drilled into an undersized hole and clecoed into assembly (the clecos will fit). After everything is pilot drilled and assembled the final stage starts and you remove clecos and drill to final size and replace clecos until all needed holes are drilled to final size, then debur, dimple and countersink, paint the primer on all on enclosed surfaces and only then start riveting.

The AN 3 rivet is 3/32" dia.(.0938) and the finish hole is #41 drill (.0963). The AN 4 rivet is 1/8" dia. (.1250) and the finish hole is #30 drill (.1285). You need that slightly larger diameter to make sure the manufactured head seats properly. As you set or squeeze the rivet, the shaft of the rivet expands into the hole and the shop head forms and compresses the members. Remember the #3 (3/32") rivet needs a 3/16" edge distance and the #4 (1/8" rivet needs a 1/4" edge distance minimum to prevent tear out during normal structural tension.

OPERATIONS

PROPER CROSSWIND LANDING

-From Canadian Flight Publishing Company
Flight Safety Book Bulletin 276

There are a large number of pilots who believe that they can safely land an airplane using the crab technique. Most of these pilots are believers because they use the technique and successfully get away with it year after year. Their definition of safety is that if they didn't crash the airplane, they must be doing something right. This, of course, is not true because they are not thinking about those occasions when they had a close one and nearly wrapped the airplane in a ball. They also ignore the excessive strain that they have repeatedly placed on the landing gear. There are two other reasons why they believe in the method:

1. They have a strong belief that they can accurately predict the instant of touchdown. (That they actually cannot is beside the point.)

2. They believe that after the crab maneuver is performed during the flare for the landing, there is some time period before the airplane starts drifting to the side. They have no idea how long (or short) this instant in time is, but nevertheless believe that it exists. The believers will never be convinced otherwise without some kind of concrete proof being presented to them.

Now, there are two kinds of proof that can be offered, and each has its merits. The first kind of proof is the relevant analogy: find a similar situation and use it. The first useable one that comes to mind is the question of how quickly does an airplane start drifting to the side when a takeoff is made in a crosswind and no correction is attempted? In other words, a crosswind takeoff made without lowering the wing prior to leaving the ground. The answer is that the airplane starts drifting instantly. There is no delay time or short period. We've all made that kind of takeoff - if unintentionally - and have experienced the instant drift.

The second kind of proof that one may use is analytical or mathematical and is a bit more difficult to come by.

First, the equations are found to be non-linear differential equations and therefore are difficult to solve. A different approach is to use the digital computer to effect a simulation that will give us the equivalent of a solution. This is easily done using a personal computer.

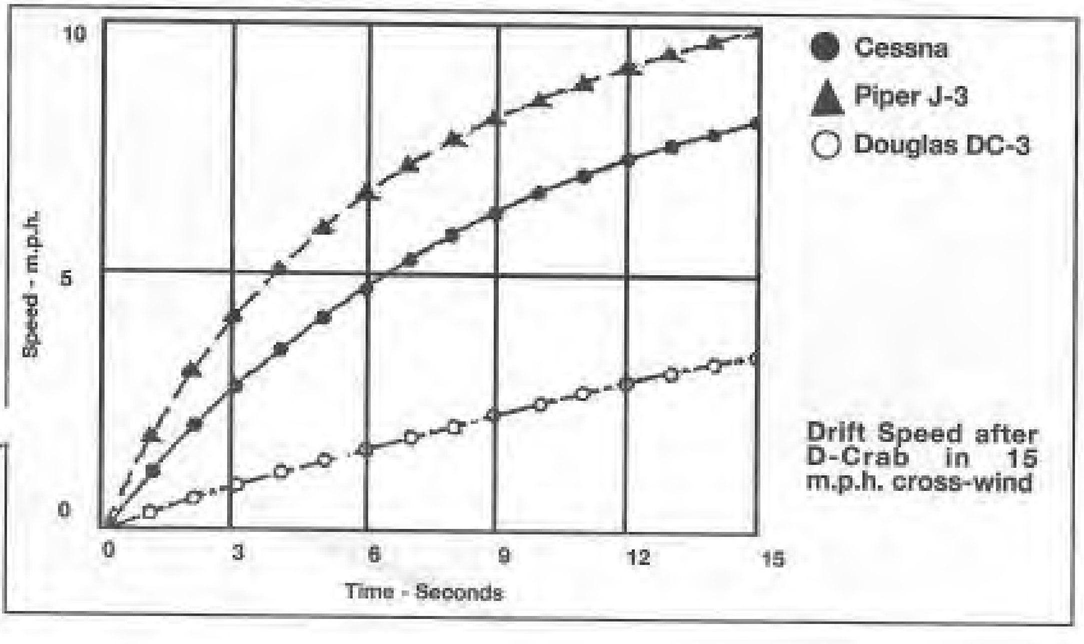
Before discussing the result, I would like to point out that the two variables that distinguish various airplanes from each other in this regard are gross weight and side area (fuselage and tail) which the wind pushes against.

Thus, once the computer program has been written, one can obtain results for any airplane by providing the area and weight of the airplane in question. In my particular simulation, I obtained results for three airplanes: The J-3 Cub, the Cessna 170, and the DC-3. These results are shown in the accompanying graph. (See below.)

These results should be interpreted as follows. Let's use the curve given for the J-3 Cub (topmost curve). The graph simply says that if we have a 15 mph crosswind, and at time zero we accomplish a perfect crab (i.e., kick out the crab), the Cub's sideways velocity will start at zero and will pick up 4.2 mph at the end of three seconds, and 6.56 mph at the end of six seconds. So you see, the airplane does pick up side velocity immediately after crab. You can also see that if the pilot incorrectly estimates his touchdown by six seconds (easy to do in a Cub in turbulence), he will have accumulated a 6.5 mph crosswind before touching down. This is why the crab method does not work in light airplanes. The pilot who thinks that this is trivial has never landed a Cub in an appreciable crosswind. If this landing were on a hard surface, this kind of error is enough to precipitate a ground loop and may result in totalling the airplane.

