Versione 11/2015

Main Contributions from different TailwindForums

WINGS

Airfoil
Jim Stanton wrote : upper curve is a Naca 4309 and lower 0006 from Bonzo. The way these are joined together is probably not very scientific. The important part is the portion forward of front spar.

Jim Stanton on 12.12.05: The thinner and shorter inboard rib results in minimum drag for a high wing installation if this is done correctly.

Jim Stanton 1.8.06
The original Tailwind wing was a modified 4309 airfoil of 20' 11" span. The 4309 airfoil has a slight reverse curve in the bottom and the Wittman mod was to make this a straight line.
Around 1962 Wittman modified this wing by changing the bottom surface to a curve, the same as the airfoil on his midget racers. This increased the front spar depth by approx 13/16". The span was increased to 22'6". The wingtips remained the original style. The spars were located 1" further aft, thus locating the wing 1" forward. This wing was simply referred to by Wittman as the "New Wing". Performance was substantially improved over the old wing, especially above 5,000" This New Wing preceded the W10 design by many years. The triangle wingtip was first tested on N37SW, Wittmans W10 prototype, which had an old set of flat bottom wings.

Jim Stanton on 22.02.2006:
The original plans airfoil is a 4309 with the bottom modified to be
completely flat. This was done mainly for spar strength as the reverse
curve on the lower surface was in the area of the front spar. The
current airfoil is a 0006 curve added to the bottom of the

4309. The
top curve remains the same. The round bottom wing is located 1"
further forward in relation to the fuselage. This along with the
longer fuselage and larger horizontal tail of the W10 solved the nose
heavy condition that some W8's had. Many of the early W8's had metal props. Light weight
starters/alternators/batteries did not exist for many years. Some of the cowlings were very heavy. I think my first W8 cowl was 30#. All of these issues contributed to the nose heavy condition. The original wingspan was 20' 11". This increased to 22' 6" on the early round bottom wings and then to 24' with the triangle tips. Wittman stated that the 22' 6" round bottom wing was slightly faster above 5000' than the 20' span flat bottom wing. The round bottom wing was first installed on N374, which was a W9L, originally 160 hp 0 320 Lycoming with Hartzell c/s prop.

On 16.01.2011, at 20:46, James Stanton wrote:
The test bed for the tips was a flat bottom wing, originally 20' 0" span, with the so called Hoerner tips, which were on the Tailwind plans at one time as an alternate tip. The taper tips increased the span to 23' 0" on that particular Tailwind. (V8)☐

Jim Stanton on 4.9.2013
The original wing on the W8 prototype used a NACA airfoil with a wingspan of only about 19' 6", there is some disagreement about the exact span but it was definitely shorter than the first W8 plans wing. This wing had a nasty stall. Steve then designed the first plans wing, a modified 4309 airfoil with 20' 11"span. The modification was to remove a small reverse curve in the lower airfoil and make it flat. This was done only to provide adequate front spar depth.
Around 1962 Steve added the 0006 lower curve to this airfoil. This increased the front spar depth by 13/16". With the original wingtips the span was increased to 22' 6". Steve called this the W8 "new wing". This is exactly the same wing as the W10 except for the wingtip. Adding the triangle wingtips to this wing increases the wingspan to 24'.
In the late fifties Steve completed his third personal Tailwind. This was the W9L, originally tri gear with 0 320 Lycoming and Hartzell constant speed prop. It originally had the flat bottom wing with the span reduced to 20'. The W8 new wing was installed on this airplane around 1963, using the original style tips.

When Steve built the Olds V8 powered Tailwind he used the original flat bottom wings from the W9L. Although he called the Olds Tailwind a W10 it was really not the same as the W10 plans. There was never a prototype built exactly to the W10 plans. Steve later added the triangle wingtips to the V8 Tailwind increasing the span to 23'. He did not like to see the flat bottom span increased beyond 23', although others have built flat bottom wings with longer span and so far there have been no problems.
The "new wing" improves the rate of climb and high altitude cruise speed, the low altitude speeds remain about the same. This is with the original short wingtips, with the triangle tips there is another increase in performance. The triangle wingtips improve the glide performance by a substantial amount.

On 16.01.2011, at 20:41, James Stanton wrote:

The 22 1/2 foot wing was a big improvement over the 20' 11" expecially in high altitude cruise. The big thing with the round bottom wing is the near elimination of center of pressure over a wide range of speeds. This resulted in reduced stabilizer negative angle which in turn improved cruise. If you look at pictures of W8's with flat bottom wing, you can usually see the distinct negative stabilizer angle. On the W10 the stabilizer angle is in the 1/2 degree range.☐

John Kahn, Montreal on 23.02.2006:
Well, having time on my hands while I wait for Callbie's wing plans, I
did some investigating by downloading a free demo of the 2D wind
tunnel, "DesignFOIL" (http://www.dreesecode.com/) and playing around with it.
It's very educational and is a quick way to understand the differences
between the NACA 4 digit and 6 series sections because you can select all the parameters, altering the profiles all you want, and run wind tunnel simulations and observe the lift, drag and moment polars etc.
When run in DesignFOIL, the W 8's 4309 (4% camber height, 30% max camber location chordwise, and 9% thick) has a very high CLmax, almost 1.7. Cruise drag is not that bad, but the killer is that it's the pitching moment that's really high, about 50% more than less cambered airfoils and would theoretically cause high trim drag.

I figure that Witt decided to try to keep as much of that CL as
possible (with the small wings) while reducing the pitching moment,

basically to find a compromise between the 4 series and the 2 series
(Buttercup uses the semi-symmetrical 2412, as do most Cessnas, which has a low picthing moment but also a low Clmax, which is not a big deal due to the large wing area).

If Witt wanted just to increase the spar depth, he could have just
gone to a 4312 (12% thick), but he would have still been stuck with
the high pitching moment with the high camber of the 4 series (the
Citabria has a NACA 4412). But making the airfoil a semi-symmetrical 2312 would have given up a lot of the lift potential. So I think he kinda went half way in grafting a 3% wide lower half of the
symmetrical 0006 under the 4409, creating a hybrid which looks to me to be "NACA 3312" or pretty close to it (never heard of a 3 series as an official designation).

You can enter the parameters for a NACA "3312" in DesignFOIL and run the wind tinnel simulation. DesignFOIL shows it as having a Clmax of 1.57, which is still really good, and a pitching moment only a little higher than the 2 series airfoils. Plus the lift curve still has a
nice gentle peak, which probably accounts for part of the Tailwind's
great stall behaviour.

So basically he found a compromise between two competing goals in a totally unique way, using the existing tried and true wing sections.
If you look through the airfoils vs a/c type listed on the UIUC site
(http://www.ae.uiuc.edu/m-selig/ads/aircraft.html), you won't find
anything listed as a "NACA 3xxx", just the 4309/0006 combination shown for the Tailwind.

Are the differences enough to actually notice in the airplane? I
guess that because of variation from airplane to airplane, the only
way to know is to fly the same a/c with the different wings and
measure the results.

Jim Clement on 6.12.2011: Whatever rib plan you have will work fine as long as the spar height and spar spacing is as plans.
I've had several of the original Wittman plans rib drawings and they all varied slightly, just even out the variations to make a smooth transition between the stations. Of the at least three rib jigs I've used, all slightly different, they all flew the same.
I believe the differences were common errors in copy machine and not using one original to copy.
Jim C

Rib Construction

Dave Conrad on 21.5.07: Birch is harder to glue, it has a hard "waxy" finish. I did use birch for gussets but hit the sheet with 80 grit to scuff it up before cutting the gussets. I guess I would not consider it for wing sheeting.

Wing assembly

J.Cl on 18.07.2008:
Jim□It is easy to remove the staples if the ribs are off the spars but not □necessary except where the corner blocks will be placed. Don't install the □corner blocks until all the ribs are glued in place and the glue cured. Make □sure the corner blocks are slightly shorter than the spar depth, they will □not easily sand off later.□Pre nail the corner blocks using 7/8 - 1" 18 gauge brads. This can be done □by making two 45 degree cuts in a board to form a V to set the corner blocks □in.□□To glue the ribs in place, mark the spars where the ribs should go. Slide □all the ribs on. Glue the inboard and outboard plywood covered ribs in place □and let cure. then place all the ribs in place and pre drill the leading and □trailing edges and ribs for # 6 screws. Put the trailing edge in place and □start the screws but leave 1/2" space between the rib so glue can be put in. □The ribs are positioned 1 rib width to the side of the marked permanent □location. Put glue where the ribs will be, then slide the ribs over. Start a □1" brad in the cap strip over the spars, these will be partially driven in □to hold the ribs in place while curing and removed later. Make sure the ribs □are square vertically to the spars.Glue and screw the leading edge on.□Jim C□

On 26.08.2009, Jim Clement wrote:
Keith□Just go over the areas of West lightly with 80 grit sandpaper to level off □any nibs to get a flat surface. Make sure the corner blocks are slightly short so they are below the top surface of the capstrips and spars.□ It is hard to sand the ribs flat without scalloping when sanding over the end grain of the corner blocks. Also, over time the spars dry out and □shrink some. The corner block being vertical grain don't shrink the same and

☐will eventually print thru the skin and make lumps in the plywood.☐Jim C☐

Wingtips W 10 :
Dan Hall in EAA chapter 515 newsletter may 2003: Steve told me about the time that he decided to try out the modified August Raspet triangular wing tip design on his Tailwind. He decided to just build it on one wing tip in case it didn't work and wasn't worth the effort. When he taxied out, the tower called him to ask if he was aware that he had to different wings on the airplane, which he acknowledged. During the takeoff run, the new wing tip lifted first. He had to keep feeding aileron into it until it stabilized. He still had aileron reserve by the time he took off. So he continued the flight, satisfied that he had a winner. Steve had that kind of experience and confidence.

Wing and Wingtip venting
J. Cl. on 17.2.2011:
each bay is vented to the adjoining one and final vent is the area of the aileron counter balance area.
Jim C

Wingtip construction
comments by Jim Stanton on 8.4.07
The large block on the last rib was also used to mount the position
light on the old style wingtips. The spruce drawings show the leading
edge false spar as 3/8" chordwise dimension. This should be at least
1/2" and preferably 5/8". The rib nose block should be moved aft the
appropriate amount to compensate for the wider false spar.

Root rib question
To Alex Frizell on 22.8.06
Alex, Make the bottom of the root rib flat or the top of the door will have to be lower. This also cuts down your line of sight when looking out under the wing. Take one of your regular ribs, run a straight edge on the bottom most rear end of the rib to a line 13/16" up at the main spar location. Extend the line to the front of the rib, this will be the correct shape for the bottom of the root rib. Conform the top of the root rib to best match up with the windshield side bows. I like to cut a root rib pattern from 1/4" plywood with the spar cutouts, makes it easier to see

what you have without doing a lot of thinking in your head and getting more confused. Jim C

Rear Spar Warping .
J. Cl on 12.2.06 A slight bow in the rear spar is not uncommon. If the trailing edge spar has a slight bow also, fasten it on opposite the bowed rear spar. Glue the wing up including the trailing edge and leading all at one time on your table or saw horses. Anchor the tip and root ends and shim or clamp the center to take the bow out before the glue sets up firm. I assemble the complete wing leaving the ribs one rib width off to one side on the spars. Tack 18 gauge 1" long brads slightly in the top and lower rib capstrips over the spars. This makes holding the ribs in place while the rest of the wing is assembled. Put glue on the areas where the ribs will be positioned, slide the ribs over and drive the brads in but not all the way. You will remove them later. You will have plenty of time to square up the wing before it sets up firm. Jim C

Wingspan
J. Stanton: First TW s were 19 ' 9 " with quite nasty stall. Then 20 ' 11 " In the sixties on N 374 22 ' 6 " with later on the tapered wingtips and 23 ' wingspan . When modifying the 22 ' 6 " with the new wingtips they ended up with 24 ' removing one rib bay on each side.

Scarf Joint
Jim Clement says : 3/4 scarf on top is about right. On the bottom sand the scarf on the wing skin only and let the tip skin overlap and trim off after the glue sets. I use 80 grit sand paper.

Skinning the wings
J. Stanton on 1.6.06:
1. Wet skin on outside only. Plastic tape or something similar
around edges to keep water off gluing surfaces. Wet towels to keep
the skin wet for several hours.
2. Have a means of quickly locating the skin in reference to the
front spar (1. Place skin in exact position. 2. put 2 nails without head through skin at each end of the wing into the spar before glueing take of the skin leaving the nails as reference.)
3. NO microballoons-West sells a thickinner which is ok

4. Mix glue in small quantities, fresh cup for each new batch.
5. Nail/staple front spar first, then work along all ribs evenly to rear spar and trailing edge, then evenly along ribs forward of front spar to leading edge.
5. No need to spread glue on entire skin for lower skins. Glue/varnish can be applied to lower skins later.
5. I have done a 4 x 8 skin by myself in 50 minutes. This requires being super organised. 1 or more helpers works much better.
6. I did my last skin in an air conditioned room with the temp about 55 degrees. I then turned off the air and used a small heater and tarp to raise the temp to about 120 degrees for about an hour. This is how I was able to do the last skin by myself
7. Make a couple of glued samples from scrap wood.
8. When you get to the top skin the rear spar will be bowed noticeably from the lower skin shrinking. The spar must be clamped straight while installing the upper skin.

Q from Michael Corso on 3.1.09 :☐I have been looking over the plans (ACS) getting ready to assemble the☐wings. After laying out the rib locations and talking with Jim C, I☐moved rib 13 in 1/4 inch so as to use a 4x8 sheet of plywood from the☐root rib to rib 13. My question is if I am seeing this right, keeping☐the plywood square to the spars the plywood will fit correctly over the☐rear spar and cover completely the cap strip of the root rib, but be☐short when pulled down the taper of the front spar. I believe this will☐happen when skinning both the top and bottom. Is this true? what can I☐do to adjust for this. Or am I not seeing this

A from J.Clement on 3.1.09 : Mike☐the bottom skin will fit, if it is a little short put the short end at the☐tip.The scarf joint when you glue the tip plywood on will cover it.☐The top skin small triangular piece will be a separate piece, cut it so the☐grain is parallel to the angled leading edge. If the plywood is short on the☐top glue a 3/8 x 3/8 doubler on the inside of the end rib.☐ Yes, scarf the triangular piece.☐Add the 3/8 piece only if the plywood doesn't cover the rib.☐

Jim Clement on 27.2.2011: The spar shrinkage was in reference to the triangler rib corner blocks. On some older Tailwind and Cassutt wings, I have noticed when the corner blocks were sanded flush with the top of the rib capstrips they would shrink at a

lesser amount than the spars. This would leave a very noticeable bulge in the skin, that is why it is recommended to make the corner blocks about 1/16 or so shorter than the spar height. I believe this is because of the grain direction difference.

25.12.2013 Jim Stanton wrote:
I have reviewed the W8 plans, the Wittman W10 plans and the Spruce W10 plans. The horsepower/wing skin note was something arbitrarily inserted by Leblanc who knew NOTHING ABOUT TAILWINDS. The skin callout on the Wittman W10 plans is 1/16 45 degree OR 3/32 90 degree. The 1/16 45 degree plywood is fine for all horsepower engines. I prefer the 3/32 90 degree because it comes out smoother. Okume is better yet.
Regarding the comments about fiberglass over plywood, N564DF was built in the late 60's. It had around 1800 hours on the airframe the last I heard. This is a modified W8 with 0 360 and Hartzell prop. It is VERY heavy and has probably flown at gross weights around 1700-1800# for much of its life. It has fiberglass over the plywood on the wings. Three layers of cloth inboard, tapering to one layer outboard. The wings were repainted once to change the color, otherwise they are completely original. I last saw the airplane when it was thirty plus years old and the wings looked like new. The fiberglas is most likely boat cloth and Poly resin.
The 1.4 oz deck cloth with epoxy resin over the plywood skin has become the standard for most Tailwind builders.

Fiberglassing
J. Clement wrote: Squeegee one coat of West System on bare wood. After it cures lightly sand just enough to remove dirt. Tack rag the wing and cover it with 1.4 oz cloth. Pour West System on and squeegee from center out. Squeegee two or three times. Trim the leading edge off 1/2 " - 1 " past centerline and brush down. Don't go around the trailing edge with the cloth.

J.Cl on 24.10.09 :
Use 1.4 oz deck cloth. Overlap the leading edge 1/2 - 3/4", this should be done on the curved part. Flap-aileron area the cloth should wrap around for □a overlap also. This can be held in place by stapling a thin strip of wood that has been covered with clear packing tape to hold the fabric in place. Trailing edge of wing tip hangs straight down and trimmed after the resin cures, don't wrap around.□Jim C

On 25.11.05 J. Cl. wrote
For sure use lightweight fiberglass over the plywood, this saved a good
friend of mine after a blade came off his prop on a Cassutt. He clipped a small power line while setting up

for a landing on a road. The shock of
the wire and when it broke shattered all the glue joints on the top skin of one of the wings. All that held the skin on was the cotton fabric that
was doped on over the plywood. Skin was glued on
withWeldwood plastic resin.
I have had best luck using West resin to glass the
lightweight fiberglass cloth onto the plywood skins.
Squeegee a first coat over the bare plywood,
lightly sand after it cures.
Lay the cloth out on the wings dry and run your hands over it to remove
wrinkles. Let about 6" hang over the edges. Mix up a 4 pump batch [4 of
each] and pour it out of the cup onto the center of the wing and start
squeegeing out in all directions, After you are finished with that,
squeegee it again so there isn't any wet looking shiny spots. Try to get
the trailing edge tucked and stuck into the flap-aileron area. The leading
edge, cut the overhang of about 1/2" or so past the C/L part of the
leading edge. Glue it down. Same on the leading edge of the wingtip.
Trailing edge of wingtip, soak up the overhang some and let it hang to dry. Do the same to the other side but first sand and feather out the
leading edge area to be lapped, it should be lapped 1/2" past C/L for a total of 1" If you lap it farther back in a flatter area it is hard to hide.
After this is all done, fill the weave using more West
epoxy squeegied on,no wet looking or puddled spots, sand
lightly with 150 - 180 grit and repeat until the weave is
filled, Prime with a double coat of urethane primer. Don't
try to fill imperfections with the primer, fill them with
West. Urethane primer is real expensive, $140 - $180 a gallon and is also
heavy. You might get 1 double coat from 1 gallon,

J.Cl on 28.10.2008:
Wrap the fiberglass around the trailing edge. To hold it in
place, put clear packaging tape over a strip of wood about
1/8" thick and staple it over the fiberglass. On the
leading edge let the cloth hang over until the resin is
applied and squeegeed out, then cut off about 1/2" below

centerline and stick down.□□Drain holes can be drilled after glassing. Using a 1/8" bit, drill holes □parallel with the bottom skin thru the trailing edge spar just above the □skin. Seal up the holes with West using pipe cleaner swabs.□Jim C□

21.2.04 Dave Conrad's wing glassing: 1. coat epoxy resin on one wing panel: 7 oz. , 2 coat : 2oz., and 3. coat 1,5 oz.

Inspection holes
J. Cl. on 25.11.05
Forget the inspection holes, if you have to get in later cut them in then.

Wing Weight
Jim Berry's TW 10 : 63 lbs each covered with fabric and doped no fiberglass covered with birch plywood.

J.Cl. on 1.12.06 concerning wings * 10 . Removed clamps and staple strips this morning.Weighed one wing, 52# as pictured. Ribs were made from Sitka spruce, the rest Douglas fir except for fillers and wing tip framing. That was clear aspen from Menards. Aspen works real good as it sands real easy and glues well. I thought they would weigh more, pleasant surprise. Jim

On Jan 13, 2008, at 3:27 AM, Jim Clement wrote:
Weighed a wing.
Wing with no epoxy or fiberglass, no picture. 52 lbs
Wing with 1 coat of West, lightly sand. 1.4 oz fiberglass put on, 1 coat.
lightly sand. 2coats West, lightly sand between coats to fill weave. 56 lbs
With aluminum aileron and flap 64 lbs
I used Douglas Fir for front and rear spars, leading and trailing edges and
clear Aspen for the rounded nose. Ribs are Sitka Spruce.

Red Hamilton on 27.11.08:

Mine were 58 each with paint, ailerons and flaps.They have 3/32 ply, one layer of deck cloth with West, then paint. Flaps and ailerons are fabric covered with Stits.
Red

Malcom Lovelace on 27.11.08

54 to 58lbs. depending on what plywood you use for sheeting.

Surface Finish

Jim Clement on 11.7.2010: I wait at least 24 hours between coats. I think the biggest mistake made is □not sqeeging enough and leaving excess resin on the surface. The first coat □over the cloth should be gone over at least twice with the squeegee while □wet and should show no wet looking areas when finished. The fill coats □should be squeegeed smooth as if trying to remove the resin. If in doubt □about bond, go over the surface with acetone or mek first. I lightly sand □between coats with 150 or 180 grit dry paper.□Jim C□

J.Cl.: The smoother you get the fiberglass cloth the less primer it will take. Squeegee West epoxy over the glass evenly or use a small paint roller. After curing, lightly sand with 150-180 grit paper and apply another coat or until the weave is filled. Filling the weave with West takes ounces on a side where filling with urethane primer will take gallons @ 140$ a gallon and weighs 12 pounds per gallon. Another good way is to use Featherfill, a sprayable polyester primer that has catalyst added. You need a spray gun with a large nozzle opening.

J. Cl: After you spray the primer on, using a fast dry spray can of black, fog a light mist coat over the urethane. This will be a guide coat for sanding. Sand with 400 grit until all the black is gone.

Farmer John on 23.5.07: Go to http://curedcomposites.netfirms.com/finish.html and there is a solution. It is about 6 pages long, so if you have a friend with high speed internet, it will load a lot sooner. I still believe the golfball and vortex theory and I have both built right in. This morning I will throw ! a light finish coat on to mirror the folly and if you don't get a chuckle out of it, we will call the undertaker' as you are dead and don't know it. Farmer John

Brian Alley on 4.4.08: Loehle sells a product called Wonder-fil. It is applied like paste wax and dries to a white powder. Wipe off the residue and all open pinholes are filled. The Wonder-fil will pull solvents from the next sprayed coat and becomes chemically bonded. I use it on freshly sanded bare composite parts and have found that it fills all of the remaining fabric weave as well as the pinholes. Awsome product.

Wet Wing

J. Clement on 29.1.06: There is a lot more to a wet wing in a TW than coating the inside with Proseal and adding six feet of tubing. My 32 gallons alu tank weights 11 pounds, it would be hard to build any type of fuel tank in the wings that would weigh less. Each rib bay from front spar to rear spar would hold only about 3 gallons, that is a lot of weight to be supported by glue joints on a ½" capstrip in 6 G turns without bulding some type of fuel tank inside the wood wing.

Wing Spar Fitting Location

J. Cl. on 5.3.06: The bottom of the root rib should be parallel with the bottom longeron directly below the door. If you have interference with the flap spar hitting the top longeron, lower the rear fitting. Up to 3 degrees positive incidence is OK. I usually make a root rib pattern from ¼" plywood and mark on it where the fittings go. You can hold it on the side of the fuselage to get a better idea where you are at.

J. Cl. on 14.3.06 : The bottom shape of the rear spar at the root rib is slightly different than the other ribs. Draw a line from 13/16" up from the bottom of the front spar to the bottom of the trailing edge That will tell you how much to trim the rear spar on the bottom. Then center the rear spar fitting on the spar. The upper curve of the root rib plans drawings is way off if you plan on making a decent fairing strip between the wing and fuselage. Make up a temporary flat bottom root rib from 1/4" plywood and shape the top to match the windshield curvature until it falls lower to go under the top longeron.
If your rear spar holes are in the wrong place, glue some wood dowels in and redrill. If this still bothers you, remove the plywood plates and place new ones over the redrilled holes.

Jim Stanton on 16,3,06: I just took another look at the Spruce plans and it appears that they do not show the proper location for the front or rear spar fittings. If you build the fuselage to plans the front wing fitting location will be 5/8" above the rear wing fitting.(note that the rear carry through tube is 1 1/2" plus or minus below the upper longeron centerline) Allowing the rear spar carry through tube to float until wings are fitted allows some

variance in this dimension, however it may be necessary to use this to obtain clearance between flap tube and upper longeron. If you make a drawing as Jim Clements described, using the top line, measure up 5/8" for the rear fitting centerline and 1 1/4" for the front fitting centerline. This is about 1/16 different than the old plans and allows 1/16" clearance between the rear wing fitting and the butt rib lower capstrip. It will allow a good match between the cabin roof/windshield and the butt rib.

Wing Incidence

Rick Crossling: wing incidence is set by leveling fuselage, getting the wing on with clamps, and placing a level under wing with a 13/16 " spacer under rear of wing. Then adjust to level and drilling through attach fitting. Horizontal stab leading edge is 1 " below fuselage longeron.

Brian Alley: The wing was set as close to 0° as the flap torque tubes would allow. I believe my wing is in a 1° positive angle of incidence. Leading edge of stab 3/8 " from upper longeron -- about - 2°.

J. Stanton: I started my first TW in 1961. In those days it was generally accepted that the incidence was 0°. With the newer round airfoil it is quite difficult to figure out the real centerline.

Jim Stanton on 22.3.06: I spent quite a bit of time over the weekend looking at all the various Tailwind plans, pictures etc. Wings built to Spruce plans-flap tube will not clear longeron. Wing will be at least 7/16 high at front spar , rear fitting will require 1/16 notch in butt rib lower capstrip front spar lower taper- 7/8 dimension on plans should be 13/16

Jim Stanton on 8.1.2012

Wittman talked about this quite a lot, especially on the tri gear with the 320 Lycoming. He believed the optimum incidence was zero, especially with the larger engines. I think he believed he had zero incidence but in reality had from about .8 degrees to as much as 1 1/2 degrees. I measured Tailwind # 1 at approximately one degree. I think the "new wing" on N374 was closer to 1 1/2 degrees. I have about .8 degrees on my W10 project. The chord line on the round bottom airfoil is somewhat of a guessing game. If the taper on the lower spar surface between rib #1 and rib #2 is close to

13/16, just make the bottom of the #1 rib parallel with the lower longeron. An additional factor is that zero incidence will affect the top of the cabin where it joins the wing. A zero incidence wing MAY NOT fair as nicely into the fuselage behind the wing as would a one degree incidence wing.
I have built Pitts S1's with the standard 1 1/2 degree incidence and with zero incidence. I like the 1 1/2 degree better. It is a bit slower on a three point touchdown.
I spent a lot of time working out the proper fuselage dimensions and wing fitting locations. All this is shown in greatly simplified form in my builders manual. The W8 plans were pretty good in this area, the Wittman W10 plans not so good and the Spruce plans are a disaster.

On 03.06.2012, at 01:50, Jim Clement wrote:

Try putting the 13/16" block on the trailing edge spar, where the aileron hinges bolt to. That's where I measure mine. Not sure if the metal wing is the same but presume it is.
The initial wing incidence setup is measured using the front 18" of the lower longeron as zero. Because your fittings are already welded on and have some negative incidence, that is the reason to use wing incidence to set the stabilizer not the lower longeron. What you have is no problem.
Jim C

Farmer John on 3.6.2012

Dave, I used the wing position shown on drawing 2-108, it shows the bottom ☐of the flat bottom wing parallel with the bottom longeron, minus the 13/16th ☐of the addition for the new airfoil then added the 1/2 degree nose up. It ☐measures from the bottom of the wing at spars, to the bottom of bottom ☐longeron; rear 37 5/16th inches and front 37 inches. Like Jim stated, there ☐is no CL shown on the wing drawing, so it is pot luck on the outcome. As a ☐side note the top of the fuselage is about 21 sq. ft. to add to the lift. ☐Just remember Bernoulli says there is an anti gravity up there sucking us up ☐from the ground when we fly, only if you are gullible. Too bad his theory ☐didn't work on the space shuttles, it would have saved a whole lot of fuel. ☐Farmer John☐

Corrections of wing incidence

If you have the wing fittings installed and the fuselage built-lower the rear carry thru tube so the flap tube

clears the longeron and accept whatever incidence this gives

If you have the wings complete but have not built the fuselage-lower the top of the fuselage at stage 24 by 1/2" lower the rear carry thru tube as necessary for flap tube clearance

If you are just starting. Measure before tapering spars,locate front wing fitting up 2 1/8" from bottom AFT surface of spar before tapering spar,
locate rear fitting up 7/8" from FRONT lower surface of spar.

Move rear spar carry thru tube as necessary to obtain 1/8 clearance between flap tube and longeron.

Jim Stanton on 22.3.06: The posts on Mckennas W10 got me thinking about this. Mckenna dropped the leading edge of the standard Tailwind airfoil, I believe by about 1/2" This is similar to what Wittman did on the O & O. Since the chord line is from the center point of the leading edge radius to the center of the trailing edge, does this not reduce the angle of incidence???

Keeping the front spar fitting at the same location on the fuselage and lowering the rear fuselage fitting would result in the following numbers

1 degree at rear fitting	.42"	at flap tube	.5"	
2 degrees "	.	83	"	1.0
3 degrees "	1.25	"	1.5	

I would hope everyone would agree that tapering the side window by 1 1/4" (3 degrees incidence) would be very obvious just eyeballing the airplane. I think it is safe to say that the vast majority of all Tailwinds have incidence somewhere between 0 and 1 1/2 degrees with most being slightly under 1 degree. If you lower your wing by 1/4" at the flap tube to gain longeron clearance you have only increased the incidence by 1/2 degree.

One wing heavy

Paul Baron on 26.6.06: you may want to try raising the other flap, rather than loweing the flap on the heavy side.

Q: This is the Yellow Tailwing that is in Maryland. This is mostly for Jim C. but any other help will be appreciated. I have a heavy left wing. Jim tweaked the left flap(let me know if this is correct Jim) down slightly. Well when I fly, it bugs me to see this down, even though it is very slight. I took out the tweak and the wing is nice
and heavy, for a tailwind, so I cranked in left aileron down, and right aileron up, and that helped some but the left wing is still heavy.
So my question is, what is the best way to eliminate the heavy wing. I was thinking that to split the problem between all four of the
control surfaces would be the best however, I suppose the ailerons would be the most effective and the flaps the least, due to the ailerons being further from the aircraft axis. Oh course speed is
always a factor so I want to do the least invasive thing that will affect the speed, if this is even a factor. So other then that, thanks a lot and keep the oily side rotating.

A by J. Cl on 09.02.2006:
Jim, first, put the ailerons back to neutral position. They have no effect on wing heaviness. If you don't want to adjust the flap to raise the left wing, the easiest way is to put a tab on the bottom of the right aileron. Make the tab from thin aluminum 1" x 3". Bend a 90 degree angle 3/8" the long way on the tab. Tape it close to the trailing edge of the aileron with the 5/8" side facing forward. Adjust the size until it flies the way you want. The other way is more involved, it would require lowering the rear of the wing to increase wing incidence, much more work that way. That would involve messing with the rear spar fitting. Make sure your rudder is in proper adjustment before working on wing heaviness. Center the ball with your feet and see if the wing drops. A simple spring on the aileron linkage works also.

Gaps between Rudders
recommended 1/8 "

Aileron Tubing
Jim Cl. wrote 5.3.03: I use 6061 T6 X .058. If you are really trying to save every ounce, use .035 wall. Make alu bushing with a 3/4" hole for the aileron tube. Also use alu for the inboard end. Prime the steel 3/4" tube where it fits

into the bushing, epoxy and rivet in place.
I also use 6061 T6 .025 for doors and other panels

Ailerons and Flaps
Free up the hinges just enough so they turn freely with a little oil. Put an oil hole in the top. Don't need a washer between flap and aileron. Make the center bearing in the flap extra loose and taper the outboard end so the 3/4" aileron tube slips through easier. Mask off where the bearing go, spray a light coat of zinc chromate on the 3/4" tube. Grease the whole thing when you do final assy.

Don Mildebrandt Q on 9.4.06: When I tighten the flap horns the aileron become stiff. When I assembled the flaps and ailerons they were free and moved with no binding. When I loosened the flap horn comp. bolts the ailerons move fine.

