

Wood Propeller Fabrication

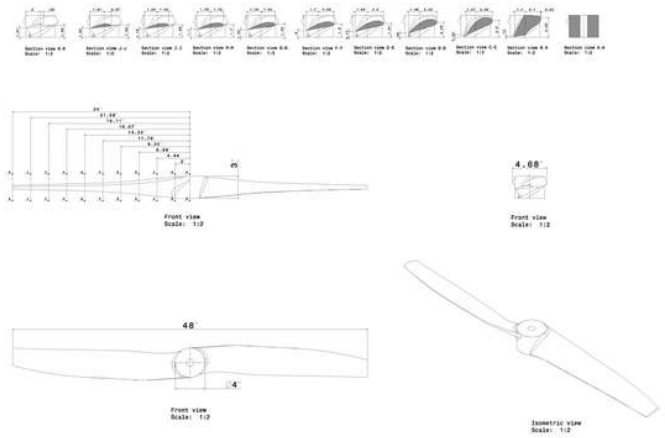
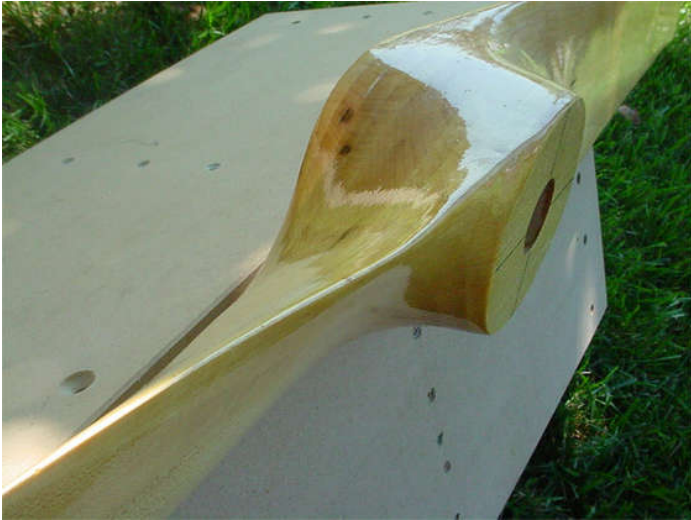
by [AeroEngineer](#) on January 21, 2007

Table of Contents

intro: Wood Propeller Fabrication	2
step 1: Obtain Propeller Cross Sections	4
step 2: Choose your wood and prep it	5
step 3: Cut out paper templates and glue to thin sheets of metal	5
step 4: Cut the propeller profile	5
step 5: Begin hogging out material	6
step 6: The fun part is when you get down to the Templates	7
step 7: Final Step is to Sand and Add Stain	8
step 8: Propeller Duplicator	8
Related Instructables	8
Advertisements	9
Customized Instructable T-shirts	9
Comments	9

intro: Wood Propeller Fabrication

This tutorial will show the steps needed for anyone to carve a propeller out of wood.

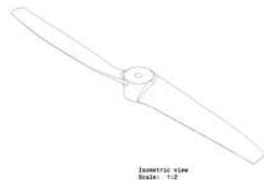
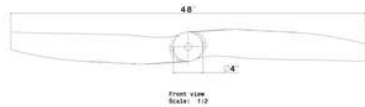
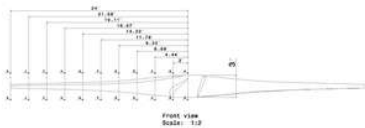
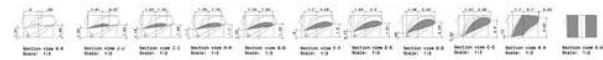






step 1: Obtain Propeller Cross Sections

First you must have full size cross sections (about 10, from root to tip) of your propeller. There are tools online for designing propellers, but you will need some CAD software to create the drawings and 2-D cross sections. I used CATIA, but any 3-D modeling software will do. (I also have a detailed instructions on design of propellers here (www.aerodyndesign.com). Of course you will have to print out the cross sections of the propeller on to paper, at full scale size. Because you will need to cut them out and glue them to thin piece of aluminum or tin.



step 2: Choose your wood and prep it

You will need to choose your wood. This propeller is made of Hard Maple. If you are creating a propeller for actual load bearing use, you will need a hard wood like Maple. You then cut your wood into thin boards and glue them together like in the picture. You must glue them together with no gaps. You will need lots of clamps.