If we now return to the graph, we see that for the slightly heavier Cessna 170, the results are much better, or more benign. The side velocity at six seconds is only 4.75 mph. If we look at the curve for the DC-3, we find that the side velocity gained at six seconds is 1.8 mph. So you see the reason for the difference of opinion between the flight instructors (teaching in light airplanes) and the airline pilots flying today's Boeings. With enough weight, the questions indeed become trivial.

To sum up; What crosswind technique is right for one type of aircraft may be wrong for another. I once heard of a Boeing 707 captain who liked the wing-down method so much that he used it on the first jet airliners. That is, he used it until one day he scraped the wing tip and that put a stop to the wing down method of counteracting drift when flying the big jets.



Drift Speed after D-Crab in 15 m.p.h. cross-wind

FIN OFFSET REVISITED

-By Ralph Korngold of Palo Alto, California

Now I am familiar with the "P" lead on a magneto, and I've heard of the "P" factor as it relates to the difficulty of certain aerobatic maneuvers, but I haven't a clue as to how it applies to propeller performance. I am sure not convinced that an aircraft in a climb wants to yaw because "the descending blade has more bite than the ascending blade". My experience has been that the yawing tendency can be most pronounced when that traditional biplane is charging down the runway with its tail up in flying position, doing its best to get airborne, and definitely not climbing at all.

Another theory I have trouble with is that of the "rotating" slip stream. We're familiar with the classic textbook illustration of the particle of air leaving the rotating blade face, doing a barrelroll around the fuselage and striking the vertical fin on the left hand side, causing the nose to yaw left. So we offset the fin a little to the left to bring it into alignment with this swirling relative wind. Uh-huh! No way.

You fly a duster through the rain and the streaks down the fuselage do not reflect this pattern. They're as straight as you can get. You can stand behind an engine being run on the test stand on a foggy morning and you can <u>see</u> what's going on. The air drawn into the propeller arc takes the shape of a giant funnel, and as it passes through the blades it straightens out and flows straight back. And I mean <u>straight</u>.

Certain engineers who ought to know better have tried to take advantage of this "rotating slipstream" by installing turning vanes in the cowling bugeyes in the hope of scooping in more cooling air. The vanes on the right are inclined upward, while the little airfoils on the left point down. But if you install a bigger engine and you have to <u>have</u> more air, you take your trusty hacksaw and cut them out completely!

I followed the plans on my homebuilt religiously and offset the fin 3/8" to the left at the leading edge. During takeoff and climb you are not aware of any yawing tendency. But as soon as you level off and the speed starts to build, the faster it goes, the more it wants to turn right. Throttle setting has nothing to do with it. In other words, you can reduce power dramatically, but as long as you maintain airspeed the yawing moment remains constant. Dive a little steeper and off it goes again. The solution was to put a bungee on the left rudder cable, a 1/2 x 3" coil spring attached to a length of parachute shroud line which is wound around a drum. Once the airspeed is stabilized, a turn of the knurled knob lets you take your feet off the rudder. But one of these days I'm going to get out that aforementioned hacksaw and put that vertical fin where it belongs—right smack-dab on the centerline!

EDITORS NOTE: *I received some education on this particular subject in F6F Hellcats which as soon as you put the power on takeoff, require you to STAND on the right rudder, sometimes with all the force you have to keep from a disasterous excursion off to the left of the runway. I strongly believe in "P" factor on <u>this</u> airplane. The fact is that descending blade on the right in a <u>powerful</u> taildragger is at much higher angle and a lot more effective than the ascending blade on the left-hand side at a high angle of attack. I also know for certain that there probably isn't a Pitts or an Acro Sport with enough fin off-set to the left to fly "hands off" without the use of an additional trim-tab which is pushing the rudder even further to the right. The range from stall to cruise speed varies with each airplane so much as to make generalities really speculative. Also my friend owned "Shoestring" when it was burning up the Formula 1 races. It had the carb intake <u>right up</u> at the prop and the inlet canted 10 degrees right - gave more power.*

NOTE ON FLYING SAFETY

-By Bill Marcy

Departed Kerrville for Denver with ceiling about 1500 feet, visibility about 5 miles, occasionally 3 or less, occasional scattered clouds at 1000 or less. Compass course 323 magnetic, 216 miles to gas stop Snyder, Texas. There are no section lines, and darn few roads or landmarks leading northwest out of Kerrville, so about 20 minutes out, the chief navigator announced that we were no longer sure of our position. Turned on the new Magellan GPS receiver, which promptly announced that its batteries were low. Plugged in the backup battery pack, only to find that it had already been used and was also dead. Back to dead reckoning. Found that looking outside and trying to correlate with a map, it was nearly impossible to maintain the compass course, and after about 30 more minutes we gave up and started looking for an airport. Followed a highway north and found the town of Winters, with an unattended airport, about 20 miles off the course line. No marking pen in the navigation kit, so used a pencil to mark a new course following highways the rest of the way to Snyder, and from there past Amarillo to La Junta, where the visibility was finally good enough to fly direct again. Visibility was plenty good enough to follow the roads, and the deviation from the course line was seldom more than 20 miles until heading straight north from Amarillo to La Junta. The good news is, there was a tailwind component most of the way, so flying low was not much of a loss of time.

As a strictly VFR pilot, I find that I rely on outside references to help me hold to a compass course, and do not have the experience to keep on course simply by reference to instruments, especially with distractions like trying to figure out where I am. We learned three things from this experience:

1. Don't plan on flying direct in poor visibility. Plan to follow roads, rivers, and other good landmarks. Flying direct is for good visibility, which means a definite horizon, not just 5 miles.

2. Keep marking pens and a plotter in the navigation kit; you can never tell when you will need them to plot a new course.

