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Project: Trebuchet

Overview: This medieval launcher would reek havoc on enemies castles. However, the modern day conversion using 20lbs of weight will easily through a tennis ball the length of a gymnasium. Teach students about history, trajectory, mathematics, etc. Enjoy.

Materials: 3/4" plywood, 2' of 5/8" threaded rod, 3' of 1 1/8" dowel, 12 1/4" dowel pins

Minimum Cutting Area: 2 sheets of plywood that measure 4' x 8'

Bit Size: 1/4"

Finishing: Spray paint works great to accent the gussets. A polyurethane coating will cover all of the natural wood and seal it up.



Always read the entire project details before starting to cut the file yourself

Account for the thickness of the physical material on hand and the material thickness in the file

This file is zeroed to the tables surface, Zero your bit to the tables surface



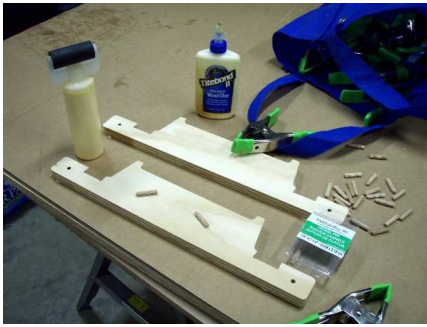
Included with the cut file is a hold down tool path that shows where it is safe to put screws. Run this file separately from the cut file so you can screw down the work piece, or if you have a different size board or different type of hold down disregard the file.



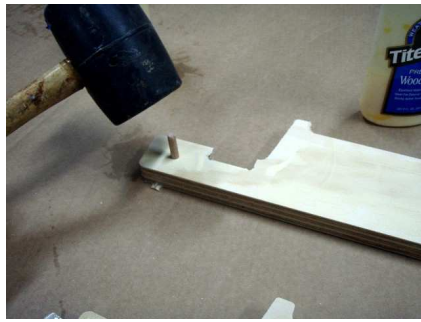
As the file starts cutting the profile of the parts make sure the cut is going all the way through the work piece and into the table surface. If you need to adjust any part of the file make sure you do not remove the hold down or you will loose position.



Tabs are use to hold all the pieces to the scrap wood attached to them. Use a utility knife to score these edges. Never try to push a piece out without cutting the tab, it will tear the grain on your project. Sand remaining tab flat.



The bottom supports need to be doubled up, use some dowel pins and glue.



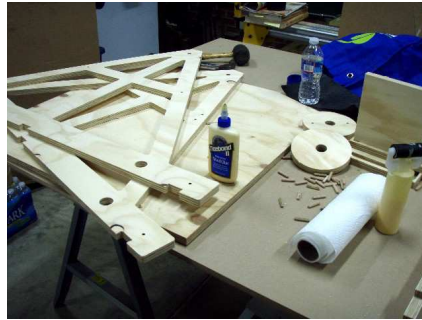
Insert two dowel pins into the first half, this will help with alignment for the second half of the glue assembly.



Using a rubber mallet lightly tap the two halves together.



Clamp the assemblies for at least an hour so the glue can set up.



As done with the bottom supports, glue up the vertical supports. There are four pieces that will be glued into two assemblies.



As the parts are drying sand all of the gusset pieces. These are the pieces with the giant pockets on the back side.



The weight basket can also be assembled prior to full assembly of the trebuchet.



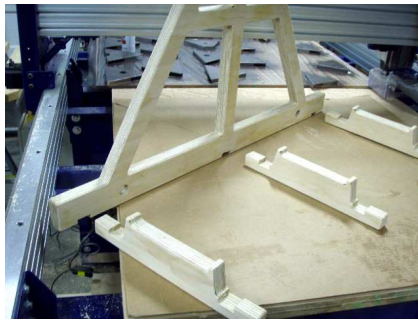
The bottom trough consists of one bottom and two side runners.



Glue the joints and clamp until the glue has had a chance to set up.



Adding a texture paint to all of the gusset pieces will add a authentic look to the overall project.



Assemble the three bottom supports onto the two side supports.



Add a 2" wood screw up through the bottom to help support the assembly.