Jim Clement on 20.4.10
Jim☐Nylon type material will work fine for the outboard and center bushings. If ☐used as the inboard bushing the flap arm when tightened will compress the 1- ☐1/4" flap tube and bushing creating drag on the 3/4" aileron tube. I use ☐aluminum but bronze will work fine. The center bushing should have a bevel ☐on the outboard side to help center the aileron tube during assembly. Also, ☐make the center bushing a loose fit.☐Jim C☐

J. Cl: A: If the bushings are plastic, make them from aluminum. If they are alu or brass, put them in a Lathe and increase the I.D. slightly. It's a common problem.

J.Cl. on 7.4.04: The center bearing in the flap should have a sloppy fit so it doesn't bind up!

J.Cl on 13.1.07: Earl, Using steel hinges on aluminum makes a better bearing than steel on steel, oil is all that is needed. A good example is steel camshafts running in aluminum engine cases without insert bearings. Jim

Jim Stanton on 20.5.2015
I like the black, lubricated nylon material for the bushings. I fit the 3/4" hole with minimal clearance, probably .002 or less. Using a piece of 3/4 tubing for an arbor in a lathe, I turn down the outside diameter, .001 at a time. Each time I fit the bushing in the flap tube, tighten the arm and check for freedom of movement. You will wind up with somewhere between .005 and .010 clearance between the nylon and the flap tube. I have never measured the difference but I believe the aluminum tube probably

compresses more compared to the steel.
The aluminum bushing works fine but will require more frequent lubrication and is a potential problem with dirt/dust in a desert environment. In this environment the metal can bind, the nylon, properly installed, will not.
The black nylon is available from MSConline.com.

Red Hamilton recommends: you could try some moly-disulfide assembly lube.

Q: Do you put an extra layer of fabric where the flap-aileron and the elevator horn tube goes through fabric ?
John D
A: J.Cl: yes.

Q by A. Frizell to Jim CL. what size bolt do you use on the flap hinge that you make, 3/16 or 1/4?
A on 15.10.06: ¼

Metal flaps an ailerons
Q what size rivet do you use on the flaps and ailerons?
A from J. Cl.: 1/8" pops will work but make sure they are short so the 3/4" steel aileron tube will clear the rivets inside the flap spar. Also 3/32 or 1/8" bucked aluminum rivets will work using a long solid steel bar slipped into the aileron and flap spars used as a bucking bar.

Q on 5.12.06:Any tips on rolling the .025 flap & aileron skins around the torque tube. Thanks, Mike N1066Y
A by J.Cl: Mike, I put the bend in the trailing edge and put a slight bend to fit the 1 1/4" tube in the front cut edges. The front edges are riveted with 1" spacing. Jim

Jim Clement on 13.1.07 answering Skip Steward about alu ailerons and flaps: the aileron torque tube is 3/4' x .035 4130, same as plans. You can
either make a bushing to insert into the aileron to reduce the ID to 3/4' or
weld up a fitting to weld on the end of the 3/4" torque tube to fit in the 1
1/4" aileron spar. Sounds like you have the correct material.

Q: from Jerry: What type aluminum is called □ out for the TW flap and ailerons as built by JC.

A: by J. Cl on 27.10.08: 6061-t6□.020 or .025□

Jim Clement on 2.8.2012
2024-t3 will crack when bending the trailing edges unless a very large radius is used. 6061-t6 will work much better and also used for the boot cowl and doors. Ailerons and flaps .020 or .025 6061-t6.
Doors and boot cowls .025 6061-t6.
Wood wing tips, taper out to tip in a smooth transition and look right.
Jim C

Aileron Balancing
Jim Stanton on 26.1.06: The paper cup and led shot is the way factory aircraft control surfaces are balanced. This is done off the airplane on a balancing rig. The cup is located a specific distance from the hinge point and the specs are in inch ounces. Obviously there are no specs for the TW. This would just be a method of balancing both ailerons and elevators the same.

J. Cl.on 15.10.06 I balance the ailerons on a bench. Two upright pieces of metal and set the aileron on. If you make the counterweight 5/16" thick steel plate shaped like the wing it will be real close. That is if making aluminum ailerons.

Jim Stanton on 28.04.2009:
I started out in the early sixties to build a Cougar. I had the wings fairly complete when I went to the EAA flyin(then in Rockford) and very quickly realized that the Tailwind was a much better choice. So I finished the airplane as a Tailwind with Cougar wings. There was minimal if any information on aileron balance on either the Tailwind or Cougar in those days. I wanted the ailerons 100% balanced after covering and painting. This IS NOT what Wittman later recommended and is not how most Tailwinds are balanced. To achieve this I made the balance weights removeable so I could add or remove weight easily. This worked fine until I landed one day and found one counterbalance missing. My thinking was that it flew fine so I removed the other counterweight and kept flying it. One day I was doing a low pass, at or near VNE, in formation with a friend in another homebuilt. I got some of his wingtip vortice and my ailerons fluttered instantly and violently. The only thing that saved me was that I

thought the metal prop broke and I pulled up agressively and closed the throttle simultaneously. The flutter stopped almost immediately. I added some power and turned on a downwind to land. The ailerons felt different and when I looked at the left aileron it was not moving when I moved the stick. I landed uneventfully. The G meter showed plus and minus 6.5. One "arm" of the left aileron bellcrank was broken. The ailerons had moved so far past the stops they punched small holes in the top fuselage fabric. ☐Wittman first encountered severe flutter on the Chief Oshkosh in one of his first races with the airplane. He later encountered flutter with Little Bonzo but I don't know how severe. Torque tube ailerons are inherently prone to flutter. I lost two good friends form flutter in aerobatic monoplanes. Both had torque tube ailerons. Ground vibration testing later proved that the tip balances on the first airplane were not adequate. A mid aileron span balance was added to other airplanes of this type and the problem was solved.☐I know of one other case where Tailwind ailerons fluttered and broke both rear spars just outboard of the fittings. The wings otherwise stayed together and the airplane landed safely. I don't know what caused the flutter. ☐Wittman called for the ailerons to be balanced before covering. After covering and painting they would be "slightly" tail heavy, which it what he believed correct. Every factory airplane of similar or higher speed that I have studied calls for the ailerons to be balanced 100% or slightly nose heavy. ☐

Aileron Differential Movement

J. Cl on 13.6.03: Guido the ailerons are so small differential doesn't make much difference. At cruise, moving the aileron up or down ½" will result in a steep turn with no yaw.

Jim Stanton on 16.5.2011:

Because of the very small size of the Tailwind ailerons, differential travel has little if any effect. The Cougar is an entirely different system that uses mostly cables for the ailerons. ☐

J. Cl on 26.3.10: This is the position of the aileron arm in full down position. When up it just misses the top fuselage fabric. I don't have a smart level here to find the degrees of travel. Measuring from the trailing edge of the flaps to trailing edge of aileron, up is 3 1/4" and down is 3". The lower aileron bell crank I think is 90 degrees, I've made the angle different several times but they all seem to work ok. One other thing, the arm length is 4 1/2" hole centers.

Dave Conrad on 26.03.2010 wrote:

Thanks Jim, I'm working on the pushrods this week and thought I'd ask what the thought on it was. If the crank on the aileron torque tube is

located down far enough to get 36˚ of up it may go over center to get the down throw 27˚ to plan spec.
Jim C what do you work yours out to be?□□

J.Stanton on Mar 25, 2010:
Dave- Unless you make a radical modification to the aileron bellcranks you will get little if any differential. The bellcrank angle would have to be around 55 degrees to get the specified differential. I made some bellcranks of approx 55 degrees, they are now going in the junk pile because of my concern of the system locking overcenter. The Tailwind flies just fine with no differential. □

J.Stanton on 26.03.2010:
Another issue with the aileron controls: The Wittman W10 plans show the arm at the aft end of the stick/torque tube assembly as 5" long. The Spruce plans show the arm as 6" long. This makes quite a difference in control stick travel-side to side. Make the arm 5" long or if you have the torque tube welded in place change the short arm(increase the length) on the bellcrank so that you have a reasonable amount of stick travel for full aileron.Also make sure that the bellcrank will miss the fabric on the bottom of the fuselage with full travel.

J.CL.ON 26.5.2011
This has been brought up before. My first three TWs had the straight rear door post. TW # 4 was the first with the large door and the CAFE tested Tailwind. It had the 110 edge bellcranks which resulted in no aileron differential but flew exactly like the first three with no adverse yaw. Several were built like this.The latest TW has 90 degree bellcranks and flys like the rest, travel is 2 3/4" at the tip of the aileron up and down from neutral. 36 degrees up and 36 down travel. It will make a ball centered turn using aileron or rudder only.□> Later, Tailwind 3 was changed to the larger door opening and the original bellcranks were just inverted. It also resulted in no change in yaw.□> The TW ailerons are small, 35" with a average chord of about 5 1/2" but will make a steep turn with about 1/2" of travel at the tip, very little increased drag on the down aileron.□> Jim C□>
□

Push Rods

J.Cl: Only 4 Heim type rod ends are needed on the mod to the controls. They are on the aileron arm on the stick to the left and right bellcranks. I use welded clevis type on the flap and aileron rods that go up to the wing. The plans built will work fine instead of the welded clevis type. The clevis type are the easiest as you just push them in a .035 x 3/8″ tube and weld.

Rear Spar Detail
Jim Clement wrote 5.3.03: The bottom of the root rib should be parallel with the bottom longeron directly below the door. If you have interference with the flap spar hitting the top longeron, lower the rear fitting. Up to 3° positive incidence is ok. I usually make a root rib pattern from 1/4" plywood and mark on it where the fittings go. You can hold it on the side of the fuselage to get a better idea where you are at. There is a slight taper from main rib #1 to flat at the root rib, the root rib is flat on the bottom from the front spar to the trailing edge.

Wing Fittings
J. Cl. on 9.2.06: Wing spar spacing is 24 " for both trigear and tail drager. I like to bolt the fittings that will be welded to the fuselage on to the wings. Hang the wings on , position them where you want them and tack weld to the fuselage.

Spar-Strut Fittings
J. Cl. on 19.2.06: Use the strut fitting angle as drawn on the plans. This angle is accurate on the original plans. Make shure the bottom hole in the fitting, where the strut bolts on, is low enough from the wing with the plywood on to get the strut in place. Most people place the birch plywood spar doublers grain parallel to the spar. The top hole in the spar where the strut fitting bolts on can have a bushing thru the spar. It would have an i.d. of 3/8". This is an option the original Wittman plans didn't call for. It is a good idea to seal the inside of all holes drilled thru the spar. I use pipe cleaners dripped in West epoxy to swab the inside. After it cures you can run a reamer thru o the bolts fit.

M.Wilson on 12.2.06: I built essentially per plans, except I sectioned a piece of ½" rectangular 4130 tube available from Wicks. The wall thickness was thicker than .072. I also welded the reinforcements per plans.

J.Cl. on 4.11.07: Main spar fittings are fixed with nylon lock nuts only , no safety wire.

Jim Stanton on 21.7.08 The proper strut wall thickness is .049. The .058 is one of many errors on the ACS plans.

Struts

Rick Crosslin argued on Clevis fittings on 10.3.04: The Clevis designs when and not if it gets wet, will dry and can be inspected, and even wire brushed and repainted if necessary. More than one OEM strut even appearing to be adequately welded has been found with moisture and rust inside. To expand on such matters I will not reinforce the strut tube with a piece of wood driven inside. Wood always has moisture or will absorb water like a sponge! My struts are doubled with a length of 7/8 x .049 tubing, secured with rosette welds at each end, Two of which are under the reinforcing patch.

On Nov 11, 2007, at 3:12 AM, Jim Clement wrote: The wood insert is for compression buckling of the struts.Douglas Fir ¾ " would be good Jim

Jim Stanton on 21.07.2008:
Wittman recommended hardwood instead of spruce for slightly better □compression strength. The 2 3/8 x .049 material is equivalent to 1 3/4" □round in tension and 1 1/8" round in compression. No need to use □anything heavier than .049. Maple or oak from the local lumberyard is □fine for insert.

Jim Stanton on 22.07.2008:
N223A which is at the mini museum in the historical site in Pawnee City □NE has the small struts. It has around 3000 hours. The former 100G □still has the small struts, tested to 3.8 negative G. Wittmans first □two Tailwinds, along with several others, had the small struts. The □large struts are Cessna 120/140 strut material. Wittman was a Cessna □dealer and probably got the material cheap. There was one failure with □the small strut. It was a very heavy airplane, over 1000# empty, maybe □closer to 1100#. It happened in the Reno area. Wittman believed it was □either mountain wave or a close encounter with wake turbulence behind a □large airplane. An early 0 320 powered W8 broke the wings where the □strut attaches in negative G. The strut held.□□

J.Cl. on 26.9.2011 (slide on type fitting)

Use a piece of the same size strut material to make the inner. Trim the trailing edge only and slide it inside the strut letting one end extend about 1”. Tack weld the extended trailing edge together and slide out another 1” and tack weld.

Repeat until it is tacked the full length. Slide it out, complete the welding and file to fit. If you are using this type of strut fitting it is very important your rosette welds are properly done. It is hard to get good penetration of the inner sleeve without burning the outer hole bigger. What I do is drill through both inner and outer with a 1/8 or #30 drill bit, remove the inner strut then drill the outer holes to 1/4”. This will make getting good penetration when welding to the inner sleeve easier. If you can’t see weld penetration when looking through the inside it isn’t good enough. I don’t recommend this type of strut fitting if any doubt about making good rosette welds. In fact I don’t recommend this type at all.

What I did to fasten the short tube the bolt goes through into the strut. Make another short piece of strut that will fit into the inner sleeve, the short tube the bolt goes through can be welded in from both ends. This can be inserted into the inner strut sleeve and edge welded. A couple of rosette welds could added if you think they would be needed. To seal the open end I pressed a piece of foam in and added epoxy over it. Also epoxy was added to the joint where the inner and outer joins to seal it.

Jim C

Wingtip Nav Lights/ Strobes

Many people think of using LEDs instead of conventional lights. LEDs are much lighter, use less energy and last longer 50 000 hours. Do a google or yahoo research on 12V LED and you will get hundred of listings at least for auto use.

J.Cl. on 14.11.08:

The wing tip lights are 5" long and the depth is to the face of the spar. I frame them out before putting the top skin on, skin the tip completely and cut out later. Laird Plastics in Madison but they also have a store on the west side of Milwaukee. Sometimes they have small pieces of cutoffs in red and green.

Wing Fairing
J. Clement: The fairing has a 90° bent on the inner edge and riveted to the upper door opening panel. It is built with a interference fit so when put in place the outer edge fits tight to the bottom of the wing.

Best Pitot Tube Location
J.Clement on 12.6.2012
Go with the plans location, in left wing leading edge about 32" out from wing root. Make a fitting 1/4" tube will slide in, not threaded as this will break off when hit. Pitot tube can be about 5 to 6" long held in and sealed with silicone. Aluminum tubing works but copper tubing can easily be straightened several times without breaking.

Dick Von Berg on 12.6.2012
Best Location should also include best angle! The pitot tube should angle downward at a 10 degree angle. This insures accuracy in the low speed range, when you are landing or taking off, just when you need it most. Any errors in cruise can be verified with your GPS.☐Consider that a wing generally stalls at about 14 degrees. You could split the difference at 7 degrees. Dick Von Berg☐

ENGINE

Firewall
J. Clement : .025 SS is to heavy for firewall. I like to use 28 gauge, about .015. The alu side panels, roll the bottoms around the longerons 1 1/2 " and fasten to the lower boot cowl. Sandwich the side windows between the side boot cowl and the top instrument panel with screws going into the instrument top panel. I make the top panel in three pieces, the sides about 6 " wide.

J.Cl. on 31.1.04: I use 1/2" foil backed rigid house insulation, held in place with aluminum tape. Fasten it between the tubes on the front of the fuselage.

Distance firewall to spinner back plate:
Gatsby: 34 15/16 "

Rick: 34 3/8 ‟ 0-320 Lyc
Bill K: 34 5/8 ‟ 0-320 Lyc
Jim Cl: 34 1/8 ‟ 0-360 Lyc

Jim Clement wrote: Firewall - back edge of spinner 35 ‟ includes 4” prop extension

Distance firewall - back of the engine case
J. Clement : 9 1/4 ‟

Engine Baffling
Some people use RV 6 baffling sets trimming them.

Exhaust System : Vetterman system for RV 6 looks to be the right one (stainless steel crossover)

George Turner 12.2.03 : If you ordered a Vetterman with pipes 1 ‟ shorter than the RV 6 system , I think you would have no problem with the fit, or may be he makes a system so to fit common TW cowls.

J.Cl. on #9: The two front cylinders go into the front pipe and the two rear go into the pipe that is closest to the oil pan. They are made from mild steel 1 3/4 ‟ tubing and ceramic coated inside and outside by a place in Phoenix (about 140$ white or silver color is the best) I used a ‟sprint car header set for small block Chevy V8 from Speedway Motors (part # 418-65600 94.95$) or you can use assorted bens (part# 910-13817) The Chevy set will make two exhaust systems if you are careful. Lycoming flanges from Wicks. Ceramic coating: Custom Thermal Coating, 3517 E. Illina St. Phoenix, AZ, Phone 602 243 0071.
The reason for #1 and #2 cylinders connected and #3 and #4 connected is the firing order of the Lyc being 1-3-2-4. each time a exhaust valve opens it needs something like 23” of exhaust pipe to exit before the next cylinder exits exhaust into the pipe. Connecting 1-3 together and 2-4 together will create more backpressure as they are each on the same side. It will work with both sets of two going out left and right sides. The reason I run both out the me side is it gives more heat for the cabin heater and keeps heat away from gascolator which is on the left side.
The only joints are the ones in the pictures just above the carburetor. The tailpipes are fastened to a bracket that is bolted using the oil pan to case bolts. This bracket also holds the carbheat mixture and throttle cable. The bracket has 2 legs coming down and one going forward and bolted to a

carburetor stud. Make the forward tube removable, otherwise the whole bracket assembly has to be removed to get the carburetor off. Use rubber belting between the hanger bracket and the tailpipe.
I made a mounting bracket and welded it to the top cross tube on the engine mount . Yes I agree that the old school says to keep the drain lower than the carb but on a TW that would put it outside the cowl. I will put a drain tube on the bottom and it will drain farther from the exhaust near the left gear.

Thomas Barnes on 7.12.06 Just finished welding up my homemade cross over exhaust and gave it the smoke test in some static WOT run ups. Here's some info....(Lyc O320 160 HP, Sterba 68X75 prop)
run # 1 with new X-over exhaust 2270 rpm (readings are as best as I could tell on the steam gage tach)
run # 2 with the Y pipe exhaust 2220 rpm
run # 3 with new X-over exhaust 2280 rpm (higher reading this time may be due to warmer engine ?)
so it looks like about a 50 to 60 rpm gain on the avg on a static runup. Now on to making some heat shields for the alternator, starter, etc where those pipes come close to...

Exhaust fasteners
My Q: Do you use high temp antiseize paste to fasten the exhaust flanges to the cylinder block. How much torque on the nuts and what brand of antiseize

On 29.11.08 Bill Bernard N40WB wrote:
Guido . I've found that using stainless steel nuts on the plain steel exhaust studs prevents the bolts from seizing. I use a split lockwasher under each nut and simply tighten them firmly with no specific torque,

On Nov 29, 2008, at 6:46 PM, jrs14855 wrote:
Lycoming manuals specify STD 35 flat washer and STD 475 "star" locking washer, 204 inch pounds torque. There is a note in the Lycoming torque specification that says "lubricate threads unless otherwise specified". ☐I have never seen anyone lubricate exhaust studs. I use MS 35333-41 ☐lock washers and AN960-516 flat washers instead of the Lycoming ☐hardware. The star washers should not be reused. If you torque the nuts ☐and then have to take the exhaust off, use new lock washers. I have ☐always used plain steel hardware on exhaust and have never had a ☐problem. I think I left the flat washers off on my Pitts on the exhaust ☐only but can't remember for sure.☐

On 30.11.2008, at 03:09, John Haedtler wrote:
On the old round engines all they use are Brass nuts on standard studs. I have never had problems with that set up

Tail Pipe fixation
On Aug 25, 2007, at 2:37 PM, Jim Clement wrote:
Yes there is a hanger, from the rear oil pan bolts. It is triangulated from
the pan bolts to the exhaust. Jim C

Exhaust Pipes Rectangular
George Turner wrote : mine was done under supervision of ST. Wittmann at Ocala Fl. It is rectangular about 2″ high and 1″ wide about 6″ long. There are about 7 1/4″ holes drilled in the last 4″ of the bottom angled back. Steve said the rectangular pipes make less noise.

Carburetor on 0-320
Brian Alley wrote 9.2.03: Since I reworked my cowl air box my 0-320 -A2B doesn't want to run right. Everything is normal until I rotate max rpm in climb at 100 mph is only 2150 instead of 2400. I did full power run up with the tail tied down and got 2350 static at full throttle. Size of airscoop inlet ? Aerocarb the Sonex people sell?

B. Alley's 15.1.05 with pictures: The bottom of the airbox is a stock RV 4 part. The a glass part I made. The whole thing is bonded to a carbon fiber bowl that fits up over the carb. I angled the airbox to match the cowl airscoop and bonded it to the carbon bowl. The air filter is a K+N that is cone shaped and fits up over the bowl. I drilled and tapped plastic ring. Screws attach the filter to the top.

Earl Luce: Drain the fuel out of the lower back side of the carb. I know it sounds to simple but I had this problem and found out this was it.

Rick Crosslin: Intake should flow air at least as a 3″ Sheath hose

Dave Conrad on 21.1.06: As I recall 12°is the convergence angle that works the best. In an air plenum 11.75 ° from your intake hole to the carb head is ideal.

Eric Schlanser on 2.12.2012:
my carb is not tapped at that location. Instead, there is a lead plug.☐I called Marvel and got the story. The lead plug must be punched out with a

1/8 in. punch and the lead residue picked out. Then, the hole is drilled with a #3 drill and tapped with a 1/4-24 NF tap. In mine, the mounting flange must also be relieved to make room for the top of the nut on the probe as the hole is too close.□□

Primer .

Dave Magaw on 16.10.06 The standard carburetor that comes with an O-320 has an accelerator pump. This is fine for priming. Throw away, sell or give away the primer system. However, if you have an Ellison or Aerocarb, you will need a primer system (no accelerator pump). No separate primer needed for fuel injection, but then you will have a boost pump.

Graham Mitchell to Mike: mine starts just fine with no primer, just a pump on the throttle once. I originally had a priming system installed but found I did not need it and yanked it out. I personally don't have an electric fuel pump either.

Carb Heat

J. Cl. on 15.1.02 is a A740- black from Wicks. Carb heat top is alum bent forward from the front edge of the carb to the top of the cowl inlet. The bottom is made from foam core covered with fiberglass, the foam removed later. Comment to the picture of *9 airbox: there is a flap under the screen that shuts off the outside air and opens the screened area. The hot exhaust is above the screened area. The lever on the side moves the flapper. This has worked in temperatures from -25° F to + 95° F.
As throttle control I use Wicks 10/32 sized A800 friction controlled version but buy it only when you get the tube thru the tank so you know the exact length.

On Feb 10, 2007, at 1:38 PM, Jim Clement wrote:
Guido, Close fit with the aluminum flapper, no other material added on. Jim

On Feb 8, 2007, at 1:49 PM, Jim Clement wrote:
Guido, It just gets it carb heat air from inside the cowl. The exhaust
crossover is close above so helps heat things up. I have mounted a
hose outlet on top of the airbox where the screen is and ran a hose up to
the exhaust pipes above on a couple of my TWs. A simple aluminum duct

from the airbox to the bottom of the exhaust pipes would work too. Never had any carb ice problems with the pictured method. Jim

On Feb 18, 2007, at 4:10 AM, jim stanton wrote:
Hi Guido- I made the main mounting plate, the part that bolts to the carb, out of .050 or .060 aluminum. I then spot glued a piece of tan foam to the plate and carved it to the desired shape for the bottom portion of the scoop. Three or four layers fiberglas over the foam with clear tape for mold release where the glass contacts the aluminum. Some clamping plates of plywood/tape to hold the glass in place where it contacts the aluminum base plate. After curing, pull the glass part off the base and dig the foam out and sand the inside smooth. The two rear attach screws go outside the scoop and the two forward screws go inside the scoop. The scoop is quite small in cross section, I think less than 2" high. I am thinking about putting the KN filter on the front, there is not room for it as shown on your drawing. This thing took a lot of time. I made one for myself and one for Eric. A LOT of work. Take a close look at your engine, many of the 0 320's have the carb offset to the side approximately 1". Your cowl tunnel will probably have to be offset to match. Jim

Red Hamilton on 17.2.2011:
Like Dave says no carb, no carb heat. I may remember a spec for 50*F rise with the application of carb heat for certified; seems like that would do it. Most of the FI systems just use inside of the cowl warmed air from colliing the cylinders as the fallback I think. It is already there.
Kent Pasers book has some interesting diagrams on hot air and filtering setups.

J.Clement on 19.1.2012
Cy, I do have a 3/16 hole in the bottom of the air box and it drains onto the lower cowl. I have also had a fire in the air box that spread to the lower cowl. This is hard to detect while trying to start but any kick back or backfire thru the carb better be checked immediately with a halon fire extinguisher in hand. Usually this will happen when the engine doesn't start immediately in cold weather. If it does start it will most likely suck the fire out off the airbox but the burning fuel in the cowl will still be there. Luckily for me all I had to do to repair was repaint the lower cowl.
A airbox fire can also partially melt the venturi in the carburetor.

Noise and Mufflers
Wittman said in this regard: a round hole makes loudest sound. Reshape the end of the pipes into rectangle and put a series of small holes underneath near the outlet. And of course a crossover system makes less noise.

Dave Conrad: Square holes make less noise than round holes. Hard part is trying to make a nice round to square transition. I noticed J.Cl's tail pipes end more or less square. They fit the relief in the cowl very nice. I guess a square muffler would probably work well. If only the corners wouldn't crack.
Good web site: <www.pfa.org.uk/engineering services/submit modification.asp>

Red: So far all the mufflers I'm making have square or rectangular outlets. They range from 1,7 lbs to 2,6 lbs with attaching hardware. I do not think that any add back pressure -- none has changed the static rpm.

Lou Owen N6PJ builder: I went through the muffler thing years ago and found that a very large part of the noise comes from outside the airplane in the form of wind noise. I too used a noise meter. Shut down the engine and dive at 160-170 mph and listen.

Exhaust tunnel
23.9.06: Dave Conrad made it in s-steel same as firewall

J. Cl. : Couldn't find any pictures of the exhaust tunnel. The left and right sides are bent up plus 1/2". The center panel, each side is bent up 1/2" and it is riveted to the plus 1/2" on the sides. The filler in the picture is to prevent exhaust fumes from leaking into the cockpit, it is urethane calking.
.016 (0.4mm) should work, put a slight bend on the back edge to stiffen it some. Angle the exhaust about 45 degrees where it exits, this will keep the heat off the fabric.
Jim C.

Red Hamilton on 28.8.06
If you want some insulation in there you could use hi-temp silicone in fiberglass, that would add a bit of sound deadening also. I have 2 plies of that sandwiched between my SS shield and the boot cowl, seems to be holding up well.

Fred Weaver on 28.8.06 on Gary's Q: Is high temp silicone and fiberglass something one buys or do you mix it up on your own... You impregnate the bidrectional glass cloth with the Silicone using a squeegee. It makes a piece of fiberglass cloth full of silicone as opposed to epoxy resin

or whatever other kind of resin you are used to working with. Then you drape the cloth onto your SS and squish it into place. I imagine Red is using about 4 oz cloth..
PS.. Fiberglass is the cloth stuff. Silcone is the goo you wet it out with in this case.

Alternator

W. Bernard on 16,1,06: I use an alternator from B&C Specialty. It is based on Nippon automotive alternator but they claim to rework it to improve reliability. They also market a couple of different models that will fit in the vacuum pump pad, but the output is reduced at that source because it turns at half engine speed.

C. Galley: The only difference is the alt. in an airplane is being run faster than in a car. This would increase the frequency but no difference in construction. Many aircraft certified alternators are in fact off the shelf automotive. Cessna uses a Ford pickup for example.

Alex Frizzell on 16.1.06: Nippon Denso I think makes the smallest and lightest alt. It is used on the Suzuki Samurai. I plan on using this one on my plane. Auto parts store carry it for about 120$ or less. If you buy it with the "aviator" prefix you will pay better than 300$

J. Cl. on 18.1.06: The Lycoming pulley on the flywheel is much larger than the about 5-6 " pulley on the crankshaft of the Japanese autos making the alt. turn much faster. Some think too fast and wears the bearings out. I've used them for years with normal sized alt. pulley with no problems.

J. Cl.: the alternator on *9 is a Suzuki Samurai, same as Spruce sells for 400$+. I bought two of them for less than 50$ each on e-Bay, core charge alone is 80 $ at he parts store. Have used them before and are trouble free, much better than the Honda I have used on another TW.

About Lyc 0-235

Eric Schlanser on 28.1.06 :
C 2 C - conical mount 115 hp 2800 rpm, fuel 80 oct. comp. ratio 6.75 : 1
L 2 C - dynafocal mount , 118 hp 2800 ropm, fuel 100/ 110 LL, comp ratio 8.50 : 1

Spark Plugs

Paul Baron on 14.2.06: recommends Champions

My Q: Which ignition harness and which spark plugs are best for an 0-320

A from Cory Thomson on 28.2.09:

Guido,☐Last I knew, (about 2 years ago), the Champion Harnesses were built ☐by Aero-Lite. Just buy an Aero-Lite Harness from Aircraft Spruce (or ☐whoever you choose) as they are MUCH less expensive and I have had ☐excellent service from them. The Slick, or Unison brand of harness ☐is an excellent value also, but many do not know that about 6 months ☐ago, Champion Aerospace purchased the Slick magneto line from Unison ☐(but not the Autolite sparkplug line), so Slick mags and harnesses ☐are now a Champion product. Haven't heard if there have been any ☐issues since the buyout. ☐☐As for Sparkplugs, there have been reports of excessively high ☐resistance is the Champion plugs as of late, which is very hard on ☐the coils in the mags, leading to premature failure. The Slick mags ☐seem to be less tolerant of the high resistance. I have seen this ☐and verified it myself. As a rule of thumb, you want less that 5,000 ☐ohms resistance, new should be about 1-2k I think.☐☐Have measured many Champion plugs at random and seen 30% or so over ☐5k ohms.☐☐Have measured many Unison Autolite plugs and not found a single one ☐over 1600 ohms. ☐☐As for the O-320, I would suggest the 40E for high or low ☐compression, or alternatively the 38E for the high compression ☐engines. The plugs would have a prefix of UREM for the small 5/8" ☐threaded barrell or URHM for the 3/4" "all weather barrell" ☐connectors. It doesn't matter which one you choose, just get the ☐proper one for the engine/magneto combination you have.☐☐Let me know if you have any other questions about this.☐☐Cory☐Cougar/Tailwind rebuild in progress

☐

Engine cylinders

Q for Jim C.on 23.5.07: I took a close look at my cylinders today and three of them are chrome plated and the fourth one is chrome plated also but it looks like it is cracked all to hell (spider webbing) and was told by a local rebuilder that that was just a special process and not to worry about it and just go ahead and use it. it is ok dimension wise and according to the logs only has about 520 hrs on it. Have any of you come across this situation before. It is a "choke bore"

Alex

A from J. Cl.: The one that looks like cracked egg shells is channel chrome, that has been around a long time. The

other three are most likely Cermichrome or Nuchrome.
Make sure you use cast rings in them, not chrome rings.

A from C. Galley:The Cracked chrome is called Channel Chrome. It is supposed to improve oiling and ring seating.

