# Pneumatic Groundbreaker Zombie

**Instructions By Greg Miller**
**Based on Casa Fear's design**

## Parts & Equipment List

1 8' long 2x4 (Select the Top Choice wood, not the cheap stuff)
4 3" hinges
2 2 ½" hinges
6 ¼" x 2" long flat head machine bolts (for attaching shoulder hinges)
6 ¼" nylon lock nuts (or use lock washers and regular nuts)
16 ¼" x 2" long flat head machine bolts (for attaching cylinder mounting brackets)
16 ¼" nylon lock nuts (or use lock washers and regular nuts)
24 drywall screws (for attaching elbow and wrist hinges)
2 drywall screws (optional; for attaching PVC "neck")
3 drywall screws (to attach the scrap OSB)
1 PVC pipe, 1" Outside Diameter, approximately 12-15" long (for optional "neck")
1 Scrap piece of plywood or OSB: roughly 1' x 2' (or size to suit your needs)
4 #6 screws, 1 ½" long (to mount the solenoids)

Pneumatic Kit (see supplier info below):
2 Solenoids: 4-way, 5-port, ¼" NPT in/out, 1/8" NPT exhaust, 12VDC
2 Cylinders: 1-1/16" bore, 2" throw, double acting, double end mount (aka universal mount)
6 Push-fittings: ¼" male NPT, ¼" OD tube
4 Push fittings: Right Angle, ¼" male NPT, ¼" OD tube
4 Speed Control muffler or adjustable exhaust, 1/8" male NPT
1 Push fitting: Branch T or Y-splitter, ¼" male NPT (for all 3 branches)
1 Quick coupler: ¼" female NPT to ¼" male coupler (to attach to compressor)
2 Rod clevis (to fit cylinders)
4 Clevis brackets (to fit clevis), with pin and clips (4 sets for each end of 2 cylinders)
Polyurethane tubing, black, ¼" OD, at least 10 feet

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## PREPARATION

Cut the 2x4 into six pieces, using the following approximate measurements (refer to photos and the diagram in step 1):

Shoulder: 13" long, each end cut at approximately 30 degrees
Upper Arms: 13" long, one end cut at approx. 30 degrees, the other end cut square. MAKE TWO
Lower Arms: 11" long, both ends cut square. MAKE TWO
Base Board: Whatever remains (approximately 3' long, give or take)

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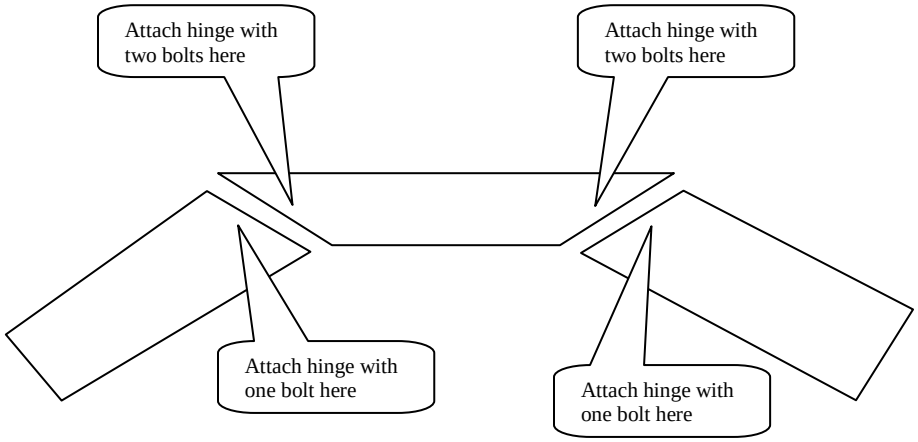
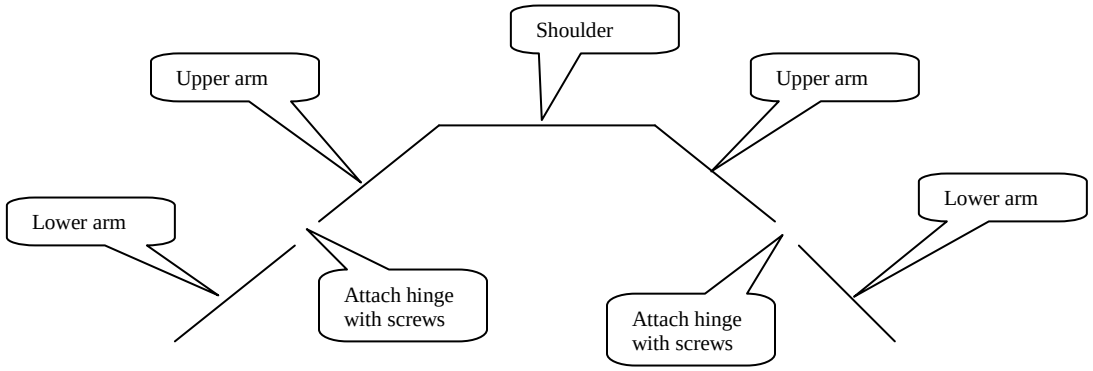
**ASSEMBLY INSTRUCTIONS**

