Building a practical velomobile — Part 2

By RadicalBrad

Now that I have come up with a basic plan, which so far includes putting a body around a sturdy delta trike, I can move ahead into the specifics of the project. Winter has officially moved in around here, so all of my good bike parts and the few bikes I still have together are now resting in a quiet corner of the basement where I intend to build the velomobile body over the next few months. Since the Aurora Trike was one of the last projects I did in 2012, I still have it completely assembled, which was a good thing. It seems to be a perfect reference vehicle for the practical velomobile.

I had a few hours to spare, so I made a 3D model of the original Aurora with a few modifications such as a wider track, higher seating position, and over seat steering. I’m still not sure if I’ll be using over or under seat steering, and will probably not know until I have enough of the body work done that will allow me to climb in and out to see how everything will fit together. I had this idea to allow the entire body to lift from the front, allowing the pilot to just sit down into the vehicle without having to climb through the side, and if this does actually work out, then under seat steering will be the better choice.

Using the 3D model, I scaled it for printing so that 1 inch on paper would equal 1 foot in reality, which will allow a cardboard model to be made so that I can test a few different body designs using construction paper. One of my key goals is the use of only common and inexpensive materials here, so I will need to

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keep the maximum side profile of the body to no more than 4 foot by 8 feet so that off-the-shelf materials can be used.

Cutting out the shapes based on the 3D model

I printed out the 3D model and then traced out the trike frame bits onto some cardboard. Each of the parts were then taped together along with a copper wire rear axle in order to make a scale model that represented 1 inch on paper for every 12 inches on the real trike. I cut out several 4x8 inch rectangles from yellow construction paper to represent the 4 foot by 8 foot panels that I will be using to make the body. A lot of strong and lightweight materials can be purchased in 4x8 sections from a hardware store, so as long as I stay within these dimensions, there will be plenty of options available.

The first shape I made for the side body profile was based on the previous Photoshop drawings, representing a simple curve that flows from the rear of the trike, up over the pilot, and then around the front head tube just above the front wheel. This body design just seems to look nice, and is less than 8 feet long, so it fits the requirements well. The longer body that encloses the front wheel would need to be almost 9 feet long, and it just doesn’t look as nice as the shorter version.

Making the model body with the construction paper was as easy as taping it all together at the edges. The entire body consists of only three panels - two sides and a top strip, none of which exceed 8 feet in length or 4 feet in height. The body is wider at the rear, tapering towards the front so that there will be maximum cargo room and elbow space at the rear and just enough room for the pilot’s feet at the front. The body will also include the high brightness LED headlights, brake lights signal lights, and dual rear (Continued on page 3)
view mirrors. The front windshield will be made of thin Lexan, travelling from the top slop of the body all the way down to the curve over the front wheel for maximum forward visibility.

The side openings will allow enough room for the pilot to enter and exit the vehicle if I use over seat steering, but at this point I am swaying towards hinging the body at the rear to allow it to just lift right open at the front, allowing the pilot to sit into the vehicle and close the lid back over a front latch. This would allow for riders with less than perfect agility to enter and exit the vehicle easily.

As for doors, I haven’t decided if I want removable hard panels with side windows, or just a zip or snap up material type of door. Either way, the side panels (doors) will be fully removable and likely only used during extremely cold months or when it’s raining.

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The 8 inch model takes a test ride

Considering that the body is made from only simple 2 dimensional curved shapes, it still has a nice flowing look to it. This design is certainly not as sleek as those hand sculpted 3D teardrop streamliners, but it is certainly practical and will be inexpensive to manufacture from basic materials.

I fully expect this body to weigh only a little more than some of the commercially available units, and have no doubt that I will be able to lay across the top without having it buckle under my weight. All edges will be made with 3/4 inch wide angle iron with a 1/16 thickness, so this body design should not need much reinforcement either, a problem that often plagues ultrathin fiberglass/epoxy designs. It makes sense to me to go heavier right from the start rather than trying to build an internal skeleton just to support a flimsy shell.

I am happy with the look of the paper model, so next weekend it will be time to switch into high gear and actually start gathering the materials that will be used to make the body. Currently, I am looking at using 3/4 inch angle iron to make a complete perimeter frame and then fastening 3/8 thick flexible plywood to this frame so that the metal corners create a full weather seal and protect the body from any accidental impact damage. I will probably roll a coat of epoxy over the completed assembly.
Hub flange discs for your bike projects

Our laser cut Hub Flange Discs will make it easier for you to build your own delta trike wheels and save you time on your project. This Hub Flange Disc is made with 24 spoke holes so that you can build wheels directly onto any 3/4” axle using rims with 48 spokes.

The Hub Flange Discs are made of steel and are approximately 1/8 inch thick as required by the plans. Spoke holes are 7/64” in diameter so that standard bicycles spokes can be used.

All hub flange discs are sold as a set of four identical discs.

