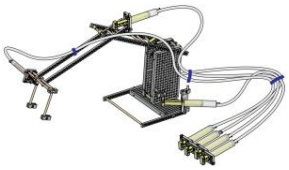
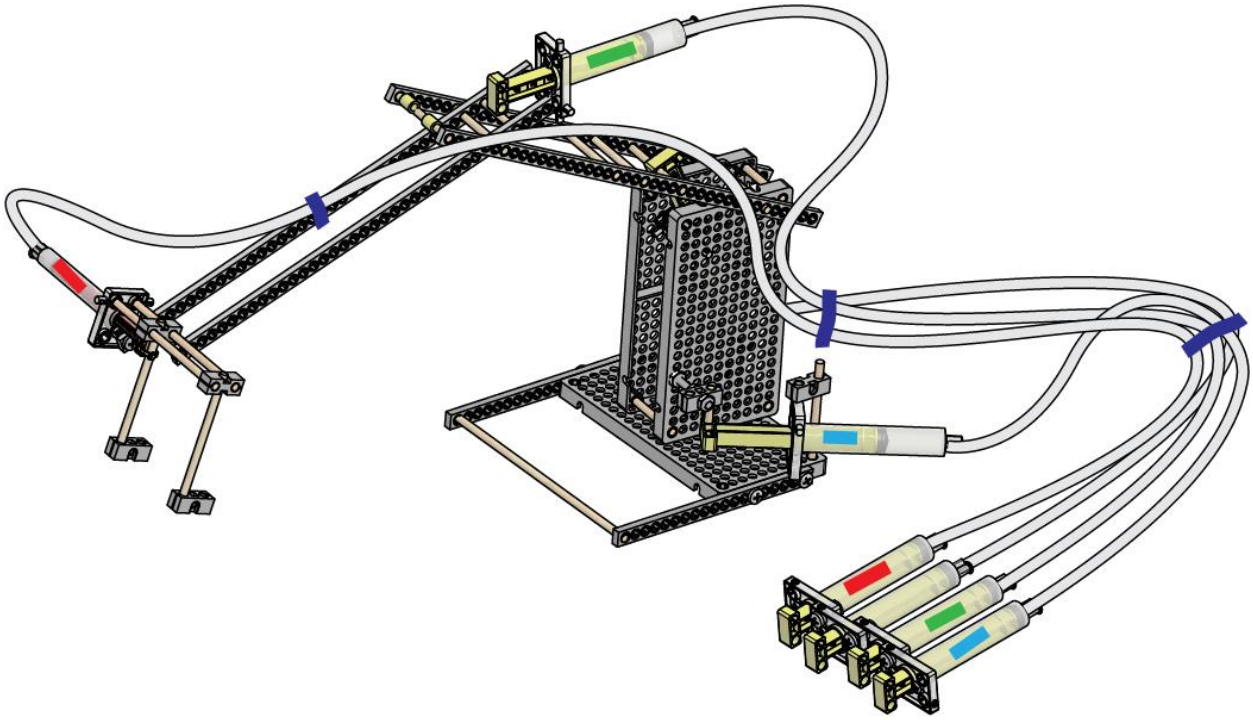
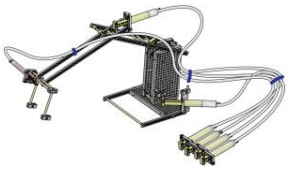


ADVANCED HYDRAULIC ARM

Build Guide

Name: _____ Set: _____ Date: _____

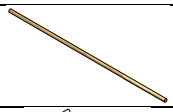
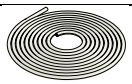
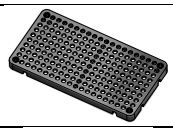
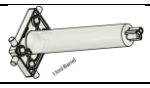
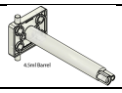




ADVANCED HYDRAULIC ARM

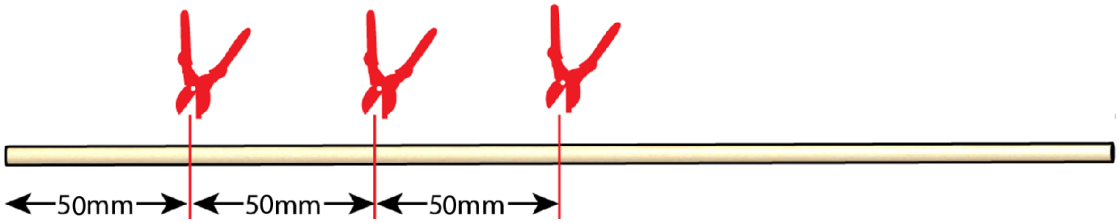
Build Guide

Materials Included in the TeacherGeek Advanced Hydraulic Arm Packs:

Component	Picture	# in 10 Pack	# For a Single Advanced Arm	# Required to Build Example Arm	# Extra -To Innovate Your Own Design
Strips		80	8	5	3
Dowel		80	8	5	3
Tubing		30M (100ft)	285cm (~10ft)	285cm (~10ft)	15cm (~6in)
Blocks		100	10	7	3
Hole Plate		30	3	3	0
Slide Stop 3cm Section		10	1	1	0
#10 1.5in Screw		10	1	1	0
#10 1in Screw		140	14	12	2
#6 x .5in Screw		240	24	24	0
#10 Nut		160	16	14	2
#10 Locking Nut		10	1	1	0
Rubber Band		100	10	4	6
Cable Tie		20	2	1	1
13ml Cylinder Barrel		70	7	7	0
13ml Cylinder Plunger		70	7	7	0
13ml Cylinder Piston		70	7	7	0
4ml Cylinder Barrel		10	1	1	0
4ml Cylinder Plunger		10	1	1	0
4ml Cylinder Piston		10	1	1	0

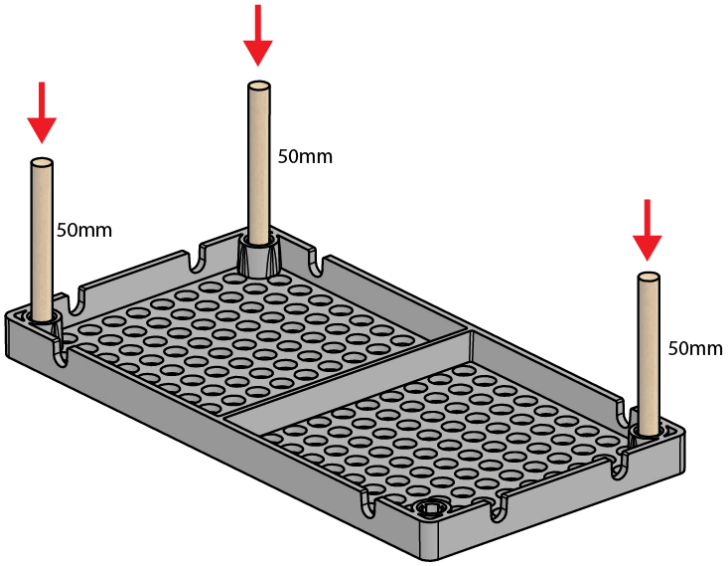
Step #1

Cut three 50mm (~2in) dowels. Save your extra dowel pieces. You will use them later.



Step #2

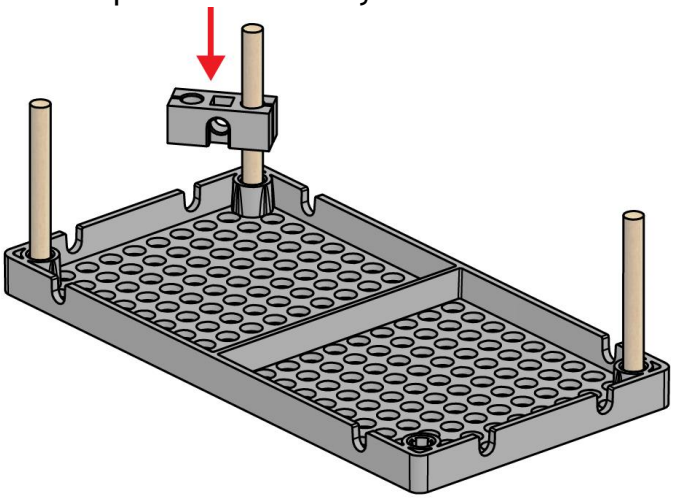
Push/tap the 50mm dowels into a plate, as shown.