1. Lay out the boards for the shoulder and the two upper arms. Position the 2 ½" hinges on each end of the shoulder, leaving a slight gap between the hinge pins and the boards. Mark the location of the center hole for each hinge (ignore the two outer holes) on the upper arm boards and the two outer holes for each hinge (ignore the middle hole) on the shoulder board; drill ¼" holes through the boards. Using bolts and nylon lock nuts, connect the hinges with one bolt on each of the upper arm boards (don't fully tighten) and two bolts each on the shoulder board. These hinges will be the "shoulders."

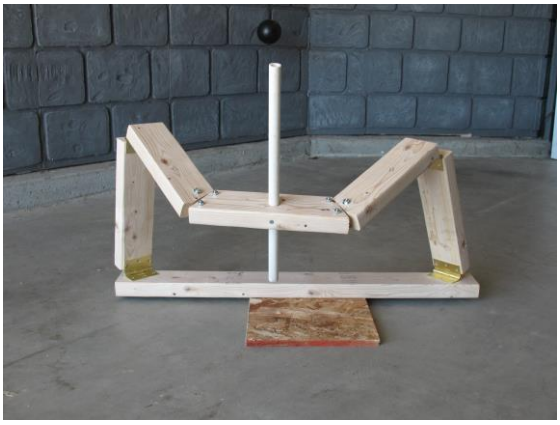



2. Position the lower arm boards next to the upper arm boards and put the 3" hinges in place, leaving a slight gap between the hinge pins and the boards. Drill pilot holes and attach the hinges with screws. These will be the "elbows."




3. Attach the last two hinges to the ends of the lower arms with screws in the same manner as in Step 2. Only one half of each hinge will be connected at this point, and attach the hinges backwards, so that the hinge won't close all the way back against itself (this will help the prop "stand" by itself when mounted). These hinges will be the "wrists."
4. Drill a 1" hole through the center of the Shoulder board to accept a piece of PVC pipe for mounting a wig head or other support for a mask. (This step is optional, depending on how you will attach your mask or foam-filled prop head.)

5. Attach the scrap piece of plywood or OSB to the remaining long 2x4 board. This is to help with stability and can be replaced or removed later, depending on your final application of the prop.
6. Turn the entire assembly over so that all hinges are facing downward. Hold the armature so that the lower arms are more-or-less vertical, and position them on the remaining 3' long 2x4 board. Mark the location of the hinge holes (the other half from Step 3), drill pilot holes, and mount to the long board with screws. The whole armature should now be able to stand upright by itself, albeit a little "saggy" looking.
7. If you are using the PVC "neck" to hold a Styrofoam wig head or similar, insert the PVC pipe and hold in place by using two screws on the edges of the board into the pipe. (This step is optional depending on how you plan to mount your head.)



8. Prepare the cylinders by screwing the Right Angle push fittings into the two air supply holes on each cylinder. Hand tighten the fittings first, then GENTLY tighten with a wrench or pliers. DO NOT OVERTIGHTEN. If you later find an air leak, just gently tighten a little more. This procedure applies to ALL push-fittings.

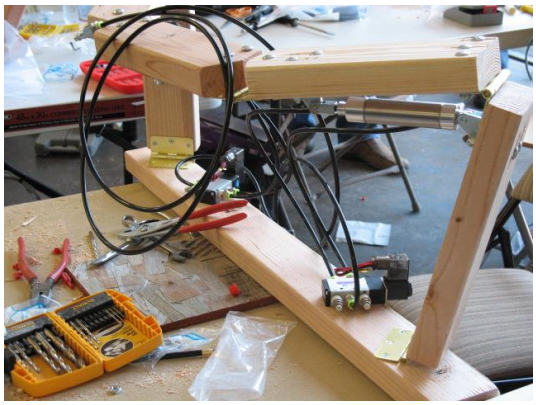
9. Attach the Rod Clevis to the extendable rod end of each cylinder simply by screwing it on.