High EGT

On Dec 26, 2007, at 11:28 PM, Jim Clement wrote to:
Q:
full throttle rpm is 2800 and the egt will go up past 1400
It is a single probe at #4 cyl,.....Its a cheap one at that, And I
thought that maybe the problem, But I had the same problem last
summer and a buddy convinced me that somthing had plugged the wide
open jet in the carb, so i pulled the carb and cleaned it and that
seemed to solve the problem for about 15 hours..... I
noticed the egt starting to run higher again but this time
when I cleaned the carb it didnt change anything.....
this is a 2000 hr first run o-320 e2d
out of a 172 never been opened other than the ass. case, comps.are
all pretty low.... I plan to do a top OH this winter. the guy I
bought the engine from thought the carb had been OH...the
carb does match the engine.... when I pull the rpm back
after take off to 2350 rpm everything seems to run
normal....Im wondering if maybe I have an
exhaust valve leaking ???.....thanks for any
insight.....Mike N1066Y
A:
I would check the timing first to make sure it isn't retarded. Put the probe
in a different cylinder and see what it says. With compressed air in a
cylinder, listen for leakage coming from the exhaust pipe.That would be
leaky exhaust valve. If leaking past the piston rings the oil will get black
soon after changing, high oil temps and hissing from the filler tube with
the cap removed. If the compression is less than 65/80 exhaust valves that
might be the problem. Jim C

EGT, CHT

Question : if we install just one sender for EGT and one for CHT on our Lyc 0-320 which cylinder is the first choice (3 or 4 and can both senders go on to the same cylinder) For the CHT is it better to use the lower spark plug or the upper one ?
Thanks for your help. Guido

Jim Stanton on 03.06.2008:
In most cases the #4 cylinder will be the hottest. The spiral flow of the air from the prop has a significant influence on this. The airflow on the left side is moving upward and the air on the right is moving downward.The downward flow results in cooler temps on the rear cylinder. A lot of the RV's have the cooler behind #4 and quite a few are having oil temp problems.

Bill Bernard:
Guido, On my engine, cylinder #3 runs about 130-150 degrees F. hotter than #4. I would concur that a lower mount for the cylinder head temp thermocouple is probably best. There are also bayonet-type thermocouples that screw into the bottom of the cylinder. I depends on the lead you get.

Red Hamilton on 3.6.08
Hi Guido,
I don't think that it matters on the EGT.
On the CHT, you would want it on the cylinder that is the hottest, and of course that may not always be the same one all of the time on the same engine, to say nothing of different engine installations. If your oil cooler is behind #3, then put the CHT there for starters. I think that the lower plug would be hotter if you have downdraft cooling.
Both senders could go on the same cylinder.
You may find that it helps to have small deflecters at the front of cyl #1 and 2 to make the temps more nearly equal, I can send photos if needed.

D. Lamphere on 17.1.2012:
You will probably see CHT readings that are 60-70 F higher with under-plug ring thermocouples than bayonet/screw-in CHT probes.
(I'm talking about those ring probes being installed under the bottom plugs)
That's what I see with my installation. I had read that the ring style probes

read higher and just lately verified this with a laser-thermometer.
I guess as long as you know about this, it's OK. I know I'm not about to change my CHT setup. Not worth it. When I see 400 F CHT, I know it's really 340 F.

Cy Galley on 17.1.2012
It is well known that the spark plug ring shows a higher temp as it is in a hotter location. This happens with all engines as the well is in a cooler location. It is not because they are not reading right, it is only the location.

About 0-320 and 0-360

```
Here are a few facts O-360 180 hp compared to O-320 160 hp.
Both can run on 92 octane auto fuel
Both use the same amount of fuel per hour at the same speed
The O-360 is about 10 pounds heavier than the O-320
The O-360 is about 12-15 mph faster top speed
The O-360 climb rate is about 500 fpm more than the 160hp
The O-360 engine cores are four times harder to find and
cost $3,000 more
than the O-320.  Jim C
```

Choice between Continental 0-300 and Lyc 0-320

Jim Clement has built ten Tailwinds and is the authority on all things Tailwind. This is from an earlier post from Jim. It says it all!!!!

O-300 is 40# heavier than the O-320, fewer c.i.and less power.
O-300 has a log type engine mount making a sleek lower cowl difficult
Unless the wing is moved ahead 1 inch on the spars the weight and balance c/g will be to far forward.
Common Lycoming props have a different prop bolt spacing than the O-300 and C-145 so a special extension will be needed.
My first 2 Tailwinds were O-300 powered and the next 7 were Lycoming, I prefer Lycoming.

Some of the reasons.
Easier to build exhaust
Cylinders have fewer problems

Unless you figure out how to run a oil cooler the oil temps will be very hot on the Continental.
The Continental is noisier inside but good headsets will take care of that.
The O-320 powered TW will be about 10 to 15 mph faster but if flown alongside the O-300 powered TW at the same speed will use slightly less fuel.
More good Lycoming engines around for sale than O-300s
The typical economy cruise with the O-300 Tailwind is about 165-170 mph. O-320 powered 180 – 185 mph.

Don't get my wrong, I'm not knocking the O-300, it does make a nice TW but I think the Lycoming makes a better one.
Jim Clement

Oil Cooler Hoses
Jim Stanton on 14.8.06: cooler houses for any four cylinder Lyc are normally * 8

Fuel Lines
Wilson Werhan on 11.10.07: on page 118 of the current Spruce catalog are shown Weatherhead Barb Tite hose fittings and how to use them. Take a look. These fittings are extremely compact and have a small ferrule which hides the cutoff ends for a neat appearance. They utilize special fuel hose made by Weatherhead and others, which is simply pushed on over the barbed ends and cannot be pulled off with a John Deere tractor. They were recommended to me by the well known older designer Molt Taylor.
I used them inside the cabin to connect my tank outlets to the threeway Weatherhead fuel valve recommened at the time by Burt Rutan for Variezes, . No problems for 25 years although I replaced the hoses a couple of times for age. You have to cut them off with a sharp knife. Do not use hard tubing between the tank outlets and the fuel valve, for safety reasons.

J. Clement on 9/11.10.07: This is the easiest and what I use:
www.SpeedWay-Motors.com
Aeroquip blue hose 106-332-6 works with -6 AN type fittings
Fittings, socketless re-usable
106-1222 straight

106-1439 forty five
106-12 ninety

Oil the inside of the hose when putting the fittins on. You can cover the hose with fireshield if you want.

Tank and fitting lubricant Ez-Turn works on AN and pipe thread fittings (Wicks catalog)

John Haedtler on 5.8.09: Remember to use EZ-Turn on all fuel and oil connections. And rocker covers. It is a must with a round engine or an old Cont.

Eric Schlanser/ Jim Stanton on 3.12.07:
I got my fuel line made by: < http://www.aeroinstock.com >

The Aeroquip 303 hose has been proven over a long time. I know about the auto fuel issue. The hose shops can probably recommend other aircraft hoses, some of which have the firesleeves bonded in place. There have been problems over the years with the Aeroquip with the metal braid on the outside, I never heard of a problem with the 303. I have seen 303 hose that was probably 20 or 30 years old and still ok. I believe the recommended life is 5 years. For the two pieces of hose on the Tailwind cost is not really a big deal. I personally have decided not to bother with the racing stuff for a few dollars.
The adapter bushings are AN 912-2D or AN 912-2 for steel. However I think you can use AN 822-6 -6D (90 degree) in place of the AN 822-6D and it will fit directly into the gascolator. Likewise on the engine side AN 816-6-6D (aluminum) or AN 816-6-6 (steel) should fit directly into the gascolator. There has been some recent info that suggests that the automotive fittings and hose which look the same as aircraft do not have the same wall thickness on the fittings. The length should not be critical on either of your fuel hoses. Measure fitting to fitting in a nice smooth arc and add ¼ to ½ ". The Spruce catalog shows how to measure the hoses flare to flare.

Jim Stanton: Eric, here is how I have my fuel plumbing set up :
Finger screen screws into the fuel tank
Shutoff valve should screw into finger screen
AN 822-6D 90 degrre elbow into fuel shut off valve
Aeroquip 303 hose with 491 fittings to gascolator
AN 822-6D fitting on aft end of gascolator

(90 degree end on hose is an option but these are very expensive)
AN 816-6 fitting on forward side of gascolator
Same hose as above but with firesleeve from gascolatro to carb
Hopefully the carb has a -6 straight fitting. I think this will work ok. The hose should be at least a couple of inches from the exhaust.
I prefer all steel fittings forward of the firewall, however the gascolator is aluminum and the hose end are aluminum so its your choice. Titeseal on pipe threads, hoses installed dry.

Fuel System

Bill Bernard on 12.12.2009, at 21:25, wrote:
Ryan, I just removed the pump and used gravity to get the fuel to the engine. IMO the pump just adds more complexity and something else to fail. There have been a lot of Tailwinds and Mustang IIs built with only gravity feed to the engine. I never used an electric pump. I suspect that if you used a pump some of the time and gravity at other times, you would need check valves to make sure that the fuel flowed in the correct direction. Also, keep in mind that it does take a bit of pressure to open a check valve. The fuel head will affect the pressure but not enough to make a noticeable difference. I believe that use of gravity flow (no pump at all) would only be a concern if taking off with very low fuel, say less than 1/4 tank. I usually avoided this situation. I also had the fuel pickup in a small sump in the rear of the tank, so it was always getting fuel. Tank design is a factor with or without a fuel pump.
I used a 3/8" line to my O-320 and that worked fine. I just matched up the fittings on the carb to size the line. I am not aware of any modifications necessary to the carb when operating with or without a fuel pump.
I would also point out that the path the air takes to get to the carb can make a difference in the mixture setting. The best bet would be to try to duplicate the air path from the one in which the engine was originally installed. Otherwise, you can get into changing jets or even carburetors. Of course, if you think you want to go with fuel injection, then you will need a pump, but a higher pressure one.
All this is for what it is worth.
Bill B.

There should be a drop of 7-8" from the bottom of fuel tank to the inlet of carb . Best Test is Fuel flow test in climb attitude
With a carburetor and gravity feed you will need the tank pressurized by the appropriate sized and placed fuel tank vent. They will take off and fly

fine with a full tank, and quit when the fuel gets low.
About fuel pumps: If it ain't on the airplane it can't fail !
2. replay:
Ryan, I believe that the best approach is to simply remove the engine driven fuel pump, install a cover plate and move on to something else. I do not feel that a fuel pump is necessary at all. If you want a fuel pump, that is fine, but please install a back up pump. This can be plumbed either in series or in parallel with the mechanical pump. Look at some certified aircraft to see how the plumbing works.
Bill Bernard

I think that trying to use gravity to backup a fuel pump is asking for trouble. Bill B.

This is the fuel system on my O-360 TW. I have never run any type fuel pump on my TWs except for the 180 hp that Fred has. It has a horizontal carburetor and is level with the bottom of the fuel tank therefore very little head pressure. Everything Bill Bernard has posted makes good sense, the less systems, fittings and elbows the better the flow. The system pictured has a removable filter that can be inspected and cleaned and connects to a firewall bulkhead. firewall side goes directly to the carb with no gascolater.
A good test for flow is after flying the fuel down to 1/4 tank use full throttle and a steep climb, if it keeps running without losing rpm try it later with less fuel. You will be able to detect the rpm drop before the engine quits. Jim C

Jim Clement on 14.12.09 : Chris
I have used a firewall mounted gascolator in previous TWs but never liked where they could be mounted. I run my exhaust out the exit cooling air tunnel. The logical mounting location would be directly above the exhaust pipes. Mounting off to one side would require several 90 degree fittings and additional line and create less flow. Another problem is it cannot be mounted low enough to be the lowest point in the fuel system so is totally ineffective once the bowl is full of water. My reasoning is if a load of water gets in the tank, the engine with the small volume in the fuel lines will quit shortly after starting not after TO. As for the drain in the cockpit it might not be ideal but is better than on the gascolator bowl over the exhaust. A tube from the drain would be a good idea if it doesn't get drained on the ground near the exhaust.
The only gascolators that I have used were the Cessna all metal type with the bolted bowl The others with a strap holding the bowl on I never trusted.
I do agree completely on having a sump drain separate from the fuel outlet, A sump as picture in Bill Bernard's tank maybe centered on the bottom with the

bottom drain and outlet slightly higher would be good.
I take no offence in constructive criticism, It bring up several points to think about.
Jim C

Jim Stanton on 14.12.09:
Chris- I find the comments on Jim Clements fuel system very offensive and ill informed. Many Pipers with fuselage tanks require, by AD, a drain at the bottom of the tank. They do use a plastic tube to drain the fuel overboard, but this only complicates things by requiring a large container to catch the fuel. Jim's quick drain is at a low point Any contaminants in the very small amout of fuel in the line between the drain and the carb will be long gone two minutes after engine start. Gascolator- Steve Wittman never used a gascolator and although I have a gascolator on my W10 project I am considering removing it. Don Rivera at Airflow Performance, strongly recommends NOT to use a gascolator. The race car filters, as opposed to the small screen on the typical gascolator, will remove substantial amounts of debris that would plug the gasolator screen completely. Gascolators, by the very nature of their required low point location, have caused hundreds if not thousands of fires in relatively minor crashes. Many homebuilts, including Tailwinds, have the gascolators mounted much too close to the exhaust pipes. There are probably still some older Tailwinds with glass bowl gascolators which are incredibly dangerous. The Cessna Cardinal RG is just one example of a certified airplane with a very dangerous gascolator location. It is extremely close to the exhaust, and in the event of a nose gear failure there is a very high probability of fire.

Oil pressure Port

Guido's Q: Where is the port to connect the oil pressure line to the engine?
Dave Magaw on 7.12.08: Look at the attached picture. It shows a plug No. 11 on the upper right side of the accessory case (looking at the engine from the rear (accessory case end) just above the right magneto. That port is normally where you take your oil pressure sensing.

Ben Austermann on 8.12.08:
I was told by my engine builder to install the sensor on the front port on the right side looking from behind the engine or on the left looking at the front of the engine. He told me the oil pressure is more accurate from that location. I installed a 90 degree fitting then ran a stainless steel braided Teflon tube to the oil pressure sender. I mounted the sender between the cylinders on the right side then ran thewire back through the rear baffle then through the firewall.

Jim Stanton on 8.12.08:
The oil pressure reading at the forward port will be about #10 less than at rear. Cessna is using the front port which results in a higher oil pressure after adjustment with the oil pressure guage reading the same as before. Theoretically the higher oil pressure inproves the oil flow to the valves. newer Lycomings also have an upper red line of 115#

Oil Filter
Bill Bernard uses 90° version Caspar Lab with no spacer there are optional spacers of 0.75", 1.4" and 2.5 "

Air Oil Separator
Earl Trimble: I ran a clear plastic tube down the firewall from the separator, it is not even attached to anything and is about 10 " long. This plastic tube fits snug over the protruding alu tube coming out of the bottom of the separator. The other end that hangs down I plugged with the pointed end of a silicon tube cap. After 3-4 hours of flying it contains about 4" of oily water. I pull the plug and drain the water into an old soup can.

Alternator Belt Tension
(Lycoming Service Instruction 1129B)
1. Torque method 3/8" belt: New 11-13 ft/lbs, used 7-9 ft/lbs torque in clockwise direction the pulley retaining nut measuring the torque required until the pulley slips
2. Deflection method: attach a small springscale to the belt halfway between the ring gear and alternator pulley and pull 14 lbs for a new one or 10 lbs for a used belt. The deflection should be 5/16". If less than that , your belt is too tight

ENGINE MOUNT

Jim Stanton on 13.6.2012
The engine mount drawing is not much good anyway.
1. Buy a welded dynafocal ring
2. Place the ring in place on a engine or crankcase and locate thrust line. Thrust line is NOT the intersection of the bushing centerlines.
3. Make all measurements in reference to the centerline of the lower longerons, the front face of the firewall, and the thrust line/center of crankshaft.
4. Option #1 is to jig the crankcase, mounted to the ring, in place in front of

the fuselage. Option #2 is to clamp the ring to a flat steel plate and bolt it to the front of the fuselage. For this use some angle steel clamped/bolted to the firewll tubes, and some threaded rod between the firewall angles and the flat plate. The flat plate should have scribed lines for the thrust line on both sides, or just drill a small hole thru the flat plate for the thrust line. I like #2 because it is much easier to get the engine perfectly straight.
5. For an 20" front bay the aft face of the crankcase should be 9 1/4" from the front face of the firewall. For the standard 18" front bay 11 1/4 will put the engine in the same position in relation to the wing.

Jim Stanton on 29.8.09
The gear should be removed. I use a stack of washers machined the same size as the gear.
1. Put them on a threaded rod about 3/8" apart and put them in the gear socket before welding. Even if you are not welding on the socket you will get things hot enough to distort the sockets. ☐
2. The forward most point on the ring should be approx 10" from firewall. This will give you 9 1/4" from firewall to rear face of crankcase. This is using the Aircraft Spruce ring.☐
3. The 9 1/4 dimension is to the split between crankcase and accessory case.☐
4. I clamp the ring to a flat piece of 1/4" steel a little bigger than the ring. Use 3/4" wide steel strips and threaded rod for clamps. Clamp where the socket touches the flat plate. With the gear portion of the mount bolted to the fuselage, the ring/plate is positioned with threaded rod. Angle iron, square tubing or lumber at firewall to bolt to. Note that the crankshaft centerline is not the centerline of the dynafocal bushings. Position the ring on the engine and mark the centerline of crankshaft on side ring tubes before positioning ring for welding. ☐
5. I like to do as much welding as possible with the assembly bolted to the fuselage. This will minimize warping.☐
6. If you put the two lower diagonal tubes on tube centerlines, they will hit the sump. The diagonal tubes at the center should be spaced a generous amount apart. Check fit of engine before welding. ☐
7. In my opinion the mount shown in Tailwind Times is not an optimum arrangement of tubes. I am adding a tube from the bottom of the gear socket to the bottom of the lower mount sockets.
☐

Jim Stanton wrote on 4.8.06
I used an Aircraft Spruce ring and the non certified mount rubbers from Spruce. Every thing fit pretty well. It's a lot easier to bolt the mount to the engine and then bolt the mount to the firewall. I start with the bottom mounts first because the uppers are easier to reach

with a
hammer. I have two "bullets" made from 7/16 bolts with a taper
machined on the end. The long one is to force the mount rubbers into
approximate alignment and the short one is driven in place with the
bolt.

JCl on 29.8.09
This is how I jig up the engine for making the mount. Bolt the engine mount ☐ring on the engine, space at 9 1/2" from firewall with bottom longeron ☐level. Tack weld the tubing in.☐Using this method there is no surprises later with tubes hitting the sump ☐and other places. I use a mig welder to tack it together.☐Before doing the final welding, temporarily tack weld flat stock across the ☐front of all four dynafocal rings to keep from pulling out of shape.

A welded on engine mount probably has more advantages than disadvantages, ☐the only disadvantage would be not being able to make a one piece firewall ☐and easily sealing it up completely. If I were to build another, that would ☐be one thing I would consider changing to. The original Cassutt plans mount ☐was welded on.☐Jim C

Q byBob Schultz on 29.8.09
Is there a crank shaft reference point, or is it necessary to remove the accessory case?☐☐Jim, looking at the brace clusters going to the top firewall longerons ☐(where they are all welded together) are the bolt spacers increased in size?☐

A: On 30.08.2009, Jim Clement wrote:
Bob☐You can level of the top of the valve covers and clamp a strait edge or strait board to the crankshaft flange horizontally, then measure back to the front vertical tubes on the fuselage.☐I try to set mine up level with no offset but a little tilt down on front ☐and turned to the passenger side is ok.☐I think the bolt spacer might be a little longer but are the same as the ☐lower ones.☐

Thomas Barnes on 11.12.05: I am the actual owner of Rick Crosslin's N393RC. I noticed something about your engine mount that was similar to the one on N393RC that developed cracked tubes. The tube going from the gear leg socket to the top corner on each side has two tubes from the engine mount tied into it. Apparently the positive G loads from landing and bumps in the air caused this tube to crack,

starting at the weld where the two tubes were welded into it and then the crack propagated into the unwelded tube. N393RC was down 6 months while I came up with an alternate design to take the tube from the lower engine mount and weld it to the top of the gear leg socket. I am keeping an eye on this alternate design to see if it develops any problems. Again this is just for your information, yours may never develop the problem, just thought I'd pass this along

Thanks Jim !! So, in this shot, it appears the 7/8" vertical tube intersects the lower lug, center on center. Is this correct ? In the plans drawing, it appears the vertical tube is about 1/3 toward the inboard side of the lug.
About a year ago, Thomas Barnes wrote in about a crack that developed in the engine mount on N393RC. I'm not sure exactly where this crack was, but I think it was in one of the two tubes that go from the gear leg socket, to the top corner. I think someone else also had a crack in the same area. Is there a mod to prevent this, or was it just a one off ?

On Feb 11, 2007, at 12:55 AM, e. schlanser wrote:
The RV6A factory motor mount has gussets. So, I added gussets to my
trike project motor mount. I did it off of the motor thinking it would
not warp...wrong. I had to cut the gussets and stretch the mount to
get it to fit back on the motor. It couldn't be that simple to fix so
one tube cracked during the stretching process. I repaired the cracked
tube after studying AC 43.13 for a week or so. See a photo of the cut
gussets in the Eric's project album in the photos section.

J.Cl. wrote (16.9.03) I try to set mine up straight, but a little down and off to the right is OK also. Right as you sit in the airplane

Jerry Hey wrote (10.9.03) I recommend that you extend the corner bushings outward 5/16". These mate with the engine mount bushings which are 5/16 long to give the proper engine distance from the firewall. The bushing stock should be 9/16" o.d. x .120 wall. Bore this out to 3/8" i.d.

Rubber Mounts

J. Stanton about rubber mounts: A&S non certified mounts are Pn 08-03500- 158$ for one set. Try < vansaircraft.com > webpage , saves searching for the proper length.

J.Cl about rubber mounts : try <ricevilian@aol.com> where I bought a complete set for 50$ + 8$

Engine Mount Bolts

J.Cl. 10.12.03: I use undrilled AN 7-35 . AN 7-35A are drilled in shaft

J.Cl.on 3.12.03: Engine mount to fuselage is 3/8”. Engine with dynafocal to engine mount is 7/16”. Engine with conical type mount is 3/8”. Usually you need the castle nut type, they are the fine thread. That’s what the newer TW gear take. The early TW gears used the coarse thread and used the tubular nuts. You will need two ¼” spacers on each side. Double check the dimensions on the brake bracket flange, the old drawings didn’t take into account the spacers, don’t know about current plans.

Engine Alignment

Jim Stanton on 4.6.09 : I just looked at the W8 and W10 plans. W8 four cylinder continental, no downthrust or offset. W8 four cylinder Lyc. bottom mounts are 3/16" shorter than top, no offset. W10 six cylinder cont is straight. I made my 0 320 mount straight. i believe the Lyc dynafocal mount in Tailwind Times was straight. ☐

Jerry Hey n 06.02.2006:
Guido, concerning the engine mount I built for you, I have learned that the lowest cross member
is incorrectly positioned. It is lower than it should be. Proper position would be at the same height as the bottom cross member of station A. This can be fixed cutting out the cross member and the diagonal above it and replacing them with properly positioned tubes. This is a free service I offer but in your case, it probably is easier to do it yourself. Some builders have chosen to ignore this and use the engine mount as is. The main consequence would be that the tube is blocking some of the exit opening used for cooling air.

I am very sorry about this.. I had tried to produce a "perfect" product and to learn now that it was flawed...I

cannot tell you how disappointed I am. Regards. Jerry

COWLING

J.Cl. wrote (16.8.03) The easiest way for the carb intake is to buy the scoop from Vans and glass it on, also maybe the best. You will get higher manifold pressure by taking the air straight in from the front.

Dimensions of Cowl Air Inlet
J. Cl wrote: 7 - 8 " wide and 2 3/4 - 3 " height per side. Especially for 0 -300 Conti better with oil cooler

J. Cl on 9.1.07 Tom, 2 3/8 - 2 1/2" opening is about right.
The top and bottom doesn't fit real good, you can get it closer using a heat gun and doing some glassing and sanding. The scribe lines were put in the mold as a guide several years ago from one of my TW cowls. The upper and lower mating line should be centered in the intake opening. The spinner opening should be 11 3/8 - 11 1/2".

Red Hamilton on 27.10.08:
On mine I incrementally reduced the cooling air inlets to two 2X7" with 1" radii at all four corners. I figure that to be about 26 sq inches. You also need to carefully use all of the air that you allow into the cowl to reduce cooling drag.
Actually, I reduced past that, but got higher cyl temps than I wanted, so went back to what worked, but is smaller than it was originally.

Dave Magaw on 27.10.08:
I think that for faster aircraft, like the tailwind, you can get by with much smaller openings for cooling. Sam James has cowls with 4" diameter openings and 5" for 180-200+ HP--which would result in approximately 1/2 of the EAA recommendations.
See http://www.jamesaircraft.com/Index.html Also do a google search on Dave Anders, RV-4 and the Cafe Foundation for more tips on cooling drag and inlets. It is much more than just inlet size that counts, smoothing and directing the airflow through the engine, oil cooler and cowl is very important.

Joe Gambucci on 27.10.08:
this is from the EAA regarding inlet opening size"□□"Homebuilders have been using a simple formula for about 30 years to □determine the size of the cowling air inlets. Simply multiply the hp □by .35. For example, a 160 hp engine should have an inlet opening of □160 x .35 or 56 square inches. Since we normally have an opening on □each side of the spinner (propeller), a 23.5 square inch opening on □each side is necessary. This would give you a fairly small □opening . . . approximately 3" x 8" with rounded corners. Larger air □inlets in a high performance aircraft would merely result in so much □useless cooling drag."□

Distance between Cowling and prop
Farmer John on 9.1.07 The openings on Sam James latest are 5/8" between the air opening and the rear of prop and 1" for the carb opening. That should really stuff in the air. Farmer John

Weight of the cowling halfs
Red Hamilton: Top 13 lbs, bottom 17lbs = 13.6 kg

About epoxy
Q on 28.11.05 : What is the best type of epoxy to use for cowl mods (heat resistant)
A: J. Berry and J.Cl.: For Madden cowling vinylester is the way to go . It is not a epoxy but a cross between polyester and epoxy. Same as Glasair and others use.
A: from C. Galley: One thing you can do is postcure at an elevated temp. Most epoxies have this “feature”. The higher the postcure the higher the resoftening temp becomes. Of course if you go to high then the epoxy is destroyed.
A: from Mr. Suter of SwissComposites on 10.1.06 : he doesn’t see such a big problem if you do the seams with epoxy instead of vinylesther, since epoxy is for sure the better material.

Cowling Mounting
The straps for mounting the cowling were bolted to the firewall and a pop rivet into the crossbow. 3/16 bolts. On the new TW the brackets are welded on.

John Leslie (3.4.04) I am fitting a Madden cowl on my trike. So far I have had to add 2.5” to the side and bottom of the bottom section. I also had to split all 4 corners in order to get it to fit. The left inlet is about 5/16”

lower on one side

Cabin Heating

Bob Connor 27.11.03 wrote: I did mine off the exhaust like most conventional aircraft are done and I get plenty of heat. I just keep a carbon monoxide detector in case of an exhaust leak.

Dave Magaw: I did it the traditional way, with heat muff on the exhaust system. Fresh air is ducted with 2″ scat tube from the front baffling right behind the cowl opening to the muff, then to Van's little heat control which mounts on the firewall- have cable control to the panel. I have a little homemade plenum on the cabin side of the firewall which ducts through 1″ scat some of the hot air up the side and front windows and the rest at my feet.

J.Cl. 29.11.03: about Heat control box: the valve can be made of about any gauge aluminum .032-.050 but the slider should be steel or SSteel.
The hose clamp is riveted to the small end. The funnel opens up to put it over the exhaust pipe and a few screws to close it up. It should not fit too tight on the small end, you want some air movement thru the funnel, so the pipe doesn't get to hot. This is similar to what Steve Wittmann used. The one in the picture is a little small but works good. If it is more towards the elbowed area it will melt your tennis shoes. Usually I take it off for the summer. Mine takes in two pipes as they both exit the same side and this fastens on as near to the firewall as you can. The heat box is 3″ wide, 6″ long and 1″ deep and closed at one end. It has a 3/4″ flange bent out on side of the 6″ base. 2″ inlet on the front and back, straight thru when the slider is pulled open. This picture has a 2 1/2″ hose but 2″ works also. The slider had the end bent up to close the box when it is pulled past the 2″ inlet.

J. Stanton about heating 30.11.03: A spring wrapped around the exhaust pipe in the heat muff area will increase the amount of heat available. The Beech's solution is a bunch of studs-1/4″ diameter or so welded to the pipe in the area covered by the muff. The left rear cylinder normally runs the hottest , so locating the heat muff on this pipe should produce the most heat. Closing up the baffle outlet below the cylinders so that all cylinder heat temps are about the same should also produce more heat. On Fred's pictures: note that the exhaust pipe support tubes connect to the engine

rear case bolts which is the best way to do it. Mounting the oil cooler on the right side is optimum. Mounting cooler on the left robs air from the hottest cylinder making it run even hotter. Otherwise you can install a electric heater like in Eze/ Cozy's.

J.Cl. on 31.1.08 I wrap a funnel shape piece of metal around the exhaust pipes. Big end is open and the small end clamped to the exhaust pipes. I had a picture somewhere, will see if I can find it.

On my cabin heat box, when the slider is closed to the cockpit the heat box bottom is open for free flow flow from the heat muff. Just like a Cessna.

I understand completely your thoughts on fresh air supplying the heat muff. But here is my thoughts, 90 percent of exhaust leaks happen inside a enclosed heat muff, even SS tubing gets brittle and prone to cracks. The open funnel type doesn't overheat the exhaust tubing like the enclosed muff does. There is so much fresh air going thru the cowl a small leak would most likely not kill you but a small leak in a enclosed muff might I did have the enclosed muff on my first two TWs and froze in the winter. Even tried to preheat the incoming air by tying the scat tubing between two cylinders. I asked Steve how he kept warm and he showed me the funnel method.

Landing Lights

J. Cl: on 3.4.04: I used a automotive type small diameter driving light. Fastened the bracket on the pilot side air inlet lower flange and cut a hole for the light. Epoxied a plexi lens on the inside of the hole. Works great for taxing and take offs but never landed in the dark.

TANK and FUEL SYSTEM

Size

Rick Crosslin: Typical TW 10 size is 28 to 34 gals

J. Clement: 32 - 34 gallons is normal. Make the width of the tank 3/4 or 1 " less than firewall dimensions. A size 91/2 shoe will fit under a tank that has 12 " from floor to bottom of the tank.

Alu Tank

J. Cl. I use .050 so called 1/2 hard from local sheet metal shop. Most likely .050 3003 or 5052. Give yourself at least 1/2” clearance on each end of the tank or it will be hard to get it in and out.
The front of the tank isn’t beveled, the sides are beveled 45° to clear the top engine mount bolts and the side instrument panel covers that fasten on the side windows. The side bevel is the 3” mark, 3” down from the top and 3” in at the top (see Photo) One other thing that differs from the plans is the front vertical fuselage tube is 1” higher where the W/S meets the firewall.

Eric Schlanser on 24.6.04 : uses alu 5052 H32 .064 instead of .050 which gives 2,7 pounds more weight. 34 inches wide would allow 1/2” clearance on side at the bottom of the tank and 1 “ at the top.

J.Cl: check for clearance of the upper engine bolts!

Lou Owen on 31/5/04: I use weldable rivets to hold the baffle , then welded over the heads outside of the tank.

J.Cl: use AN470A rivets, not AN470AD. if you want to do it this way.

J.Cl. on 20.4.07
The end caps have a 1/4" roll in, not out like most tanks. The end caps are
fitted in the outer wrap of the tank flush. I believe the chance of
cracking the weld is less and makes getting a tight fit easy.
If I were to make another, I would put a slight curve in the bottom instead of the flat bottom. That would eliminate any chance of oil canning. Have no less than 12" from tank bottom to floor. Allow 1/2" clearance on each side.

Tank Rubber Strapping
I am using a 1” wide SS strapping to hold my tank and I am looking for the rubber sleeve in order to keep it from chafing the tank A&S catalog 2003 “ rubber channel” p. 124 also from Wicks C- rubber channel 1,50 $ / ft It’s a bit heavy and rather than use it again I intend to carpet the tank like J.Cl.

Lou Owen: I think I used thin woven tie down strap on 6PJ

Epoxy Tank.
Jerry Hey: best choice: West System Pro- Set which requires postcure! Light bulb or hair dryer in the tank.