Do not ream any holes.

Step #3

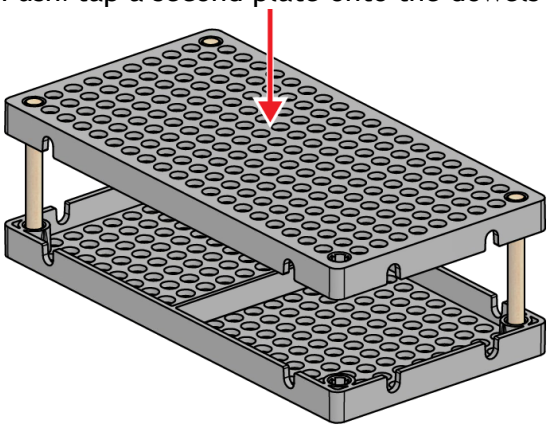
Push/tap a block half way down onto the dowel as shown.



Do not ream any holes.

Step #4

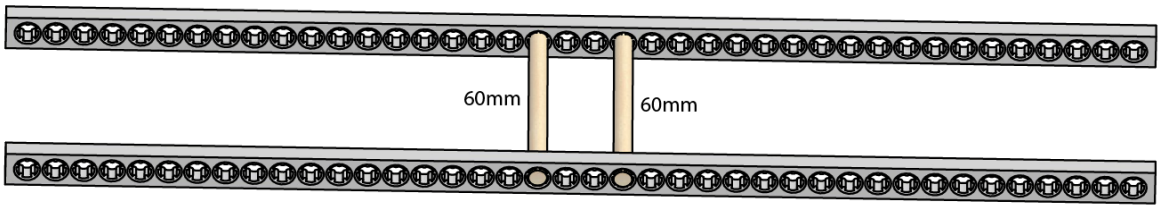
Push/tap a second plate onto the dowels from Step #3. This will become the waist for your arm.



Do not ream any holes.

Step #5

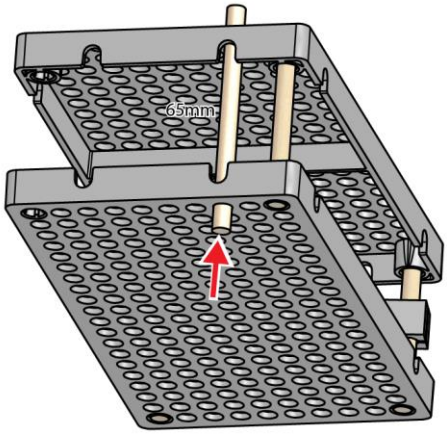
a) Cut two 60mm (~2 3/8in) dowels.
b) Push/tap the 60mm dowels into two strips. This creates the main arm.



Do not ream any holes.

Step #6

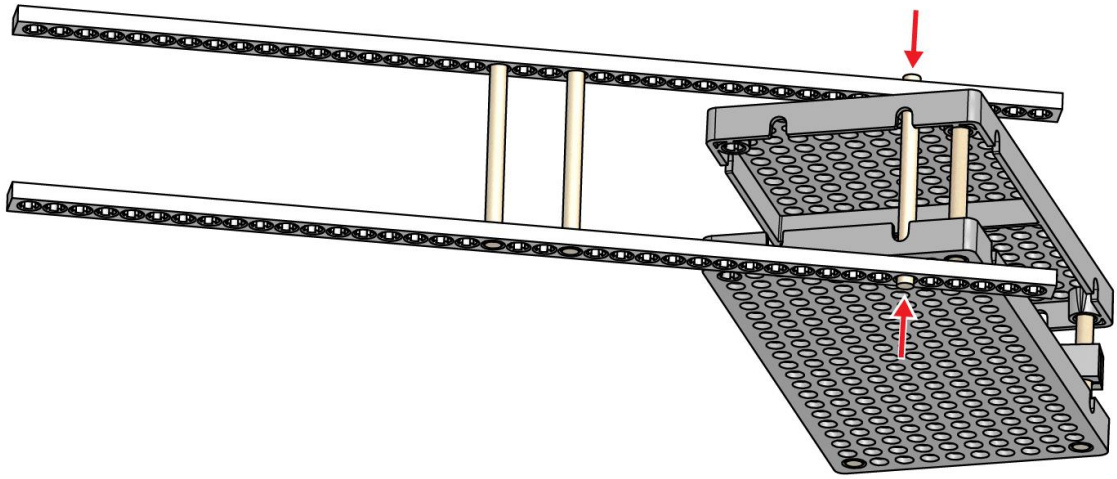
a) Cut a 65mm (~2 3/8in) dowel.
b) Slide the 65mm dowel into the plate holes.



Do not ream any holes.

Step #7

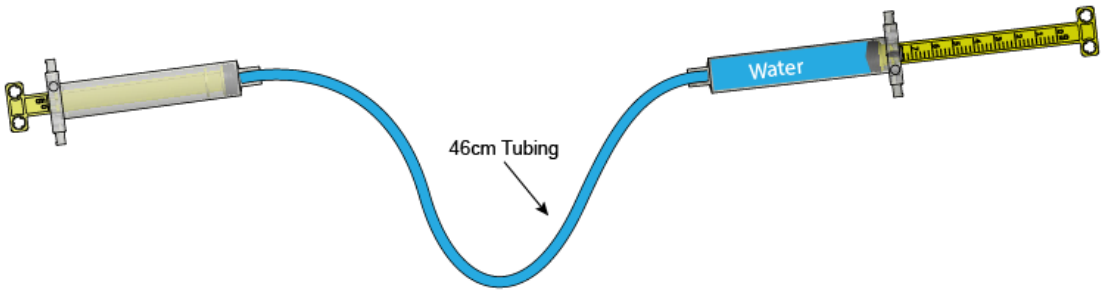
a) Spread the main arm strips apart slightly and position them on either side of the 65mm dowel. Push/tap the strips together to attach them to the dowel. This creates the arm fulcrum (pivot point).



Do not ream any holes.

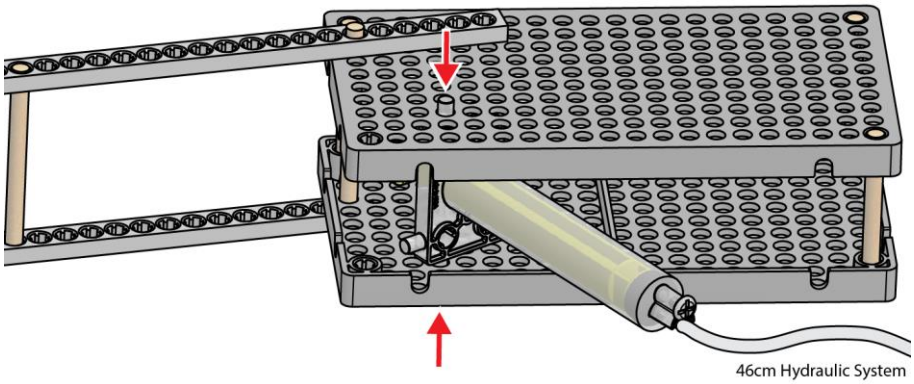
Step #8

Use 46cm (~18in) of tubing and two 13ml cylinders to create your first hydraulic system. See the *Cylinder Assembly and Fill Guide* at teachergeek.com for instructions.



Step #9

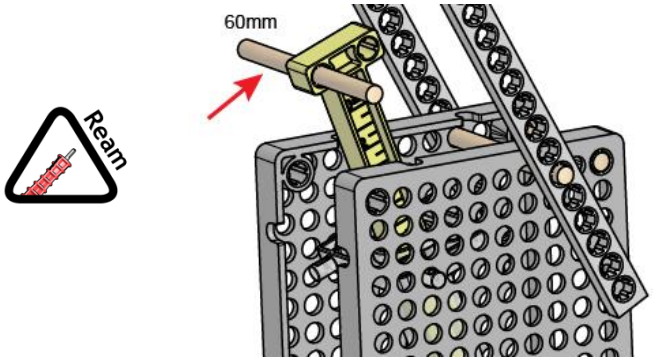
a) Spread the plates apart to place a cylinder from Step #8 inside the plates. The cylinder should extend through the plate holes.