Our Hub Flange Discs come in several varieties with various spoke hole counts and axle hole diameters. Each of our DIY plans offer a recommended axle size and spoke count, but you can certainly change this to suit your design needs or parts availability. For instance, the Aurora Trike can be built using rims with 36 spokes rather than 48 spokes, or the DeltaWolf can be made using a 3/4 inch axle rather than a 5/8 inch axle. Please make sure that you order the correct Hub Flange Disc size for your project.

To keep costs to a minimum, our Hub Flange Discs are laser cut from flat sheet metal. Each disc will have a small imperfection on the outer edge and inner edge where the laser started cutting out the disc. There is also a mill scale on the surface of the metal that will need to be removed using sandpaper or a sanding disc. Neither of these imperfections will compromise the strength of the disc, and once they are built onto your hubs and painted, the imperfections will be unnoticeable.

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The surfaces of the Hub Flange Discs are coated with a mill scale at the factory to help protect the metal from oxidation. This coating easily be removed using a sanding disc to prepare the part for painting. The laser cut edges are also somewhat sharp, so they need to be smoothed off using the sanding disc by running it lightly around the edge once.

Once the mill scale has been removed from the Hub Flange Discs, the spoke holes will need to be beveled slightly to remove the sharp edges around the holes. This is done so that the spoke exiting the flange is not cut by the sharp edges of the hole. To bevel the spoke holes, use a 3/16 inch drill bit and push lightly into the hole until a small bevel is made. The beveled spoke holes are shown here after running pressing lightly with the 3/16 inch drill bit to remove the sharp edges. The Hub Flange Disc is now ready to be welded to your delta trike axle.

Remember, our Hub Flange Discs are sold as a set of four matching discs, and there are several versions available, so please choose the correct number of spoke holes and axle diameter for your project. These discs are manufactured to keep costs to a minimum, so you will need to bevel the spoke holes and prep the surface for painting, an operation that will only take a few minutes per disc. All of our DIY Delta Trike Plans make use of these Hub Flange Discs, which allow you to lace a rim directly to the rear axle. By integrating the flanges directly onto the axles, you’ll save some money instead of needing to have complex and expensive machined hub parts made. Our trike plans also include instructions on how to make these parts from scratch, as well as a drawing that can be sent to a machine shop in case you want to make your own hub flanges.

Our goal is to offer parts that save you both time and money when building your own DIY bike or trike project. For more details and to order, visit the AtomicZombie store.
“Great 6 pack special. I’ll have so much to keep me busy.”
~ Sean M., Ireland

November 12, 2012

From the Builders Gallery

**Darrell’s TimberWolf Build**

Seat is mounted, cranks are mounted, top triple tree nearly finished, handle bars mounted.

**Feedback on the AZ velomobile project**

“You guys are great! I can not wait until you share your velomobile plans with us. I live south of Canada outside of Buffalo NY and would like to build a velomobile to ride all winter! My current velomobile is a bit sad. Keep up the good work!”

~ Dan Moreton

"Howdy AZ folks! Your website and newsletters have really gotten me excited about modifying some bikes. Here’s a picture of a cargo bike that I made recently that has become a hit in our village and is used for transporting lots of stuff. Keep up the good work. We’re watching the progress from over here in West Africa (The Gambia)! Erik Brohaugh"
“I very much enjoyed your article last week on the velomobile project. I’ll be following this build closely and hope to make my own next year, too.”

~ Steven V., London, England

Freewheel and disc brake adapters for trike & quad projects

Our **Delta Trike Axle Freewheel Adapter** (left) fits any Shimano style thread-on freewheel and a standard 6 bolt bicycle disc brake rotor. Drilled for a 3/4 inch axle and includes a 1/4 inch mounting bolt. Disc brake mounting holes are tapped for standard M5 bolts. This part will fit the following plans directly: **StreetFighter Racing Quad, KyotoCruiser Tandem Trike, LodeRunner Cargo Trike**, and **Aurora Delta Racing Trike**.

This fits onto any 3/4 inch axle and allows the installation of a standard Shimano style thread-on freewheel and bicycle disc brake rotor. With this part, you can add a pedal transmission to any trike or quadcycle using only standard bicycle components. The included locking bolt secures the part to the axle and allows for easy removal at a later time. The 6 disc rotor mounting holes are also tapped so you can mount your bicycle disc brake rotor using the standard M5 bolts that were supplied with it. The FDAX34 Delta Trike Axle FreeWheel Adapter is a high quality machined part made of aluminum and anodized black.

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Very pleased with my recent purchase of six plans.

~ Peter Y., Australia

This part can fit the following plans with modifications: TimberWolf Suspension Trike, DeltaWolf Racing Trike, DeltaRunner Delta Trike, Gladiator Chopper Trike.

Note: Before purchasing this part for use on these plans, read through them first so you can understand what will need to be changed in order to make them fit properly. It helps to own one or more of the above plans in order to see how the part should fit before you attempt any modifications. If you are unsure about modifying our plans to use this part, or would like to know if our parts will fit your own custom design, then visit our forum and we will answer your questions.

And, the Delta Trike Axle Disc Brake Adapter (right) fits any industry standard 6 bolt bicycle disc brake rotor. Drilled for a 3/4 inch axle and includes a 1/4 inch mounting bolt. Disc brake mounting holes are tapped for standard M5 bolts.