William Bernards epoxy tank weights 15 lbs. Old Aluminum tanks 25 gallons , 12,5 lbs
See pictures: 34 gallons, 34.5” wide, 15” front to back , 14” deep.
Epoxi resin: Aeropoxy, foam : vinyl closed foam cells 3lbs/ cubic foot and 1/4” thick. The foam parts were cut to shape and covered on one side with 2 layers of 8,9 oz cloth. When the layups cured the parts were bonded together using flox and 2” fiberglass tapes on the inside of the tank. The front/back/bottom was put in 2 steps. There is a seam along the bottom of the tank. Once all the parts were assembled the outside recieved 2 layers of glass as well. There is a baffle in the tank too. The sump is a 3 sided box on the back of the tank positioned so that it is the lowest part. The fuel outlet was installed as far back as possible. All metal parts were Attached by embedding them in flox. The tank was coated inside with extra coat of resin. The basic dimensions were taken from TW Times article by J.Clement. The only thing I would do differently would be to make the ends parallel to the sides of the fuselage rather than straight up and down. This would make it easier to install.

Fuel Tank Test
J.CL. 11.11.03: 2lbs of airpressure and soap suds will stretch it out pretty good and therefore might be right like also Bingelis says in his book.

Fuel Cap
Eric Schlanser on 4.10.04 : he used Wicks part number FC 100-002 (40$)

Fuel Line Fittings:
Werhan wrote on 11.10.07: On page 118 of the current Spruce catalog are shown Weatherhead Barb Tite hose fittings and how to use them.
Take a look. These fittings are extremely compact and have a small
ferrule which hides the cutoff ends for a neat appearance. They utilize special fuel hose, made by Weatherhead and others, which is simply pushed on over the barbed ends and cannot be pulled off with a John Deere tractor. They were recommended to me by the well known older designer Molt Taylor, who designed and built the original Aerocar. I

used them inside the cabin to connect my tank outlets to the three way Weatherhead fuel valve, recommended (at the time) by Burt Rutan for Variezes. No problems for 25 years, although I have replaced the hoses a couple of times for age. You have to cut them off with a sharp knife. Do not use hard tubing between the tank outlets and the fuel valve, for safety reasons. Wilson Werhan
N447A

Fuel Fitting Lube
Brian Alley on 9.10.07:recommends Pro Seal on pipe thread fittings.

Cy Galley recomends ordinary pipe dope or if this doesn't work and the fitting threads are ok use Loctite PST

Fuel Hose
B. Kuenen wrote 30.1 03: Use EPDM hose (ethylene-propylene-diene- monomer) It is not effected by any of the additives they put in car gas.

Q from Eric Schlanser:
Hi Jim or Malcolm or anybody, What are the recommendations for fuel hoses and fittings? The hose under the gas tank from the on-off valve that runs into the firewall bulkhead fitting at the gascolator and also the hose from the gascolator to the carburetor? What size/style/brand? Also, what are the fittings at the ends of the hoses at the Cessna type gascolator and Lyc O-320 with the MA4SPA carburetor? The catalogs are a little confusing to a novice. The Tony Bingelis's book seem a little out of date on this subject. It looks like hose technology has progressed some since he wrote Firewall Forward. Any help will be appreciated.
Eric Schlanser - W-10 project, South Haven, MI

A: On Oct 11, 2007, at 5:00 AM, Jim Clement wrote:
Eric This is the easiest and what I use.
www.SpeedWayMotors.com
Aeroquip blue hose 106-332-6 works with -6 AN type fittings
Fittings, socketless re-usable
106-1222 straight
106-1439 forty-five
106-12 ninety
Oil the inside of the hose when putting the fittings on.
You can cover the hose with fireshield if you want.
Jim C

Eric, I use copper tubing from the tank to the strainer and aeroquip hose to the carb. aeroquip steel brade hose can handle alcohol and has a long service life. Dave Conrad

My question : When you put together all the fuel line parts do you put
some sealant and if yes what brand on the different fittings before you
tighten them.

J. Cl. answer:
Guido
Tank and fitting lubricant EZ-TURN
Works on AN and pipe thread fittings, Wicks catalog.

Guido, The only thing that I think of, that the others may not have mentioned, is to put the sealer on the male threads only. That way none of the sealer can be pushed into the passage.
Red Hamilton

Flared fittings use no sealant. Pipe fitting I use Teflon past available at most any pluming outlet.Proseal will definitely work but it is a bit overkill.
Jim Rust

Fuel lines sealer
Brian Alley on 9.10.07: I use Proseal from Seal Pack on all pipe threads on fittings for fuel, oil and hydraulics. It is the only thing I have found that works on everything. It is a 2 part material that cures like RTV but is harder and impervious to anything petroleum. Many aircraft use it to seal pressure vessels for pressurization and RV's use it to assemble the fuel tanks. It's nasty to work with but not bad in small batches for pipe thread fittings. I've never had one leak even when I could not fully tighten an angle type fitting. Another important factor is that it can be taken back apart if needed.

Jim Stanton on 10.10.07 : I recommend heavy weight Titeseal for pipe threads only. Available from Spruce. Non hardening so if you have to adjust the angle of a fitting it will still do its job. Much simpler than Proseal. If you store Titeseal in a very hot environnement you will need to stir it thouroughly before each use. There is also a product called bolube (boeing co.) which I believe is approved for

pipe threads. Flared fittings-hose or tubing should be installed dry.

Fuel Filler Location

F. Weaver: lateral position of fuel filler blocks some valuable peripheral vision !!! especially on the right side.
Lateral position gives big problems with the vent system being in a neg. pressure zone. (article in SportAviation 1993)

Tank Vent

J. Cl. on 27.3.04: On 168A I ran a line from the filler neck up the passenger side windshield frame. It then curved around and fastened to an alu tube protruding about 1" from the wing root fairing. Tube and fittings should be at least 1/4" ID. A vent tube out of the cap facing forward also works if the cap isn't put on backwards.

Ralph N7100H: Mine is a 1/4" alu tube I ran down and it exits out of the rear of the cowling near the top of the right side landing gear so if you get in rain, the water will have a hard time to run uphill and never get in to the tank. The tube still faces forward to pressurize the tank.

John Leslie on 26.6.06: Increase the vent tube size from ¼ to 5/16 ". Since We think with the smaller size there could be a problem.

Jim Clement says he used even 3/8 in his last TW.

Red on 5.8.2012 :Put it close enough to the outside edge so that you can see into it more easily. Put the vent connection as high in the neck as is easy.
Red

Gordon Parker on 18.10.09:
When Konicek built my 9168Q he did simular to Jim C. the open tube is 9 inches forward of trailing edge of flap and 1 1/4 in out and hangs down 1 1/2 inches. Works ok. Just one problem I had. Had just fill with gas. Was over 100 degrees. After I had put the pump hose away, my wife decided to open the door on the vent side and get something.. The overflow worked like its was supposed to. She didn't know about it and I had neglected to warn her. She got gas down her back. Good thing she doesn't smoke. This was Redding,Ca. So gas must have already been warm. Dumped some bottle water on the back. No damage seemed to come of it. Gordon

Jim Clement on 18.10.09:
Guido
Without measuring I think about 3/4" down from bottom of wing and 3/4" out from fuselage side. Just behind door opening about 1".

Red Hamilton on 18.10.09:
I had to move the fuel vent down, away from the bottom of the wing, in two steps to get enough ram to do the job. It is about 6cm below and about the same from the side of the cabin, the door just clears it as far as fore and aft location goes.
Those bumped up edges are worth a little speed....and they really make people wonder what you are up to! I don't know why they work, but they appear to.

Dave Magaw on 18.10.09
Guido,
Clement's Trike, which I have, has the vent coming out of the leading edge of the wing root fairing--it is covered with the Red Cover in the picture attached. The vent extends just beyond the windshield so that it receives undisturbed the oncoming airstream. No door interference either. Inside the fairing it makes a U turn and has plastic tube inside along the windshield to the fuel fill tube. This location works good. Make sure there are no leaks in the vent piping--you want that pressure from the airstream.

However, I do not particularly like the vent opening above the fuel tank, because an off field landing is more than likely to have the plane end up wheels side up, which puts the fuel vent below the tank and likely to drain fuel out accordingly. Dennis and my Pitts (also because they spend time upsidedown normally) each have the vent go down and extend out of the leading edge of the gear leg intersection--below the fuel tank--again extending 5-6 cm so that it gets into the airstream slightly away from the fuselage. A number of Thorp aircraft utilize that same position for the fuel tank vent. I have not seen a tailwind with a vent in this location, but I would think it would work fine.

Fuel flow test

Red Hamilton on 16.9.06:
We set up an 18* angle of attack by putting the main gear on the taxiway and the tail in a hole. Also in the hole was a metal stake to tie the tail (down) to. With that setup we were looking for 24 gph fuel flow through the carb, we got it, but sure did not have it the way it was at first. Changed out some fittings and the fuel valve, modified the carb needle valve. Also found out that the pressure pickup for the tank vent had to be lower than the bottom surface of the wing by at least 1.5", since there is apparently a dead air area next to the surface and needed to be 3/8 tubing, 5/16 was too small.
No problems in flight, no bugs in the underwing vent yet either though.
Red

J.Cl on 22.07.2008:
Maybe you have a fuel pump but with a gravity system the first flights can be very interesting without a fair amount of fuel head pressure. I would never take off in any of my TWs with less than 5 gallons. On takeoff the fuel goes to the back of the tank and away from the tank outlet. The climb out with low fuel can also create problems.

About Fuel by pass

David Wilcox on 10.2.2011:
A quote from AC90-89A
(http://www.faa.gov/regulations_policies/advisory_circulars/index.cfm):
"Formula for fuel flow rate gravity feed is .55 x engine horsepower x 1.50 = pounds of fuel per hour divided by 60 to get pounds per minute, divided by 6 to get gallons per minute." The .55 (poundsfuel/hp/hour) is the specific fuel consumption for typical low compression aircraft engines. The 1.5 is a 50% fudge factor.

For a 150 hp engine that equates to .35 gallons per minute, or about one gallon in 3 minutes. This flow should be achieved through the so called "flow through" pump. If the pump is centrifugal, maybe. If the pump is diaphragm, doubtful. A diaphragm pump has two check valves in series. For fuel to flow through a non-operative diaphragm pump it must unseat both check valves. The only way to assure that a diaphragm pump can be bypassed is to install a manually operated bypass valve in parallel with the pump (which is not a good idea).

A plugged or siphoning vent system will shut off gravity fuel flow from a tank very quickly. But don't take any credit for ram vent pressure if you are lacking flow rate on the above test. It's not much. It's only worth about .43 inches of fuel head pressure during climb (80mph). Calculation: pressure =.5*.00238*(80*5280/3600)^2= 1.6 psf units conversion=1.6/144/14.7*396/.7= 4.3 in

Fuel Gauge

J.Cl. recommends on 25.10.04: Wicks has Mitchell gauges either with capacitance type (D1-211-5074) and/ or mechanical sender (PS-211-8038) that will work. Also automotive store has similar ones but about half prize. The ohms of the sender has to match the gauge so be aware of that, there is about 3 different senders. You want one that will handle a 12 " tall tank. This type works excellent. I have tried the probe type and found them inaccurate and prone to failure.

Gascolator yes or no

Farmer John on 24.3.10:

While checking out the W-10 today, I turned on the gas and the gasket had shrunk over the winter and gas ran out on the floor, the gascolator was from ACS and is a piece of junk. It looks like the Piper one, but there is not enough threads on the retaining bolt and nut to secure the bowl snug unto the gasket. I would recommend that you look else where for a suitable gascolator. Farmer John

J. Stanton on 25.3.10 wrote:

If you insist on using a gascolator, use one from a single engine Cessna. An all metal fine filter from summitracing.com/parts/SUM-230100/ is better than a gascolator. Properly installed it virtually eliminates any chance of leakage.

Summit Racing has a huge variety of filters. The one that I used takes AN6 hose fittings or tubing on both ends. The filter body is easily dissambled and cleaned. The filters seem to be available in a range of 40 to 100 microns. ☐

J.Cl on 26.3.10: This is what I'm using on N168WH, it is easily taken apart to clean and inspect. I think it came from www.jegs.com and has a metal replaceable filter.
Jim C

J. Clement on 26.03.2010:

John, There is a sump formed into the bottom of the tank and as the picture shows the fuel drain is at the bottom of the elbow fitting. For the gascolator to be functional as designed it has to be lower than the carb bowl. On the Tailwind this would put it lower than the bottom of the fuselage. Other things that I considered are, All my cowling air

goes out the 3 x 12" exit air tunnel and that also is where the four exhaust pipes are. Any type of fuel leak forward of the firewall would be a big fire. I have one -6 fire shielded line going from a firewall bulkhead fitting to the carburetor. The fewest number of fittings and direction changes in a gravity system the better it will work.

Jim Stanton on 30.9.2011:
Alex- Get rid of the gascolator and use a race car filter installed just below the tank. Summit Racing or Jegs.

Farmer John on 30.9.2011
As a note of safety, use a static line when doing anything with gasoline.

PROPELLER, SPINNER

Size.
Rick Crosslin: Felix 68 x 74

Brian Alley Ed Sterba 68 x 74 on an 0320-A2B 150hp on N320WT .It turns 2300 and 2700 full throttle . Climb at 110 mph is usual 1100-1300 .He usually flies at 22" mfp and 2550 rpm = 155 mph indicated.

Dave Magaw Catto 68 x 72 wood core adjusted , carbon fiber covered-- 2700 rpm full out I think it may be 68 x 71 now , top speed 190 mph on his white and yellow J.Cl trigear: 68 x 74, top flat out is 2800 rpm, 160 hp, top speed 200 + mph, second prop 68 x 77 worked out by J.Cl.

Brian Alley has a 68x74 Felix Bi-cambered prop for sale :he says it has to much pitch for his 150 hp 0-320

Graham Mitchel : 72x 68 Woodies on 0-320

Paul N557CL : 68-72

Bob Danner : Fred Felix 68 long-73 pitch with Lyc 0 320 d2 160 hp 120 mph rate of climb 1300 fpm. Maybe 72 pitch is better for climb and it does 2650 rpm flat out at 2000 feet

Russ H: Felix 68-73

J.Cl comment on 68-67 on 0-320: at 2450 rpm I would guess about 165 mph and would top out at 200 with 3000 rpm. Will be real good on take off.

J.Cl. recommends Felix or Sterba props.

J.Cl. on his 10th TW : Colin Walker fixed wood prop , marked 68L-76P reworked by Jim to increase pitch. (engine Superior XP 0-360 180hp)

Fred Weaver on 16.1.06: he just could test a 3 blade prop from Greg Cato. Although it was built for a Lancair 360 and was pitched for 235 kts TAS and 2750 rpm my TW went 10 miles faster than with the 2 blades in the same conditions. It is so smooth !!! I had to order one of these at once. For the o-360 it is about 1850 $ + freight and for the 0-320 about 200 $ less.

Jim Berry on N 168A uses the original Aymar-Demuth 68x74 tuned by Jim Clement

Propeller Fixing Torque

Rick: Felix gave me 20-24 lbs/ft for his prop. This would probably be a good number for any maple prop.

J.Cl.: Malcom Lovelace says 14-16 ft /pounds , Forest Product Lab says 25 ft/pound. I tighten them up till it feels right-- 20 pounds.

```
    Standard values are:
    1/4    bolts   132 inch/pounds   ( + - 10 inch /pounds )
    5/16  bolts   144     "                  ( + - 15      "
)
    3/8    bolts    200    "                  (  + - 25
"              )
    7/16  bolts    250    "                        "
"
    1/2    bolts    300   "                         "
"
    note 12 inch/pound = 1 foot/pound
```

On Feb 16, 2012, at 8:43 PM, "Red Hamilton" <redswing@mcn.org> wrote:

I have a Hegy prop on a taper shaft A-65 on the Lightwind, it has four laminations, the crush plate is 5.25" dia, the bolts are 3/8; what should I torque it to?
Red

Red,
15-18 ft/lbs is what is generally recommended for 3/8"'prop bolts used on a

wood prop.
Be sure to recheck torque regularly.

I just checked info I had for my Sterba prop, 15-18 ft/lbs it is.
Sensenich recommends 15-19 ft/lbs.
Cory

Brian Alley on july 06
Having tried 3 different props on my Tailwind, prop bolts had become and issue for me. When installing my Catto prop, I finally ended up purchasing the bolts sold by Saber Manufacturing. They have an extra long threaded section to help prevent bottoming out the bolts and also carry extra thick washers to help get that perfect fit.

Prop Positioning
J. Cle on 10.2.2010: Pull the engine thru until it starts to come up on compression, then mount the prop at 10-4 clock position.

Duane in Indy : Mike, I set mine so that if hand propping, my impulse mag "clicks" at about 8 o clock. That way it will start much easier and at a position that you will be free of the blade in case of a kick back. By the way, mine stops in the vertical position and then I just adjust it to horizontal when parked.

Paul Mulwitz : With wood propellers, it is important that the engine stops with the prop in the horizontal position. If not, the liquids in the wood will slowly flow to the lower blade and the balance will be ruined ??? Questionable according to others

Spinner

J. CL : The Madden spinner requires a 3/4 x .049 tube going from the first 1-2" in the prop extension, through the 3/4" hole in the prop and crush plate. Round off the tube where it goes into the tip of the spinner and weld in a 1/4" nut. A plug of some kind must press into the bore of the extension with a 3/4" hole. A thick O- ring on the tube between the front of theprop and crush plate will lock it in

place when the prop is torqued down. It is also a good idea to glass in a bulkhead forward of the propbolt heads, this doesn't fasten to anything but the spinner but keeps the spinner from getting out of round at higher RPMs. If you order a crush plate, tell them you want a 3/4" hole, not the usual 1 1/2".

J. Cl. on 7.9.2010: I usually glass in a 1/4" foam bulkhead just forward of the crush plate and some reinforcement around the prop cut outs.
Contrary to your Hatz friend, I have never had a fiberglass or carbon fiber spinner crack but almost every aluminum one has.
Jim C

Brian Alley (N320WT) on 14.2.06: Begin by mounting the backplate and prop to mark where the prop will exit the spinner on the back plate. Use the marks as a guide only! Establish a true centerline thru the backplate that crosses these lines (They may not both line up but thats OK). Transfer the true centerline to the spinner and use this line as the reference to the leading edges of the prop blades. Make no cuts beyond this line. Be sure to make witness marks so that everything is assembled the same way each time as you assemble the spinner. From here I use poster board to fabricate a cut template to go by when marking the spinner. Cut the spinner 1/8" inside the lines and slowly work your way out to a perfect fit. Good luck and have fun!!!!!

Farmer John on 14.2.06: look up T. Bingelis book. Make some templates out of heavy paper or poster board and use masking tape in short strips to follow around prop contour o transfer to spinner. Put a strip of masking tape on the prop so the fitting doesn't scratch up the finish.

Larry H. on 15.2.06 Make a paper mache spinner. Use your real spinner as the male plug, lay up the top using newspaper and starch. Once it dries take it of the real spinner, use the fake one to cut to fit prop, lay it over prop and fill any areas that you over cut with more paper mache. Once you have it fit to your desire, lay it back over the top of your real spinner, mark the cut out area and cut it exactly.

Jim Clement. On 5.8.2012

Aluminum spinners are more prone to cracking compared to fiberglass or carbon fiber. If a front bulkhead isn't used, at higher rpms the cut out area flattens out. Aluminum will eventually crack exactly where yours was repaired. On the fiberglass spinners I use, I glass in a bulkhead forward of the prop cutout.....Jim C

Repitch propeller

On Sep 26, 2007, at 11:59 PM, Jim Clement wrote:
Graham, sand off on the backside only. To get more rpm, leave the leading edge where it is and sand from it, taking off more wood as you work toward the trailing edge. You will end up with less chord, pitch and a thinner blade. All will pick up rpm. Jim C

Crush Plate

3/8" thick aluminum X 6" diameter minimum. Better is ½" Aluminum X 7" diam. You can buy them through Aircraft spruce or directly from Saber. Though, relatively easy to make if you have the tools. I have not seen them in steel, but suspect they would have to be similar sized, but would be much heavier. Dave M

Propeller Extension

J. Stanton: if you use the Madden cowl use 4 " extension. I would not recommend the 6" since the larger the extension the more load is on the crank and front main bearings. see <http://www. geocities.com/sabermfg/>

Jim Stanton on 3/7/04: If a spool type prop extension is used the prop to extension bolts are standard AN bolts, usually AN6 or 7 for 0 320 Lyc. The bolts holding the prop extensionshaft are drilled head AN bolts. Vans Aircraft is another source for prop bolts.
Almost everybody uses 4" prop extension 7" diameter. If you use the same spinner stabilizer that J.Cl. uses be sure that you want the 3/4 hole in the extension and crush plate

Propeller protection against rain damage

Farmer John on 26.9.08
When you get it reshaped with West and filler, get some 3M tape from Aircraft Spruce, I believe Jim mentioned the 4 in width and put it on the leading edge of the prop.

J. Cl. on 26.9.08

Have been using it for several years with no problems and could see no loss of performance. If using the 4", cut it into two 2" strips, one for each blade. Put a center line down the length so you can center it on the leading edge. 1" on the front and 1" on the back.Jim C

Prop Clearence:
FAR 23,925 : in taildraggers in taxing position 9 inches (22.86 cm) in trigear 7 inches

STABILIZER AND RUDDER

Building Stab
In case you didn't notice in Jim's pictures: make the two elevators in one piece: JCl: I use on long 3/4" tube and cut it in two after the elevators are built. Easier to keep things lined up while building.

Piper Channels
Jim Stanton on 9.9.2014 answering to Aurélien Parent:
The original Piper channel was .016 material. This is fine except for the bottom rib in the vertical stabilizer, which could be damaged on the ground. Heavier material on that one rib would be good.
The inboard ribs on the horizontal stabilizer should be 3/8" x .035 4130 tube. The ACS plans show .028 wall which is not adequate. The inboard rib should be welded, all other ribs can be brazed.
The tubing and the channel ribs should be supported by some type of vertical brace, halfway between the leading edge and the main spar.
I use either channel or small diameter tubing to support the top and bottom ribs on the rudder and the aft bottom rib on the vertical stabilizer against the pull of the fabric. These braces can be brazed or welded.

Stabilizer Fixing
Rick Crosslin answered to Bill Bernard: This is a very important part of the airplane. Be sure that the fit is close on a 3/16 AN bolt, and be sure only the shank of the bolt is engaged in the stabilizer and fuselage, i.e. use a couple of washers on the inside to ensure there are no threads engaging the hole. Use an access panel in the underside of the fuselage, standard wing type fabric inspection rings are a little on the small side, you might want to make something a bit larger to access the nut inside the fuselage. Please don't even consider a nut plate!

Fixing Plate
J. Clement: .072 and 3/16 AN bolt is ok, plans say .063

J. Cl: When building the inboard stab. rib, try to keep it tight to the fabric. Even a small amount of pressure onto the fuselage fabric is good, this will eliminate a fairing to fill out the gap.

Stab Incidence:
almost everyone gives - 2° as standard

Most W 10 at Baraboo are 1" to 1 1/2" from bolt hole to top of the longeron (not very accurate measurement) .

J. Cl. last few TW trikes are set 0° wings and 0° stabilizer. Older ones had 0° wings and - 1/2° stab. It is better to have some additional holes for the setting especially in negative incidence.

Fred Weaver and J. Cl stabilizer settings: - 1/2°

On Nov 17, 2007, at 1:27 AM, Jim Clement wrote:
Drill the top hole with the stab at 0 degrees, then drill holes down from
there. It should end up about 1/2 - 3/4 degrees negative for the initial
setting. Put in more holes than you think you will need, you don't want to
drill later when the fabric is on. I might have a picture
Jim

JCl. On 13.2.2011:
My final setting was -1/2 to -3/4 degree measured from the flat bottom of the root rib or the bottom longeron area under the door. This could vary some depending on engine setup and angle of incidence of the wing. Drill several holes close to each other in the mounting plate so changes can be easily done later without drilling new holes. I would favor a slightly more minus setting initially for the test flight.
Jim C

Elevator Push Rod
Jerry Hey : If you raise the height of the hole at the end of the control push rod to 1 " (from 1/2 ") the elevator tube will just clear at both ends. I think the plans should be modified to indicate this. It would save a lot of frustration (Leblanc/page 10 detail C)

W. Bernard about push rod : The 3/4 " tube needs a support in the middle to prevent bending. As a alternative some aircraft such as RV-6 or Mustang II use a large diameter(about 1 1/2") alum tube with no support in the middle because the tube is stiff enough. This would probably be a problem in the TW because the elevator pushrod has to pass through a very small space in the tail.

B. Bernard on 11.3.2005: The elevator pushrod in a W 10 is in tension only for up elevator. For down it is in compression. The short tube from walking beam to the elevator horn is in compression for up elevator, but from what has been described, it is short enough and stiff enough so that bending is unlikely.
The W 8 used a similar arrangement, but had cables from the back of the stick assembly to the walking beam under the stabilizer leading edge.
My own aircraft has a pivoting support in the center and the pushrod is in two pieces to get clearence from structure. I wish I'd thought of mounting the elevators upside down instead. Things would have been a lot easier.

Dave Conrad wrote on 10.3.05: Protocol would say control system design should be to operate the linkage in tension rather than compression in the predominant direction of travel. You also pick up more nuts and bolts etc. etc. with walking beam. While it may solve a problem, foresight in your construction should eliminate the need !!!!!

J. Cl.: Plans show it as one length, but if you needed to splice it for some reason, that would be o.k. too, as long as you followed approved splicing techniques. (30" cut)

Wilson Werham N447A on 30.1.06: I put a walking beam in my W 10 to reverse the direction of movement of the elevator push pull tube, at the back of the fuselage about a foot forward of the horns. This allowed me to put the elevator horns on the bottom, pointing down, rather than hidden away inside the fabric of the fin. The walking beam consists of a piece of ¾" square tubing about 10" long, with forks on both ends for Heim ball ends. Through the center of this tube is welded a length of ½" tubing acting as an axle. The ends of this round tube ride in bushings, which are welded to truss members on either side of the fuselage. The push pull tube from the stick attaches to the lower half of the walking beam and another push pull tube , onlyabout a foot long, runs between the upper half of the walking beam and the

horns. All with Heim ball end. A couple of normal sized inspection holes and I have complete access and could remove the elevators if I wanted to. I also have a second bolt in the middle of the horns. Heim ball ends throughout. Shorter stiffer push pull tube. See my article on the internet or Sport Aviation , March 1984.

Q: Gerry van Dyk: Thanks Jim, a couple of good details there. I see you've added vertical segments to the inboard 3 ribs, I presume that's to prevent them collapsing under air loads. You've got a diagonal tube to prevent the inboard rib from bowing with the covering shrink. And lastly you don't appear to have the diagonal tube in the last bay at the top of the fuselage. Is that true? I've got my pushrod just barely rubbing that tube at the moment, I'd really like to prevent that happening, if it's not really needed, chopping it out would be a quick and easy fix.
Gerry

A: Jim Clement on 17.10.2012
Sharp eyes Gerry, the diagonal tube is needed but left out temporarily and installed later to make sure it clears the elevator push pull tube. You might get clearance on your diagonal by cutting the rear welded end loose and moving it forward slightly.
Jim C

Tail Design

Jim Clement on 21.04.2009:
I asked Steve Wittman about the flared fin to top of the fuselage area and he said it will slow the airplane down and make the fin less effective. The W10 method makes the fin to fuselage a near 90 degree junction with less drag and no need for any type of fairing.☐☐The swept tail saga, Russ Hasenbalg from Baraboo had a swept tail W8 for ☐many years and often complained that the tail wandered more than our W10s. ☐When we rebuilt it several years later we made a modified W8 - W10 fin and ☐rudder on it. That made for a much nicer flying TW.☐

Rudder Cable

Most people use 1/8 stainless steel (W. Bernard, R.J and D. Magaw uses adjustable turnbuckles near rudder pedals, but he recommends custom made cables with a clevis end on the end attached to the rudder and a regular right hand threaded end on the other end. Make up a P or U shaped piece to attach to the rudder pedal arms that is long enough to allow for threaded adjustment in the "o" part of the P shape.

J. Clement on 26.12.05: Q: I like the tubes that you brazed on for rudder cable to pass thru. Can I put double tapes where the cable comes thru the fabric?

A: Some dope in a teardrop piece of thin leather and then tape over it. Hope you measured where the cable comes out before putting the fabric on. I use 1/8” galvanized 7/19

Cable Guides
J. Clement wrote 30.1.03: Question: How many cable guides do you use from behind the seat back to the rudder?
One guide in the corner of the truss behind the seat, another low and near the front door post. In the rear a piece of 3/8” tubing to line up with the rudder horn. This tube is mounted about 6” long. My rudder horn is mounted at the very bottom of the rudder and also steers the tail wheel. You can use 3/8” for the other guides.
Good place to get mil spec wire: < http://www.sea-wire.com/ >

J.Cl. on 9.2.04: Cables go through the 3/8 “ tubing. Use 1/8” cable, put thimble and shackle on after running it thru the tube.

Rudder horn
Mike Ruhnke on 12/7/04: In most TW s the rudder horn has been lowered and beefed up. I had mine where the plans called for, but cut it out and lowered it.

Elevators
J. Clement wrote 26.3.03: used dimensions for the elevators: when the rudder swings it should miss the inboard end of the elevator by at least 1/2”

Elevator Balancing
Wittmann said he balanced control surfaces 100% before he covered them with fabric and paint, leaving them slightly underbalanced which he thought they should be. This is referred only to flap and ailerons not elevators and direction.

J. Cl: On elevators no lead needed, I don’t think it has been a problem .

Elevator Buzz
Fred Weaver described having had an elevator buzz above 235 mph.
Bob Danner on 28.1.06: I did bolt thru the elevator horns down close to the base of the horns on the trike like recommended. There is no space in between the horns, they butt right together so no spacer was needed. A while back

Alex was talking about some gap seal tape they use on sailplanes. May be it’s worth a try.

J. Stanton on 26.1.06 : I have a feeling that if you hung a 0-320 on your TW your problem would go away. The 0-360 ‘s have some weird vibration issues, mostly with constant speed props, No guarantee this cannot happen with a wood prop.

Brian Carlsen on 28.1.06: In good old days Monocoups used to dope a thin piece of alu from the horizontal stabilizer across to the elevator gap with a strip of fabric both top and bottom. Then they sewed the strips together with thread thru the elevator gap. When the elevator went up or down the gap was sealed.

Stops on moving surface

J. Stanton on 19.8.06 The fitting retainer ring at the aft end of front pushrod contacts aft end of control stick torque tube for up elevator stop. For the down stop I welded a spacer to the forward face of the 3/4 square tube to contact U channel between 5/16 bolt and pushrod attach point. For rudder stops I copied Wittmans arrangement on the V8 Tailwind which is
a piece of 3/8 tubing welded to the lower longeron behind the arms
where the front end of the control cable attaches.

Control Stick Stops

my stops are 4” up from the center of the torque tube and 2 1/8” wide ID with the Clement mods.

Trim friction pad

On Nov 18, 2007, at 12:15 AM, Jim Clement wrote:
The biggest problem is the plans washers are to small. I cut two washers 2 1/4" diameter from .080 aluminum and flush rivet them onto the smaller washers on the trim assy. Used silicon baffle material between the washers. Jim

Rudder Trim

J.Cl.: If you want a quick fix while you make a rudder trim , bend a 1/2” high wedge about 3-4” long and tape it onto the rudder on the opposite side you hold. If it is to much, trim it shorter, or make it longer if not enough. Put it near the back edge close to the bottom.

Q from Mike on 19.4.07: I'm having to hold some right rudder in level cruise. does anyone have a photo of the

trim wedge that you mount on the rudder and some advise on the best place to mount it?
A of J. Cl: Put the wedge on the pilots side near the lower part of the trailing edge. I fasten it on with vinyl tape.

Hinges Spacing
Polyfiber says one layer of finished fabric is about .006" thick which makes .024 for four layers (2 on stabilizer and 2 on the rudder)

Fabric Covering
J.Cl. on 12.12.05: about covering the transition area fuselage- vertical fin: slit the fabric length ways and glue to the bottom of the fin.

Fabric reinforcement tape
2", the only place 3" would be nice is on the fin post and that is only two
feet long. A 2" on each side will work there. No bias tape needed. Jim C

Drain Holes
J.Cl.on 17.1.06: I don't use drain grummets, just melt them in with a round tipped solder gun. Don't forget to put a couple in the bottom of the fuselage near the tailpost.