3. Make sure your backup equipment, such as a battery pack, is in good order.

4. (This one I already knew): Don't count on electronic devices; they can give up just when you need them the most, and ALWAYS have a backup plan.

FAA SAFETY BULLETIN

Before your next flight physical exam, which might require a blood test or drug test, consider the following:

- If you've taken Advil, Nuprin, Mediprin, or Motrin it could show up as MARIJUANA.
- If you've taken Nyquil, Vick's Inhaler, Diet pill, Heat/Asthma medicine, or many nasal sprays, it could show up as AMPHETAMINES.
- If you have taken tonic water, or herbal tea, it could show up as COCAINE
- If you have taken Benadryl, Soma, or Norflex, it could show up as METHADONE.
- If you have taken Dilantin, or Phenobarbital, it could show up as BARBITUATES.
- If you have taken Vick's Formula 44, Tonic Water, or have eaten poppy seed rolls, it could show up as HEROIN.
- If you have taken Contact, Dristan, Nyquil, Hall's Menthol Drops & many cough medicines, it could show up as ALCOHOL.

The message here is that if you use these over-the-counter drugs before the medical exam, there could be some very serious charges against you because of your head cold. There could be a lot of reactions by the FAA to some of these things, and it would not only delay renewal of your medical, it could cost a lot of time, money and written statements from doctors to get this straightened out.

SAME ALTITUDE, CONSTANT BEARING, DECREASING RANGE —

means a mid-air is imminent. And the problem is ?

by Ben Owen

The problem is constant bearing which means that the object is not moving in relation to you. This makes things very hard to spot. An excellent example of this constant bearing decreasing range can be related to cars. If we're coming up on an unmarked intersection and a car is coming from our right, it appears to us that it is not speeding up or slowing down. It's staying in the same viewpoint on the windshield...if you or he don't stop at the intersection, you will collide. This is the easiest way I've found to relate it to something we do more often than flying. The big problem again is, that the aircraft that's on a collision course will stay in the same spot on your windshield. If that spot on the windshield is covered by steel tube or aluminum, you will not see that aircraft until he's at too close range to maneuver. This was proved conclusively in the mid-air collision between the light plane and the airliner in California several years back.

A friend of mine who flew the Concord had a habit of turning the controls to his co-pilot as soon as they were airborne, moving his seat up to the front windshield and spending his entire flight scanning. Not a bad idea for all of us to follow. Particularly when we're close to airports, where most collisions occur.

NOTICES From the FAA Files

NEW KIT AIRCRAFT

There is a kit that was demonstrated at Sun 'N Fun and it's basically a Cessna 172 look-alike known as the "Cyclone", C/O Avionnerie Lac St-Jean Inc.

373 de la friche Dolbeau
Que G8L 2T3
CANADA
Telephone: 418/276-7903
Fax: 418/276-9079

EXCELLO FUEL INJECTORS

If anyone among the Technical Counselors knows of a source for Excello Fuel Injector parts please contact Ben Owen at EAA Headquarters. Of course, the Excello Fuel Injector would be used on the Continental 85 and similar engines.

NOTE:

In the December/January/February '93 TC News there was a news item on Ron Denight rebuilding his father's Goodyear Racer #97, the Denight Special. We'd like to enter a correction in that the aircraft was built by the Senior Denight but was designed by Nick D'Apuzzo back in April of 1962.

EASTWOOD COMPANY

This photograph caption shows the Eastwood Company's new extra capacity Sandblast Cabinet kit. If you are in the market for a Sandblaster, the Eastwood Company has this and many other fine tools. Contact the Eastwood Company, 580 Lancaster Avenue, Malvern, PA 19355. Telephone 1/800/345-1178 for a catalog.

Unapproved Aircraft Parts

1. **SUBJECT/PURPOSE.** This FAA E Mail Transmittal contains information regarding the use of unapproved parts manufactured in China/Japan/Taiwan.

2. **BACKGROUND.** During a suspected unapproved parts investigation, the Federal Aviation Administration discovered parts manufactured in China, Japan and Taiwan were being sold and installed on U.S. type certificated aircraft and may have been illegally imported into the U.S. These parts had not received any certification approval from the FAA.

These suspected unapproved parts are not eligible to be installed on U.S. certificated type aircraft in the standard, transport or utility category without FAA approval. Flight Standards District Offices throughout the country are being requested by the purchasers of these suspected unapproved parts to field approve these installations on type certificated aircraft using FAA Form 337. Numerous customers are receiving paperwork with these counterfeit parts that cite a TSO number, even though the part is not TSO'd. Several of these instruments were tested to TSO standards and failed the quality control tests.