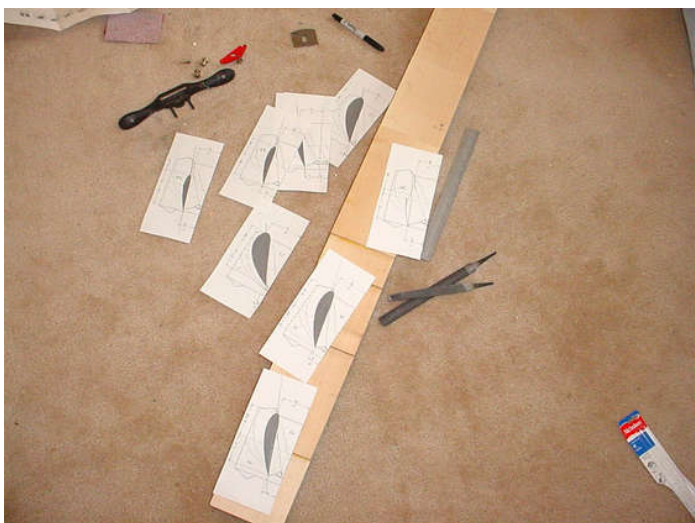


step 3: Cut out paper templates and glue to thin sheets of metal

You will now glue your templates onto thin sheets of metal, and then you tin snips to cut out the cross section.

You will need to file down the rough edges because the template needs to be dead on.

Typically you will want about 10 stations, or 10 cross sections from blade root to tip



step 4: Cut the propeller profile

By marking the profile of the propeller (looking down on the wood) you can use a hand saw to cut out the profile of the propeller, this will save you time when you go to 'hog out material'



step 5: Begin hogging out material

Now this is the most time consuming part, you will use a chisel or draw knife, or any cutting tool to start widdling away wood material until you can start fitting on you templates to see where material needs to be taken out.





step 6: The fun part is when you get down to the Templates

Once you have hogged out most of the unwanted wood, you can now use the templates and hold them up to the correct stations along the blade to see where material needs to be removed. Be careful not to remove too much, you can't put it back once its gone. The hardest part will be the root area, were the templates are hard to align. Marking the front and back of the propeller with a small notch will help align the templates.



step 7: Final Step is to Sand and Add Stain

You can use sand paper to sand down and smooth out the contour. Be sure to start with rough paper 40 grit to 100 grit, and work your way down to a nice 600 grit or finer. Then you will apply some water proof finish. If it is an outdoor propeller you will need to use a thick water proof varnish. This propeller is for an airboat (http://www.aerodyndesign.com/FAN_BOAT/FAN_BOAT.htm)



step 8: Propeller Duplicator

If you're really ambitious, you can make a propeller duplicator, which can more or less duplicate anything, but right now it's duplicating a propeller, so we call it a propeller duplicator.

I might make an instructable on how we made it, but for now some pics and a video here: http://www.aerodyndesign.com/PROP_DUP/PROP_DUP.htm

video:

<http://video.google.com/videoplay?docid=-2413717528443348681&hl=en>



Related Instructables



Model Wind Turbine :: KidWind Project
by kidwindrob



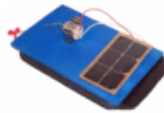
Windup Boat by engineer_01



Propeller Powered Skateboard: Construction (video) by crazybuilders



Making 3"x5.5" mono and bi planes! That Fly!!!(over 15 ft) by SoDDiggerCpl



Solar Boat Kit :: KidWind Project by kidwindrob



The 1st TRULEY Aerodynamic paper airplane by inventor1488



Propeller Powered Skateboard: Test (video) by crazybuilders





Pop-pop or put-put steamboat made easy for children by masynmachien




Comments


50 comments [Add Comment](#)

 **Rotor-Head** says: Aug 4, 2008. 12:45 PM [REPLY](#)
Question.. I have a wood prop and the tip has a small piece out from a rock hit.. Other than that it's perfect. If I were to make a mold of the tip (from the other side) drill a few small holes in the damaged area and fill the holes and mold with an epoxy or something to rebuild the tip... what would I use in terms of a filler material? Thanks

 **bd5** says: Nov 9, 2008. 11:19 PM [REPLY](#)
If I were you, I would dig out (even grind if necessary) the damaged area. Leave no loose or damaged wood in the nick. Get some high quality epoxy (do NOT use 5 minute epoxy), mix fiberglass (no longer than 1/8") into the nick. Use a metal file to carefully file away the excess epoxy/glass. Make sure you cover the epoxy with a good quality paint as epoxy can deteriorate with light. Rebalance the propellor. Voila, you're done.