Do not ream any holes.

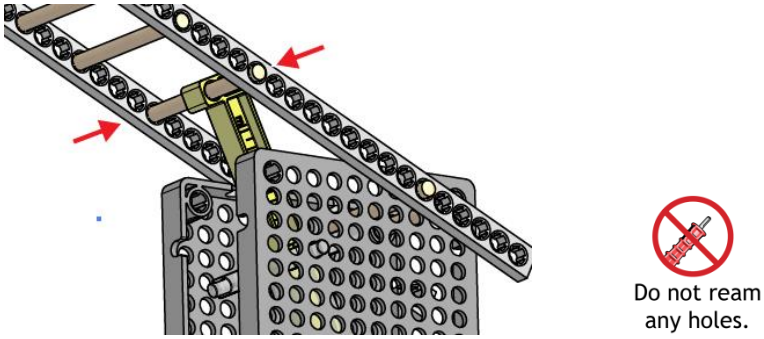
Step #11

a) Ream the hole shown with a 60mm dowel.
b) Cut a 60mm (~2 3/8in) dowel and slide it into the reamed hole.



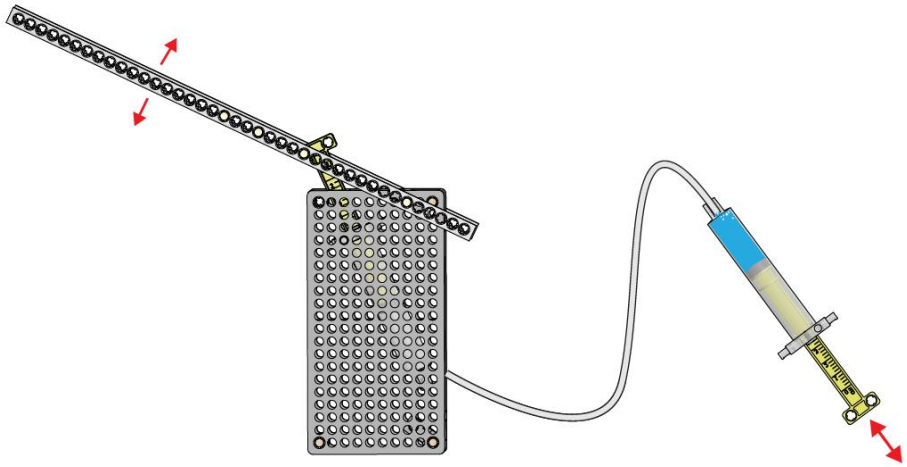
Step #12

a) Spread the main arm strips apart.
b) Insert the 60mm dowel from Step #11 into the strip holes.
c) Push/tap the strips back together to attach the 60mm dowel.



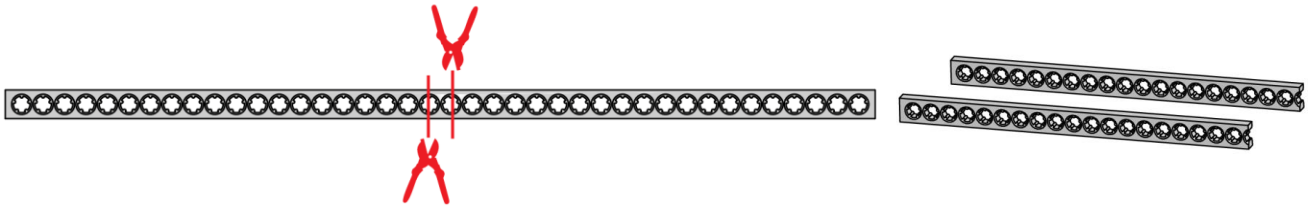
Step #13

You have created the shoulder for your arm.
The arm should move as the cylinders are pushed and pulled.



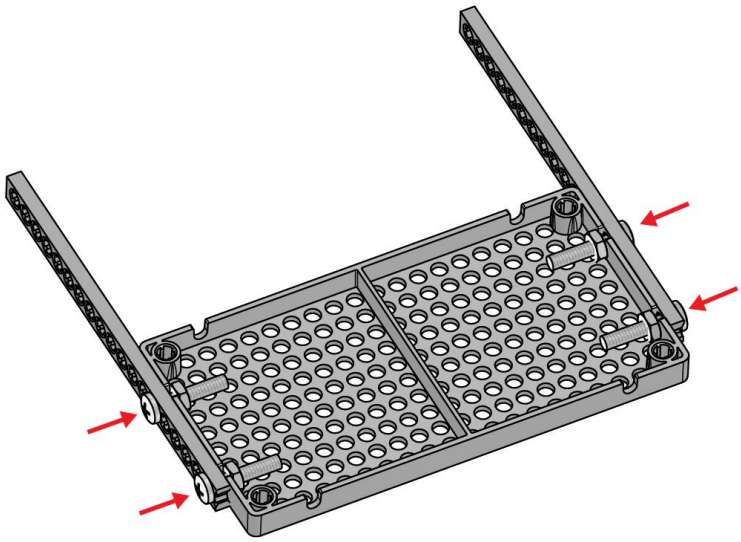
Step #14

Cut a strip in half. Strips do not have a center hole so they must be cut as shown to get two equal length strips.



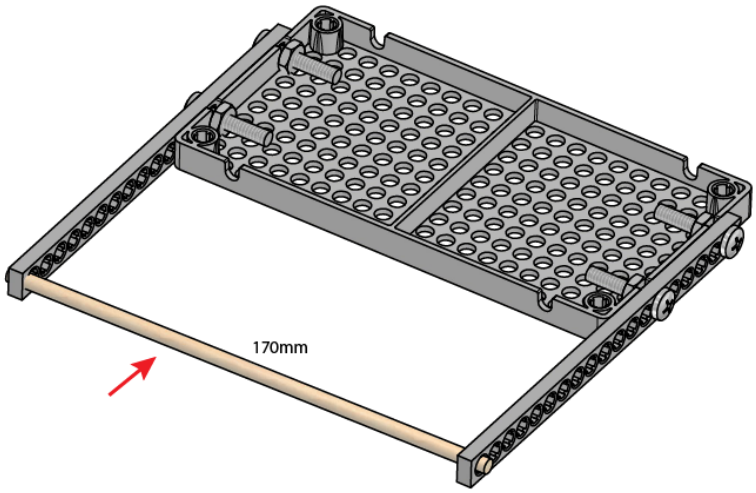
Step #15

Use #10 screws and nuts to attach the cut strips to a plate.



Step #16

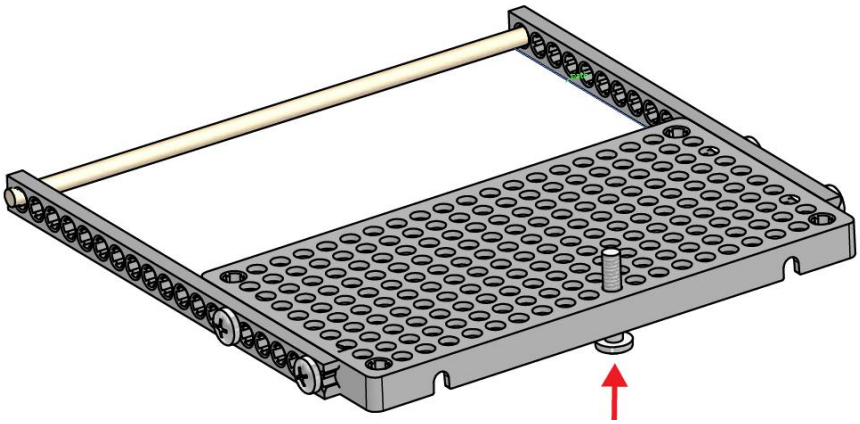
Cut a 170mm (~2 3/4in) dowel and push/tap it into the last holes on the strips. You have created the base for your arm.



Do not ream any holes.

