**From A Velocity factory guy…setting toe in…**

I have used the push back and the greased plates methods.  I don't know that one was more accurate than the other.  I know the grease was a mess.  Somehow the harder I tried to work clean, the more the grease found a way to escape.  Same thing with epoxy...

I recently had to replace my main gear bow.  I hired Travis Holland to help me.  Many of you know Travis.  He has been working on Velocities for 30 years.  He has build 14 of them.

When it came to the wheel alignment I asked his preferred method.  He had done both, but likes the push back and pull forward.  That's what we did.  He felt it gives a better set on where the gear will actually roll.

One of the biggest challenges of doing the alignment is getting measurements to be consistent and repeatable.  The process of taking a measurement can have error in finding and marking the datum point.  There can be error introduced measuring the distance between the mains.  There can be error introduced by imperfections in the sidewall of the tire as you put the laser against it.  A sixteenth here and a sixteenth there, and the measurement is now off by a 1/4" at the nose.  Not funny when you added a shim to change the toe in by 1/8".

There are four bolts on the axle.  Travis instructed me to always tighten the forward bolts first.  I had not thought of it, but the leg will yield under the pressure.  We're trying to make small changes and the amount of compression will make a difference.

I've taken Travis' teaching one more step.  I know have a specific tightening order AND I use a torque wrench on the damn things.  I torque the two forward bolts (top first) to 30 ft-lbs, then the aft (top first) to 30 ft-lbs.  Then I repeat torquing to 50 ft-lbs.

BTW, Travis suggested we get rid of the 5/16" bolts.  His installation practice is to immediately drill everything to 3/8".  He has never had a problem.  If anyone needs a set of the tiny 5/16" adapter spacers, let me know.  I won't be using them again.

The other thing I've done is make alignment targets.  Travis said I was the first owner he had met that made a set of targets.  Alignment is a difficult job.  It is even harder when you're doing it alone.  I have a target board that goes at the front of the plane.  It has a mark that goes on the datum point at the nose.  Datum is found by using a plumb bob at the nose.

I have a centering stick that is used at the wheels.  I use this stick to measure the outside distance.  This calculates where the laser should hit the target at the front.  I think it saves time.  If not time, it takes some headache out of the process.

Last, I had done this process twice before.  Each time I didn't quit until I had the prescribed toe in.  Even so, I was getting excess wear on the left tire.  Despite my effort, something wasn't right.

I was going to re-check the alignment and then the gear bow failed.  Originally I purchased an inexpensive laser to do the job.  We all know the definition of insanity, and I want to be sane.  My theory is the laser wasn't 100% true inside the frame.

This time  I bought a better laser.  The new unit is guaranteed to be true.  It also fits nicely against the side of the tire for a repeatable measurement.

http://www.amazon.com/gp/product/B00275FROK

It cost me $120.  Not cheap.  It will be worth it if the plane track true.

Since Travis had done the alignment dance many times I was expecting him to bring his Yoda skills and tell me how we get a perfect alignment in three easy steps.  He just smiled and said "nope."  There is no easy way.  It to something like 10 iterations until we were happy.

Again, FWIW, do what you can to make the measurement process as predictable and repeatable as possible.

Best of luck,

P.S. The construction manual calls for 1" toe in on each side.  I downloaded the latest version before we replaced the gear bow.  I have no idea when the factory started recommending 1.5" toe in per side...

Andy

George Happ (Matco) has quite a engineering background. When I noticed that the newer calipers were designed to use 5/16" in place of two of the 3/8" bolts, I was tempted to drill them out as well. After looking them over I decided that George would not have changed it without a solid reason and decided to forgo that Idea and go with the spacers. I think it thins out the back plate material around the bolt hole just a tad too much.

You'll probably be okay but I'll stick with the design that the space shuttle engineer came up with.  
  
Tom Mann  
Long-EZ N200LZ (in construction)  
Velocity N951TM  
Pres. EAA Chapter 80

Prior comments by Terry Schubert:

Terry,  
  
The measurement is off the nose (datum for the plane) so either a laser off the axles or i-beams.  The total difference in-between the i-beams at the axles and them again at the datum.

John Abraham  
Executive V.P. Sales and Marketing, Chief Pilot

-----Original Message-----  
From: "Terry Schubert (jschuber@juno.com)" <mailer@mail2.clubexpress.com>  
To: , "Main Forum" <forum@velocityowners.com>  
Date: 06/09/14 11:58  
Subject: re: [VOBA Forum] ReWheel alignment and weight

Hi John,

Thanks for the information.

You mention 3" toe in requirement.  I wonder over what distance that 3" would be measured.  Do you use a 3' straight edge or what length?

Thanks,

Terry Schubert  
Central States Association Newsletter Editor  
  
---------- Original Message ----------  
From: "John Abraham (john@velocityaircraft.com)" <mailer@mail2.clubexpress.com>  
To:  
Subject: [VOBA Forum] ReWheel alignment and weight  
Date: Mon, 09 Jun 2014 06:36:45 -0500

A 700lb aircraft vs one pushing 2000lbs+ empty does have an effect with wheel alignment.  
  
The XL wings weigh in at 130lbs a piece.  Each time you adjust the alignment you need to push the plane back 15' and pull it forward again.  This puts the main gear in "normal track placement"  Out aircraft the engine will affect the toe in an chamber the most but with wings on is the preferred method as you are going to also be throwing in an additional 100+ pounds in the cabin.  Too much toe and you grind tires, not enough or toed out and the back end walks around on takeoff.  want around 3" total toe in.  make sure that you have 1.5" on each side so you arent tracking sideways.

John Abraham  
Executive V.P. Sales and Marketing, Chief Pilot

Having wings on usually refers to camber adjustment, while toe in is little if any affected by weight.  On the Long-EZ there is not much change with wings on & off.  You can also "approximate" the wing weight by put that amount of sand bags in the back seat.

Be sure you put the tires on grease plates ( I slop some grease inside a garbage bag and put it under the tires on a smooth surface.  That allows the tires to assume the unloaded position as found while the wheels are turning.  You can of course use real grease plates like the pros but it is a clean up mess.  A greased trash bag just needs to be thrown in the trash.

Terry Schubert

I just finished converting my Matco brakes to a new Cleveland set supplied by Velocity. My plane has 5/16” bolts in the top holes and 3/8” in the bottom. The backing plate with the new kit was drilled to 3/8” on all four holes but it also had spacer rings for the smaller bolts. I had to clearance for the new calipers as well. It took a small amount of grinding and sanding on the gear leg. I weighed the old Matco and the new Cleveland assemblies side by side and to my surprise I saved over 2 lbs on each wheel. They work great!

Grover McNair