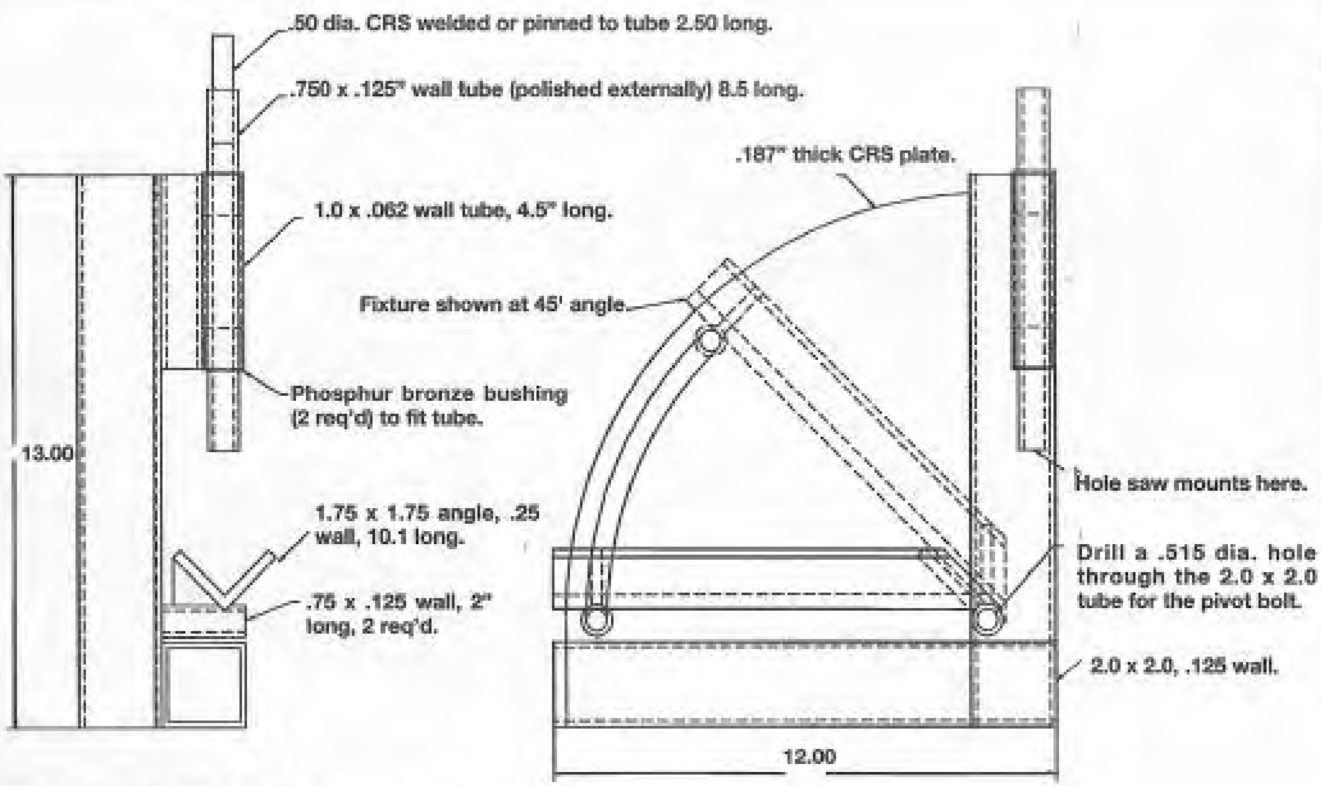
Known non U.S. manufactures/marketers are, but not limited to:

a. China National Aero-Technology Import/Export Corporation
b. China General Aviation Corporation
c. Beijing Ever Bright Industrial Company
d. River Enterprise Company, LTD.
e. Sunyard Corporation, LTD.
f. Sen Li Wire Rope Company, LTD.

The alleged suspected unapproved parts are but not limited to:

a: Radio Transceivers
b. Altimeters
c. Air Speed Indicators
d. Rate of Climb Indicators
e. Carburetor Air Boxes
f. Oil Tanks
g. Pressure Cylinders

3. **ACTION.** Any of the above mentioned instruments/parts or any parts of questionable origin should not be installed on any type certificated aircraft, aircraft engine, propeller, or component unless it can be determined that they were manufactured with evidence of an Approved Production Approval. Flight Standards District Offices should not issue FAA FORM 337 field approvals on these instruments/parts in question unless these parts have proper FAA engineering approval and a determination of airworthiness can be made through appropriate tests and inspections.



This fixture is constructed entirely of cold rolled steel tubing and plate. It is welded together. 1/2" bolts go through the two tubes and are used to angle the fishmouth. The tubes are "C" clamped to the angle. The fixture itself is "C" clamped or bolted to the drill press table. A plate could be welded to the bottom to facilitate mounting. The 3/4" round tube should be a sliding fit in the bushings. The length of the tubes supporting the bushings can be varied if the hole saw is a different length.

A hole saw is mounted to the .75 dia. tube. The saw should be the same size as the tube that will be joined to. Use a good quality saw and run it at low speed while using a lubricant.

Lorbiecki Racing Fishmouthing Fixture

By John Lorbiecki

ELECTRICAL/ELECTRONICS

HINTS 'N TIPS

CESSNA 150 NEWSLETTER

LONGER WIRE ANTENNA IS BETTER to feed strong signal into your LORAN receiver - By Ed Burkhead.

You need a big antenna to scoop in those LORAN radio waves when you have a cheap LORAN radio.

When I first bought my LORAN, I spent hours trying to make it work with a whip antenna I already had on my plane. The whip antenna wasn't designed for a LORAN, but I had hopes.

I couldn't get enough signal strength from this antenna to make the LORAN work — so I had a long-wire antenna installed. It works great!

The avionics shop that did it for me charged a little over a hundred bucks for the parts and labor.

A large hole was drilled in the middle of the reinforced area for the insulator and conductor to go through the skin of the plan. Inside, a nut holds it in place.

At the tail, a very small hole was drilled in the (already reinforced) leading edge of the vertical stabilizer. The end of the long-wire antenna has a spring attached to keep constant tension on the antenna wire.

There is also a (very skinny) ceramic insulator that keeps the antenna from electrically touching the metal of the airplane's tail. Finally, at the end of this assembly is the hook. (The whole assembly is in the order of insulator, spring, hook). The hook simply "hooks" into a small hole in the vertical stabilizer.

At the front end of the antenna, attached to the cabin, the antenna wire connects to the metal end of the insulator/conductor assembly. The conductor goes through the insulator to take the signal inside the airplane; the insulator keeps the metal conductor from contacting the metal of the airplane.

Inside, a co-axial cable takes the signal down to my baggage compartment which contains the pre-amplifier gadget. The center conductor of the co-axial cable connects to the preamplifier. The shield around the outside of the co-axial cable gets connected to a metal part of the airplane to ground the cable.

It's really pretty simple when you see it. It's just hard to explain.

Before the mid-continent gap was closed with new transmitters, one person wrote in to tell us he'd crossed the gap with his low cost LORAN without losing the signal—he was using a long wire antenna.