 **dandumit** says: Aug 24, 2008. 12:11 PM [REPLY](#)
please tell me what routing bits did you used ?
Those : http://www.copycarver.com/copy_carver_burrs.htm Worth the money ?

 **vulcano911** says: May 1, 2008. 6:06 PM [REPLY](#)
Engineer: Please give us the blue prints. We will thank you forever.

 **AeroEngineer** says: Jun 4, 2008. 3:02 PM [REPLY](#)
Vulcano,
I have uploaded a pdf drawing, and an excel spreadsheet which has the airfoil sections. You just have to enter the correct t/c to get a thicker section
Drawing: http://www.aerodyndesign.com/PROP_10/PROP_10.pdf
Airfoil: http://www.aerodyndesign.com/PROP_10/4412.xls

 **budsiskos** says: Aug 4, 2008. 10:04 AM [REPLY](#)
what is the t/c?

 **buhamad9** says: Jul 14, 2008. 3:03 PM [REPLY](#)
Thank You Very Much for Reply my dear
www.aircraftsdesigncenter.com
What Kind of wood used for your Propeller Project



 **AeroEngineer** says: Jul 10, 2008. 4:55 PM [REPLY](#)
Simple 'Elmers' wood glue.



buhamad9 says:
www.aircraftsdesigncenter.com
please my dear what kind of The (Glue)used for Laminate Propeller wood? .

Jul 8, 2008. 11:24 AM [REPLY](#)

Thanks



AeroEngineer says:
Simple 'Elmers' wood glue.

Jul 10, 2008. 4:52 PM [REPLY](#)



AeroEngineer says:
Simple 'Elmers' wood glue.

Jul 10, 2008. 4:49 PM [REPLY](#)



vulcano911 says:
Hello Engineer. Thanks for your time, the tutorial is very clean and easy to understanding.
Sorry, but I have big doubt. How should I use the templates on paper?
Do you can give us the model templates drawings in another format different than .JPG? (may be autocad plans or a bigger picture), please.
Best regards.

Apr 27, 2008. 4:21 PM [REPLY](#)



AeroEngineer says:
Templates are only printed to paper so that they can be glued to thin sheet metal, and then tin snips are used to cut the profile. So the templates are actually made of metal, but the paper is used to get the shape.

Jun 4, 2008. 3:08 PM [REPLY](#)

I posted drawings and an excel spreadsheet here:
http://www.aerodyndesign.com/PROP_10/PROP_10.htm



thewoodcarver says:
I have used old X-RAY film for mine but I am doing things like the horse to the leftVery well done I have made smaller ones some for kids at sons school by eye a few that had to be spot on for RC planes ..

Jun 5, 2008. 12:20 AM [REPLY](#)



Gavabc123 says:
would i be able to make a mini propeller for my model rc plane?

Jun 3, 2008. 10:06 PM [REPLY](#)



AeroEngineer says:
Yes, a good website for small propeller design is:
<http://www.mh-aerotoools.de/airfoils/javaprop.htm>
Must install java tho

Jun 4, 2008. 3:03 PM [REPLY](#)



Gavabc123 says:
thanks heaps

Jun 4, 2008. 9:32 PM [REPLY](#)



just mike says:
good job man! I sure would like to see an instructable on your duplicator

Jun 3, 2008. 8:16 PM [REPLY](#)



AeroEngineer says:
I have some what crappy instructions at this website:
http://www.aerodyndesign.com/PROP_DUP/PROP_DUP.htm

Jun 4, 2008. 3:05 PM [REPLY](#)

There are drawings on the site for free download of the parts, but they require machining which is not easy.



hachi-control says:
Good one, Tin Tin.

Jun 4, 2008. 2:14 AM [REPLY](#)



flyer says:
What kind of wood did your propeller made of?
and are there any other wood can be used?
What kind of epoxy or material are used to combine the multi-layer wood plate?