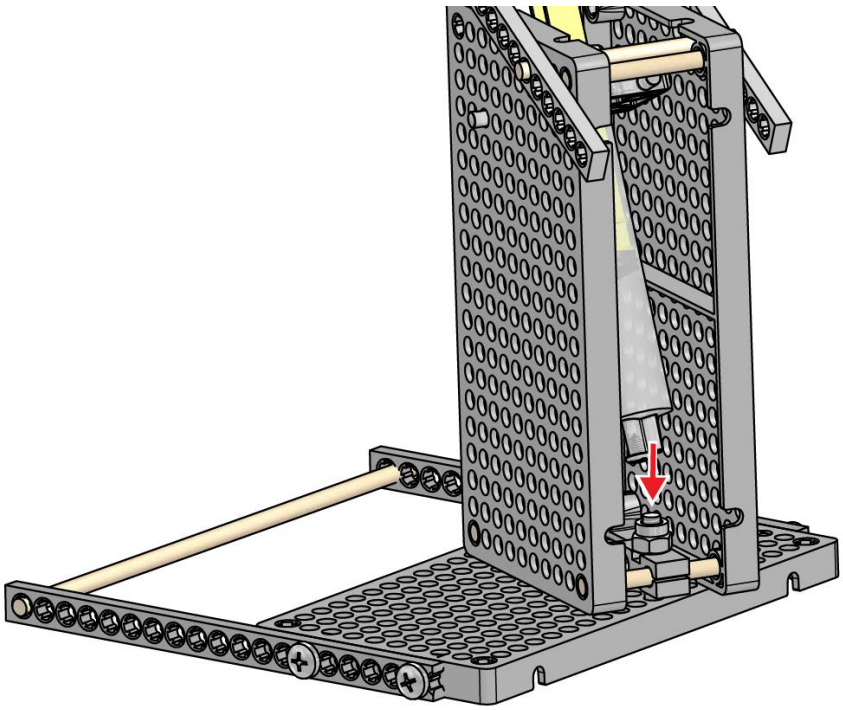
Step #17

Place a #10 x 25mm (1in) screw up through the plate.



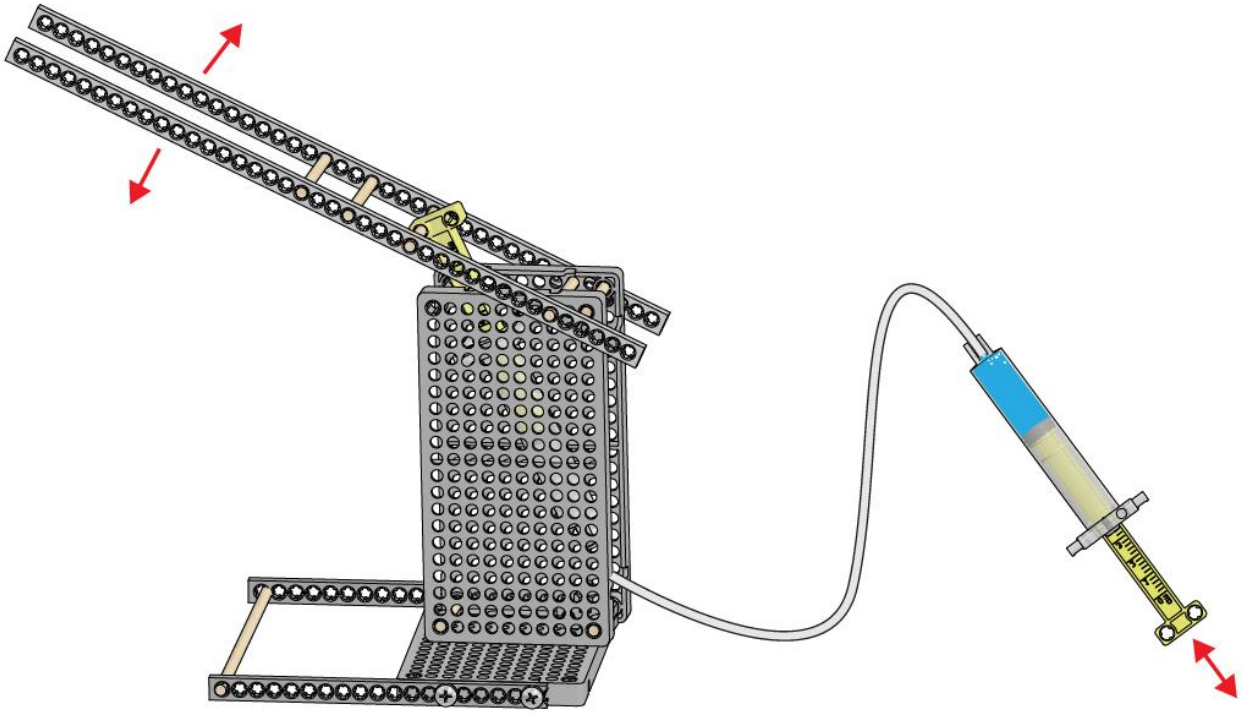
Step #18

a) Turn the screw from Step #17 into the block on the waist.
b) Turn a locking nut onto the screw to hold the waist to the base.
The screw and nut should be loose to allow the waist to easily turn on the base.



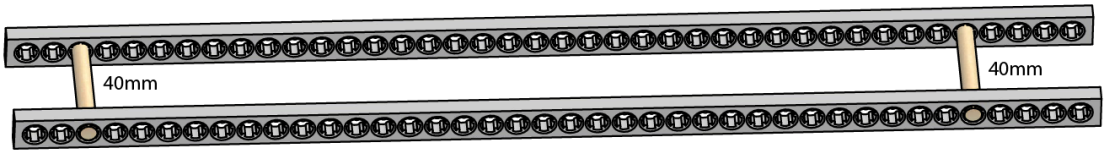
Play!!!!

Experiment with your hydraulic system and lever arm.



Step #19

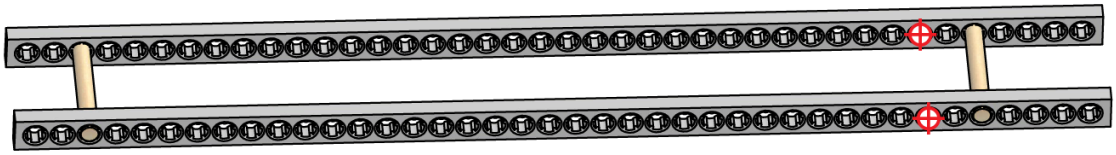
Create the forearm by cutting 40mm dowels and placing them into strips.



Do not ream any holes.

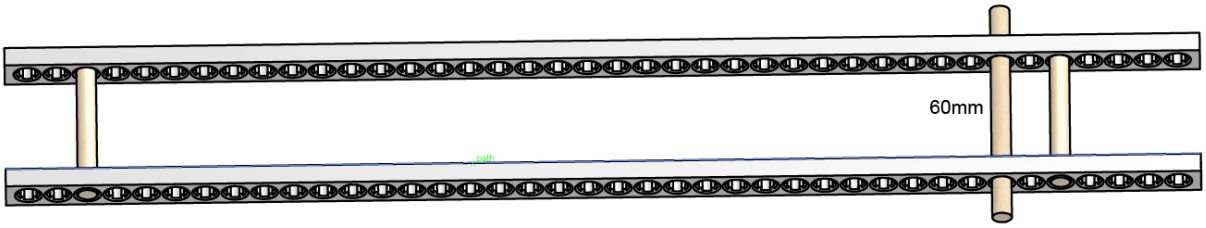
Step #20

Ream the two holes marked with a ⌖.



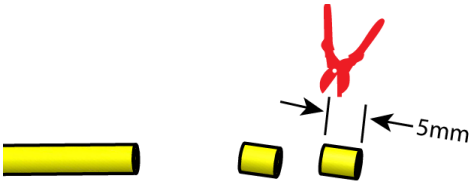
Step #21

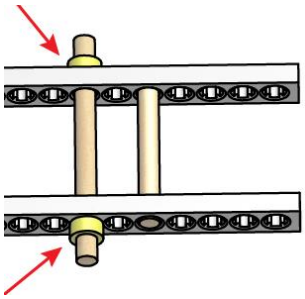
Cut a 60mm dowel and slide it into the reamed holes.