Oiling Holes in Hinges
J.Cl. on 12.2.08 Holes about 1/8 in the lower part of all hinges (stabilizers , ailerons and flaps) is a good idea because oiling through the little hole is easier than on both sides.

Stabilizer Reinfocement Tube Main Spar

Jim Stanford on 29.7.2010:

It is MUCH easier to leave the heavy wall tube round and flatten the outer tube- 1 1/4" X .035. This can be done in a relatively small vise without wrecking the vise. The oval on the outer tube is oriented horizontally instead of vertically. ☐

Stabilizer Failure
Jim Stanton on 16.12.08:
The first five W8's were flight tested to 4 G's at gross weight. I ☐believe all had the small wing strut. The horizontal tail on the W10 is ☐considerably

stronger than the W8. The only Tailwind structural failure ☐that could be considered aerobatic related was an 0 320 powered W8 with ☐hartzell C/S prop. The pilot was doing high speed dives and sharp ☐pullups. The horizontal stabilizer failed downward and then the wings ☐came apart. Alcohol was involved. ☐

Flight Test

J. Clement on 6.2.10

To check stab and elevator position, take a tape rule and measure from the stick to a fixed point such as the fuel tank and then check on the ground to see where things are positioned.

Jim C

Taping stabilizer/fuselage junction

J.Stanton on 26.11.2014

Wittman taped the stabilizer/fuselage junction on all the Tailwinds and all the racers. I don't know about Buttercup and Big X. Everything that Wittman did had a reason.

Gap seals work on any control surface. Keeping the air from bleeding from one side to the other always makes it more efficient. The minus can be it will change the feel. It can make it the controls have a more weighty feeling. The surface is working at its best with no losses. Some people dont like the change.

FUSELAGE

W-10 plans from Aircrft Spruce

All of the top and bottom fuselage width dimensions are wrong. Add 3/8" to all the dimensions, for example the top of the fuselage at stations 24 and 48 should be 40" between longeron centers or 40 3/4 measured to outside of longerons.

W 10 versus W8

J.Cl: W10 is just 6 inches longer than W8

Fuselage Construction

J. CL. (7.03. 03) : Make up the rear spar carry thru on the bench. Notch out the 1/2” ends so you can slip the carry thru tube in place. Don’t tack this in place, let it float until you fit up the wings, then you have some adjustment for wing incidence. Also just tack temporary diagonal tube at the firewall station to keep it square. The most

important dimension to keep square is the front to rear spar bay.

Brian Alley : It's not necessary to weld the full circumference of every tube. Instead fit all of the tubes in the fuselage sides and tack everything together. After removing the sides from the jig complete the welding of the sides. Then do the cross and diagonal tubes to form the fuselage. By completely welding the sides first they will be more likely to form equally to the bends you have to make to form the fuselage. Below is an excerpt from an email Jim Clement posted on welding the fuselage that will help you a lot.
Stack the sides flat on the floor. Using some short 2X4s or something like that, make sure they are aligned perfectly. Weld the upper and lower longerons at the rear where the two sides come together. This should be at the very end of the tubing. Now you can stand it up and spread it apart, no jig required. Make up the rear spar carry thru tube on the bench. I make mine about 1/2"long on each side. On the ends where the vertical door post goes, drill 3/4" holes. Then notch out the 1/2" ends so you can slip the carry thru tube in place. Don't tack this in place, let it float until you fit up the wings, then you have some adjustment for wing incidence.Next tack in place the lower truss tube, the one in back of the seat bottom. Tie wire the firewall to the approximate dimension.Put in place the front spar carry thru tube, the strut carry thru tube and tack in place. Go to the firewall and tack in the upper and lower cross tubes. Square up this bay and tack weld a temporary diagonal to hold this bay square.Now it should look like a TW fuselage. The most important dimension to keep square is the front to rear spar bay. Use the cross tube width dimensions on the plans only as a guide, they are close but let the longerons take a nice bow back to the front of the stab area. Tack in the cross tubes. Run a string from center of rear spar carry thru to tip of rear longerons, mark the centers and tack in the diagonals.Turn the fuselage over and do the same to the bottom. To square the top to the bottom, level the bottom across the strut carry thru and plumbob the top cross tube C/Ls to the bottoms. Tack in the diagonals. Don't heat up the clusters after tacking without putting diagonal
1"x 2" boards in or the longerons will bend in. Put these in on each side of the bay you are welding. they should push the longerons out so it is noticeable. They are X in the bays.This method is the easiest and quickest I've found

and welding the longerons together was told to me by Steve Wittman. Jim C

Priming tubular structures

J. Cl on 31.8.06: If the self etching primer gets a good bond the Epibond will stick to it. I usually spray the Epibond over bare steel.
I refer paint as the final top coat, primer is needed whatever is being painted to get a good bond for the paint. Epibond epoxy is dope proof, glue proof and nothing will lift it. It also dries with somewhat of a smooth glossy surface requiring no topcoat. Some primers are porous, without top coating they are less durable over time.

Jim Stanton on 31.8.06:
Why does any one want to reinvent the wheel. The Epibond/RandOPlate
Epoxy primers are far superior to anything else on the market. I was
told they were developed for the tube frame of the Grumann Ag Cat.It
can also be applied in fairly cold temperatures.The primer should be
applied to freshly sandblasted structure. I just blow off the dust and
shoot the primer. I try to sandblast on a clear-low humidity day and
apply the primer the same day. I have always used the first generation
Imron for color coat. The Imron has more pigment than many other
paints and it flows out fairly well when painting a complicated tubing
structure. I am using PPG colors for every thing else including some
of the smaller steel tubing parts. The Imron will hold up fairly well
to the nitrate based fabric cements after 24 hours. I have not used
the urethane based fabric cements.

Wilson Werhan on july 2005
When I built my Tailwind, N447A, some years ago, I was at the time in
the epoxy curing agent (Part B) business as a salesman for a leading
manufacturer, General Mills Chemicals. After talking to our

chemists,
I came to a couple of conclusions: It is the cured epoxy which adheres to the metal, not the pigments.
A glossy epoxy coating would protect the metal just as well as a
primer. Since a lot of the tubing and structure in the cabin area should be
color coated for decorative reasons, why not coat the entire fuselage
and structure with a glossy epoxy coating in the final color of your
choice? That's exactly what I did 21 years ago and it still looks great. One
spray session and the job was done."

However, there have been no recent posts received on painting from you. Always look forward to your comments, you have good info like Jim Cl.

Tube Treatment

J.Clement on 21.02.2009 summery of a longer discussion:

I totally agree that inside tube treatment is not a good idea. If you ever ☐have to weld, wear a firesuit and full face welding mask. Just when the weld ☐starts to puddle it will blow out flaming linseed oil, like looking directly ☐into a blow torch. Then as you try to continue welding it melts the coagulated oil and you will have a fireball around the area you are attempting to weld. Also as it drips to the floor that also will be burning. ☐As a previous poster stated, he would never work on another fuselage that was treated on the inside, I agree.☐Most of the rusted internally longerons have been Piper and Champs and that ☐came from rusted holes behind the welded on door fairings that held moisture ☐and dirt. Water would run into the inside of the longeron and follow to the ☐tail, have seen split longerons from water filled tubing freezing in the ☐winter.☐☐One other thing, the smell of burnt linseed oil will stay in the shop for a ☐month.
☐

Repairing small dent in tubings

What size tubing would you use to sleeve the 7/8" longeron, in order
to fix a small dent per the split sleeve method in AC43-13? 1"x.065
would provide a 7/8" ID to match the longeron OD, but would welding
the .065 to .035 be troublesome? Perhaps something thinner would be

better ...?

J.Cl. answer on 28.8.06;
If it is a small dent, drill a hole opposite and use a small round tip punch
and straighten it, then weld the hole shut. If it is bigger, cut a small
.035 patch that covers the dent and weld it on. Using a .065 or .058 sleeve
is a overkill and will leave a big lump that will be very hard to hide when
you put fabric over it. Jim C

Tailpost
J. Cl. on 20.7.03: The tailpost height is the same as the plans. What you might see is the 1 ¼" tube is reduced just above the top rib to prevent the fabrichitting if reduced higher, as shown in the plans.

Wing Attachment Fittings
J. Cl. wrote on 26 April 03: Weld the cluster first. I make up the fuselage fittings first and the bolt them to the wings. Level up the airframe and suspend the wings in place, then tack weld with Mig welder the fittings onto the fuselage. A couple of tips to make it easier. Instead of making the inner U part of the fitting in one piece, split it in the bottom of the U leaving a 3/16" gap. Then use washers the same thickness as the outer gussets and bolt the fittings to the wing fittings. This saves the hassle of bending up many fittings that don't quite fit and gives a good place to tack weld onto the fuselage. I use the Mig welder to weld the 3/16" gap and a few other places on the fitting. Remove the wing. Drill the holes in the outer fitting pieces and then bolt them on. Heat up the side pieces and shape them with a hammer. Weld them up.
If you have a low ceiling, suspend the wing from 4 threaded rods and 2 2/4S (each wing)
Tack weld the bolt bushing in place, otherwise it will fall out when you are trying to put the bolts in and the guys on the wing tips are telling you to hurry up.

Wingstrut Fittings Placement
J. Cl. wrote 21 April 03: The fittings angle shown on the plans is very close. I drill all holes for strut and wing attach fittings using a drill press. Do this before any ribs are put on.

Wider Fuselage
Some build it 2 " wider.

J. Clement: D. Flamini's is 2 " wider . Several have built wider ones without problems.

G. Turner : 2544 was 2 " wider from firewall back so it looked normal. It was great, but I didn't appreciate it until I bought a standard width.

E. Schlanser: The shoulder room can be increased by augmenting the rear door posts. Add a strip of sheet metal or plywood to the outside of the rear door posts. The strip is wider in the center and tapers in at the top and bottom. As to a bulkhead station in a wood or sheet metal airplane, attach the fairing strips to the outside of those strips. Then bump out the center of the doors to match. This mod is included in pictures in Clement's photo pack. He added 1 1/2 " inches total at the rear door post I believe.

J. Stanton: Guido : The 180 hp W8 that used to be N4JB is 2 " wider and 2 " higher in cabin area. The "higher" lows down the speed quite a bit. It is important to maintain the same relationship between top and bottom dimensions at each station. If you widen the bottom at station 3# too much without widening the top, eventually the flaps will not work. If you really want a wider cabin I would widen all dimensions at station 2# and 3# the same amount. Widen the firewall a little and the station at the leading edge of tail a little. Ignore the other width dimensions and just make it look right. The width dimensions for station 4# and 5# on the plans are probably not right anyway. I don't believe larger or heavier wall tubes are necessary.

J. Cl: If you put the door mod in, it will move the top tube of the truss back about 2" giving more leg room. Then increase the first bay from 18" to 20" will give you 2" more. Move the rudder pedals ahead 1-2" for some more gain about total 6".

Flap Tube Clearance
J. Stanton: The front fitting is raised approx. 9/16 " on the spar which drops the wing the same amount on the fuselage. The rear fitting centerline is approx. 5/8 " below the front fitting centerline. This puts the rear bolt holes close to the rear spar centerline. I have about 3/16

clearance on the flap torque tube , so it appears that if everything were built exactly to plans there is an interference problem on the flap tube. Some of the early W8 ‘s including Wittman’s #2 had a very noticeable arch in the upper longeron, which would also marginally increase clearance on torque tube. I put a very slight arch in my W10 fuselage upper longeron between station 3 and tail. Total is less than 1/4 " I would guess that this arch increases the flap tube clearance by maximum of 1/16 "

J. Stanton on 16,3,06: A friend of mine in the 60’s got his fittings in the wrong location. Flap tube would not clear longeron. He heated the longeron and put a big lump in it. End of the problem.

Q from A. Eldrege 11.3.07
I am in the process of laying out the fuselage jig and wanted to clarify the issue of the torque tubes interfering with the longeron. I would certiaionly prefer to avoid notching the structure. Checking back in the archives it appears that there are some solutions such as:

1. A deeper wing attach fitting with an off center hole to lower the rear wing spar slightly,
2. Bowing the longeron so that it makes a gentle arc betwen the tail and the rear cockpit. deviating no more tha 1/4".
3. Waiting to build the root rib until the wing has been fitted to the fuselage, making the necessary adjustment to the root rib ath that time.
4. Notching the longeron

If you were doint it all over again, which of these approches makes the most sense, or is there something I have not picked up on? At this time I am dealing mainly with pencil marks but wanted to be clear on this before things get increasingly permanent.
Second question. The plans call for the longerons to be bowed slightly between stations to prevent sag while covering. I am taking Jim's recommendation to use the larger tubing (3/4 x 0.028) on the aft longerons. Does this obviate the need for bowing out the longeons while welding? If not, I have interpreted the bowing out process to take place midway beween clustered stations in a manner that the original dimensions will be preserved at the stations, but in between there will be a temporary swelling of the otherwise straight lines on a diagonal directions which would appear as several bumps in the longeron while sighting down its length. It seems to me

that the glamorous solution would be to build in the gentle bow on the upper longeron between the the cabin and tail with the larger diameter tubing, and this with the larger diameter tubing would combine to form a sufficiently stiff structure so as to prevent the sag.

A from J. Clement 11.3.07
Andrew, make a full size copy of the wing rib from a piece of 1/4" plywood. Make the bottom flat as the root rib drawings show. Cut out the spar openings and put a mark where the spar fitting centerlines are. When you lay out the fuselage jig you can lay the rib pattern over the jig to see if everything fits. Bottom of the rib should be parallel with the bottom longeron. If the flap spar hits the longeron, lower the rib until it misses. Then lower the front spar carry thru location in the jig to match the front spar fitting C/L. 0 to 2 positive degrees incidence is ok.

Flap Handle versus Stick
RJ on 22.2.04. I think I moved the flap handle arch farther aft, maybe I shortened the handle or both. It clears the stick at all times since probably the stick will be full aft on landing and stalls.

Flap position
Q: Jack Stewart on 30.9.07: What do you set the flap notches at?
A by J. Clement: I just drill holes about 1" aprt and take what it goes. 40° id about right for max. flap.

Location of Battery
J.CL.: as far back as you can get it under the baggage floor.

Baggage Compartment
J. Cl (4.2.04): I bend up alu angle from .050 sheet but you can use 1” store bought hardware store type angle. Tabs are welded onto the fuselage and the angle is pop riveted on. It is finished off with 1/4 “ poly board, (looks like corrugated cardboard) , then covered with automotive foam backed headliner material. Luan plywood from the lumber yard works for the baggage floor, make it in two pieces with stiffener at the joint. Places that sell plastic products and some sign shops carry poly board, it’s about 10 $ for a 4x8’ sheet.

Location of Rudder Assembly Tube
J.Cl.: 31.12.03. Distance rudder assembly tube to firewall: 4” from the back side of the vertical firewall tube to the C/L of the rudder assy.

Tube Sizing
Brian Alley wrote: I used .035 instead of .028 and got no argument from FAA when I submitted. 875 lbs empty and 1500 lbs gross weight.

E. Schlanser: I substituted .035 for .028 in all but a few places e.g. the
3/4 x .028 elevator control tube that extends from the cabin to the tail.

Jim Clement on 19.8.06:
The original W10 plans called for 5/8" X .028 from the station at the rear of the baggage compartment to the tailpost. That was for both upper and lower longerons. This tubing wasn't stiff enough to keep from bowing in when the Ceconite fabric was shrunk so I used 3/4" X .028 instead and it worked fine. The upper longerons from the front of the fin to the tailpost can be 5/8" X .028 or .035 spliced at that cluster, this gives more room for the elevator horn. If you use 3/4" all the way to the tail post, oval the longeron in the area of the elevator horn for needed clearance.
Jim Stanton on 20.8.06
I have a fuselage drawing 2-102 with no date. It has a bunch of
revisions marked in various locations including tubing sizes and
dimensions. These revisions indicate that the lower longeron from A to
B was originally 3/4 x 035. From B to D 7/8 x 035. The revised drawing
is 3/4 058 from A to B and 7/8 x035 from B to D OR 3/4 x 058 from A to
D The longerons were further reduced to 1/2 x 035 top and bottom at
the leading edge of the tail to the tailpost. There was NO .028 tubing
used in the W8.

Covering.
J.Cl on 1/7/04: The green urethane adhesive is from

Superflite and the clear that is in most of the photos is Randolph Urethane. Most Superflite dopes and covering products are Randolph with Superflite label.

J.Cl: on 9/7/04: One coat of Airtech primer. Direction call for simple coat, the two more a day later. It is recommended to spray the primer on flat position if possible. The tail surfaces can rotate as well as the fuselage.

j. Cl on 9.11.05: Predrill the tubing before mounting and make sure all the drill shavings are removed. After covering but before putting the reinforcement tape on, mark where the holes are with a pencil (no ball pen on fabric !!! it will always bleed thru even after different layers of final painting) stick the reinforcement tape over the fabric and find the holes with a sharp awl. Use 1/8” normal hand pop aluminum rivets without washers.
Sequence: round tube, fabric over tube, reinforcement tape over fabric, pop rivet just through this into on side of the aluminum tube, then surface tape goes over the whole thing. No filler is used.

J. Cl. on 27.9.2011 about fixing the fabric on fuselage top: Center stringer is fastened 54” sides 42” spacing 2”

J.Cl. on 18.1.06: Don’t forget to put some drain holes in the bottom near the tailpost .

Stitching
J. Clement: Spacing of pop rivets to fix fabric to fuselage formers?
I space them 2 ". The center stringer about 3/4 way to the vertical stab and the shorter side stringers about 1/2 way to the vertical stab.

J.Cl.: Top center fairing rivet ¾ of the way to the fin. The outer fairings a little short of the ends. I don’t fasten the bottom fabric, there is enough curve in the belly to keep it tight.

J.Stanton: Pitts uses 1” behind propeller and 2” outboard of propeller. On Wittmans airplanes the screws that hold the fabric on top of fuselage end about 2/3 of the way from the rear spar to tail. The fuselage is thereafter narrow enough that it is not necessary to secure the fabric. Most of the early TW s used #4 truss head PK screws with plastic or

thin metal washers on top of fuselage.

J.Cl: 10.1.04: I don’t stitch or fasten the fabric to the bottom stringers, never had problems.

On 06.08.2009, at 00:08, Jim Clement wrote:
1 I reach thru the hatch to put a nut on the bolt that holds the leading □edge of the stabilizer. Cover is .025 aluminum.□□2 I rib stitch or use pop rivets on the fuselage top three stringers only, □2" spacing.□□3 The surface tapes should wrap around edges when ever you can get at the □backside.□□4 I like the Randolph products, the Ranthane is more susceptible to cracking □on fabric than butyrate dope. I like the butyrate system on fabric and □Ranthane on the metal and fiberglass parts. Paint match is good.□□5 Most paint white because it reflects heat and UV better.□□6 I make the horizontal stabilizer to fuselage side have a slight □interference fit so it fits tight with no need for taping.□□7 I recommend you get a fabric covering manual for the system you plan on □using, It will help a lot.□□Jim C□

Stringers
William Bernard 28.9.02: I used 1/2” aluminum tubes for the stringers, The holes for the stitches are spaced 1/4” apart to minimize the pull down of the fabric around the tube. I’ve been using a 6” curved needle to do the stitching but now I have problems. To get the needle up the far side of the stringer it has been necessary to push the needle completely into the fuselage and reinsert it from the inside by reaching in through the door/window opening. I can’t reach far to the back.

J. Cl. 1.10.03 : 1/2” 6061T6 round alum for stringers is what you want, either .028 or .035.

RJ Hardin 23.12.02: Stick to rib stitching, Pop rivets would be week unless washers were used also.
I am using spruce for the formers (they are really called stringers)

Dallas Benham on 8.2.06: Drill thru the saddle into the alu stringer and fasten with a pop rivet. I think I used 3/32” but 1/8” rivets would work also.

J.Cl. on 8.2.06: If you can get at the half round a pop rivet will work. Safety wire also works, drill a hole thru the alu tube and tie it on with safty wire.

Tubing Splices

J. Clement: Steve usually when splicing same diameter tubing used an internal sleeve it is done with a 30° cut, which you have done, and rosette welds on each side of the joint. The easiest and best rosette welds are made by drilling the outer tube with a 1/4 " hole and the inner with a 1/8 " hole. You will easily get good penetration on the inner without burning up the outer.

Doors.

J.Clement : 1/2 " alu tubing might bee a little small, it will most likely bow out at the top. I've been using 3/4 "x .058 and cover with .025 6061-T6 for both. Fasten it on with adhesive and counter sunk pop rivets. Make the outside of the door to match the outside of the jam, the door is convex as is the rear door post if faired out.

Wilson Werhan on 26.9.05

I built my doors out of 5/8 square pieces of spruce left over. They are covered on the outside with .020 aluminum, countersunk screws, with 3M ¼" sound deadening foam glued on the inside surfaces. This foam makes the aluminum seem much thicker. Woden doors are lightweight, fun to build and very easy to attach things to.

Farmer John on 25.9.05: I used 2024 and .030 Thick aluminum for my doorskin which may be verkill but my old Colt has this.

A: on If the door opening is made from round tube, extend the skin on to the centerline of the tube. If square about 1/4 or 3/8" works. Leave a raw edge on back, bottom and top depending on type of panel you make above the door. Folding the T-6 tightly over 180 degrees will crack it. The front edge can be bent 90 degrees and riveted on to the front edge of the door frame.
Jim C

Brian Alley on 29.9.2011
did my first W-10 with 3003, was never happy with it. It was not stiff enough and came out wavy. I'd use 6061 or 5052.

Jim Berry on 29.9.2011
.025 6061 will work better than the 3003.

About adhesives to fix the doorskins

J. Cl. on 30.9.03: As adhesive lots of stuff is available (3M window weld Super Fast Urethane , * 08609), the last ones I primed the aluminum with epoxy primer and bonded the skins on with a caulking tube of auto windshield urethane. It is used to glue w/s in cars. Wear latex gloves!

Rick Crosslin (12.3.04): I use 3/32" pull rivets and a bead of silicone.

Eric Schlanser: I attached an aft door jamb of .025 steel sheet to the fuselage like RJ explains in TW times. It extends 3/4" at the center of the aft edge of the Clement door opening and tapers in at the top and bottom to meet the fuselage.

Jim Stanton about adhesives: My favorite is the 3M epoxy used by Pitts for gluing the canopy glass to the frame. I figure if this will hold up all the aerobatics it is good enough for door skin. I don't have the 3M part number. Aviat in Afton WY should have it. Very expensive.

When bonding the alu door skins to the alu door frame etch and prime the alu where you are going to glue with epoxy primer. (Aeropoxy ES 6279 Structural Adhesive) Using urethane primer is a good idea before the w/s adhesive calk is used. Also some countersink pop rivets should be used. Don't use urethane adhesive or primer to glue the windows, you will have a mess that cannot be cleaned up.

J.Cl 12.12.05: .025 alu is fine for the doors. The wing fairings work better using .032. The window frames should be no less than .032, thinner will pull out of shape when the fabric is shrunk and the windows don't fit nice to the frames. The alum angles ca be .025 or anything you have.

J-Cl on 7.9.2010: Drill all the holes and cleco the skins on the door frame, install and make sure it fits the way you want.
Remove the door,sand the areas to be glued with 100 grit or similar then glue and cleco, remove one cleco at a time and rivet before glue sets. Rivet spacing 4-6" depending how well it fits.
Jim C

Seats

J. Clement wrote: Guido, one TW I built had adjustable seats. They worked ok, but were in my opinion more work than

they were worth. The ones I have built lately adjust by moving for or aft, before getting in. Pegs with a bent hook on top are welded on the 1 " cross tube that goes under the front edge of the seat. The seat rails have holes in them that fit over the pegs.

J.Cl on his 9th TW: The bottom rails are 3/4"x.035 or .049. The two cross pieces can be 5/8" or 3/4" .035. The back pieces can be 1/2"x.028 or .035. These seats do not slide but have four holes in the bottom rail at the front that slide over two standoffs that are welded onto the big tube under the front of the seat. The standoffs are 3/8" tubing with a 3/16 bend bolt welded on top to hook into the holes in the seat rails. The seat back can be covered with light alum. pop riveted on or fabric covered to save weight. Weld 4 tabs on the bottom to screw 1/4" plywood to. the seat foam can be glued together to a thick block and carved to shape. Use extra firm on the bottoms and soft on the back. No thicker than 1 " on the backs .

Seatbelts

J.Cl. wrote 15.4.03: For the inboard point the most likely place is at junction of the bottom cross tube and the flap handle support, one bracket and bolt both belts to it, one on each side of the bracket.

J.Cl.: Hooker Harness listed in Sport Aviation makes a good belt 2 " commercial is over 100$. Otherwise look with Wicks

William Bernard got them from WAG aero : they were the cheapest (lap belt with Y type shoulder harness.

J. Cl. on 2.10.04 : The shoulder harness bracket is placed in each upper corner of the baggage compartment. It is a single point for Y type harness and it feels completely normal when strapped in. It is .065 or .072 strap welded into the corner.

Bill Bernard on this: I did almost the same thing but just 1 fuselage bay backward. I then ran a cable (1/8" 1/19) from the bracket forward.

Lou Owen: On 6PJ I did essentially the same except I welded the straps inboard of the cluster about 3-4". I figured in crash the tube would bend and take up some kinetic energy.

Floor Material

J.Cl. uses Polyboard about 10$ 4x8’ looks like corrugated cardboard, brand name Corrplast.

J.Cl. on 23.9.06: ¼” plywood from the lumber yard works ok.

Static Port

D. Magaw on 4.8.04: On my W8 it is on the left boot cowl, just like a Cessna
150. J. Cl. puts them on the bottom of the plane near the tail.

Brian Alley on 27.1.06: I have my static port in the pitot tube under the wing. It’s a blade type from a Piper Cherokee. I wouldn’t use this pitot again even though it works great., because of the dangerous location. I think J. Clement uses a static port under the fuselage a foot forward of the tailpost with good results.

William Bernard on 27.1.06: My static port is on the left side of the boot cowl and works well. The only disadvantage is that the static line has to be disconnected to remove the side panel.

Firewall

J. Cl and Tony Bingelis recommend stainless steel .016 - .018 “ R. Crossling goes till .025 = 0,6 mm.

R. Crosslin: The central step at the bottom needs to be 11/2” or slightly more. In TTimes he described 11/4”

Windshield

1/2 “ tube is fine for the W/S frame but use .028 or .035. Weld tabs to screw the W/S to
Q: what size of tubing did you use on the outside W/S bows, and center W/S support?

J.Cl: The center is 6061-T6 x .058. The sides can be the same or if you want weld in use 3/8” x .035 or 1/2 x .028-.035 4130.

The center W/S support tube is needed

Windshield Plexi

for mounting polycarbonate material drill the holes somewhat oversize as usual. When installing the window apply clear RTV in the holes and install window with flush head screws and dimple washers. The washers allow for additional surface

area and the RTV even when cured will allow the window to float as it expands and contracts, but dimples help to center everything.

Dave Magaw wrote : I used tinted 1/8” plexy from A&S for front w/s and 1/16” plexi for side windows but they have some cracks after 2 years.

R. Crossling used all over 1/8 “ Lexan (polycarbonate cave gas spills) Make sure you get it with both sides coated to protect against chemical attack or scratching. He used clear silicone for sealing the windows to the frames. For the fuel filler neck hole cover with sort of alu washer about 1” larger than inner diameter and fasten it with silicon.

Rick uses Lexan in his O-O very steeply shaped and 62 #6 screws secure it to the frame.
When making holes in Plexi or Lexan turn the hole saw as slowly as you can, have a helper flood the plastic with water while cutting , don’t allow it to get hot, don’t rush After cutting the hole radius the edge well with 220 the 360 grit paper.

Brian Alley had bad experience with acrylic. Latest is polycarbonate (Lexan) and it didn’t crack yet.

Most people recommend Lexan

B. Alley recommends Lexan 3/16” W/S and 1/8” sides (mar guard coating on both sides against fuel injuries) “ I placed the cutout from the holesaw for the filler cap in a jar of Avgas for a week and it remained clear. Lexan may be a little heavier that acrylic but sure better for a fast TW.

Red Hamilton: I just put in a Lexan W/S and used Percy’s Speedglass, it is coated and is said to be unaffected by gas, hydraulic fluid etc. and it is even stronger than uncoated.

J.Cl about W/S mounting: Pull the sides down and see how they fit the sidebows, you don’t want much of a gap created by a compound curve. If there is you might have to reshape the center bow.
About fixing the W/S on #9 : He uses 6 flush screws and Tinnenman washers. Maybe it would be a good idea to use a continues strip down the center of the W/S.

J.Cl on 4.2.07 I fasten the center of the W/S about every 6 inches

J.Cl: 2.1.04 In his newest project (# 9) he uses 3/16” W/S plexi instead of 1/8”

J. Cl. on weight of different plexi size: The weight of a TW w/s 48” x 42” is for so called 1/8” actually .117 “ (3,2 mm) thick is 10.368 pounds and so called 3/16” actually .1875 (4,75 mm) thick is 16.4052 pounds.

J.Cl on 15.10.07: My first choice is 3/16" light bronze tint acrylic.1/8" is ok but bird strike may break it. Side windows might be thinner. The light bronze works better in cloudy overcast than gray. I get it from Laird Plastic in Madison. I prefer acrylic: less money. My W/S is 47" long.

J. Cl: about W/S details: I have tried at least 6 different ways. If you raise the center of the bow 1 1/2”-2” and slope it ahead. The W/S lower edge is cut perfectly straight across and when put in place the W/S bow will follow directly under the front edge of the W/S. I did this to the new TW I am building and it makes building the W/S trim and other things much easier. Plus it looks just right.
Is the arch sloped forward until it perpendicular with the slope of the window?

J. Cl.s answer: Yes ist is 90 ° to the center of the W/S. It was sealed with windshield urethane . It was applied without the primer first, I think that’s why it didn’t stick.

John Downing on 31.1.06: glue for windows: I got it from Car Quest: 3M window-weld super fast urethane pu/08609, preceeded by 2 part epoxy primer.

J.Cl. recommends 3M window weld adhesive too Lexan or Plexi
Solvent/Glue: Red Hamilton on 12.2.06 Trichlor is not readily available now.Methylene chloride and / or ethylene dichloride may be, they will both work with plexi. You can make a glue dissolving plexi shavings into the solvent. Don’t breathe the stuff. I don’t know what might work for Lexan, may be ask GE

J.Cl. on 31.01.2006 :
Any glass shop that installs auto windshields will have it. There is also a primer that should be put on first. The

adhesive will come in a calking tube. It is usually about $7-8.00 a tube. It might be another brand but it will work.

R. Jamieson on 12.2.06 : Auto Zone's 99 cents carb cleaner (AutoValue) is methylene chloride. It works on carbs too.

W/S Bow J. Cl. on 9.2.04: Tabs are welded on to give more edge distance for screw holes. Center bow is 6061 T6 &/2" x .058 alu and slips over a 3/8 " dia 4130 stub welded on to the w/s frame.

Ron Steber on 11.2.04 : My inner bows are 3/8" square alu tubing bent to shape. I attached the 3 tubes by slipping them over a short piece of 1/4 4130 welded to the front fire wall bow, then I welded 3 U brackets to the forward carry through spar and finally 3 more U brackets were attached to the top tube where the fabric terminates. I arranged the rear brackets in such a way that the plexi is flush with the top fabric. I use A strip of alu as a clamp at the rear of the W/S. The square tubing is drilled approx. every 8 inches and is fitted with rivnuts for 10-32 stainless screws. The W/S is drilled and countersunk for the machine screws. The side angle bows are drilled and the dimpled to accommodate the countersink.
(I used a shrinker to form the curve.) In the center of the W/S I used countersunk washers painted black to blend with the dark W/S. Using this technique allowed me to drill larger holes into the plexi to allow for expansion without stress. The countersunk screws give a nice smooth finished appearance from outside. The forward part of the W/S is retained by a lip bent on top of the SS firewall.

Spider webbbing on Lexan
Brian Alley on 29.9.06: After more than 2 years since I installed Lexan, I have noticed some of what you call spider webbing in the tight bend across the main spar carry thru. I think it is in hard coating, not the material itself. Lexan without coating is very soft, will scratch very easily and is vulnerable to fuel damage.. Marguard is a trade name but there are others.