Jul 22, 2007. 9:08 AM [REPLY](#)



AeroEngineer says:
Propeller was made of hard wood Maple
Mostly any hard wood can be used (Maple, Walnut, Oak, Cherry)
No epoxy, just simple wood glue. Thats all. Lots of clamps, lots and lots of clamps

Check out the duplicator on my website, i did some glueing there:
http://www.aerodyndesign.com/PROP_DUP/PROP_DUP_FAB_2.htm

Jul 26, 2007. 9:32 PM [REPLY](#)



ankido2000 says:
Nice work true, but: How about the Balance and the rated RPM?
Nice piece of Art no doubt, but I would not consider it a functional propeller unless it run on very low RPM.

Jun 28, 2007. 1:44 AM [REPLY](#)



AeroEngineer says:
Incorrect, it will function at 2200 RPM for our Fan boat.

www.aerodyndesign.com

Jul 26, 2007. 9:30 PM [REPLY](#)



AeroEngineer says:
Propeller was made of hard wood Maple
Mostly any hard wood can be used (Maple, Walnut, Oak, Cherry)
No epoxy, just simple wood glue. Thats all. Lots of clamps, lots and lots of clamps.

Jul 26, 2007. 9:29 PM [REPLY](#)



thewoodcarver says:
Very nice work! Very clear instructable ! I have made small props for toys , i think a large one would look nice on my garage wall

Apr 14, 2007. 3:00 PM [REPLY](#)



CameronSS says:
Wow. You have far more patience than I do. I just want to carve one out of cheap 2x4s or something to put on display and look cool.
Hmmm...propeller+chainsaw engine+bicycle...

Mar 26, 2007. 6:46 PM [REPLY](#)



AeroEngineer says:
Thanks, the Propeller + Chainsaw Engine + Bike thing has been proposed to me before. I might just do it for the reason that you are the second person to recommend it! this is going to work well on the airboat which we are designing now.

Mar 28, 2007. 7:56 PM [REPLY](#)



CameronSS says:
I know a guy who did it...It was before I knew him, though

Mar 28, 2007. 8:06 PM [REPLY](#)



Machuse says:
Great work, great Instructable!
Just curious. What actual finish are you using? I do some work with wood and am looking for something that wont turn yellow and has that great gloss you've achieved with this propeller.

Jan 24, 2007. 10:50 PM [REPLY](#)



BoilerUp says:
Amazing. I'm also really interested in your next project: a Wind Turbine. My senior design class (Undergrad Mechanical Engineering) just decided to make a portable wind turbine this semester - and I'm in charge of selecting/ purchasing/ making a prop for our application. So any direction you can give on where to look for materials on NACA section selection would be awesome (there are so many to choose from!).

But particularly from a craft point of view - this is impressive stuff.

Jan 22, 2007. 9:32 PM [REPLY](#)



AeroEngineer says:
There are lots of good books to help choose airfoils for low RE number propellers like the ones found on Wind Turbines. I am going to be modifying my BEMT program found on my website, and using it for my Wind Turbine Design. Not sure what airfoils i want to use yet.

Jan 23, 2007. 4:32 PM [REPLY](#)



twistedself says:

Jan 22, 2007. 12:08 PM [REPLY](#)

The hovercraft community often creates their own props as well. They have full size plans available as well. .Have to buy them though. I have plans for a prop and hovercraft from hovercraft.com.

I believe they recommend you fiberglass the prop for strength. They also balance the prop with weights added to the root of the prop.



WolvesOfWar says:

Jan 22, 2007. 11:28 AM [REPLY](#)

wowwowow

next instructable how to build a plane?



trebuchet03 says:

Jan 21, 2007. 11:12 PM [REPLY](#)

Do you have any resources for finding the proper propeller design, size etc.

Like... say I wanted to make a bike powered by a propeller turned by a crank :P how would I go about finding a propeller design that met my specs?