10. Position the brackets and pin onto the rear of one of the cylinders and hold in place by hand (don't use the pin clip yet, as it's easier to mount if you disassemble it after you mark your mounting locations).

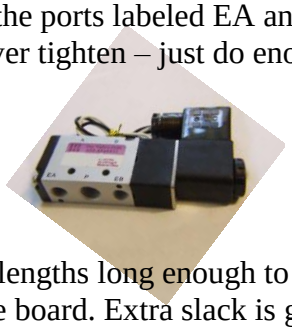
11. Figure the attachment point for the cylinder on one of the Lower Arm boards and mark the location of the mounting holes where the rear of the cylinder will attach. Drill ¼" holes then attach with bolts and nylon lock nuts. (Tip: Mark and drill the holes for only one of the brackets first, then disassemble the bracket set and attach with bolts and locknuts. Position the cylinder and the other bracket with the pin, mark and drill the holes for the second bracket, then attach with bolts and lock nuts.) Repeat for the other cylinder on the other Lower Arm. Feel free to experiment with different mounting positions; closer to the elbow gives more of a lurching movement, whereas mounting closer to the wrist gives more of a vertical movement. Place the

Pin Clips on the Pins to hold the cylinders in place in the brackets. Both cylinders should now be hanging by the rear pivots.

12. Place the other sets of brackets inside the Rod Clevis and hold in place with the Pin and one Pin Clip. Experiment with the positioning of the rod end of the cylinder by holding it in place against the Upper Arm board (while retracted) and then extend the board and cylinder as one unit to check the movement. When you have found the desired movement and ensured that the cylinder can fully extend and retract without any binding, mark the location of the mounting holes for the rod bracket. Drill ¼" holes and attach with bolts and lock nuts (it may be easier to disassemble the brackets and attach them one at a time, as before).



13. Double check the movement of the prop and the cylinders and adjust if necessary. You may have to shave some wood off of the edge of the Shoulder board and/or Upper Arm boards later on to help with smooth movement.
14. Prepare the solenoids by screwing in Push-Fittings into each of the ¼" holes (labeled P, A, and B). Hand tighten and then GENTLY firm up with a wrench or pliers. Screw in the four Flow Control/Mufflers in the ports labeled EA and EB. Mount the solenoids to the base board with the #6 screws. Do not over tighten – just do enough to hold them in place.



15. Cut tubing into four lengths long enough to run from the cylinder connections down to the solenoids on the base board. Extra slack is good, but avoid excessive lengths that could snag or get in the way of the prop movement. Push the tubing firmly into the push-fittings.
16. Cut tubing into two lengths to run from the Branch T (or Y-splitter) push-fitting to the IN (P) push-fitting of each solenoid.

17. Screw the Branch T (or Y-splitter) push-fitting into the air compressor coupler (or into a pressure regulator).

18. Connect the wires of each solenoid to your two 12-volt power sources / switches.
19. Connect the air coupler to the air source, starting at about 30 PSI. If either of the cylinders extend when power is not yet applied to the solenoids, simply reverse how the tubing connects from the

solenoid to the cylinder. Both cylinders should remain in the retracted position until the solenoids have been activated.

20. Switch on and off power to the solenoids to activate the prop, either manually or via a controller. Adjust the air pressure as needed.
21. The body can be made by wrapping hardware cloth (chicken wire) around the Shoulder board. Make sure the hardware cloth is not longer than the distance from the Shoulder board to the base board when the prop is in its resting position. Dress the prop in whatever clothing and mask you desire. You will need to detach the hinges from the base board one at a time to fit the sleeves on the arms. Make sure that the tubing does not bind; it may be prudent to cut slits in the back of the sleeves to feed the tubing through to help ensure that there is no snagging. Staple at least the front of the clothing to the base board, but make sure the prop can fully rise up without binding, snagging, or ripping the clothing or any components.
22. HAVE FUN!

**PNEUMATIC SUPPLIERS**

Kits for this project can be purchased from the following vendors:

- Devious Concoctions, Brent Ross -- brent@deviousconcoctions.com (www.deviousconcoctions.com)

- Evilusions, Brian Warner – gadget@evilusions.com (www.evilusions.com)

The kits may not be listed on their websites, but if you mention this project and my name they should know what you need and can put together all the pneumatic components for you.

*If you have any questions or need assistance with this project, you want to discuss variations and/or controller options, or would like information on suppliers for individual pneumatics items, please contact Greg Miller at djdude@comcast.net .*