Step #22

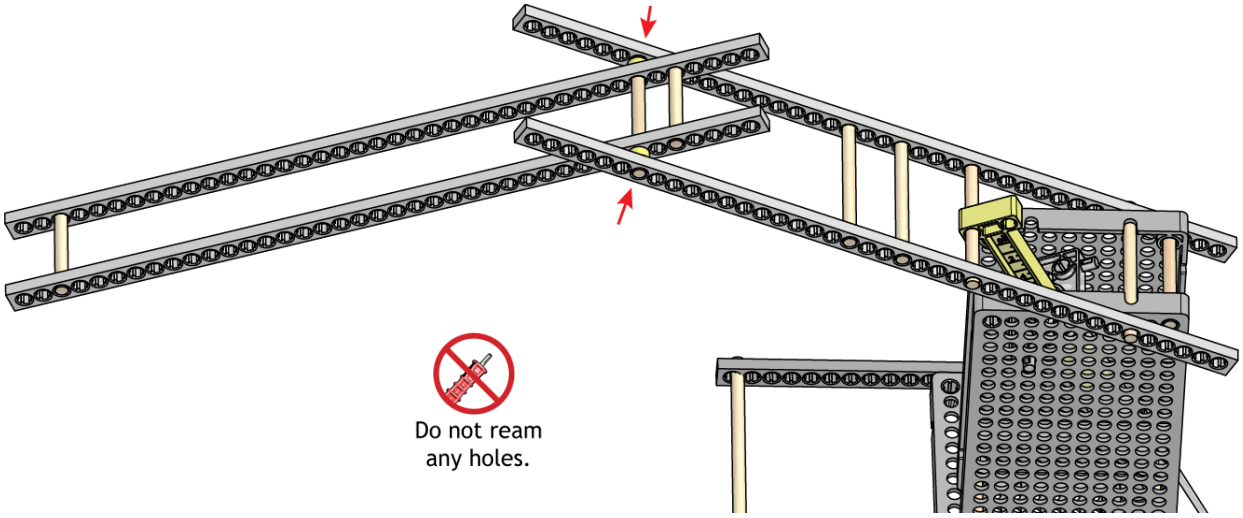
Cut slide stop into two 5mm (~3/16in) sections. Slide the 5mm sections onto the 60mm dowel. This becomes the forearm.





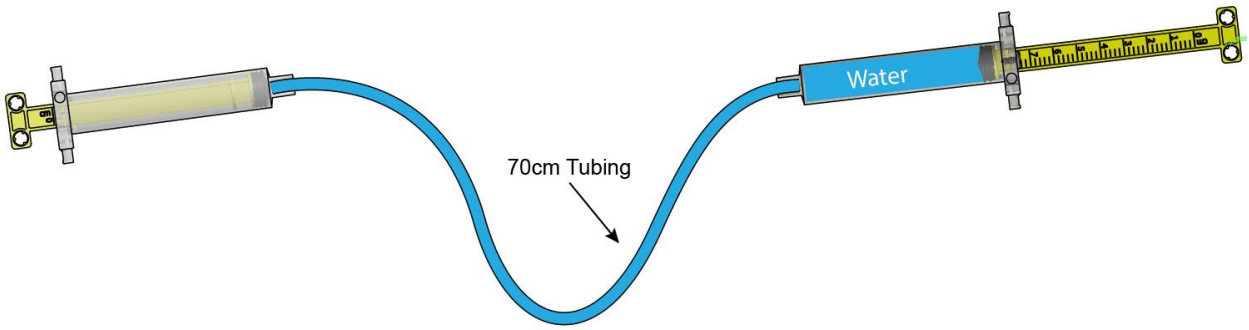
Step #23

Spread the strips on the main arm apart to insert the forearm 60mm dowel. Push/tap the strips together to attach the forearm. This becomes the elbow.



Step #24

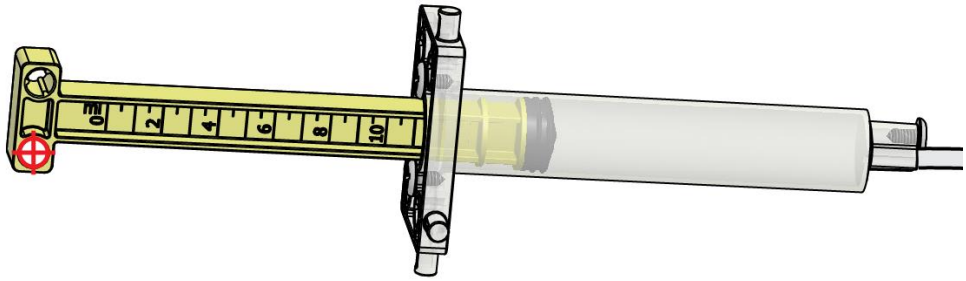
Use 70cm (~28in) of tubing and two 13ml cylinders to create your second hydraulic system. See the *Cylinder Assembly and Fill Guide* at teachergeek.com for instructions.



Step #25

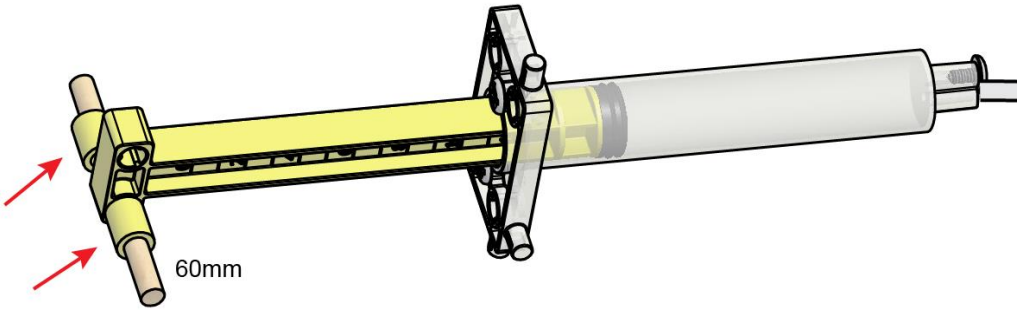
For one of the cylinders from step #24:

a) Take out one of the #6 screws and turn the piston as shown.
b) Place the #6 Screw back into the piston.
c) Ream the hole marked with a ⊕.