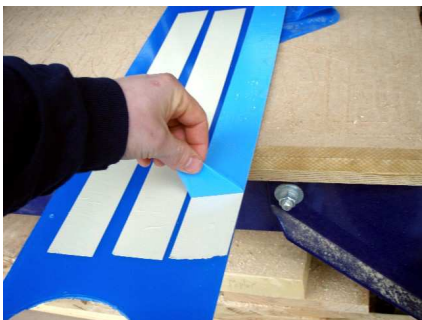
An assortment of 5/8" washers and nuts will go along with the assembly of this trebuchet.



Assemble all of the gussets before adding any hardware. Glue from the pocketed face plus a pin nail will hold the gusset in place.



A 23-gauge micro pin nailer leaves no nail holes so one does not need to come back and putty any holes.



A Plexiglas file is included for the wheel washers. Either a screw hold-down or two sided tape will hold the material to the ShopBot.



After the pieces have been cut, use a disc sander to clean off the tabs.



Now is a good time to get the dowels, Plexiglas and wheels together so this part can be assembled.



A plexi washer should be put on each side of every wheel.



Drill a hole vertically through the dowel axle and use a punch and hammer to push a smaller dowel into place.



Repeat these steps until all four wheels have been added to the assembly.



Double check your assembly is staying parallel by using a tape measure at the bottom and top of the assembly.



A angle grinder with a cut off wheel works great for cutting the threaded rod to length. Depending on the plywood thickness used on your project will determine the exact length.



Start pushing the rod into place, remember to add washers and nuts to help keep the arm assembly centered.



The same goes for the weight basket. It needs washers and nuts added to each side so that the basket stays in place on the end of the arm.



A piece of leather or cloth will work for the sling. The measurements on the example work the best. Trimming the ends to a round add a visual effect.



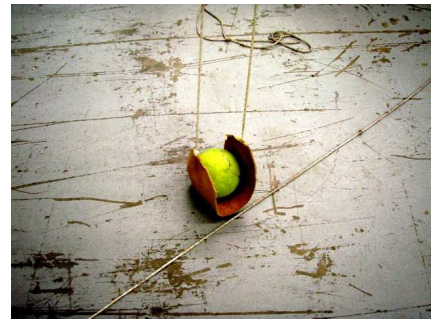
Experimentation with the string lengths are crucial to obtaining maximum distance, so buying a full roll is recommended.



Eye hooks are mounted by eye just in from the end of the arm. One end of the string needs to be affixed as shown above.



A center hook is mounted in the center of the arm. This string will let loose during launch.



The leather sling holds a tennis ball perfectly. Each string that gets tied to the sling should be appx. 30" in length. This is a great starting length that can be adjusted later for further distance or a higher arch shot.



For this example, 20lbs is needed to launch a tennis ball. If you increase the projectile weight one must adjust the counterweight.



Eye hook placed along the bottom work as a track for constructing a trigger system.



A simple screen door hook will work to hold the arm into the cocked position until it is ready to be launched.



Notice the eye hook closest to the end of the arm is the one with the string tied to it. The second one back is left open so the firing mechanism can be hold to this.



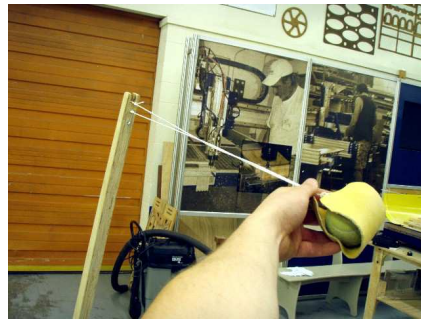
Here is the machine cocked, loaded and ready to fire.



Always stand off to the side when firing this machine. Standing in front of or behind can be very dangerous.



Once the trigger has been pulled the arm will start to rise pulling the tennis ball and sling through the machine.



As it reaches the correct angle the rope will let loose and release the projectile into the air.



The trebuchet will rock back and forth, achieving a distance of a full gymnasium floor. Make sure everyone is standing off to one side and not directly behind or in front of the machine.

There are lots of resources on the internet that discuss the history of the trebuchet, physics behind the design and different sized launchers. This is a great project for teaching history, mathematics, design process, trial and error(calculating trajectory), etc.