NOTE: After installing the long-wire antenna, I heard a way that might have made my whip antenna work. The "antenna base" unit on the Ray Jefferson L-100 LORAN contains the preamplifier. This thing looks like a cylinder, tapered a little. I clamped the 10 foot lead-in wire from the antenna to the top of the preamplifier yet still didn't get enough signal strength to make the LORAN work.

One Cessna owner said he cured this problem by clamping his preamplifier right next to the antenna itself—he connected the antenna to the preamp with a very short wire and it worked well.

Table 1

VHF VOICE COMMUNICATION FREQUENCIES

Frequency (MHZ)	USE
118.0 to 121.4	Air Traffic Control
121.5	Emergency, ELT Signals (Guarded)
121.6 to 121.925	Airport Ground Control
121.95	Flight Schools
121.975	Private Aircraft Advisory (FSS)
122.0	FSS Enroute Flight Advisory Service (FLIGHT WATCH)
122.025 to 122.075	Flight Service Stations
122.1	FSS Recieve Only with VOR or FSS Simplex
122.125 to 122.175	Flight Service Stations
122.2	Flight Service Station Common Enroute Simplex
122.225 to 122.675	Unicom, Uncontrolled Airports
122.725	Unicom, Private Airports Not Open to Public
122.75	Aircraft-to-Aircraft Communications
122.775	Future Unicom or Multicom
122.8	Unicom, Uncontrolled Airports
122.825	Future Unicom or Multicom
122.85	Multicom
122.875	Future Unicom or Multicom
122.9	Multicom, Airports with No Tower, FSS or Unicom
122.95	Unicom, Controlled Airports
122.975	Unicom, Uncontrolled Airports
123.0	Unicom, Uncontrolled Airports
123.025	Helicopter Air-to Air Communications
123.05 & 123.075	Unicom, Heliports
123.1	Search and Rescue, Temportary Control Towers
123.15 to 125.575	Flight Test
123.3 & 123.5	Flight Schools
123.6	FSS Airport Advisory Service, Uncontrolled Airports
123.6 to 128.8	Air Traffic Control
128.825 to 132.0	Aeronautical Enroute (ARINC)
132.05 to 135.975	Air Traffic Control

SAFETY

ACCIDENT SUMMARY

A recent report on an amateur-built aircraft shows a reduction of over 50% in the numbers of accidents per aircraft and the numbers of fatalities per aircraft when you compare 1992 with 1979. There are 700 plus Technical Counselors who can take a great deal of credit for this improvement. It's the individual counselor out working at his volunteer assignment - self imposed, that has made this safety record what it is. Congratulations to all of you!

TIP # 1

KR BUILDERS USING THE DIEHL LANDING GEAR

It has come to the attention of Dan Diehl that the lower casting on the landing gear is prone to breakage. The upper casting is more malleable and has shown no signs of failure. They have sent letters to everyone they know of who have purchased the gear, warning them of the situation. However, some may have purchased the gear from others. They are replacing all of these parts with a steel welded unit at no cost to the KR builder. For further information contact Dan Diehl, 1855 North Elm, Jenks, OK 74037. Telephone: 918/299-4444.

TIP # 2

SELF LOCKING NUTS & BOLTS SUBJECT TO ROTATION

There is an advisory circular on this very subject, AC 23.607-1. What it mentions is that the FAR section 23 requires that no self-locking nut may be used on any bolt subject to rotation and operation unless a non-friction locking device is used in addition to the self-locking device.

EDITOR'S NOTE: I've seen a landing gear axle nut of the self-locking type on a 5151 recently and I also saw a self-locking nut on a Pitts with a Haigh tailwheel that had come off at Oshkosh '92. This is an important fact for Technical Counselors to remember when looking at aircraft. If there is rotation involved, and the bolt is essentially an axle, it is essential that no self-locking nut be used in that application.

TIP # 3

FROM THE FAA BULLETIN BOARD #1

A poorly tightened connection on a conductor to a high aperage consumer such as a starter can cause enough heat at the junction of poorly mated parts to melt metal.

Next the gluing - save resin samples. When most aircraft were made of wood there was an expectation on the part of FAA inspectors that they would get to examine glue-joint samples to verify that structural properties of the bonded sections were appropriate to aircraft. With the wide-spread acceptance of modern composite structures, the old practice of saving sample glue joints was abandoned. However, sample lay-outs, glue joints and our cured resin samples are still worth saving. You pour it into a small wax paper drinking cup, the kind you don't use to mix epoxy in due to the wax. Allow time for it to cure. Afterwards peel the paper away from the disk and test it by scratching the date into the surface of the disc. When properly cured the scratch marks will be wide and produce dry chips or dust and the noise the awl makes will be distinct. Afterwards, drill a hole somewhere in the disk, tag it and catalog with the manufacturer's name, lot number, date of manufacture and the application.

By contrast, epoxy that has failed to cure properly will not chip or dust and will sound noticeably different when scratched.

TIP # 4

FOAM CORES AND FUEL

Rutan aircraft has published warnings and called for inspection of all critical parts that use Styrofoam cores. While no accidents have occurred to their aircraft (see below), the potential is very high. Effects on the core can seriously degrade the strength of components and can allow flutter to occur. Intrusions of solvents or even paint primer can cause core voids. Never use any solvent near a Styrofoam core. Seal the surface with epoxy/microballoons before painting. Make 100 percent inspection of all skins by feeling for voids and by coin tap.

EDITOR'S NOTE: Unfortunately there was a mishap of this type when a fuel aux tank was placed over the top of a Q2 mainwing, leaked into the foam core dissolving it, and causing in-flight collapse.

TIP #5

HARMONIC BALANCERS

Vital to safe operations. Builders who convert auto engines to aircraft use should exercise restraint when stripping these engines of harmonic dampeners. If the front crankshaft drive pulley appears to be made of separate pieces of steel or cast iron, joined by a bonded rubber interface, it is a harmonic balancer and vital to the safe operation of that engine. Removal could most likely cause a destructive failure of the crankshaft.