W/S Size
J. Cl on 28.9.06: I make my w/s 47" long measured from firewall to rear of w/s. This gives some sun protection and also lets you see over the wing in a steep turn.

Front Bow W/S Cowling Intersection

J. Cl. wrote 26.3.03: If the sides are raised one inch the center should be 2 1/2" up from the 5/8" cross tube. The slope at the firewall is determined by putting a W/S pattern in position. The W/S pattern should have a straight cut on the forward edge, when held in place, this will give the correct slope to the top of the firewall. This allows making the trim pieces without any curves and curved joggles.

W. Bernard: The cowling is attached with #8 screws on about 4" centers and only is held to the airplane at the firewall. The top and the bottom are fastened to each other, of course, but the is no attachment at the front of the engine.

W/S angle

Jim C. on 1.10.12
N168WH Tailwind
Using bottom longeron as zero and slope measured at firewall area
center 28.3
L and R sides 31.0

N168HW Buttercup
Center 34.0
L and R sides 38.5
Jim C

Red Hamilton on 27.9.2012
37* has 29.8°

Farmer John on 23.9.12
29 °

W/S Support Channels

answer from J. Cl. Put a piece of wood like a capstrip in the channel and bend over your knee. Also use mild steel not 4130. 1/2" x .058 alum square tubing works fine. Weld one inch long 3/8 " tube onto the airframe at each end where the bows will fasten on. Spring the alum square and slide it

over the 3/8”. On the side bows, 3/8 “ round will also work. Weld short tabs on the tube facing in for the screws. This will also give more edge distance for the screw holes to prevent cracking the plex.

W/S Fastening

J. Cl. on 2.9.04: On my first TW built in 1980 I used #6 pointed sheet metal screws. None fell out or loosened up.

Rear Window Frames

J.Cl on 3/7/04: Window frames on * 9 are made of .040 6061-16 alu and pop riveted to welded tabs. The only problem with .025 alu frame is if the fuselage side fabric is fastened just over the side window lip it will pull the lips outward and the window won’t be flush. If you glue the fabric completely to the outside and inside lip of the alu frame you should be OK.

J.Cl.on 9.2.06: The fabric goes over the alum and is wrapped around and glued to the inside of the window opening. Also glue the fabric to the outside of the alum window frame. It helps to bend a 90° on the bottom of the window frame but I used .025 aluminum on one set and after covering and doping, the fabric distorted the opening some.

J. Cl. on 9.2.06: I prime the alu windowframes. Fabric sticks on better, wrap the fabric around the window opening and around the front.Fabric is glued down on all surfaces it touches on the outside and inside. Surface tapes go to the edge of the window opening but go allthe way around on the door opening side.

John Downing on 7.2.06 commenting on Gary Knapps pictures: One thing I did, was to put the top tab inset the thickness of the window frames so the frame would not hold the fabric out away from the top longeron. Harold had his covered like yours and he cut he fabric off and moved the tabs in.

W/S Cleaning

Fred Weaver recommends Plexus and J. Cl Pledge (furniture polish) George Turner: Ace Hardware sells Plexiclean (acrylic and Plastic cleaner) Blue Ribbon Product. There should be no alcohol !

Weld on Mounting Tabs
Jim Clement answered my question 10.1.03: Seems they are size you mentioned, about 5/8x 3/4”. I use .050 and tap for either # 6/32 or 8/32 screws, saves on nutplates.
J. Cl on 3.4.2011: spacing between tabs for W/S and side window attachment about 4 inches.

Airvents
D. Magaw on 27.1.06: The best vents however, though not so pretty are the round 3” plastic ones in my W 8 side windows. They are fully adjustable for no air, little air or lot of air. Depending on which way you point them or pull them in. Being in the lower part of the forward side window, they can get a lot of air toward the upper part of your body without getting a blast in your eyes.

Fred Weaver on 27.1.06: My W 8 had the big assed round airvents on the windows and I discovered by taking them out during winter months and taping over the holes, that the noise level went down significantly. Dave Magaw you are so right about the summer months though , and the amount of air they will draw in is twice as for the boot cowls ones. To overcome this on my W 10 I taxi with the doors open… once I add power to fly, the J. Clements vents in the boot cowl bring enough air to keep the temps in line and comfortable, and they don’t make a sound as far as I can tell.

W. Bernard on 27.1.06: I used two different vents in the boot cowl. One is a plastic NACA type that rivets to the skin. The other is a door that opens. The mechanism comes from a Cessna 150. And has the advantage that it is run by a Bowden cable so I can reach it in flight.

Brian Alley on 27.1.06: My airvents in the boot cowls don’t work well, as this is a low pressure area on the TW. Unless you want to add drag with a scoop that sticks out into the slipstream. I used a 1 ½ “ scat tubing off of the rear engine baffle. All the airflow over the engine is down so no heat is released in the vent system. Keep the tubing flanges up high on the rear engine baffle and as far outboard as is practical. Mine enter thru the firewall under the fuel tank up to the instrument panel. A tube made from upholstery material covers the scat tubing.

GEAR,WHEELS AND BRAKES

Gear Legs

Jerry Hey wrote 18.2.04 after asking Harmon Lange: The gear legs arrive from Lange final treated... not annealed. You can drill the gear legs even though they are hardened with sharp drill bits, plenty of oil and even more patience. With the mill I can drill the 5/16 " registration hole without a pilot hole. If you are using a hand held drill, then a pilot hole probably will be necessary.

9.3.04 J.Hey : According to Harmon Lange today 6150 steel as specified in the TW plans for landing gear is no longer available. A switch to 4340 will probably take place. This is usually referred to as spring steel material and has 110 000 psi tensile strength in the annealed condition.

J. Clement on 23.1.06: The Trigear uses RV6A legs and they are already 7/8" and not like the origina plans calling ¾".

Paul CVX on 20.1.06: Since putting Lange's heavy gear legs on my TW with new wheels assy's and tires and rigging them according J. Cl. Indications I have had no problems with the shimmy even under heavy braking with two fat boys inside.
Paul F. Baron on 3.12.07: Malcom straightend and reheat treated my gear. He said there was quite a difference in the hardness over the length of the gear. When I talked to Harmon he said they did have some issues for a while regarding this. Possibly you should check the hardness on your gear at a shop.

Gear Leg Fairings and Stiffeners

J.Clement: PVC streamline tubing 4 " or 2 1/2 " slide on and either foam or silicone in place. If you order gear from Harmon Lange get the 7/8 " bottom end size.
Streamline Fairings , 2320 Chesley Road, North Port, FL 34286,
Tel: 941 423 3591
Lots of people use oak or hickory as stiffeners of the gear legs in order to avoid shimmy. J. Cl used spruce, pine ash and redwood just without knots but couldn't tell the difference. Size at the top 3 1/2" and bottom 2 1/2"

J. Cl. on 19.2.06: Fasten the fairings (wood) to the legs by wrapping 2 layers of fiberglass all the way around and add 2 more layers on each upper and lower ends.

Fairing with clay molding by Paul CVX: I might add that you want to use water base clay , not an oil base ”non hardening” . Then when you have the shape you want just fair it with a wet sponge and instant smooth. Instead of a mold release I use duct tape or vinyl tape to keep the epoxy from sticking. Getting them on and off is the hard part because of the stiffness of the fairings.

Paul F. Baron on 20.1.06: As per Dr Hoerner the fluid dynamics guru the correct tear drop shape ratio for the perfect streamline is 3.4 : 1.

Good web site:
< www.ultralightnews.ca/ultralightstore/streamlined struts.htm >

Brian Alley used oak. I bonded oak on the front and aft of the gear legs and wrapped it with 3 layers of 4 oz. fiberglass. This stopped oscillation completely.

J.Cl. 17.1.05: about gearleg reinforcement: use the new design with 7/8” there won’t be shimmy any more.

Jerry Hey on 28.1.06 I used wood fairings with ½” square notch on the leading edge for the brake line incl fittings

Jim Clement wrote on 21.4.09:
The wood stiffeners mostly helped out the original sized gear legs with the 3/4" bottom □ends. The newer have a 7/8" bottom and are stiffer. They stiffen the gear □and help prevent wheel shimmy and are good for 7 or 8 mph. On my number 10 TW I used clear aspen□. The wood is shaped to create a airfoil shape and glassed onto the backside of the gearleg.

Red Hamilton on 20.4.09 :
I used formed Balsa. I coated it with resin, then wrapped two layers of 2 172" wide glass cloth and resin around the balsa from top to bottom. It did the job and is still in good shape 4 years later.

Gear Length

R. Lamb : The prints (old and new ones) call for 44 ” over all length. I measured mine - 46 inches! A penciled note on the old plans say 9 1/4 ” sweep instead of 10 5/8 ”. Looks

they had the same idea to get the nose up as high as possible . Holding 66 inches track and 9 " sweep and 2 " extra length gives 23 " or so vertical!

Rick Crossling 13.4.03: Keep the airplane as tall on the mains as possible, you can let the sockets extend below the fuselage 1/2-3/4", they'll be faired anyway. CL of axle to be 8-8 1/2" behind firewall. I used 9/16" camber, 5/8"-11/16" would have been better. Toe in of 1/16" is marginal, 3/32" may be better.

Jerry Hey 25.11.03 wrote: The new Lange gear is a bit heavier and stiffer, necking down to 7/8" instead of 3/4". The angle that the axle is bent has been changed from 49 to 50 degrees. I don't believe the new gear legs are any longer. Extra prop clearance ca be gained by reducing the wheel base to 66" and the trail to 8".

Gear Alignment.

J. Stanton: on my TW 10 project I have moved the gear forward and in .The gear legs are 13/16 " instead of 3/4 ". I have 1/16 toe in in the length of each axle with the fuselage level. I have a slightly less camber than shown on W 10 plans on the assumption heavier gear will not bend as much.

J. Clement on 6,3,04: I set my gear up with bare airframe less engine and wings, with tailwheel on the floor with main gear wheels off. 3/8-7/16" drill bit just fits under the heel and of the axle for caster. Using a long straight edge placed on the backside of axles, measure 1/16 " toe in on each axle.

It is all a guess. I would think 3/8" under the heel of the axle and still 1/16" toe in. It will all seem to much cambered, but all finished and loaded most wish they had more.

J. Clement recommends: 66 " between heel of the axles which should give 5/16 " camber and not 3/8 " + when used with 64 " shade between heel of the axles. Q and A from J. Cl. : Do you go for a little toe in or out? A: 1/16" each wheel on taildragger and 0 on trike.

R. Crosslin: Clement advised me to keep the nose up as high as the mount/gear legs would allow, this has proven to be good advice. You can let the sockets protrude from the underside of the fuselage 1/2 -3/4 " and then fair them in

with your gear leg fairings. This will let you lower the gear on the mount as much as is possible. Track should be 66 " measured between the inside of the axles unloaded. Center of axles 8 " behind firewall with heavy engines i.e. 0-320, 0-290

J. Clement 12.3.03 TW Forum answering Gordon Parker: With the wheels off and the axles sitting on a flat surface, place a 7/16" drill bit under the heel part of the axle. It should just fit at the heel end. Toe in can be checked by placing a straight edge across the backside of the axles. About 1/16" toe in on each side. I do mine with tail on the ground .

Ted Strange Q : my right landing gear has to much tow in. What solutions are there?

J. Cl. A on 2.2.06: Anchor the TW down on a tie down front and rear. Remove the wheel and put a block under the axle. Take a 10-12' piece of heavy pipe and slide over the axle, get a friend to help and guess what next. It does work but you can't imagine how far it bends before it takes a different set.

J.Cl on 03.02.2006: The hardness of the TW gear is not brittle and can be bent some in a press or as I described without annealing or heating first . We have done this.

J.Cl. on 24.10.2008:
If you didn't already heat them to change the camber, put them in a press and bend cold. It will take a fair amount of overbending but they will bend and stay put. No need to re heatreat.

Ted Strange's reply on 5.2.06: Jim I am eternally in your debt. I straightened the LG just like you recommended and it worked perfectly. That is one tough gear. I really had to pull on a 9' bar to get it to budge.

Jim Stanton on 16.10.06: When I built my first Tailwind I made the axles straight with the airplane in 3 point position. This meant more and more toe out as the weight was increased. This never gave me any trouble. But if you have too much toe in, especially on a non spring gear, the ground handling will be terrible. For anyone making a first flight, leave the tire
pressure a little on the low side, this will make a

noticeable difference.

Q to Jim C.on 20.4.07 by Alex Frizell: while setting toe, are you using the same process as setting the camber (tip of axle to heel of axle) or are you setting it from the center line of the airframe to the edge of the tire? also how much? I saw some earlier posts that went from 1/16th to 1/8th inch and is this a total measurement or from the center line to the edge of the front of the tire tread? hope this isn't as confusing as it was to write.

A from J.Cl: A couple ways of doing it. With the wheels off and tail on the floor, put a wood 2x4 across the back side of the axles.Put a 1/16" shim on the threaded end and clamp on the heel end.Or with wheels and brake discs on, use a straight edge clamped to the brake disc in a level position and mark on the floor. This will give the toe in and if it is centered with the c/l of the fuselage. Jim C

Q. from Guido (21.9.2010): In the 1st issue of Tailwind Times I found different numbers (Camber 3/8 - 7/16" (I suppose positive) and Toe In 1/16") Are these values with the airplane on three wheels or in horrizontal position with the tail up ? And is this with full load ? (2 persons on board and full tank)

A by Jim Cl.: Good question , what I do is set the camber to 7/16 and 1/16 for toe in for taildragger. This with the tail on the ground as most of the time it is in that position. Trigear set at 7/16 and zero toe in. I use these settings during construction.

Gear Location

Jim Stanton on 8.5.2014

The reference point for the gear is the firewall on both the W8 and W10. On the W8 the reference point is the centerline of the 5/8" vertical tube at the firewall. On the W10 it is the FORWARD FACE of this tube, or a difference of 5/16".

The W8 plans show the centerline of the gear axle 10 1/4" aft of the firewall.

The W10 plans show the axle centerline 8 1/2" aft of the firewall.

The W8 thrust line is 14 3/4" above the centerline of the lower longeron. This is for the flat layout of the fuselage sides. If you are measuring a completed fuselage, the reference should be the centerline of the lower longeron below the doors.

W8's have been built with both the flat bottom wing and the round bottom

"new wing". The round bottom wing is mounted 1" further forward compared to the flat bottom wing. A few airplanes have been built with the round bottom wing moved forward 2".
When creating a new weight and balance the distance from the main gear and secondary gear to the datum should be confirmed with the airplane level, as weighed.
When Steve designed most of his airplanes, the vast majority of runways were still grass, muddy in the spring. He mounted the landing gear well forward from conventional protocol to avoid flipping upside down in muddy conditions.
The Cassutt is very similar to the two Wittman racers in many respects. BUT the landing gear on the Cassutt is several inches further aft than the Wittman racers.
The tail on the Cassutt comes up very easily compared to the Tailwind. I have been axle deep in mud and snow with the W8 and had no problem keeping the tail on the ground. This was also with a forward cg load condition
The downside of the forward mounted gear is the directional control is more demanding and with the Tailwind the crosswind takeoff and landing capability are reduced.
For anyone building a new gear mount for a W8 I would recommend using the W10 axle location.

Wheel Pant Mounts.
Brian Alley on 15.1.06: I use a .045 - .050 soft alu bracket attached to the brake torque plate. The rear half of the pant attaches to the plate with 3 10-32 screws. The outboard mount is a threaded PVC pipe cap screwed onto the axle and drilled to match the aft wheel pant half. The front half of the pant is attached to the aft wheel pant flange only.

Wheel Pant Clearing
Thomas B on 10.10.2011: N393RC flys off a grass strip sll the time - trailing edge of wheelpant is 1.75 inches above the hangar floor in the 3 point position. Seems to clear all bumps and never had a problem with ground clearance. Always flown it this way, so no info on speed differences.

J. Clement wrote on 25.3.2012: TW 168X with the black Whirlwind GA prop is my O-360 TW, Clearance at the back is 1 1/2", 2X4 laid flat at the tail of wheel pant. (with Sam Sheppard wheelpants)

White prop is N6168X the CAFE test TW. Different wheel pants but also about 1 1/2" or slightly less. As Brian said, no less than 1/2" over the top of the wheel. Not only the tire growing but if you taxi thru gravel, stones will follow the tires up and punch holes in the top of the wheel pants.

Wheels and Brakes
B. Alley wrote: Matco wheels and brakes are excellent and half the price of Cleveland are 1 1/2 " narrower than the Cleveland 5x500 allowing a narrower wheel pant.

Fred Weaver recommends: Cleveland 5.00-5 for the mains, also have a look at Van's tailwheel assembly. Also a nice shock strut that goes between the rudder and tailwheel: www.iwantarocket.com and follow the links for the steering link

J.CL. recommends Matco MT-MC5 from Wicks. Put the arm that comes off the brake pedal no higher than half the way up, not like the plans, at the. Lower the better. If you stay with the TW type tailwheel , the plans built bracket will bend and brake. The wheel must be supported on both sides. Use the 6" TWNP-6 from Wicks.
I have used the TWPD-66 too and it worked ok but I like the -6 better , it is stronger with more thread rubber and much less chance to throw of the tire. You would never believe what a load is on the tailwheel until you pick it up with 2 people and baggage onboard.

Wheels and Brakes Mounting
J.Cl. to Gary Knapp (19.9.03) : with Harmon Lange gear and Cleveland wheels and brakes and axle nut and flange from Van's you need the two 1/4" thick washers per side, they are part of the dust seal for the bearings. Using the Van's flange they should fit on without changes. If using the TW plans flange you have to shorten up the sleeve to make them fit. Should use them on the TW type flanges or dirt will get into the bearings. Wick's part number is A484 $ 3.75 each.

William Bernard: I used Van's gear with Cleveland wheels. The brake flange mounts on the inboard end of the axle. It will be outside of the brake disk on the wheel. The brake caliper will bolt to this flange. There are two large washers, about 1/4" thick that are used with the Cleveland wheel. They go between the bearing and the axle nut on the outside of the wheel, and the bearing and the edge of the flange mount on the inside. Wicks or A&S has them if you need to order.

Brian Alley on 23.1.2011: I put the brake caliper behind the wheel high enough to prevent it hitting the ground if a tire goes flat. This fits inside the wheel pants I make without a bump on the pant.

Brake Master Cylinders
J. Cl. wrote 28.1.03: I use Matco MT-MC 5. The mounting holes are cross drilled so they can face any direction.

J. Cl. on 13.4.04: Mount the bottom of the brake cylinder stationary to the floor and parallel to the rudder pedals when in upright position. The arm coming off the brake pedal should be mounted no higher than 1/2 way up the brake pedal, not at the top as shown in the plans. The lower the arm on the brake pedal, the better the brakes work. It also might help if you make the rudder part of the assembly 1 " higher so the bottom brake cylinder mount doesn't mount below the belly.

On Aug 10, 2007, at 11:09 PM, Jim Clement wrote:
Q: I was just wondering why the cylinders can't be mounted on the rudder pedals themselves. I had to move the rudder pedals back (after I had the mounts all welded and all) just to fit the master cylinders in without hitting the plane of the firewall.
A: Mark , mounting the cylinders to the rudder pedals doesn't work, when putting in part - full rudder the brake pedal follows the rudder pedal and your foot won't bend far enough to apply brakes. Mounting the bottom of the cylinder about 1" forward as Alex posted will work much better. Jim

Jerry Hey to Fred Weaver: A couple of time in heavy crosswind when getting on the rudder, I have accidentally hit the brakes. Not hard but I could hear them dragging. I think that if the rudder pedal tread was little higher from the floor I would be less likely to accidentally activate the brakes. Per TW plans the axle center to the rudder tread center is 5 1/4". Same style pedal in the Acro Sport this distance is 6". The TW break tread is 2,5" above the rudder pedal while the Acro Sport is 3.375", so the Acro Sport brake is 9.375" above the floor. The TW brake only 7.75

Brian Alley on 11.2.07 :I have Matco on my W-10 N320WT. Excellent product but be sure to follow the directions on axle nut torque. It is different than Cleveland!!!!

Brake Lines and Fluid
J.Cl: Keep the extra stock length at the mastercylinder end and not the wheel end. Also a good idea is to slip another short piece of soft plastic tubing over the brake line in the brake disc area. Leave yourself plenty of stock so you

can cut the fitting nuts off later if needed and add new ones. It seems if they ever leak this will be at the compressed area of the tube and fitting nut. Nuts are available without having to buy the complete fitting assembly.

C. Galley: RV- 4 had a brake problem because the plastic line melted. The line was a bit too long and rested against the metal wheel pant bracket. It got hot and melted a hole into the line. Fluid came out !!! flammable and not stearable. So if you have extra tube length make sure it doesn't touch where it could get hot.
Rutan's Long Eze had similar problems. He recommended Silicon based brake fluid, which is used also in auto racing vehicles.

Malcom Lovelace: uses Nylaflow nylon tubing SK 8201-3/16 from Wicks. You need to use the 268 or 269 male connectors or elbows. Also make sure you also use the 2040x4 brass insert. As far as the amount of slack just make sure it does not pinch the line on either end when the gear moves. I run the Nylaflow all the way and not part of the system in aluminum tube.

Eric Schlanser on 3.11.07. The brake lines should be flexible at the wheel cylinder. I went with Teflon lined stainless steel braided from a local speed shop at he wheel cylinder. This is what Malcom said to use. It went about 12" up the leg then transitioned with a compression fitting from ACS with nylon hose up to the master cylinders and then braided again.

Bob Connor: used Nyloseal tubing with the Polyflow fittings but had a lot of troubles with the fittings. I finally got regular brass fittings with the nylon ferrals and haven't had any problems.

Jim Stanton on 17.2.08: The nylaflo should be used with brass fittings and brass inserts which may require reaming the tubing for the insert. I fried the nylaflo on a five mile taxi at Sun No Fun years ago and would not use it again. Aluminum tubing worked fine on my W8 and several Pitts's. If you run the aluminum all the way to the brake caliper it may be necessary to remove the line to remove the calipers, then bleed the brakes. I am going to use stainless braided hose all the way on my W10.

Q: In the Cleveland brake cylinder assembly can the bleeder valve or the fluid line fitting be inserted on either side of the block or is there a specific position for each one. In other words can the bleeder valve and fluid line fitting be placed interchangebly .Thanks Guido

John Haerdtler on 21.03.2010
There is nothing inside that will know witch way the fluid is traveling! Install the way that works best for you! There is nothing that will not allow the unit to be used on either side. Just change the inlet and outlet. And the outlet or bleeder can be used in the up position! But you must use a hose and jar like the old car brake bleeding system used!

Yes the fluid line comes it the top while the bleeder goes in the bottom position.
Cy Galley - Chair, AirVenture Emergency Aircraft Repair
A service project of EAA Chapter 75 since 1963

Wilson Werhan N447A on 22.03.2010:
Introduce brake fluid from the bottom up, with a Plews oiler, and there is no necessity for bleeding. Just stop when the master cylinder fills up.

Dave Conrad on 22.03.2010:
I didn't do it that way. Because of the way the lines come down my gear legs my line connects to the bottom. The bleeder being on top. I can fill my masters and pump the fluid down to the wheels with the bleeder open and all air evacuates with no problem. tighten the bleeder and I'm done. I had no problem pumping up my brakes this way.

Go and see
http://www.vansairforce.com/community/showthread.php?t=33493

Hydraulic Fluid for Matco MC-5 brake cylinders (from Matco Form)
MIL-H-5606 = Aeroshell Fluid 41
DOT 5 yes
DOT 5.1 no (contains glycol)
DOT 3 no
DOT 4 no

Tires : J.Cl.: I use Condor 6 ply. They are good tires at lower price 100$ for 2 of them with 2 Michelin no leak tube.

Jim Stanton on 18.4.07: The real expensive Goodyear and Michelin tires and tubes will greatly reduce or

eliminate gear shimmy. Most of the cheaper tires are badly out of balance.

Wheel Pressure
J.Cl on 16.9.2010: Guido I use 35 pounds on my tailwheeler

Tailwheel: J. Cl. on 20.9.03: I have used the twpd-66 and it worked ok but I like the-6 better. It is stronger with more tread rubber and much less chance to thow off the tire. You would never believe what a load is on the tailwheel until you pickup the tail with two people and baggage onboard. Also the tailwheel assy built to original plans isn't strong enough, it should be supported on both sides of the wheel.

Tailwheel assembly (J.Cl. on 8.6.06)
As Pat said in a previous post, the tailwheel takes a lot of pressure. On
the original plans the tailwheel bracket had support on one side of the
wheel only, this will most likely fail. Make one supported on both sides.
Don't skimp on the tailwheel assy, if in doubt, with two people in the
airplane try lifting the tail up. I use the 6" wheel from Spruce or Wicks.
Another thing that failed on the original plans is the round tube the tail
spring fits into. The original plans had the forward part of the tube welded
on top of a tube between the lower longerons. The twisting movement of the tailspring would eventually crack the 7/8" tube the spring fit into. If you look closely at the pictures you will se the cross tube is a piece of 3/4" x .049 or .058 ovalled in a vice. The 7/8" tube is butted up to this and welded. It is also a good idea to weld small patches to add wall thickness
where the hole goes thru for bolting the tailspring in. Forgot to mention, drill the threads out of the tailspring and run the bolt all the way thru. Weld a all metal stop nut on top of the tailspring sleeve.
This way the bolt can be easily checked for tightness with out getting in with a wrench. Jim C

My Q for Jim Clement on 6.6.2010:□How is your experience with the RV Tailwheel combo on your number 10□TW ? Since the RV tailwheel fork is out at 90° towards the different□set up in the□Wittman's solution and all your earlier TW's with the fork looking□somewhat downwards, isn't the

RV solution more prone to shimmy ?□
Thanks for your answer□Guido□□----

A: Guido□The RV tailwheel assy. works great and no shimmy. If building a TW I would □recommend using it. The rudder travel might not be enough to unlock to full □swivel but using the spring loaded steering rod solves this problem. The □diameter is 7/8" compared to 3/4" for the TW style so it can be turned down □to fit existing TW receivers. New construction use 1" x .058 tube welded in.□Jim C

Tailwheel Mike Mears (G-BJWT) on 13.6.06
Having talked at length about rudder cable arm failures recently, I suffered a tailwheel spring failure last weekend. Whilst taxing along a grass taxiway at Headcorn in Kent, I kept to the side to keep away from the runway it ran alongside. Suddenly there was big bounce and a double bang and a bystander started waving furiously. I stopped and got out to inspect the aircraft. An ancient bridleway crossed the runway, though the ruts had been filled in recently near the runway, they were deeper further away. The tailwheel had bounced up on the first rut and as it hit the second one, the tailspring attachment snapped and it was hanging off by its steering springs! Though perhaps you could say the airfield operator could have kept the ruts a bit more level, once he heard of our predicament he couldn't have been more helpful. He rang his engineer and between them, they took the tailwheel off, prepared and welded the bits toget! her, adding a strap underneath the weld to reinforce it, redrilled it and refitted it, all within an hour and a half. We lashed the tail to a nearby fence whilst repairing the spring, I've enclosed a few pics taken whilst they want to get the appropriate spanners. (In one pic the camera has focused on the grass underneath so it's a bit out of focus. I've placed the wheel back to show how it went together.) Interestingly the metal (possibly spring steel) at the break next to the bolt hole, was quite crystalline, suggesting it's been fatiguing for some time. One more event to chalk up to experience.
Mike

If you look at a certified tailwheel for flat spring you will see they add 2 flanges perpendicular to the spring on either
side of it and it is forged steel.
A flat bar is very weak in bending and needs the depth of

the vertical side pcs to add strength. Your bracket was probably bending a little on each load cycle until fatigue failure.
Dennis in Dallas from Chicago

WEIGHT and BALANCE AND PERFORMANCE

Weight.
Jim Clements Nr 1 W 10 0-300 powered weighed 835 lbs built exactly to plans except for wood wing tips. No radio, no ELT transponder and just basic instruments. Had fiberglass nosebowl and the rest of the cowl was aluminum.
The CAFÉ TW was 865 lbs with radio etc . It was built with .028 tubing where called for

J.Clement on 17.4.09 : most W10 TWs with Lycoming engines come in at 860-900 lbs, that includes gear fairings, wheelpants and some radios. It would be hard to build a 750 lbs TW even using 0-200

D. Flamini: empty weight 1141lbs and gross 1750 lbs

B. Alley : empty 875lbs gross 1500 lbs

L. Owens: Basic fuselage 65#, gear legs each 11#, gas tank 13#, gear legs, motor mount with bolts, wheels with tires 55#

R. Crosslin: (Lyc 0-320) empty 875lbs

G. Turner (43 gallons tank) empty 851 lbs (without engine oil, IFR and had regular oilfilter and regular aircraft battery)

Jerry Hey on 28.11.06: N6PJ original weight was 753 lbs. This was with 4 quarts of oil. Last weight 800 lbs

Jim Clement's number 10 896 lbs with both seats, has heavier 3/16" w/s and 1/8" side windows, Douglas Fir spars. Haevy windows, big battery for winter starting, full interior I would guess about 25 lbs.

Chris McHugh's C-FRIS 770 lbs dry with a 0-200

Red Hamilton's MT was 848 and is 860 at the moment (6.1.2010)

Bob Danner's Trike is 925 lbs. with Lyc 0-320 160 HP

Engine only (Jim Clement) : 0-320 Lyc 279lbs with carb, alternator, starter, 4” prop extension
0-300 Cont 319 lbs without exhaust and oil

J.Clement confirms on 29.1.06: with the exact same accessories on the engines including exhaust the 0-300 is 40 lbs heavier than the Lyc 0-320

J.Clement wrote 16.3.03: this is the weight of a W10 fuselage with my door and spar mods using .028 tubing where called for plans. Complete rudder and toe brake assy, control stick assy, flap assy including the one inch cross tube with the flap arms welded on, aileron bellcranks, vertical stab with all ribs, elevator 3/4” tube that goes from the stick to the elevators, this stuff is welded in so I can’t remove it for bare weight; weight is 85 pounds . Without windshield bows, tabs and fairings.
Wings with all wood wingtips are 56 pounds each (25.6 kg). This is using 3 mm Okume which I think is much better than the 3/32 aircraft plywood. This weight is with all fittings but without the fiberglass covering. A previous set of wings with birch ply weighted 57 pounds each;
Weight of rudder, 2 elevators and both horizontal stabs all ready for cover is 15 pounds.
Total weight is 100 pounds (45,360 kg)

Fred Weaver wrote 4.12.03: the N168X has over 200 hours on it now and is running great. Yesterday I was flying at 8500 feet, 21 inches MP, 2450 rpm in fairly cold and really smooth air, 222mph over ground GPS. On the return flight about one hour later we were at 7500 feet and only pulling 20 inches MP and 2400 rpm to save gas and we had still 198 mph GPS. Oil temp at 180 CHT’s just over 350.
Our climb rates were 1500 fpm at 165 mph indicated and on the way back 1000 fpm at 180 indicated.

Jim Rust on 10.10.07: The engine was moved forward 4" to make up for fuel in the wings.
11 000 ft 20" mp 2400 rpm 170-173 kts , 7,5 gph
Take off roll solo 300-500ft

Jim Cl. on 9.7.09: Q: what weight is to expect on the tailwheel ? A:

□Empty a TW is usually about 40-50#. With two people and baggage it is closer □to 150#.□

Maneuvering Speed Calculation

On 13.12.2009, at 01:53, jrs14855 wrote:

The only information needed to compute maneuvering speed is the G limit and flaps up stalling speed. The square root of the G limit is multiplied by the stalling speed. Using 3.8G(square root 1.949) and the Clements/CAFE number of 70.6, the resulting maneuvering speed would be 137.6 m/h. For 4.4 G the number would be 148 m/h. For 6 G 172.9 m/h. For an estimated stall of 67 with the 24' wing, 3.8 G would give 130.6 m/h. □

Building Time

4-5000 hours average

Jim's number 10 TW

J.Cl. on 18.9.08
Empty weight 888# that is with both seats but no carpet on the floor or door □panel trim. My test area is a 50 nautical mile radius of Tri County Airport, □Lone Rock WI. 40 hr test time.□

J. Cl. On 06.10.2008:
Cruise at 3000' 22.5" mp, 2500rpm =195mph.□full throttle at 8500' 2750rpm 215mph, both were two way averages using □gps.□climb out to 8500', 1700fpm 160 mph ind. thru 4000' 1200 fpm 140 mph □ind.thru 8000'.□static is 2275 rpm full throttle at 2500' is 2800 rpm.