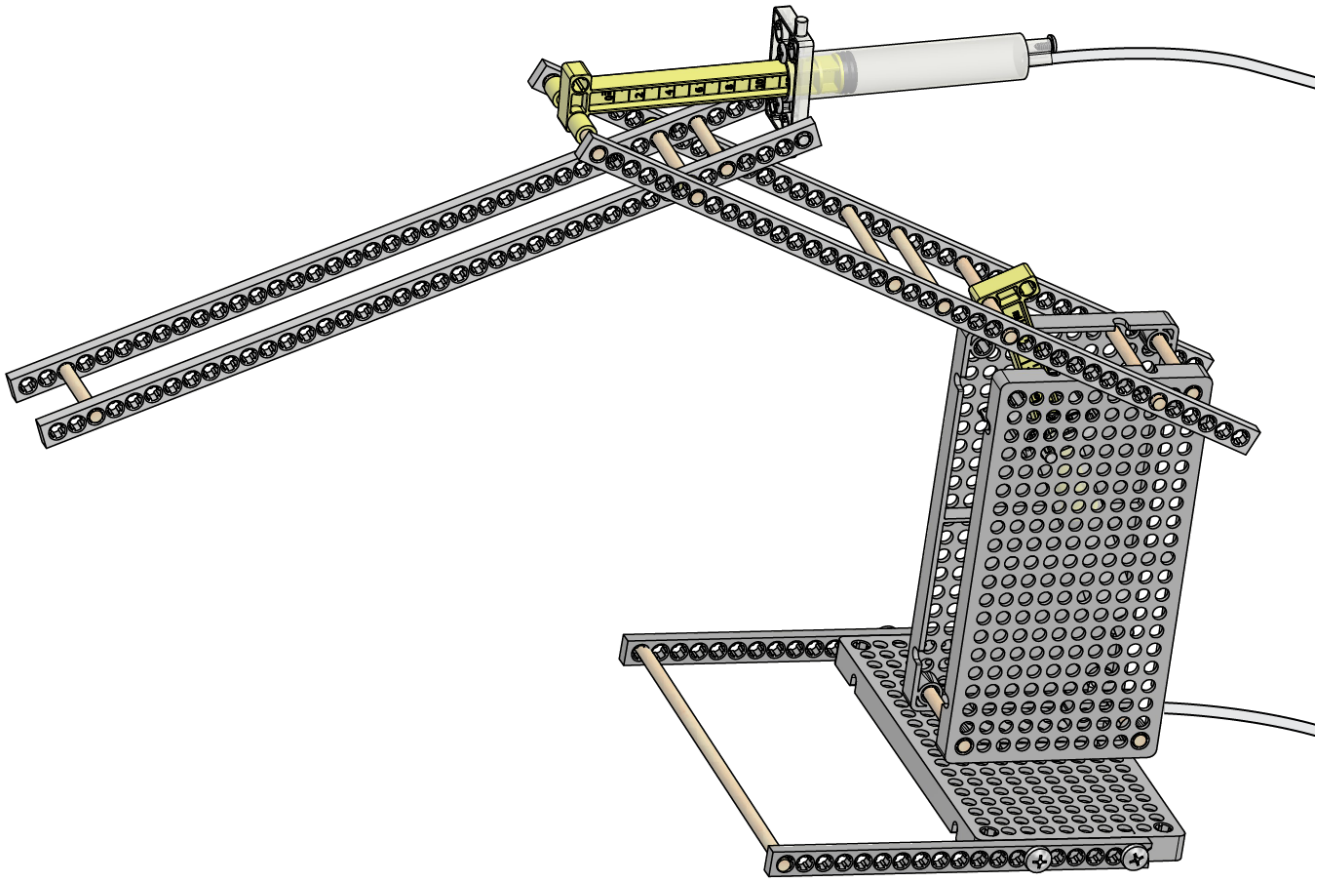
Step #26

a) Cut a 60mm (~2in) dowel.
b) Slide the 60mm dowel into the reamed hole from Step #25.
c) Cut slide stop sections and use them to secure the 60mm dowel to the piston.



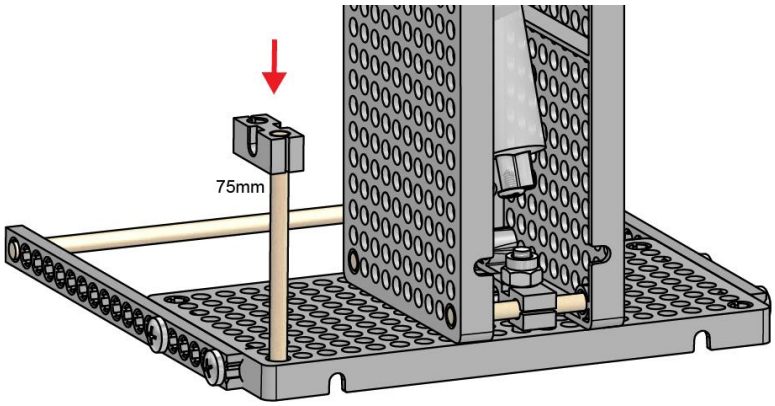
Check it out!

Your Hydraulic arm should look like this. It is not done yet. You still need to make it turn and give it an end effector (gripper).



Step #27

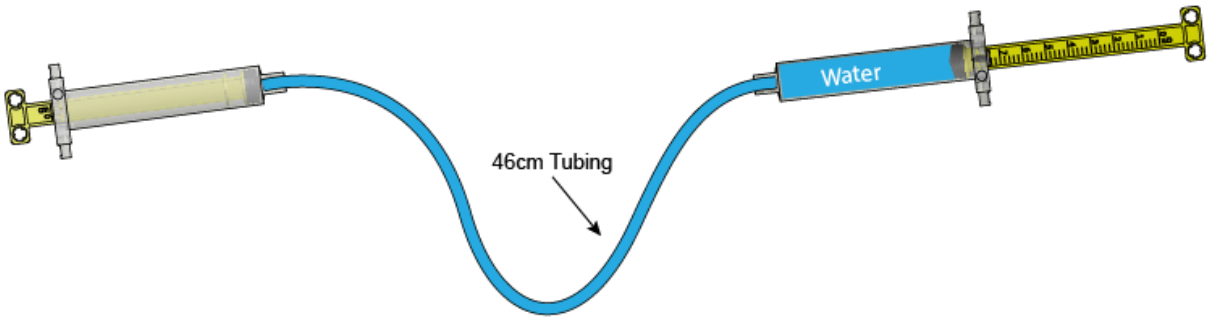
a) Cut a 75mm (~3in) dowel.
b) Push/tap the dowel into the corner base hole.
c) Push/tap a block on top of the dowel.



Do not ream any holes.

Step #28

Use 46cm (~18in) of tubing and two 13ml cylinders to create your third hydraulic system. See the *Cylinder Assembly and Fill Guide* at teachergeek.com for instructions.

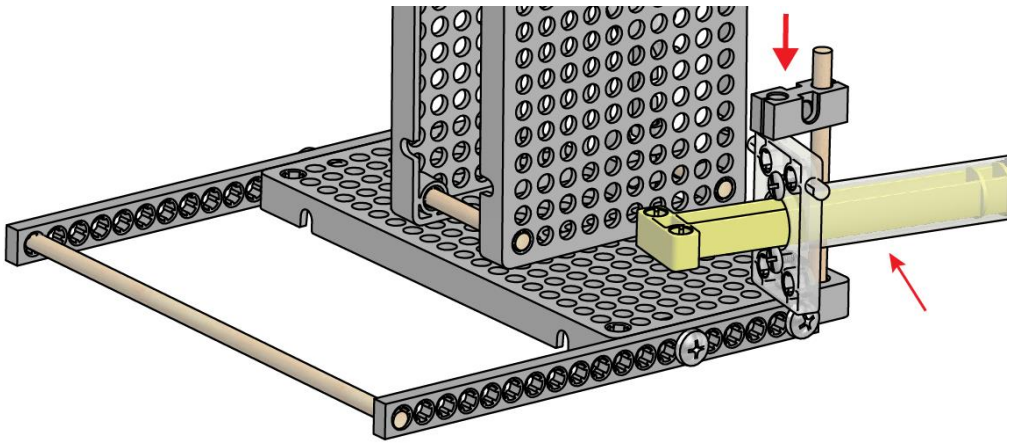


Step #29

Ream the hole marked with a ⌖ on a cylinder from Step #28.

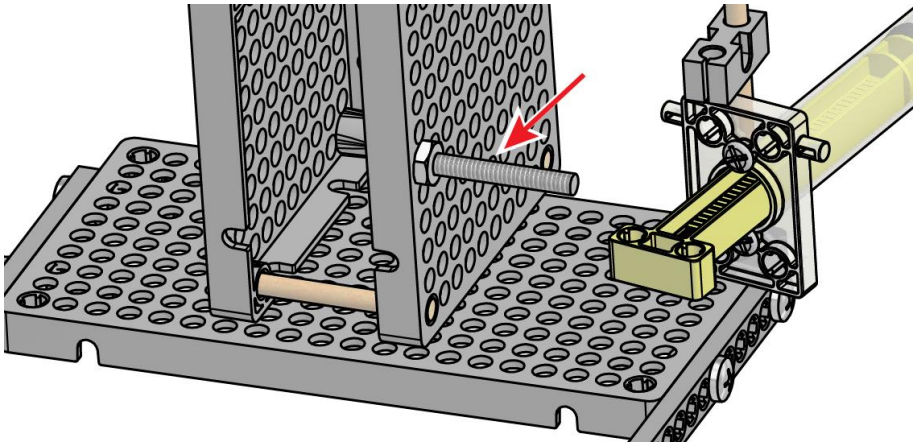
Step #30

Attach the reamed cylinder from Step #29 by sliding the block down.



Step #31

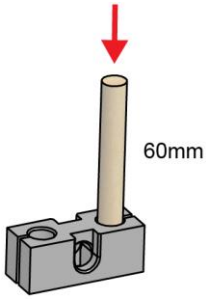
Place a 38mm (~1.5in) screw through the plate on the waist and secure it with a nut.



Do not ream any holes.