TIP #6

FUEL EFFECTS ON EPOXY

It appears that straight av-gas or mo-gas does not pose a significant problem with cured resins. However, the current problem with mo-gas is the"oxygenated fuels" containing methyl alcohol or methyl tertiary butyl ether (MTBE). These substances may attack the resins. The main problem with mo-gas is the uncertainty of whether the fuel is free of these additives. For instance, in Arizona oxygenated fuels are sold from October 1 through March 31 during the winter smog season.

TIP #7

RV-4 LYCOMING 0-320 ENGINE

Fuel pump failed on takeoff. Pilot was unable to restart the engine. Investigation revealed that the spring on one of the check valves failed.

TIP #8

TEENIE 2

Upon landing, main landing gear wheel locked up. Inspection found the axle was bent and gear upper strut had buckled just under the lower attach point.

TIP #9

BEDE-5B WITH A HONDA EB2 ENGINE

The part that failed is the ring gear. A six to eight inch section of the starter ring gear was missing. The ring gear had recently been spot welded at 4 concentric locations on the flywheel instead of using the normal 6 millimeter attachment screws. The ring gear had cracked a screw hole located at a weld point.

TIP #10

LANCAIR

Nosegear drag link failed on landing causing extensive damage to propeller and engine mount assembly.

TIP #11

LANCAIR 360 LYCOMING IO-360-B1E

Topspinner cracked. On takeoff smelled fiberglass burning. Returned to airport and found the cowling gouged behind spinner. Removed cover and found three of the four bolt holes with cracks out to the edge of the back plate. The part had less than fifty hours in service and was perfectly balanced. Upon checking with the factory and consulting with another builder the factory was aware of the problem and had started shipping reinforcement plates, but had not yet notified existing builders who are flying Lancairs.

TIP #12

QUICKIE-2 WITH A REVMASTER OF 65 HORSEPOWER AND A WARNKE PROP

During cruise flying at about 3,000 feet the propeller, prop hub and the prop spinner came completely off the aircraft. Investigation found that the crankshaft had failed at the prop hub flange. The failure appeared to have come from a pre-existing crack in the crankshaft. Approximate time on the engine was 387 hours.

TIP #13

QUESTAIR VENTURE

Continental IO-550 power. Engine idled rough, throttle jammed. When removed there was a fuel stain where the fuel had been leaking past the throttle valve shaft.

TIP #14

LongEZ

Excess play in the nosewheel fork could not be eliminated with friction dampener. Increased dampener pressure to max; fork still exhibited 0.100" play. Found phenolic friction pad to be loose in bore. Fork was new. Reamed bore to next fractional size and machined friction pad twice as thick so as to prevent cocking in bore. New pad prevents play in fork and eliminated shimmy. This was the fourth modification to this fork in an attempt to get it to work.

TIP #15

LongEZ

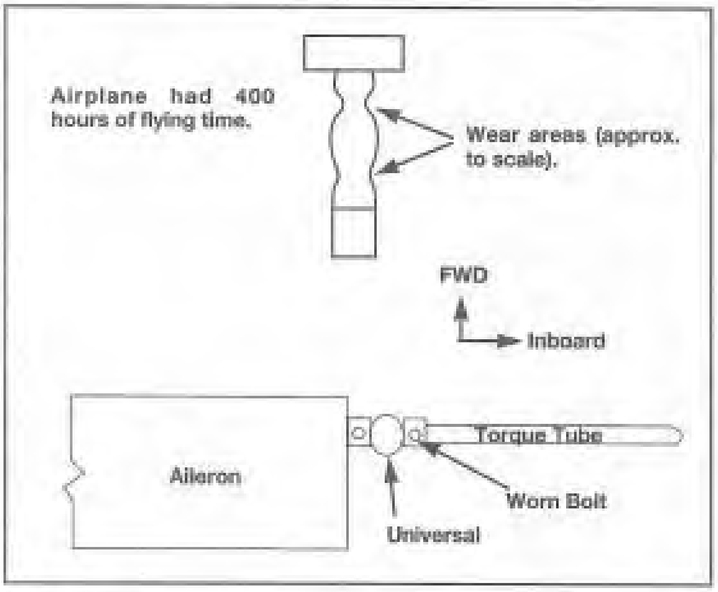
Excessive heat from the brake disk assembly has caused the main landing gear to weaken and collapse. The fix was to protect the fiberglass gear by manufacturing a U-shaped .032" aluminum shield to fit around the gear above the brake with 1/8" of fiberfax in between. Used silicone (RTV) safety wire to hold in place.

EDITOR'S NOTE: See Sport Aviation, May, 1993, page 88 for another solution to this problem.

TIP #16

UNIVERSAL JOINT

Central States Association shows aircraft using a universal joint. This airplane with 400 hours flying time had some play and the builder was surprised to find that the 3/16" bolt holding the universal to the torque tube had significantly worn down in two areas where it passed through the universal joint. Upon closer examination there was still some slight movement with the new bolt. The hole was then drilled out to 1/4". Press fitting a 1/4" bolt in the hole eliminated any free play from that connection. This was only on one side of the aircraft and was found during walkaround.



TIP #17

GLASAIR

Upon normal gear retraction the aft two inches of the nose gear door caught the tip of the door opening and jammed. Several attempts at lowering the gear were unsuccessful. A mains only landing was made successfully on a hard surface runway (recommend not to try this on grass). Heat generated from the adjacent fiberglass pipe is suspected of softening the door opening lip of fiberglass to the point that it drooped to a position that allowed the door itself to catch the lip and jam. The resulting jam caused the two fiberglass edges (the door and the lip) to notch each other into position.

TIP #18

LongEZ NOSEGEAR

To help stop nosegear shimmy I found that it is much better to not buy the cheapest tire you can find. Better quality tires provide a better balance which helps stop the shimmy.