Our Delta Trike Axle Disc Brake Adapter fits onto any 3/4 inch axle and allows for the installation of a standard ISO standard 6 bolt bicycle disc brake rotor. With this part, you can add reliable disc brake stopping power to any trike or quadcycle using only standard bicycle components. The included locking bolt secures the part to the axle and allows for easy removal at a later time. The 6 disc rotor mounting holes are also tapped so you can mount your bicycle disc brake rotor using the standard M5 bolts that are supplied with it. The DBAX34 Delta Trike Disc Brake Adapter is a high quality machined part made of aluminum and anodized black.

This part will fit the following plans directly: StreetFighter Recumbent Racing QuadCycle, LodeRunner Single Rider Cargo Trike, and Aurora Delta Racing Trike.

This part can fit the following plans with modifications: TimberWolf Suspension Delta Trike, DeltaWolf Recumbent Racing Trike, DeltaRunner Recumbent Delta Trike, Gladiator Phat Ass Chopper Trike. Note: Before purchasing this part for use on these plans, read through them first so you can understand what will need to be changed in order to make them fit properly. It helps to own one or more of the above plans in order to see how the part should fit before you attempt any modifications. If you are unsure about modifying our plans to use this part, or would like to know if our parts will fit your own custom design, then visit our forum and we will answer your questions.

See the Plans section on our web site for more information on these and other projects.
This scene will be a reality next summer just to give it a full watertight seal and to allow a nice smooth surface for painting.

Now, it's off to the steel supplier and hardware store to begin collecting materials. Hopefully the full sized body will be as easy to build as the 9 inch scale model!

Builder Feedback

“Hello from Ottawa. I really enjoyed your latest series about building a velomobile. I have looking into doing this myself for a long time. I have come up with dozens of ideas to try and make a simple velomobile. The biggest problem I found is weight. Without using fiberglass or carbon fiber, the body needs another frame. By the time you take the base trike and add the body panels and frame, it is over twice the weight of the base trike. Any aerodynamic advantage is now lost to the sheer weight of the velomobile. What I found through my research was to ditch the base trike idea and make a trike designed specifically for a velomobile. One of my better ideas is have an exoskeleton frame. This frame acts as the main frame and also holds some of the body panels, which are either fabric or Coroplast. This considerably lightens the load.

Anyway, keep up the good work and I look forward to reading how you solved these problems.” ~ TJ

“Wow! Thanks for the deal on the plans! They're very well done. This is coming from an Engineering Consultant with 33 years in the design and machine tool business.”

~ Robert
“Hi Brad and Kat. I like your newsletters. There is always something interesting.”

~ Vladmir I., Russia

November 23, 2012

TimberWolf Delta Trike

“Well I’m finally done with the build and am very pleased with the bike and it’s such a blast to ride. Thanks, Brad, for your part in making this happen. Now, I need to get into shape to do some long rides with the wife.”

http://forum.atomiczombie.com/showthread.php/7119-First-Bike-Build

Hello from Orlando

Hey to all!

Just got the fall special a few days ago, and I’m very excited but also nervous. I never have built anything like this before, but willing to try! I do have some ideals that I want to put together on the bike/trike just taking my time to work thru which one. Going over the plans is mind expanding. I don't plan on being a bother, but maybe I can call on help if I run into something sticky?


Question about strength of frame

Gonna build a TimberWolf, but intend to run 24” rear and 18” front wheels. I’m a little concerned about the strength of the .065 wall tubing, as I weigh 270 and I intend to add a Cyclone electric mid-drive. The drive and necessary batteries (36v. 20ah) will weigh about 70 lbs if I use sealed lead-acid (I’d rather have LiFePO4, but the cost is prohibitive). Add any cargo at the rear, and I’m looking at considerable weight on the frame. I know I’m gonna need a pretty stiff shock on the suspension.


We want to see pictures of your workshop!

Whether it’s indoors or outdoors, big or small — show us where you build your bike projects. Visit the AZ forum and join us.
“I am building an OverKill Chopper. I hope you will like it.”

~ Luis P., Puerto Rico

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From the Builders Gallery

You can upload your own bike pictures to the gallery. New pictures are added every day.

Help us reach our goal of 5,000 images by Dec. 31, 2012.

Visit the AZ forum and join us.

Find us on Facebook

Join our Fan Page.

November 23, 2012

Sociable dual velo project. Kyoto Trike rear was modified to fit into a double wide Stormy Weather shell. Quad is just a fun thing to build in two weeks. One seat has been removed so the drive train can be seen. I have since changed to Sturmey 8 speed internal hubs as a mid drive to reduce my chain handling issues. This version of the Kyoto should fit into the Stormy shell we are building. You can see both the shell and the sociable at the Toronto Bike Show in March.

Work trike quad was a fun thing to build in two weeks.

Trike I built for a local Autistic kid. I decided against modifying the wheels so that's why the frame is supporting the wheel outsides as well. The same frame could house a motor neatly behind the seat.

Warrior Waco Trike project in progress