Step #32

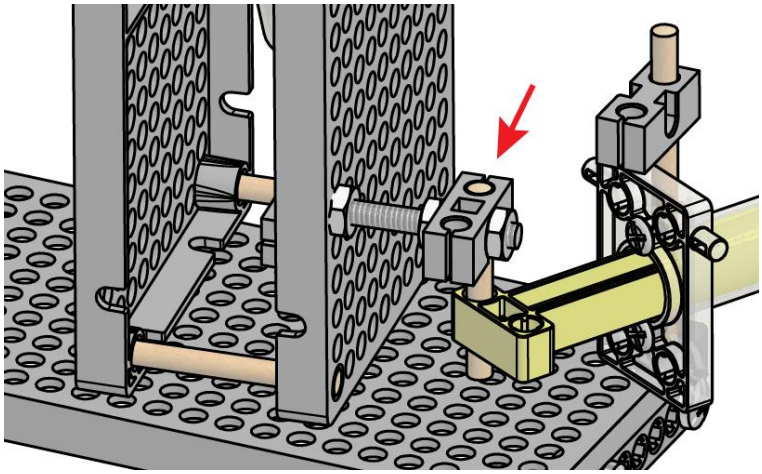
a) Cut a 60mm (~2in) dowel.
b) Tap the 60mm dowel into a block.



Do not ream any holes.

Step #33

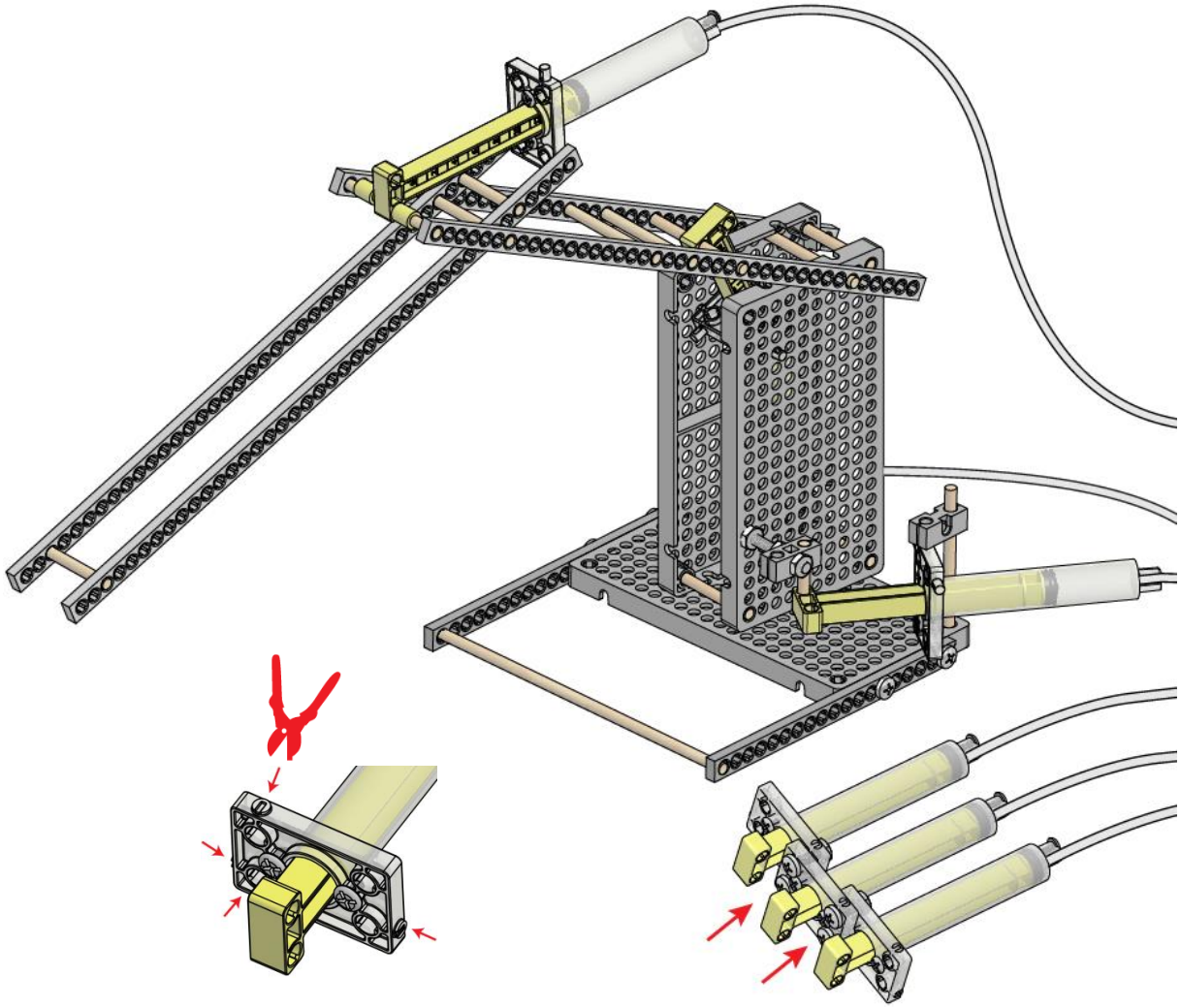
a) Insert the 60mm dowel into the reamed hole on the cylinder piston.
b) Use two nuts to secure the block to the 38mm screw. Tighten the nuts.



Do not ream any holes.

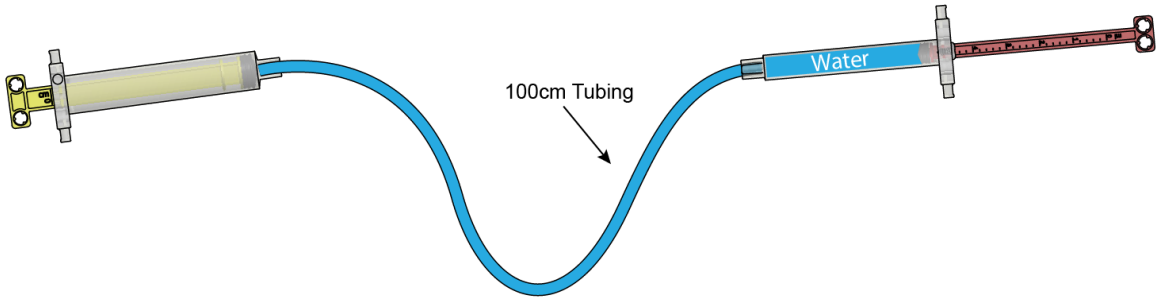
Step #34

a) Cut the pins off of the three cylinders that are attached to your arm with tubing.
b) Use screws and nuts to attach the cylinders together to form a control panel.



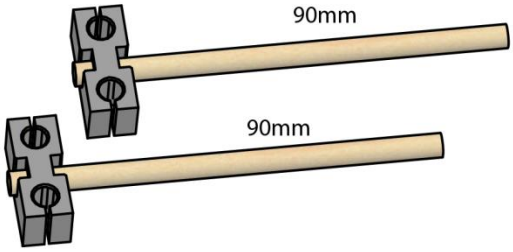
Step #35

Use 100cm (~18in) of tubing, one 13ml cylinder and one 4.5ml cylinder to create your fourth hydraulic system. See the *Cylinder Assembly and Fill Guide* at teachergeek.com for instructions.



Step #36

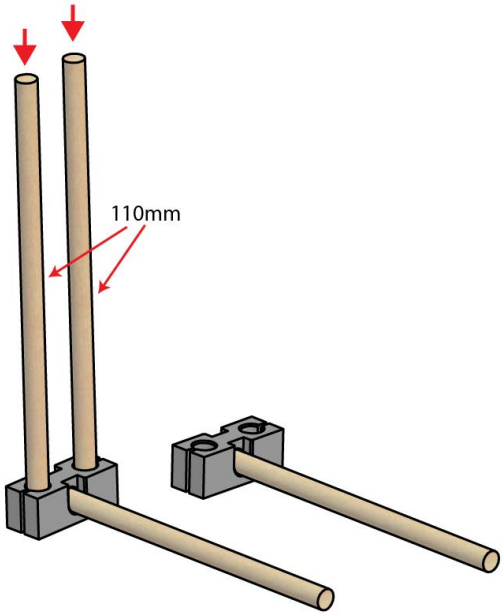
a) Cut two 90mm (~3.5in) dowels.
b) Push/tap blocks onto the dowel ends.



Do not ream any holes.