TIP #19

LongEZ

Parked outside on a rainy day. A week later the cowls were removed and pilot in command noted water draining from bottom cowl. Water had filled the bottom cowl stiffener. No visible entry point was noted where water could enter. Recommend a drain hole be drilled in the lowest point of the bottom cowl stiffener. Water in this area could cause significant C.G. changes.

TIP #20

FROM THE BD-5 NEWSLETTER

We have another report of upper middle bearing support failure. This system uses bearing holders made of plastic with a memory. The reason for using this call-out rather than an aluminum one was the material could flex under a load, returning it to its original shape when not loaded and not crack. In addition its weight is less than that one of aluminum. Last week one of the engine buyers installed the inspection hole in the drive tube housing. Thus the drive has yet to be hooked up and used, as the engine is not in. After de-burying and cleaning out the inspection hole the builder put in a finger and pushed against the bearing holder and it fell apart. From now on we will inspect prior to each flight until a suitable replacement is purchased or the mystery is solved.

TIP #21

GROUNDED FUEL CONTAINER

In the Short Wing Piper Club News EAA's suggestion was to modify plastic containers by putting screen inside to ground them to the aircraft and to the ground. The suggestion in the Short Wing Piper Club is to use braided aircraft ground wire that is about 1/2 inch wide. Drill a hole in the top of the container near the spout for a 10-32 inch bolt, one inch long. Cut a length of braided wire long enough to reach from the top of the container to the bottom and to layer along the bottom. This will work as well as the screen suggested by EAA.

DESIGN

WARNING ON WING SKINS

From the KR Newsletter

Recently in our area, a KR builder/pilot experienced a phenomenon that was a little surprising to him. After a flight into the upper altitudes of the aircraft's ability to go (i.e., about 14,000') he was shocked to see that his wing skins had separated from the spar caps. Not a good thing to have happen. It could ruin your whole day.

Why did this happen? Simple physics. The builder had done such a good job in his wing lay-ups that he had a tightly sealed drum on each side of the wing skins. The pressure inside the wing drum increased with respect to the outside pressure as he went to altitude to a point where the skin adhesion to the spar cap could no longer hold.

The moral of the story is that any sealed space in a composite construction needs a pressure balancing port to preclude ballooning and as we've seen, eventual rupture. Taking a lesson from the GLASAIR manual, each such compartment in wing, aileron, flap and horizontal stabilizer is provided with a hole or holes so that the pressure can balance out. These holes are seldom any larger than .188" in diameter and are placed such that they provide two functions, pressure balancing and moisture weep holes.

On the subject of moisture collection, another phenomenon called "pumping" is considered by the aero and aerospace designer. It is this: an enclosed space will "breathe" (or should be allowed to breathe to balance the pressures) as one goes up and down in altitude. Consider the case of the aircraft that is flying at 18,000'. There are only half as many molecules of air at that altitude as at sea level where he lands. In the process of coming down, the compartment's compliment of air molecules doubles. But that is not all. Along with the second set of air molecules comes a healthy slug of invisible moisture. Now the aircraft takes on fuel, passengers or whatever and goes back to altitude. In doing so it passes from a relatively warm, moist atmosphere into a colder atmosphere and through the "dew point" and the moisture in the compartment condenses into water. (Temperature decreases at the rate of 3.5 degrees F per thousand feet of assent.)

After a series of these actions, the compartment "pumps" in an incredible amount of water and it doesn't evaporate.

BD-5 RIGGING AIDE

From the BD-5 Bulletin

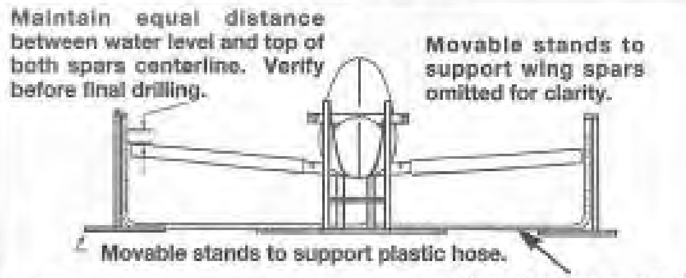


Figure 1

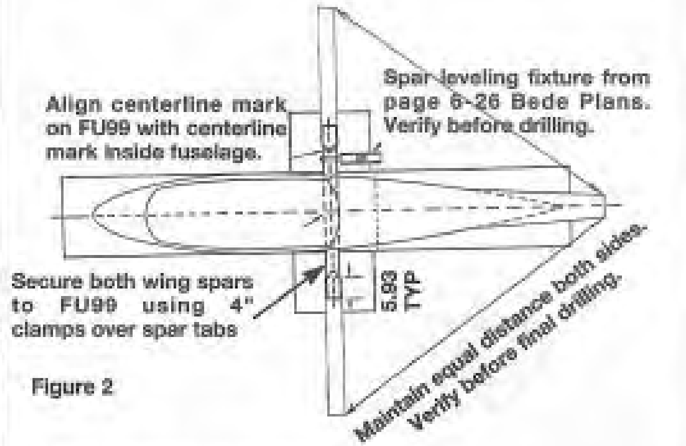


Figure 2

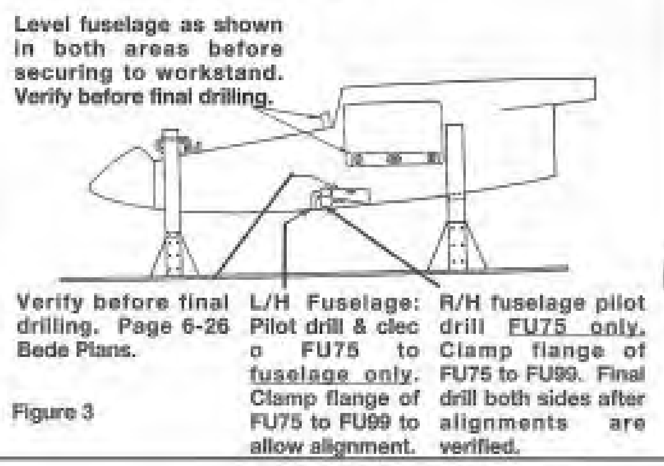


Figure 3

WING SPAR - DENSITY OF WOOD

From the Corby Starlet Newsletter

When selecting wood from a marine lumber yard or other non aircraft source, one important item to be checked is the density or apparent specific gravity of the wood, which is measured in pounds per cubic foot. In order to be able to determine the density, we must first know the moisture content (M.C.) because when we weigh the wood we are also weighing water, contained in the cell walls of the wood in the form of moisture content.