Weight and Balance practical hints

Fred Weaver: Put the tail up for w / b. You always weigh the airplane in it’s flight attitude.

Jerry Hey about moving forward engine: No problem with spacers. The Formula One guys kick their engines all over the place with aluminum spacers between engine mount and firewall. The one I have seen ar 1” o.d. x 3/8” i.d. x whatever you want . The spacers should go between engine and firewall. This may require longer bolts.

Earl Luce on 12.1.07 wrote:
I asked Wittman about the weight& balance of my TW when we met in Florida and he said " It's not a damn 747.....it's a airplane !!! " Then he told me to use 15-28% and 30% on the Buttercup. It was short and sweet so I dropped the subject.

Earl

Dave M on 11.1.07 wrote:
I have always found the datum at the leading edge of the wings is easiest to measure the moment arms. Just hang a plumb bob, and measure from it to any point, like the wheels or whatever. However, the down side is that you need to make sure that your moments are positive or negative properly—negative for those measurements in front of the datum, positive for those arms measured behind the datum. With the datum out front further, you probably won't have to deal with negative numbers, but the practicality of making the measurements could suffer a bit. Hope this makes sense.

On Apr 1, 2007, at 3:28 PM, Jim Clement wrote:
6168V first trigear
empty 21.6% of cord
most forward 18% of cord
most rearward 29.5% cord, this is with 50# baggage and that's a lot

On Apr 1, 2007, dmagaw wrote:
Depends on the load. Full fuel and light pilot only it is forward in the envelope. Light on fuel and heavy on passenger, pilot and baggage, it is well towards the rear of the envelope. The envelope is the same as for all tailwinds (I think): Between 15 and 30% of wing cord (including flaps/ailerons). This is the ideal to strive for in locating you battery, etc, since if set up like this, you cannot load the plane out of the CG envelope unless you go over gross (and considerably at that). There is an MS Excel file in the "files" section of the tailwind forum which is set up for a trike. It can be easily modified for a taildragger just by changing the moment arms. It can if you have the weights on each wheel and all the measured moment arms, it will calculate your W&B for any scenario you want. Further, it graphically displays it for you.

On 01.09.2008 Jim Clement wrote:
All this talk about incidence, I went to the hanger and measured N168WH.□These readings are using a smart level with the tailwheel on the floor.□lower longeron 10.4, degrees □bottom of root rib 10.3 degrees□, stabilizer 8.0 degrees□I might move the stab up one hole and see what it shows but would rather □have a nose up condition for first

flight than nose down.□□The FAA inspector is scheduled for September 11 or 12□ Empty weight came in at 888#□Issac Solomon, Longeze builder in the hanger in back of mine did a good work □sheet of the weight and balance. He is the math professor at the local UW □extension at Baraboo. I will try to post it in the next email.□Jim C□

Dave Magaw on 6.2.2011:
Both with my W-8 and now with the Trike W-10, I find it is much easier to grease landings with aft CG (within the back limit to be sure). Forward CG (pilot only, no baggage and full fuel) I find it harder to make those absolutely smooth landings. FWIW.

Hi,
Landing the tailwind heavy with an aft (at the limit) cg - the elevator will feel very light. I usually have to hold some back stick on final (trim issues) but with an aft cg the stick will feel loose and like you don't have much elevator authority. I like to land in that condition with a little power on - 1200 or so rpm as it improves the elevator feel and also add a little speed (not more than 5mph) Disclaimer: this is what I have worked out for my bird - yours may handle differently. Valerie

Jim, 340 lbs of crew, 5 gallons of gas, The baggage limit goes to 20 lbs and the CG is then at 28.08 As for the oil, I didn't weigh the engine without oil. I have 6 quarts in it figured in with aircraft weight. My feeling is that oil is as important as pistons. Have you ever flown with a CG in the rear end or just out of the envelope? I'll shoot that off as an open question to the group. Impressions of flying with the envelope all the way forward and all the way rearward. What works better if you had a choice? Dave Conrad

On Feb 6, 2011, jim clement wrote:
Try most rearward with 170# pilot and passenger, 5 gal fuel and 3qts of oil. Then see

what is left for baggage. 28% is good and over 30% isn't.

Dave Conrad on 6.2.2011: Hi Jim,
Figured with 40 lbs of baggage and 1 180 lb pilot and 90 lbs of fuel (15 gal) it works out to 23.5% of the chord. Working it up with 2 180 lb pilots that pushes it up to 28.5% of chord with the 90 lbs of fuel and 40 lbs of baggage. What this all means to me is with 5 gallons of fuel on landing I'd be tail heavy if loaded heavy. I'll let you experienced guys tell me how bad that is!

On Feb 6, 2011, jim clement wrote:

Perfect Dave, what did you use for baggage weight for most aft? First flight this spring?
Jim C

Dave Conrad on 6.2.2011
I worked out my CG figures tonight. Danny, your program works really nice. The other programs out there in the files section are for nose gear planes, I like the CG box they include but I would need to convert to tailwheel and move the datum point to the prop flange. I'm not that good at the excell stuff the way it is set up. Val's program lost data when I brought it into Mac format.☐I came in with an empty complete weight of 891 lbs. I did include 6 qts. of engine oil in this number. The CG is in the range of 18 - 28% as listed on the Spruce plans. Any comments?☐☐

Miles per gallon
On Aug 20, 2007, at 12:06 AM, Jim Clement wrote:

Drag is the deciding factor in mpg, horsepower makes little difference. If
you have three relatively clean Tailwinds, one with a 100 hp Cont, one with
a 150 hp Lyc and another with a 180 hp Lyc, they will all give about the
same mpg.

O-200 Cont 6 gph @ 145 mph = 24.16 mpg

O-320 Lyc 7.5 gph @ 185 mph = 24.66 mpg

O-360 Lyc 8.5 gph @ 200 = 23.53 mpg

These numbers would be at 7500' @ about 60% power Jim C

Stress Loading
J. Stanton : The first 4 or 5 TW were loaded to gross weight and flight tested to 4 G. I believe this may have been a certification requirement at the time

Sand bag story
G load with GAA present: 300 m/h +8,3 G and -3,8 G

Earl Luce wrote 22.1.03: my friend Boud Kuenen can calculate most any numbers I need. He has done a lot on TW already. He said that the wing alone was good for 20 G.

Fred Weaver: I never pushed beyond 250 m/h indicated. I wonder more about the windshield caving in at these speeds (1/8" plexi)

CG Location
J. Clement: CG most rearward 28 % up to 30 % is ok most forward if built to plans don't worry about it as told by Steve himself.

Fuel Efficiency
J. Cl. : On his way Baraboo- Arizona ca 1500 statute miles -- 8 -11,5 hours and 5 to 5,2 gallons / hour in comparison to 12-14 g/h in a Cessna 182

J. Stanton on 19.5.13 : I believe the Lycoming -powered W10 is more fuel efficient than W8 or Buttercup. A while back Doug Steen (ex Paul Baron TW) posted the following numbers for his W10; 6.5 gallons per hour-165-170 ias, 3.8 gallons per hour 120 ias. True airspeed was probably slightly higher.

Performance
Dave Conrad on 5.6.2011: I put 1.4 hrs. on the Tailwind today. I worked on getting it slowed down on final so the roll out wasn't so long. It will slow fly nicely at 65 mph, I haven't slowed it more than that yet I held 1500 rpm doing it with about half flaps. I put a 6" wedge on the rudder but that's to

much. I should have listed to Jim, I'll be making it about 3" or 4" instead. The plane flies easier than I thought it would but I have not perfected landing it in less than about 2500 ft. I find 80 mph over the fence to work ok but the approach it very flat compared to my Hatz and I have to adjust my thinking. 2400 RPMs gets me 175 - 180 mph so I'm liking that. Help or your input would be nice.☐The engine is running a little rich, has anyone had that issue? I don't know the jetting right now but I need to pull the mixture out a little to make it run real smooth. Comments on any of this appreciated, I've got about 600 hrs of tailwheel time so I understand taildraggers.☐Dave Conrad

Hi Dave,
Glad to hear that you are getting some time in your TW. At 70 IAS and idle power, full flaps, about 800 rpm, it comes down a little better; idle on the ground when stopped is about 500. The flat approach is different and something to get used to, it takes very little power to keep flying level. Ours will fly level at 15" and 1700 rpm at over 120, not bad for just being up in the air. The IAS at stall is 38 or so, but that is way off due to the angle of the pitot tube, by the gps it is about 58.
Haven't had a rich issue,
Red

Brian Alley wrote: static is 2350 rpm. 3000 to 3500 feet 22″ and 2550 rpm which gives 160-165 mph. My TW 10 climbs 1400 - 1600 at 110 mph indicated with just me and 1000 - 1100 lbs at gross.

Figures of performance by J. Cl.:
white 60 - 110 mph, green 65 - 165 mph, yellow 165 - 200 mph, red 200 mph.
First W10 plans were 200 mph redlined. When Steve had new ones printed they came up with the 195 mph redline. Fred likes 240 redline.
Steve lists also: landing with flaps at 55 mph without 68 mph.

Paul N557CL: with no wheel pants but good cowl I am cruising at 175 mph at 2500 rpm. Stalling at 60 clean and 53 full flaps. The Airspeed and the GPS seem to agree fairly well. Best rate of climb about 95 IAS gives me 1100 fpm from 2000 to 3000 feet MSL. Engine is a 0-320 E2D with 68/72 prop. Static rpm is 2250 and max firewalled at 3500 feet is 2600 rpm giving me 180 mph TAS. After the plane sitting so long don’t know how accurate the tach is or airspeed but it agreed with the GPS flying in four directions And averaging the result for the cruise performance. I am operating at approximately 1075 lbs. with my lean and mean frame in their solo.

Is there any limitation on flap operating speeds on TW? I seem to do my best landings at 90 mph for approach and touch down about 75 puts me at a good three point attitude. Subtract about 5mph for full flaps?

J.Cl comment on that: Paul get some wheel pants and gear fairings on it and you will pick up 15 mph. Do this before messing with the prop or anything else, then see where you are at. At 3000 feet you should see 200+ TAS at full throttle turning 2750-2800 rpm. Static rpm is a little low 2300-2350 would be better. The rest of the numbers seem about right. It's a blast isn't it.

Lovelace on 15/7/04: O-320 trigear takes off with 2 people , baggage and full fuel tank in 1000 feet. 1 person in 500 feet

Q: how long is the average take off roll distance and the landing roll □distance with just the pilot and 15 gallons of fuel , no baggage and □at full gross weight (1425 lbs) in a W-10 tailwheeler (Lyc 0-320)□Thanks in advance.□Guido

A: Red Hamilton on 28.3.2013
Guido,
They will not all be the same but for ours here at 72' elevation and the usual cool temps with light fuel and just the pilot it breaks ground in ~400 feet, landing with a clear approach and light braking would be about 1000'; at 1425# but the same conditions otherwise it would be off the ground at about 600' and landing roll 1400' would be my estimates. Heavy braking could reduce the landing roll a little.
I hope that others will give their numbers and experiences also.
What is your field elevation there?
Red

JohnHaedtler on 28.3.2013:
Field elevation will make a difference but I have not seen a big change in a light weight Tailwind. N456TW at a weight of about 1475 lbs with two on board with low fuel, about 10 gallons. Field elevation a KFMN is about 5500 ft. Take off roll was about 600 ft. With a rate of climb of about 800 fpm. And landing roll was about 1100 ft. This Tailwind has an O-320 with a wood prop. I was very impressed with the performance of this airplane. Cruise speed on the GPS was 171 kts.
The owner and I test flew the plane after I did the Conditional Inspection. I really feel that is the best part of the inspection!

D. Magaw on 12.12.05: yes slow flight does fine, though

controls are not so sensitive as you might expect. I can get AS to read around 50 mph (below the stated stall speed !) and still hang it on the prop. Even more fun to do it on a windy day to try to get the GPS to read negative speed.

On May 23, 2006, , dmagaw@att.net wrote:
Well this is not a scientific or response backed with empirical data, but based on what my 400+ hours in a W-8 and W-10 experience is:

Jim Stanton on 17.2.07: George is correct that each individual homebuilt airplane should be tested beyond redline. I believe the standard is 10% over redline. The then CAA required that the first five Tailwinds be tested to 3.8 G's at gross weight and 10% over redline. I know that the five included Wittmans first two Tailwinds,5747N and 9052C, 223A, built by Ed Todd, 100G, built by Don Sundby and Roger Amundson, and 5749N built in WI with help from Wittman. Todd wrote about the testing in Sport Aviation and I believe 223A was tested to 220 m/h. 100G (the sandbag tailwind) was inadvertently dived to near 300 m/h. I heard persistent rumors that John Beyreis routinely flew 223A at 235 ias in descending in smooth air, but I never heard this from John first hand. N84RK, the second W8 built by Ralph Korngold, will do about 195 in level flight with full power.
VNE 0 MPH (you might check your rib stitching on your tailfeathers and fuselage top. 1" spacing in the prop area is good for 200 MPH as I recall from the Polyfiber manual, but if you have more spacing, then you might need to reduce this speed accordingly.) Yes, others go faster in their tailwinds, but I believe that the original W-8 plans stated a 180 MPH Vne and W-10 plans specified a 200 MPH Vne.

Red Hamilton on 23.10.2011 about service ceiling
We have beeen to 18k with some climb ability remaining, I would guess that the service ceiling is around 20k.
Red

Doug on 23.10.2011 (he has recently bought Paul Baron's TW
Today, I did slow flight and a few stalls. W-10 weight at 1340 lbs, no power, no flaps, 59 mph stall straight and level. Virtually no break, a bit of mush, then nose dropped. Full flaps, same conditions, 53 mph, same behavior (airspeed indicator speeds !)□□Slow flight, std rate turns felt good at 75 mph, and a bit mushy at slower.□□Installed my Samsung 7 inch touch screen EFB with XM weather. Will swap these devices between Cirrus and Tailwind. Verified all functions work. I use TruEFlight at

www.aviationsafety.com. Mine is a Flight Cheetah 190 model with synthetic vision, approach plates, charts and terrain with a WAAS receiver.□□Chased a 180 hp Glassair Super 2S retractable, constant speed prop to lunch from 50F tp SEP today. I had to throttle back in the climb to avoid overtaking him. In cruise at 3000 ft, we both went the same speed, 195 mph indicated, but he was 2400 rpm and I was 2820. I stayed really rich due to worry about the 87 oct car gas mixred with 100LL, so I did not lean. Later this eve, after taking on another 10 gal of 100 LL, I was able to lean a bit and saw 200 mph IAS at 3000 ft. I think i can cruise the same speed at the same fuel flow as the Glassair. As his empty weight is 2300 lbs, he needs retract gear to overcome the weight penalty that he carries versus the Tailwind. He has a beautiful IFR plane that took us both to Oshkosh this year, but I am thrilled at the proce/performance of the Tailwind in comparison.□

Flap actuation speed:
100 MPH or less. Actually small amounts of flap could be added safely at about 120 MPH, but use the lower number for full flaps.

Flap Setting (Dave Magaw on 6.11.2012)

It affects low wing aircraft also. It is well known that 40 degrees of flap can cause "bunting" in Thorps, which is to say that the turbulent airflow off the wing affects the horizontal stab adversely, i.e. it doesn't have the airflow to hold the nose up and it gets real interesting, and dangerous if close to the ground, when it happens. Also, the affect varies with speed. At lower speeds more flap can work than at higher speeds. I felt the onset of bunting in my Thorp with full flaps (30-32 degrees) when using them at speeds of about 100 MPH. The nose didn't drop, but you could feel the issue in the elevator control. At 85 MPH, not a problem.
On the other hand, the Clement trike I had (now Jim Berry's) has such small flaps that 40 degrees of flap doesn't do a lot and there was never any issue with elevator control. The flaps were much more effective in the Thorp. Even my old W-8 had more effective flaps because they were bigger, but again no problem with 40 degrees, even in a full slip also.

FWIW.....Dave M

Take off speed:
generally about 70 MPH, which is roughly 1.2 times stall speed. This will vary some with weight as your stall speed also varies. Though it will vary some with weight, the stall speed will vary from approximately 55 MPH full flaps (Vso) to 60 MPH no flaps (Vs).

Vx is approximately 80-85 MPH

Vy is approximately 100-120 MPH

Best glide is approximately equal to Vy

Over the fence landing speed (no power on final into the flair) 80 MPH (light) to 85 MPH (heavy) plus gust allowance. With power, you can go slower, but you will drop like a rock when the power is pulled, unless well into ground effect.

I don't know what Va (manuevering speed) is, I just slow down significantly when there is significant turbulance.

Vx and Vy will depend on your engine and prop pitch. The lower numbers are for my W-8 with 150 HP and a 71 pitch prop. The higher numbers are for my W-10 which has 160 HP and a 74 pitch prop.

All of the above is in MPH, you can convert of course to knots. The above is my opinions and beliefs--others might differ in theirs.

Flight Speed : William Bernard' metal wing TW (22.3.04) asked since he will do pretty soon first flight
100 mph: for climb
100 mph flap lowered
70-75 mph final approach
After about 30 hours:
stall speed power off no flaps 60 mph
full flaps 55 mph
Best rate of climb 100 mph
Response to aileron although further outboard than on wood wing, is quick but not overly sensitive.

D. Magaw's W8 Lyc.0-320: Liftoff: 70 mph, Best angle of

climb: 85 mph, best rate of climb: 110 mph, best glide: 110 mph, Pattern and flap speed 100 mph, Final 1 person: 80 mph , 2 persons: 85 mph.
stall is about 55-60 mph

J.Cl (22.3.04): 100 mph climb out is a little low-- you will be climbing at 1500 fpm and wont be able to see over the nose. Try 125-140. I use 110 for flap speed. Start out your approach speed no lower than 80 mph until you get the feeling for the things. It is easy to get in a sink mode at 70 mph. This is my suggestion, others may differ.

Jerry Hey's W8 flat wing (22.3.04) : The plane will sink fairly rapidly below 80 mph with the power off. Might use 80 mph for the first landing. A low flat approach around 70 mph using a little power works good too.

Dave Stamsta: Stall with flaps 49 mph indicated airspeed and 175 mph at 2550 rpm with Lyc. 0-320 E2D with no wheel pants or gear fearing.

Dave Stamsta on 9/7/04: With only gear fairings and no wheel pants 14 mph more cruise speed. I use 30$ fairings from Van's and filled them with great stuff to hold them in place.

Earl Trimble's (C-GYYT) with metal wing on 22.3.04: Lift off speed 100 mph, pattern speed can be flown at 90-100 mph, first approach at 80 mph. When you round out add about 1000 rpm and just hold it steady, this will cushion your sink rate and allow the plane to settle on nicely. Soon as it is on get the stick back . My plane stalls at 53 mph with full tanks and a passenger.

W. Bernard on 2.4.04: First test flight in N40WB trike: the event lasted 15 min . I wish I could say it flew hands off, but it didn't. It was left wing heavy and nose heavy .. Things were controllable but I decided against too much investigation of the flight envelope with the out of trim condition.

J. Cl. comment: Were the wheel pants and fairings on? Without you will get a nose heavy condition. Lower the left flap some until you get further into the testing, that might bring the wing up. Most likely adjusting the ailerons without putting a tab on won't change the wing heavy condition. The wheel pants will also make a big change in

the nose heavyness. You won't believe the difference when you put the wheel pants and the gear leg fairings on.

Fred Weaver on that: The pitch condition is fairly easy to resolve but the wing heaviness can take a few minutes. I generally start by making sure the flaps line up again after you have flown it. If the entire trailing edge is lined up from left to right, make sure that the bottom camber is lined up with the lower camber of the airfoil. All too often, I've seen the guys split the difference and this results in a pitch down feel/ condition. By raising both flaps and ailerons about 1/8-3/16 ", it allows the stab to relax a little. This improves the speed more than you think too. A trim wedge underneath the right aileron will allow you to comfortably go fly some more to check out the new trailing edge position along with any stab change you might have done at the same time. It's always better to trim an aileron up from the bottom than vice versa.

W. Bernard answer: Jim, the nose gear pants fitted but not the ones on the main gear. I have lowered the leading edge of the horizontal stab. I found the ailerons were slightly out of rig and have adjusted them.

William Bernard 11.4.04: TW trike testing is going pretty good. It took a bit of adjustment of the flaps and ailerons, lowering the horizontal stabilizer leading edge and a tab on the rudder to fix the initial problems. I have stalled it (power off, no banks, forward GC) with and without flaps. Indicated stall speed was 55 flaps up and about 51-52 flaps down. The interesting thing was that with full aft stick, the nose did not drop through, but only pitched down slightly and the aircraft continued to settle at about 700 fpm. Heaviest weight so far during first flights 1465 pounds. Gross weight is set for 1600 lbs. I found out that if I slow down a bit to about 70-75 over the fence and carry a little power, the landings are much better.

J. Cl; comments on that: On your landings try keeping the nose higher after you flair. Pretend it's a taildragger and keep the nose up thru touchdown, hold the stick back until it comes down by itself.

J.Cl on performance problems: Before working on the prop change the exhaust to a crossover, because the Lyc firing order 1 3 2 4 fires each same side cylinders one after the other, you have exhaust from one in the pipe while the

other is trying to enter. I forget the exact number, it is like 23” or 272 of pipe to clear the exhaust for the next cylinder to have a clear pipe. This isn’t the case with 4 cylindr Continentals as their firing order si different. The proper crossover is the two front cylinders in same pipe and two rears in the same. Four individual pipes are OK also. That is what’s on Fred’s 180 hp TW.

A. Moldenhauer on 3.12.06 his first W 10 had a 0-300 D now a 0-320A3B (150HP narrow deck low compression)

1. 190 mph - 209 mph
2. 40 lbs lighter empty weight
3. improved rate of climb (by a bunch!)
4. shorter takeoff run
5. airplane is more balanced from full tank to low level fuel load

Sideslip Speed

on 25.7.2014

Q: What is the best IAS in a sideslip during landing approach in order to bring down your airspeed and height . Luca made some at 75 kts the other day. Is this too fast? What's your experience. Thanks Guido

A: Hi Guido,

I am replying off list.
As mentioned, not all Tailwinds are the same, each is different in some way(s) so what I have to say may not be true for yours, or even any others.
In my Phase I testing (the first 40 hours of flight) I explored slips quite a bit. I would measure the rate of decent at different airspeeds and coordinated and not when at a safe altitude. I found that slips were not very effective in increasing the rate of decent unless done at quite low IAS and full rudder deflection. I found further that slowing down increased the rate of decent just as well as the slip.
You may have heard that our home field is 1800 feet long and has trees very near both ends. Unless the wind is really strong, I use 70 IAS MPH (not knots) for over the trees and then do not

dive to the runway but hold the 70 until the flare for a three point landing. I am not willing to slip aggressively at 70 IAS close to the ground but the sink rate at 70 is pretty good and if need be can be arrested with a bit of power.
I believe that the descent rate is faster at 70 coordinated than at 80 IAS in a full boogie slip and I feel safer that way when close to the ground.
I do use 80 IAS on approach when landing at most runways where the short length is not as issue.
I hope that this is helpful to you and Luca and that we get to see you folks again at Baraboo and/or Oshkosh again someday.
Red

Noise Levels

Dave Magaw in J.Cl trike: always measured in the cabin :

	cruise (2500)	slow cruise (2000)	climb	
ear level	104-106 db	94 db (92 db)	(108 db)	
windshield	109-114 db	105 db (93db)	108 db (108 db)	
lap level	106	94 db (87 db)		

In brackets values from Red Hamilton 's 0320 W 10 with 8 lbs of sound barrier absorber and upholstery. He says : I have since changed mufflers and gotten about 2 db less in cruise.

J.Cl on 12.6.06: the only place sound insulation seemed to help is under the floorboards

Carburetor

Paul in Charlevoix Mi N557CL wrote 9.11.03: I am 0-320 powered with 68-72 prop turning 2200 rpm static and take off and 2650 full throttle at 3000 feet. He had to revision three times his carb MA4SPA and still has troubles. He also uses an Adapted RV4 intake box system from Vans for the 0-320. Depth from the bottom of the carb to bottom of the fiberglass box is approximately 2 1/2" with the K&N filter setup that they use.

Dimpletape

Jim Stanton wrote 5.10.03: Guido the name of the person with the dimple tape TW is Anthony Occhipinti. He has a beautiful retract gear Tailwind that he built in the 60's. There was an article and some ads in Sport Aviation but I no longer

have them. Anthony is in the New Orleans area - may be Metarie. He is an attorney and may be in the phone listings.

About Leaning

On Jul 22, 2007, at 3:55 PM, George Turner wrote:
The standard procedure for leaning in cruise: Lean until you start gettng a rpm drop, than enrich it a little to top rpm. If you want it a little rich, go slightly richer. At altitude, you may save a gal. per hour and plugs will stay clean. Been doing it for 30 years, myself.
Be good to get more opinions, search the internet. George

Structural Failures

Jim Stanton on 17.10.08:
I do not know of any Tailwind that has come apart in the air for
unknown reasons. Of the four that I know of that have come apart:
1. N11Q-A W8 with 0 320 and Hartzell C/S Prop. A high G pullup failed
one side of the horizontal tail downward, at which point the aircraft
started an outside loop that destroyed one wing. Pilot had been
drinking and had previously done high speed passes with sharp
pullups.This airplane did not have the inner stabilizer doubler tube
that the W10's have.
2. N152A Wittman believed that this was caused by either rotor
turbulence or wake turbulence from a large aircraft that exceeded the
structural limits of the aircraft. Contributing factors were overweight
and small strut.
3. Idaho accident- the main spar inboard bolt holes were oval holes
1/4" x 1/2" No mystery here.
4. N14VK A collection of parts from two derelict airplanes, one of
which dated back to the 1950's. History of wings unknown. The airplane
had been recently groundlooped and the wing had hit the

ground.
Accident report states that there were relatively long, preexisting
cracks in the main spar through the inboard end bolt holes. Shortly
after this accident, there were rumors of improperly glued wing skins.
There is NO mention of this in the accident report.

Micheal Ruhnke on 17.10.08: Bottom line, its the plywood's job to keep the spar from splitting.□ □From the accident report on N654 1999.□TESTS AND RESEARCH□The inboard 15-inches of the right wing spar was sent to the United States □Department of Agriculture (USDA) Forest Product Laboratory, Madison, □Wisconsin, for examination.□According to an examination report, provided by USDA Forest Product □Laboratory, the accident wing spar was constructed of Sitka Spruce (Picea □sitchensis). The failure surface of the spar was, "...**spilt cleanly into □two pieces by a force that was perpendicular to the direction of the □grain.**" The report further stated, "It appears that the bolt holes that □were drilled through the spars to accept the 1/4-inch bolts were not all □drilled perpendicular to the spar's outer surfaces." Examination of the □second hole from the inboard end, "suggests that this particular hole was □drilled twice to make the bolt for this connection fit." The report □stated, "...the holes that are on either side of the spar are not evenly □spaced. There is also considerable difference in the diameter of the □middle two holes relative to the diameter of the outer two holes."□The full USDA Forest Product Laboratory examination report is attached to □this report.□□□□□

Flight Envelope

Red Hamilton On 6 Dec 2010:

What is the protocol for finding best gust penetration speed? We flew in the Tailwind this morning and were in some moderate turbulence with one incidence of severe. I use 160 IAS for that, not sure what would be best or how to determine. If you slow down enough it makes it last longer ;)I have tested for flutter at 255 IAS without any indication of flutter.Am I remembering correctly that the “sandbag Tailwind” indicated just in excess of 300 indicated before coming under control again? That was a W-8 as I

recall.

Keith Nurcombe on 6.12.2010

Jim Stanton on 17.6.2012
Vne:
I think the Spruce plans say 195 which is extremely conservative. Wittman said 200. The V8 Tailwind had a Vne of 225 statute. This was not a pure W10, among other things it had the old flat bottom wings with the triangle tips spliced on.
The 60th anniversary of the certification of the first Tailwind will be Jan 13, 2013. Obviously the design work was done at least a year and probably more before that.
Something that is rarely mentioned: I found out from Bill Brennand that a mechanical engineer who was a friend of Steves did a formal stress analasis on the first Tailwind.

Red, I'm no structural engineer, but I have just received my aeroengineer's analysis of the Tailwind based on all the evidence gathered from this forum over the past eighteen months. In the end, it's clear that the EASA case on which we've based our application to raise the MTOW of my W8 is rather more conservative than you guys might be prepared to accept on the historical evidence of the type. The many reports of cruising close on 200mph (and your own race results showing considerably more) have been used by my man to emphasise that conservatism. Based on a reduced Vd of 185mph (rather than Steve's implied Vd of ca 210mph) at 1350lbs the manoevring speed is calculated as 130mph with Vne of 167mph. This accords with the rule of thumb that max. rough air = 2xVstall.