Very nice work :)

It also seems possible to make a propeller with cheaper high density foam -- then use the duplicator to make it in wood. So if you screw up by removing too much - you can just spray on some extra foam or start over without major investment losses :P



AeroEngineer says:

Jan 22, 2007. 5:28 AM [REPLY](#)

I have written a program in EXCEL which uses a blade element theory to help design. If you have no experience with this analysis, it might be difficult to use. In terms of getting the templates, you really don't need a cad program if you know how to draw. You only really need 2-D cross sections. If you are clever you can find all the airfoils you need online (ie. <http://www.pdas.com/avd.htm>) and then just print out the sections, but remember you need to choose a twist for you given airspeed) For that you need to design a twist:

My BEMT program for designing the twist:

http://www.aerodyndesign.com/ANALYSIS/PROPELLER_OR_ROTOR_IN_AXIAL_FLIGHT.xls

Other programs online for free:

<http://www.mh-aerotoools.de/airfoils/javaprop.htm>

A cheap CAD program:

<http://www.pilot3d.com/Airfoil.htm>



AeroEngineer says:

Jan 22, 2007. 5:20 AM [REPLY](#)

EXACTLY, you have good insight. That is the plan for our next project (a Wind Turbine). Which we will use foam and a hot wire to make the template blade. and then the duplicator for the wood.



spinach_dip says:

Jan 22, 2007. 2:00 AM [REPLY](#)

Nothing short of brilliant, that duplicator. But if you could duplicate the duplicator... but I shouldn't give you ideas. Nice work.



robonut625 says:

Jan 21, 2007. 7:48 PM [REPLY](#)

That is absolutely beautiful! Awesome work Aeroengineer!



AeroEngineer says:

Jan 21, 2007. 8:03 PM [REPLY](#)

We have also made a propeller duplicator, which you can watch a video in action: Which we actually duplicate this same propeller using a machine we built from scratch. And no templates are required:

http://www.aerodyndesign.com/PROP_DUP/PROP_DUP.htm



AeroEngineer says:

Jan 21, 2007. 8:04 PM [REPLY](#)

http://www.aerodyndesign.com/PROP_DUP/PROP_DUP_FAB_2.htm



jtobako says:

Jan 21, 2007. 7:44 PM [REPLY](#)

one (two) clarification(s) and one question.

you use the white part of the template and cut away the black. the wood grain is alternated when reassembling to prevent warping (presumably).

how do you line up the amount of twist in the template? or, how do you keep the center line of the templates on a common plane? do you clamp a straight edge to the hub/clamp the hub to a flat work surface and try to slide the template underneath?



AeroEngineer says:

Jan 21, 2007. 8:01 PM [REPLY](#)

OH and about the grain. For load bearing propellers, you want to get 'Quarter Sawn'sp? wood, which means they cut the wood so that the grain is always along the length. You will notice that the wood we used has the grain running along the propllers length. This is to maximize bending loads.



AeroEngineer says:

Jan 21, 2007. 7:58 PM [REPLY](#)

1) Yes you cut out the Black and leave the white, and if u look at the step 4 pic, u can see that we cut the top half of the airfoil and the bottom half for each template, so that we can place them on either side of the wood and they will meet.

2) First you measure stations out from the center, every x inches (inboard to tip). then you draw lines at each station, be sure they are square to the woods edge.

3) Then you know the Chord (distance from airfoil leading edge to trailing edge) of each airfoil section and its distance from the centerline of the propeller. You will mark the leading edge and trailing edge and then connect the dots for each station going outboard, you will wind up with step 5, which is the cut out planform of the propeller.then all u have to do is place your templates on each station and begin carving until the top template meets the bottom template.

It really works, you can mess it up. (unless u take out too much material. Then ur hosed



jtobako says:

Jan 21, 2007. 8:38 PM [REPLY](#)

sorry, i can't 'see' how you keep the templates square to each other and prevent an extra twist or ripple in the blade. it's probably just being there, seeing that the top leading edge is on line and it's the top trailing edge that needs to be taken down not the bottom trailing edge brought up.



sam says:

Jan 21, 2007. 6:21 PM [REPLY](#)

Do you need to make sure its perfectly balanced or anything? Sort of like the way people sharpen lawnmower blades on a pin to check their balance..



AeroEngineer says:

Jan 21, 2007. 7:43 PM [REPLY](#)

Actually we just carved both sides, and used the templates, it came out near perfect. You can always add a bit more varnish to one side if necessary



Tool Using Animal says:

Jan 21, 2007. 6:42 PM [REPLY](#)

That is really beautiful, the duplicator is cool too. What kind of glue are you using?



AeroEngineer says:

Jan 21, 2007. 7:42 PM [REPLY](#)

Just regular wood glue.



mothflavour2 says:

Jan 21, 2007. 6:31 PM [REPLY](#)

Wow, nice work.