Normally, the higher the density of the wood the stronger it will be, low density wood that is, below minimum, is too weak to be used in wing spars. Military Specification MIL-S-6073 has set minimum acceptable specific gravity standards for aircraft spruce. (This Military Specification is available from EAA Information Services.)

Before you purchase a board of spruce, measure the moisture content in several places to obtain an average reading then, carefully measure it to obtain the volume.

Place the spruce on a scale and weigh it, then calculate the density, or weight, per cubic foot, check with MIL-S-6073 to make sure it is above the minimum weight per cubic foot for the measured moisture content.

If the wood you have selected has been kiln dried or well seasoned (air dried) and NOT wet or, freshly cut and still green, you can go ahead and use it without waiting for a drying period...otherwise you will have to cut it up and stack it to dry.

After the wood has been cut up into strips to be used for laminations it must be carefully examined for faults in the grain, including brashness/brittleness.

Brashness/brittleness...is a condition in wood that causes some pieces to be relatively low in shock resistance for the species and, when broken in bending state, to fail abruptly without splintering at comparatively small deflections. Causes include, reaction or compression wood (from a bent tree), juvenile wood, compression failure, extremes of growth and high temperatures.

Certified aircraft wood, MIL-S-6073 is normally checked for brashness on a toughness testing machine which breaks a sample of wood by means of a cable attached to a drum on the axis of a swinging pendulum that reads wood failure in inch-pounds, with 75 inch-pounds being the minimum breaking point.

Builders living in countries that do not have the Experimental Category may have to submit samples of their wood to a laboratory for testing.

Builders using non-certified wood are urged to test samples of their wood by breaking them in a vice or by other means, to test for brittleness, the wood must be tough and break with many splinters...any wood that snaps without splintering is considered brash and must be rejected. If any builder has doubts about the quality of the wood he is urged to get an opinion from an experienced person or, take it to a laboratory for testing.

Because the density of wood is not constant throughout the tree, individual pieces, after being cut up, should be checked for density.

When assembling the spar place the laminations with the highest density on the bottom and top of the spar, and the wood with the lower density in the center (neutral axis).

FROM THE SAILPLANE HOMEBUILDER....

Bernoulli's Theorem by Nils-Ake Sandberg

According to the talk of Mr. Jack Lambie at the eastern workshop, referred to in Sailplane Builder no. 9 1992, I want to hand over some of my results concerning Instruments in Sailplanes.

The law of Bernoulli is not meant for use outside tubes. However, in wind tunnels it is okay, but not in real flight. Bernoulli's theory is P tot = 1 + s. Total Pressure (P tot) is equal to dynamic plus static pressure. It means that static will drop when dynamic rises.

As an instrument engineer I still do not understand why the pilots are fed with these badly misued theories. The proof is more than 10 years old. The theory is not valid for a flying object in free air. It is impossible for an airplane to make a difference, measurable in pressure, to an air mass when flying through it.

As the only super-sensitive instrument in the plane, the fine-course vario, gives full reading for practically no difference in pressure at all. Blowing the pitot gave a small reading, less than 0.1 m/s due to the volume in the ASI bellows. The ASI is connected, both to the pitot and the static port and effects the vario too. (Blown at 70 km/h) Blowing the static port on and off gave no readable reaction on the vario. It means the static pressure is still the same but dynamic pressure is built up by the formula q = V 2 / 1.632 pascal.

The fuselage forces away the air which causes a low pressure reading on static ports taken from the side (at the measuring point, the pressure varies along the fuselage). It is the same effect which produces lift around your airfoil. The lift is only 1/10 of the dynamic pressure. The reason for the misreading of a side static port is simply the effect of the blocking factor. If using a thin probe the misreading will be close to zero. With the whole fuselage as a static probe it is readable (5 km/h at 80 km/h in a Moneral).

The first indication I got was that theoretical figures and practical tests were not equal. Now they are, or at least seems to be. I wrote back in 1983 to soaring Magazine about the matter. The editor made a copy of each to Mr. Les Seabold and Mr. Alex Strojnik. As far as I know many miscalculations come from the misunderstanding of the Bernoulli theory. Light aircraft with small power plants will be most affected.

(Ref.: "Industrial Instrument Technology" by J.T. Miller, United Trade Press, Ltd., 41-43 Gerrard Street, London W1V 7LP England).

AEROBATIC FLUID VENTS

To prevent hydraulic fluid spillage on hydraulic reservoirs used in aerobatic aircraft, Dan Reed of Salina, Kansas recommends to vent the reservoir with a grease gun fitting. It seems to work for him.

Bob Clarks FW 190

Technical Counselor John Barcus of Smyrna, Tennessee reports on Bob Gerald Clark's Focke Wulfe 190 replica. In 1976 Bob owned and managed the Oceola, Iowa theater and started construction of the aircraft behind the motion picture screen!!

Shows some of the nice detail work in the area of the tail. Over a period of six years he built most of the parts on the fuselage.

The unmistakable lines of a Focke Wulfe 190 tail. John Barcus reports the wood, foam and general workmanship is near perfect.

The cockpit shows some nice fiberglass work. The aircraft is being built in a small, but well organized garage. Bob is also the Mayor of the town of Osceola, Iowa!

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