At least I now have several pages of erudite calculations to back the figures up, but I guess in the end it comes down to the safety margins you are prepared to live with.
To have repeated the exercise with the aim of getting approval for higher weights and speeds would have involved a great deal more time and expense, plus cutting holes and delving deep. I dare say if you started from scratch you might get a better result.
For what it's worth, from this side of the pond.
Keith

Jim Stanton on Dec.5.2010
First a disclaimer-I would not encourage anyone to operate the W10 much in excess of 200 statute. Quite a few people have had W10's to the 250

range. Weaver has done this with at least three different airplanes, probably more than three. The problem Weaver has with the elevators is not flutter. The elevators have some slight looseness when one is held in place and an attempt is made to move the other. This can be easily fixed by drilling a hole about half way between the pushrod bolt and the center of the elevator spar. A AN3 bolt is installed in the hole. This should be done with the eleavators in neutral. If there is any significant assymetry with the elevators and hinges, this bolt could cause some binding near the limits of elevator travel. ☐I asked Wittman about turbulence speed in the W8. He asked-are you talking about typical hot summer afternoon turbulence or turbulence around thunderstorms. His final answer was VNE for moderate turbulence, slow down around thunderstorms.☐

The first five W8's were tested to at least 4 G's and ten percent above proposed VNE. At least one of these had the VNE set considerably higher than Wittmans recommendation. The tests were done with the airplane loaded to gross weight, in this case with sandbags in the right seat and baggage area. The pilot was supposed to take a picture of the g meter and airspeed. In one case a sandbag in the right seat slipped forward and pushed on the stick. The result was a near 300 m/h dive, 8.3 G's positive and 3.8 negative. The center windshield support was bowed in and the sandbag pushed the fabric out under the right floorboard. This airplane, like several of the early W8's, had the small wing struts.☐

On some larger/heavier airplanes maneuvering and turbulence penetration speed are two different numbers. On most light aircraft maneuvering speed is used in the absence of a published turbulence penetration speed. The PRIMARY factors that determine maneuvering speed are stall speed(one G power off stall) and the G limit of the airplane. Gross weight is a factor because weight changes change the stall speed. I will try to remember to look up the formula for calculating maneuvering speed. Maneuvering speed is the speed at which full control can be used without exceeding the G limit. ☐The stall speed on the Tailwind has stayed fairly consistent. As the wing area increased the gross weight also increased so the stall speed is similar from the early W8 with a very short wing to the current W10 with three feet plus additional wingspan.☐

Square root of normal load limit times clean power of stall speedequals maneuvering speed. Using the CAFE Numbers of measured stall 70.6 statute:☐3.8 G 137.6☐4.4 G 148☐6.0 G 172.9☐Jims CAFE airplane was 23' wingspan vs 24' standard☐☐The realty is that most pilots operate in turbulence up to moderate at speeds far in excess of maneuvering speed. ☐I had a G Meter in my W8 and it was extremely rare to see a reading over

2.5 G in level flight in turbulence. Typical turbulence is more in the 1.5-2.0 G range.

On 06.12.2010, Keith Nurcombe wrote:
Those figures illustrate the trade-offs involved in working within the ☐flight envelope. An interesting article on the subject in Feb 2010 LAA ☐magazine raised as many questions as answers. Another rule of thumb ☐quoted there indicated that the figures for the Tailwind are very ☐conservative. ie: 33xroot(weight/wing area) for my W8 = 33xroot ☐(1300/90) = 125mph, which sound ridiculously low. For a weight of ☐1425lbs, that figure goes up to 131mph, the figure that my engineer is ☐now proposing for a weight of 1350lbs. The very fact that so few ☐structural failures have been reported in almost sixty years should ☐give us all a lot of confidence on this great little aircraft.☐~keith

I have the airfoil curves in my report. I'll scan them and mail them to you shortly, Marc.
It's good to hear that you concur with the general thrust of my engineers conclusions. Your point about inadvertently pulling G is also valid. Most pilots find G loads unpleasant, and keep well away from those troublesome boundaries of the envelope. Problem is when you are startled, as you were. Last year I had set up a 120kt pass high in the circuit in my Janus A sailplane when, too late, I realised I was almost head on to another sailplane, and dangerously close. Instinctively hauling up and left (the only option) set up the most appalling PIO as the all-flying tailplane set up a resonance with the elastic wings that then tried to flap themselves off. Fortunately I was now pointing upwards, and the speed diminished to a point I could regain control. Even with a parachute, it was a very unpleasant experience. Flying fast, it behoves the pilot to hold on tight and move things just a little at a time. The TW has only little stubby wings, but the controls are very powerful.
Keith

Jim Stanton wrote on 14.2.2013:
First Vne must be considered. Wittmans published Vne for the W10 is 200. His V8 tailwind, which he called a W10, was not entirely the same as a plans built W10. It had a Vne of 225. Fred Weaver has probably had every W10 he has owned to 250 indicated. I am not suggesting this is safe or not. ☐Horsepower, especially on an airplane in the 200 plus range, is not an efficient means to increase speed. A small gain in speed requires a significant increase in power. ☐It is relatively easy to increase the power of the 0 320 from stock 160 hp to around 175. Beyond that not so easy. ☐Jim

Clements CAFE W10 was credited with 216.9 statute cruise at altitude. This was limited by the 200 Vne, the airplane was still accelerating at 216. ☐I believe that Reds increase in speed has come primarily from aerodynamic modifications. Red has done a lot of work on cowling, cooling and other aerodynamic mods. Some worked, some did not. A lot of trial and error testing. ☐One obvious recent modification is the small tires-1100 x 4. The wheels are moved outboard on the axle allowing the intersection fairing to meet the wheel pant at a near 90 degree angle. This is an old F1/midget racer trick. It was used on several racers in the late 40's and used by Wittman on the O&O. It works. This is a mod that is obvious to anyone who looks. It can't be hidden. There are many other things that I won't discuss.☐I got to know the late Bill Falck when his racer was the fastest of the era. Bill made his living with a flight school-just one Aeronca Champ-and by doing some maintenance work for customers. He told me that every major mod on the racer was one winters work. A new set of hand hammered aluminum wheel pants-one winter. New cowl-one winter. success in any form of racing comes from putting in hundreds, sometimes thousands of hours of work for very small improvements in speed. Sometimes the improvements don't work at all and then one spends hundreds of hours putting things back the way they originally were. Red has been willing and able to put in the hours.☐
☐
Jim Stanton on 29.3.2015
As far as I know Wittman never published Vne for the W10. I believe the 195 is an arbitrary number picked by the person who redrew the W10 plans for ACS. Many W10 builders have used 200 as Vne. However Wittman used a Vne of 225 for the V8 Tailwind.
I asked Steve about turbulence penetration speeds for the W8. He asked are you talking about near thunderstorms or just typical summer afternoon turbulence. I picked the latter and he responded Vne, slow down if you're near thunderstorms. I had a G meter in my W8 for a while and was surprised that some pretty bad turbulence only registered at most 2.5 G. Most of the better W8's will exceed 200 ias at low altitude at full power. Many light aircraft use maneuvering speed in lieu of a published turbulence penetration speed, but this is not a proper procedure. maneuvering speed for the W10 would be in the 130 range. That wopuld be based on 4 G structural strength. If 6 G structural strength were used th e speed would be around 155. This is obviously not a desirable speed to operate at in light to moderate turbulence. Yanking back on the stick at high speeds is far more dangerous than operating in moderate turbulence at high speed.
Aerobatic airplanes are typically flown at Vne in moderate turbulence. A 6G pull in the Pitts in moderate turbulence would become at most 6.5G.

Flying cross country in the Pitts I have encountered severe turbulence a number of times. The highest G meter reading I ever saw in level flight was 2.5. Regarding Vne vs normal cruise, normal indicated airspeed in the W10 above 7000' altitude would be well below 200, again depending on the individual airplane.

Corvair powered TW by Bill Clapp on 4.5.2014
I adjusted the front of the horizontal down 3/8" and went out and flew 196BC another 3/4 hour. The trim still does not center so will need more elevator up. What kind of increments make the best sense?☐Climb was about 1200 '/ min at full throttle. Climbed to 3500 and settled in at 20" MAP. Cruise was right at 120. I still have not installed the fairings or wheel pants so I expect an increase. Clean stall was at 65 indicated. Controls were stable and smooth. Did several 360 turns at varying bank angles finishing up at 45 degrees. I descended at 140 to check for smoothness and any flutter indications. Made a couple low passes over the runway at 150. Everything was smooth. I have a slight vibration from the three blade prop so will adjust tomorrow....probably increase the pitch somewhat as well. Starting to plan final paint ideas and working on possible destinations coming up :)

Fuel flow and takeoff performance of 0-320
Jim Stanton on 2.7.2014
1.5 times full power fuel flow is correct. Lycoming manual specifies 15.2 gallons/hour for upper end of tolerance for 0 320 full power fuel flow. Note that with a fixed pitch prop the 0 320 is developing somewhere around 85% power on takeoff and climb at sea level, depending on the pitch of the prop and other prop factors(width of blade etc)

INSTRUMENT PANEL

Measures. John D: Rick's N393 RC: floor (1/4 " ply) to bottom of the fuel tank (29,8 gals) is 12 ". Floor to bottom of panel is 20 3/4", panel is 8 1/8 " tall. Top of panel to bottom of front spar carry through is 8 3/8 ".

J. Clement's panel measured at Oshkosh: 19 1/2 " to the bottom, 10 1/2 " of panel, which leaves 7 " from the top of the panel. Clement's fuel tank measured 10 1/2 " above the floor.

J. Clement commented: looks about right, for sure go for the 12 " floor to bottom of tank height.

J.Cl on 9.1.07 Make sure you have room in back of the instruments for fittings, electric plugs, [t/c] tack cable. My instrument panel is back 5" and it is still tight with the fuel tank and the cross tube that holds the fuel tank up. The throttle, mixture and carb heat cables also need quite a bit of room or they bind up.

Lou Owen: my floor to tank bottom was 13 " . I have rather big feet.

Instrument top panel. J. Clement: I make the top panel in 3 pieces, the side about 6" wide.

J.Cl.: Set your instrument panel 5 1/2"-6" back from the door post and if the tank sticks up higher than the tube, allow yourself at least 11 1/2" for the radio stack. For size 9 or 10 shoe you will need 12" from the floor to the bottom of the tank.
Distance from the door post of the 5/8" cross tube where the instrument panel is mounted to is about 3 to 4 "

Brian Alley's panel width dimensions: 36.5 " Bill Newkirk measured his width between the front door posts is 36.75 " a little bit too close.

Brian Alley (16.2.04): I welded a thin plate inside the fuselage (.025 - .035) forward of the front door post and along the tube that extends forward to the firewall. This is the same as the H-stab forward mount only taller. Drill 2 3/16 or 1/4 " holes each side of the fuselage and install a complete IFR panel, no additional bracing is required.

Throttle cable location
Jim Clement's comment on 1.4.07: One of my TWs also had the throttle, mixture and carb heat over the top of the tank. It was the easiest hookup and worked well. I thought at first it would be in a uncomfortable place but it worked out fine.
As you can see in the photo, the cables have a sharp bend before hitting
the fuel tank. This is marginal at best. I can measure the panel to tank
distance later today and post it. If you put a tube through the tank, it
should be ovaled to no smaller than 1" high and 2" wide. Slide plastic

tubing over each cable going thru the tank or it will eventually wear a hole in the aluminum. Jim

Dennis Flamini on 1.4.07
Here is photo of my old TW panel, cowl flap, mixture on top,
throttle, prop below..all go over the tank, simple and 2000hrs of testing so far.

Guido, I made a console below the instrument panel to mount the throttle, carb heat, and mixture controls. This allowed all the engine controls to run under the fuel tank with no acute bends. The disadvantage is that the standard control stick will not work with this installation.
I made a very much modified one that was "over the leg" style and also one that went under the leg, which is what I am using now. I've attached a couple photos showing the control routing and a poor view of the top of the stick to give some idea of the modification required.
Bill N40WB on 31.3.07

Instruments.
FAR part 91 says to fly VFR you need at minimum: airspeed, altimeter , compass with correction card, tachometer, oil pressure, oil temp. for air cooled engines or coolant temp. for liquid cooled engines.

J. Clement : My first TW had a fuel gauge in the tank and it was worthless. Go with a low buck auto gauge and sender. Mount the sender in the top of the tank and the gauge anywhere. The 2 " gauges take up very little room. I think if you mount your throttle , mixture and carb heat in the center you will find that after a very short time it is the most convenient. Running the controls over the top of the tank seems a little high at first but is ok after a while and much easier. Bring the instrument panel back far enough and the top part of the fuel tank forward enough to get the radios in without notching the tank. I think about 12 " will do. My panel is about 5-6 " back from the door post.

In a second round J. Clement wrote: Remove both panel tubes and weld angle brackets onto the front side of the front door posts. They will extend in past the post about 1/2 " and bend 90° to the panel, the 5-6 " panel sides will attach to these. The 1/2 " side clearance is needed as the door opens it swings in some and will hit otherwise. .050 or heavier is OK for the panel, bend or rivet a 1/2 " angle to

the top and bottom. A brace can be bolted from the bottom angle to the cross tube behind the upper part of the fuel tank near the center of the tube.

Fuel neck
Weld the fuel neck directly to the tank, have never had cracking there and have stuck a tube into, bend for better alignment to the windshield after welding.

Fuel gauge sender
To mount the fuel gauge sender make a ring from .100 - .125 alu, drill and tap for 10/32 screws and flush rivet to the inside of the sender hole. Make the hole in the ring as big as the gasket hole, it has to be big enough to get the sender cork and stuff through. Even if using the probe type sender make the hole big, my experience with these is you will be changing them out later for the cork type as they are usually a problem. Almost all senders, auto or aircraft use the same, bolt pattern but it is a staggered spacing so think ahead as to where the sender arm is going.

On Apr 8, 2007, at 5:37 AM, dmagaw@att.net wrote: Shahar: Most of the reputable aviation fuel flow indicators use the Floscan Transducer, which will still pass fuel even if in the very unlikely event the rotor stops. They are FAA approved, which means that they have to meet fairly conservative standards. See http://www.floscan.com/html/blue/aviation.php . I know the Grand Rapids monitors use the Floscan transducers. I have the JPI Fuel Scan 450 in my Tailwind which also uses the floscan transducer. It gets a signal from the GPS, and will give fuel needed to destination, reserves, etc, as well as fuel flow and fuel quantity. I find it very accurate, and very useful too.

Compass Location
J. Cl. on 9.2.06: Being the center W/S support aluminum this is the only location I found where a magnetic compass works in a TW. (foto shows horizontal compass on top of the covering metal sheet of the instruments) A welded fuselage picks up magnetism during the build and screws up a panel mounted compass.

EIS, Fuel Flow Options

The directions for installation are very specific: before and after transducer there have to be 3 " of straight line (for instance between gascolator and mechanical fuel pump) Comment on this item : If you put any type of restriction on the low pressure side of the fuel pump, it could cause vapor lock... especially if there were any heat sources nearby.

EFIS

Dynon D-10 is highly recommended by several people; costs only 1995$ <www.dynondevelopment.com> and weighs about 3 pounds. Recommended by RV boys and aerobatics.

RJ: I am leaning toward the EFIS from Grand Rapids Technologies as it can be built up in stages. But he price of the air data computer , (and external magnetometer) alone is 5000$

Electrical Wires

J. Clement wrote 30.1.03: Use the white wire by Wicks 18 gauge and label it with colored shrinkage tube and write on it. Don't use cheap wire. Run the white wire everywhere, just label it .

Battery Cable

Jim Cl. on 29.9.08
I use #2 welding cable, single piece from master solenoid to starter solenoid. I use a rubber grommet thru the firewall but on the backside a 3/16" thick piece of birch plywood. The plywood has a hole the same size as the od of the cable, this is also fastened to the firewall. This will keep the cable centered in the grommet and lessen the chance of the firewall cutting into the cable.

Master Solenoid

J.Cl on 6.5.06: Solenoid mounting bracket is welded to frame also serves as grounding tab for battery cable.

J.Cl on 8.11.07: Make sure it is a master solenoid first, bolt it to the airframe direct, little terminal goes to switched ground. No power to dash when switched off
Jim C

Dave Magaw on 17.1.07:
A number of wiring gremlins relate to poor grounding. I burned out 2 electric oil pressure gauges one time before I figured out that the ground strap from the engine to frame was to small, and the ground return current on

starting the engine was also going back through my gauges. (Fortunately for me, neither I or the manufacturer knew the cause before they burned out and the manufacturer was so good as to replace them on warranty). Corroded or badly done terminals can cause the same thing. Good solid ground points (and as few as possible) each solidly connected together make a big difference. Something to check if this might be a problem.

Karson on 30.3.07: In aircraft when they say 14/28 volt, they mean a 12 v system, because buss voltage on an electrical system should be at about 14volts with an alternator or generator on line, and a 24 volt system has a buss voltage of close to 28 volts with a generator on line.

Strobes

on the fin by Rick Crosslin: The strobe mounting bracket was formed from thin soft steel to fit the lens and rubber bulb holder. I used a 16 oz ball pen hammer and various backing bars of wood and steel to form the steel. If you buy a wing tip add on strobe, you can use the keeper that comes with it for a guide. A small piece was cut from the top of the fin and flattened piece of tubing was welded in for the wires to go through, a couple of 8-32 nuts were welded into the top tube of the fin to accept screws to mount the strobe bracket.

Battery

Dave Conrad uses Deep Cycle Cell from a wheel chair. 8 years . 0 maintenance and still doing ok 75$.

Fred Weaver uses Concorde RG 25 XC for both TW 0-360 and Rocket 0-540

J.Cl. most at Baraboo use sealed batteries.

Bill Bernard: I used #2 welding cable for battery leads. They run under the frame through the firewall. The (+) goes thru a grommet in the lower firewall and the (-) ground lead connects to a copper bolt on the rear of the firewall and then there is a separate section to the ground buss. This section runs up the front of the firewall to get around the tank.

Grounding the Battery

I weld a .072 bracket near the battery box for bolting the master solenoid to, the ground cable bolts to this.

Radio and Antennas

J.Cl. wrote 14.3.03: On the TW I am flying now I have antennas in both wings and recently put one on the belly. The wing antennas are a four foot loop made of 12 gauge copper wire mounted behind the front spar. There is also some looping for the coax coming off the antenna. This works fine but performance drops off when transmitting and receiving of the wingtip direction. The belly antenna is mounted on the aluminum panel between the landing gear legs. These don't seem to interfere on things.

J. Cl on 12.1.06: ICOM A 200 is a great radio with excellent warranty, works better than King from which it a clone. I have had six or seven A 200 and never had a problem with any of them.

J. CL. on 22.10.03: Best to go with a external bent whip mounted on the belly. Best price I could find was from Vans for about 115 $. This is only a com antenna, forget the nav. go to GPS.

Fred Weaver: I only use Comant.nav. The bent whip model CL-122 I think with ICOM A 200 radio

Bob Connor: I use a Sporty's Handheld and the antenna is right behind luggage area on top. I have an alum plate bolted to the frame and the antenna is mounted in the alum. It works very well and I never have any trouble contacting approach control when I fly into AMA.

J.Cl about ELT: Have had 5 Icoms (A200). They worked all good and their warrantee can't be beet.
The ELT antenna of Fred's 180 HP is mounted on brackets coming off the rear baggage floor angle. It is vertical and is behind the rear wall of the baggage area. The ELT is mounted near it under the baggage floor. Works fine.

Fred Weaver on ELT: The internal antenna thing absolutely doesn't work except when very very close. Use bent whip Comant 122 which is rated at 350 mph

Autopilot

J.Cl on 21/5/04: You can over ride the servos without disengaging but you can still tell it is trying do

something. A disengage switch is mounted on the stick. The servo arms are connected to the aileron bellcrank and elevator tube with 3/8” alu rod with Heim type rod ends. I drilled a 3/8” hole thru the aileron bellcrank and welded in a bushing for a 3/16” bolt. On elevator tube I made a 1” long clamp from 7/8x.058 tubing and one of the two clamp bolts is used to fasten the rod end. With the autopilot off you can’t tell it is there.

J. Cl. on 19.5.04: I installed a Tru Trak autopilot in my first TW trigear owned by Bob Wuillemier. It is a 2 axis with pitch, roll and connects into Garmin GPS. This will spoil you for sure, Brad the electronic genius that works here at the airport did the GPS hookup and calibrating. On the first flight, when we turned it on it pitched over quite rapidly. I hit the cancel switch and went back to the airport where Brad read the manual some more, it turns out there is a jumper that is in the elevator servo plug. We had the circuit open and it needed to be closed, that reversed the servo direction. Next flight , climbed to 4000 feet, turned the autopilot on, took my feet and hand off the controls and away we went. Flew for 45 minutes and never touched a thing. Brand went thru the complete setup modes and it works just great. For turns, the servo hooks into the aileron system. It will make a standard 2 minute turn with ball less than 1/3 out of center with no rudder input. Very stable pitch.

VARIOUS

Ice

George Turner : If you pick up some ice this will plug up your fuel tank air inlet vent, leading to engine stoppage. Wittman had an extra vent inside the plane which he could unplug if he needed. Think he used a pencil to plug it. Of course other things than ice could also plug an air vent to the fuel tank .

Machinist's Workshop magazine actually tested penetrants for break out torque on rusted nuts.
Significant results! They are below, as forwarded by an ex-student and professional machinist, Bud Baker.
Don't forget the April 2007 "Machinist's Workshop" magazine comparison test. They arranged a subjective test of all the popular penetrants with the control being the torque required to remove the nut from a "scientifically rusted"

environment.

Penetrating oil ..... Average load
None ..... 516 pounds

WD-40 ..... 238 pounds

PB Blaster ..... 214 pounds

Liquid Wrench ..... 127 pounds

Kano Kroil ..... 106 pounds

ATF-Acetone mix.....53 pounds

The ATF-Acetone mix was a "home brew" mix of 50 - 50 automatic transmission fluid and acetone.
Note the "home brew" was better than any commercial product in this one particular test.
Our local machinist group mixed up a batch and we all now use it with equally good results.
Note also that "Liquid Wrench" is about as good as "Kroil" for about 20% of the price.

Fiberglass Work

J.CL: One of the easiest sealers to use is Dupont Velvaseal. It is a one part, ready to spray sealer. What you had for fisheyes was most likely caused from oil that contaminated the surface. New fiberglass parts should be cleaned several times with prepsall or a wax remover before sanding. Using a sealer before painting is a good idea, it provides better adhesion, a uniform base coat, and will show up problem areas before painting. Spray the first coat on lightly, if there is fisheyes showing you might be able to fog over lightly and bridge them. If they are not covered they will come through in the colored topcoat also.

About Epoxy

Cy Galley : one thing you can do is postcure at an elevated temp. Most epoxy has this " feature". the higher the re softening temp becomes. Of course if you go to high then the epoxy is destroyed. A man whose profession is epoxy is Gary Hunter, Houston Tx. He is a EAA tech counselor.
< gluegaru@earthlink.net>

Brian Alley on 1.6.06: The correct filler for structural bonds when using epoxy is cotton flox or mill fibers. Do not ever use micro ballons, silica or cab-o-sil. These are fillers used to thicken epoxy for light surface filling application. They sand really easy but have no structural qualities. Cotton flox is used in every structural bond in every Lancair built, Glasair uses mill fiber the same way.

Brian Alley on 22.1.06: I use a microvawe to warm epoxy when working in cold temps as well. But all it does is make it easy to mix. If temps are 35° F or less it gets cold again as you try to wet out cloth. If you are doing body work with micro balloons and epoxy it will help to warm the surface a little with a heat gun or a hair dryer. The epoxy cures much slower but will cure if properly mixed. A small batch of epoxy , say 2-3 oz. in the microvawe for 6-8 seconds will do the trick.

Varnishing
over West system epoxy gave a sticky surface. J. Cl. recommends to remove and clean it with acetone

Painting
Jim Clement on 1.11.08: Dave Once the surface gets contaminated with fish eyes it is hard to get rid of them. Did you wash off the fisheyed paint or leave it on to sand later? To play it safe, a first coat of sealer can be very lightly misted on and let it flash off, if no fisheyes show up then a second coat can be applied. Use new tack rags, latex type gloves and don't clean your hands with waterless hand soap. You can use epoxy or urethane primer reduced about 1 to 1 for a sealer or DuPont Velvaseal comes ready to spray. Were a disposable paint suit, most dirt comes from your cloths. If I have a part with a lot of pinholes, I use Featherfill, brush it on and work it into the pinholes. Sand it later with 80 grit and repeat if needed. Final sand with 180 grit and spray primer on.

Jim Stanton on 1.11.08
Dave- You didn't say what solvent you are using to wipe down the wings. I have always used a Dupont solvent, I think the number is 3939S. I use only paper towels. I wipe down each part two times with towels soaked in solvent and then wipe dry with dry towels.Wipe down a wing a small section at a time and then go over the entire wing a second time.If you're doing a fabric covered steel structure be sure to ground it. I have used this procedure with color butyrate,

Imron, PPG and Randolph enamel, laquer and Polyurethane. Never any problems. Somewhere recently I have seen a recommendation NOT to wet the floor with modern paints. One multi Oshkosh grand champion builder paints his wings hanging vertically.

Brazing
Brazed joints are sandblasted before priming J. Cl.

Drilling Stainless Steel
D. Magaw on 1.10.07: Sharp good HSS drill bits are the key. TapMagic and similar tapping fluids work well. TapMagic + cutting oil mixture works excellent.

Welding
J.Cl on 17,6,06 recomands: Smith "Airline"AQ-1A torch with 2*,3*,5* and a rosebud heating tip if you want to heat things up like preheating clusters or normalizing Tig welds.

Joe Maj on 20.1.06: A shade 5 lens is standard with oxyacethylene welding: If you once are getting close to 40 you probably need reading glasses. Welding is detail work. You must see clearly at a working distance of 12 " .

Jim Stanton on 10.3.08:PLEASE,PLEASE,PLEASE do not quench hot 4130 with air, wet rags or any other means. This absolutely unacceptable technique killed a friend of mine in a non Tailwind homebuilt. The optimum technique is to heat one location at a time, slowly backing the torch away until all redness is gone.

Jim Stanton on 31.11.08:
There is probably no other subject that has created as much controversy on this forum. FACT: All of the airplanes built in Afton, WY, (Husky, Pitts and Eagle) have always been TIG welded and are NOT "stress relieved". FACT: All engine mounts for Aerostars are TIG welded and are not stress relieved. FACT: The Citabria/Decathalon aircraft are all MIG welded. This required special approval from the FAA. FACT: Virtually all of the welded components in popular kits are either TIG or MIG welded. As I have posted before I can weld two visually identical samples with the TIG. Neither is stress relieved. One will break with one swing of the hammer, one will not break. Its all in the technique. The welding book by Richard Finch is an excellent reference for all kinds of welding. This book

goes into considerable detail about how damaging stress relieving can be unless performed in a heat treat oven.

Sandblasting
J.Cl. uses about mid grit sandblasting sand

Best airplane to train with
Fred Weaver on 28.1.06 : Citabria or Luscombe

Location of TW's worldwide
on 30.1.06:
<http://www.frappr.com/tailwindaircraft>

Hinges
J,Clement on 27.9.07: Use extruded hinges. Never had much luck with the rolled ones

Rudder Arm Failure
Alex Frizell on 21.2.07: Curt, it appears the break is beyond the weld. Typical of when the weld is cooled too quickly, a simple thing such as just flowing cool air across the weld can cool it down too quickly making it brittle. If making the finger patch, after welding keep the cherry red on with the torch and let it dissipate slowly. Jims idea will work great just use a small die grinder to split the bearings. I did the same process on a botched elevator hinge and it worked just great without losing any structural integrity. Caution; be extremely careful of welding and heating the bearings back together because you are right under the gas tank and even fumes from an empty tank can explode the tank. Not an expert but just my opinion, hope it helps some.
Alex

The cause is that the weldor starved the joint for filler, note the
concave weld bead. Same in the weld immediately above, might be photo
distortion but the vertical tube looks to have sagged in the HAZ. Very bad.

Another reason the pedals broke is because they were made using round tubing instead of square as the Wittman plans called for. Jim C

Here's a pic of the reinforcement on the co- pilot's side. I've checked with John Bakewell, the builder and current

co-owner of G-BJWT, who was flying it at the time of our incident, and it was the rudder arm where the cable attaches to the rudder pedal torque tube, which broke - the same place as Red's. Ours was gas welded though. I would recommend the addition of a strap around these joints as per the PFA recommendations, as a wise precaution. One day one of us might not be so lucky! ..... Mike Mears.

Tailwinders, We had an interesting experience over the weekend.
Marilyn and I were landing at a small airstrip in OR and the left rudder arm broke off of the rudder torque tube. It was recoverable with brake, but not by much. The weld did not break, the round tubing forming the torque tube broke, adjacent to the weld.
I note that the plans that I have (2 different vintages) do not ask for a finger patch on the forward side of those arms, like they do on the aft side of the rudder pedals. I would suggest that finger patches be added there at the next opportunity.
We have less than 150 hours on our plane.
At the least, that would be a good area to inspect closely with a light and mirror oftener than at condition inspection, IMO.
Another issue is you might want to check that you can still apply brake when the rudder pedal is full forward.
As always, your mileage may vary. .... Red

Whenever Tig welding is used, although the weld is strong, it makes the adjacent tube brittle next to the weld. The tube needs to be annealed next to any Tig weld where there is extra stress. I did an experiment with a two Tig welds. I put one in a vice and tried to bend the tube and it broke off easily next to the weld. I annealed the area on the tube next to the other Tig weld, and it would not break, only bend as much as 90 degrees. It proved to be very tough. George Turner .....Phoenix

Not withstanding your experiment I will continue to TIG weld my aircraft and not anneal the welds. I am basing my project on the research and experience of Scott Helzer, Ph.D. who teaches welding at Oshkosh and is a professor of Welding Engineering at Embry Riddle in Florida. His research on welding 4130 chrome-moly steel showed that given the same thickness material and use of the same rod to fill the joint, there was no benefit to annealing and could be done improperly with a torch in uncontrolled

"field" conditions. I believe that the TIG process leads to a more consistent and reliable weld, the "annealing" of welds is an Old Wives Tale that deserves to die. Properly done it may do no harm but improperly performed it can crystalize the 4130 to martenzite, a crystaline structure that is much more brittle than 4130.
Bruce E. Butts [bbutts@columbus.rr.com]

George, Agree with Bruce, as this the current industry standard (i.e. TIG welding for 4130 with no 'annealing' until tubing thickness reaches over 0.80). For further information see the AWS website. ... Rich Ellis

Red's rudder arms were Tig welded by one of the most professional Tig welders around, (not me,) His job was a welder with General Motors, and after doing the test mentioned, based upon info about brittleness if you do not anneal or 'stress relieve' the area around the weld, I did the test. Red got the fuselage from me. I thought I had annealed all the main stress areas, but I missed the rudder tubes. George, Phoenix

IF any post welding treatment of welds were required, the proper procedure would be normalizing, NOT annealing. Annealed 4130 is considerably weaker than normalized 4130. Any treatment of TIG welded
assemblies in the field with a oxy-acy torch is impossible. The only exception to this is when a weld is made with oxy-acy torch, the welded area should be slowly cooled down. If this is not done, the welded area will air harden. Such treatment would have to be done in a heat treat oven. The Tailwind rudder tube assembly has been a known problem area for many years and likely has nothing to do with welding method or any post welding treatment. ... jrs14855 [jimstanton55@hotmail.com]

You are right on George. Tig welds will not let go, however the tube will break right where the heat ring colors the tube. .... Dave Conrad

Whether it is called annealing, or normalizing, or stress relieving, I just followed the directions in a article on welding possibly from Sport Aviation or a Bingelis book. It said you run the torch over the tubing-weld area until you see a certain glow, and let gradually remove the heat so it cools slowly, without any wind or air movement to cause it to cool too quick. That is what I did, and it

caused the brittle condition of the tube next to the Tig weld to be gone. I am a certified novice welder and rather dumb on top of it, but if I could do it as per instructions, anyone could.

Weav, Well I guess I woke up the forum!
The event woke me up for sure, the strip is 1700 feet x about 20 feet wide, in Oregon, on the K Falls sectional, about 2 miles south of Coquille. When the arm broke out of the tube, the TW went to the right edge of the runway, or maybe off a little. Even though the pedal was a long way forward, there was enough braking action to bring it back to the center. Yes, I was and am quite happy about the braking availability. There are trees very close on both sides and both ends of the runway.
I have a friend that lives just out of Coquille that has a welding shop. He helped me take the assembly out and then gas welded it back together. I made finger gussets out of the back side of a 1" bandsaw blade and he welded those on also.
If someone wants to come and take it back out, then I will take photos! We were kinda busy up there working without the proper tools or light and hoping to get it home by flying.
Red

I think that George's experiment is the answer, but do not know. I did see a similar test done at the EAA NW flyin at Arlington done by one of the welding seminar guys. Two samples, both said to be 4130, both welded TIG, one right after the other. One was heated with a oxy-acetylene torch to dull red, then covered to cool slowly, the other not. The un-heated one, put in a vise, broke with the first hammer blow, next to the weld. The other was bent with the hammer back and forth without breaking.
The rudder arm broke out of the rudder torque tube next to the weld. ..... Red

The english PFA gave out a note october 25 1999 about a modification of the rudder pedal assembly .See
http://www.chlassociates.com/Aviation/AD/sheet1.htm
http://www.chlassociates.com/Aviation/AD/letter.htm
Guido

It was on our aircraft that the in flight failure of the rudder pedal attachment happened, although before I joined the group. I'm told it made the landing "interesting".

The PFA sent out that letter after our 'event'. Now all UK tailwinds have to have a reinforcement to the rudder pedal attachment. The assembly was gas welded.
Can I clarify whether this failure happened at the rudder pedals or at the rudder at the back of the plane. The way I'm reading it is that the failure was at the rudder itself. Or am I being dense?
Mike Mears, Nottingham England.

Yep, that is why it was such a chore getting it out and in with relatively primitive tools. The 18" Crescent did not help much. ..... Red

I have written about the W8 torque tube several times. I have a member in my EAA Chapter with the problem... but he can't see it as a problem. Scares me but it is a free country. .... Cy Galley

This is the area of Red's rudder failure. As the picture shows, I do have a finger patch on the rudder pedals but none on the cable arm. I think it would be a good idea to finger patch that also.
On the subject of Tig welding I would have to side with George on this. I have done the same test on a Tig welded cluster with the same results. To heat the Tig welded area I used a rose bud tip and brought it to a dull red in color and slowly backed off on the heat. ..... Jim C

Internet links

http://www.earltrimble.com/index.html

www.tailwindbuild.blogspot.com

Peter Mather's blogspot

http://laportesaeroplanefactory.com/main/page_10722_192.html

Graig Leporte's excellent build documentation

http://www.youtube.com/watch?v=d1C3YhDQryo&feature=related

http://www.youtube.com/watch?v=5VcrOhfjQoA&feature=related

http://www.youtube.com/watch?v=omqC3AvfiYQ

Schalldämpfer Gomolzig: http://gomolzig.de/index.php?id=3&L=1

buildlog4apexaviation.webloc
excellent Buttercup builder report

Schalldämpfer Liese: http://www.hliese.de/