Step #37

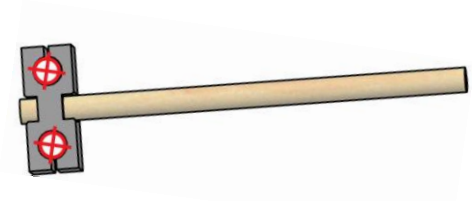
a) Cut two 110mm (~4 3/8in) dowels.
b) Push/tap the dowels into one of the blocks from Step #36.



Do not ream any holes.

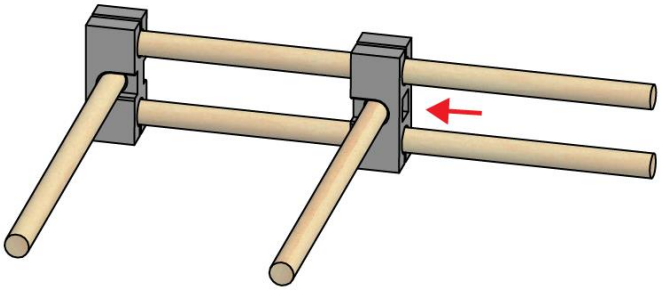
Step #38

Ream the holes in the block with open holes.



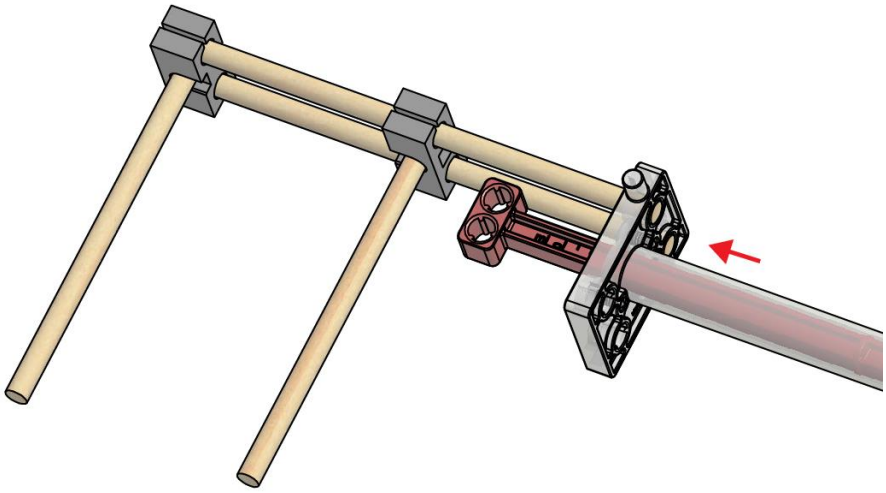
Step #39

Slide the reamed block from Step #38 onto the 110mm dowels from Step #37.



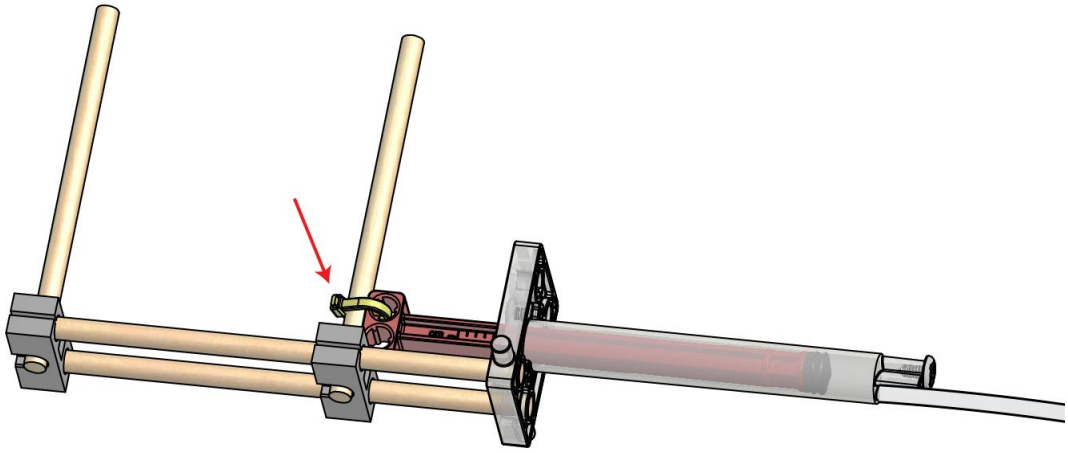
Step #40

Push/tap the 3.5ml cylinder from your hydraulic system onto the 110mm dowels.



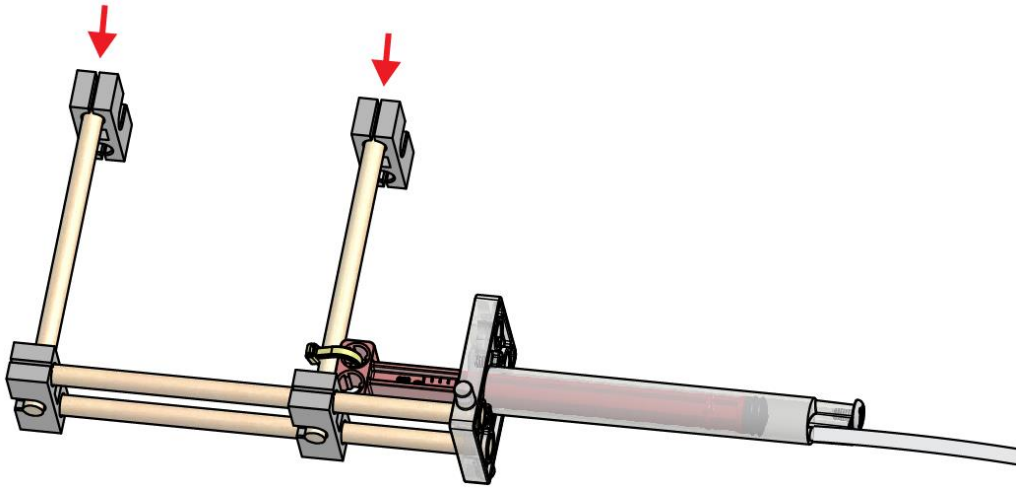
Step #41

Use a cable tie to attach the cylinder piston to the dowel on the sliding block.



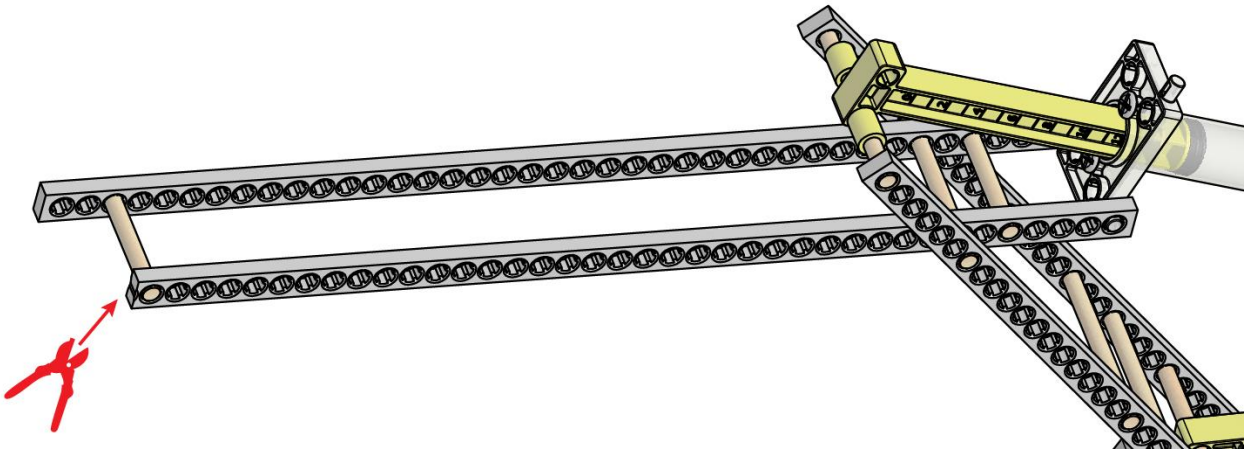
Step #42

Place blocks onto the ends of the 60mm dowels. This creates your gripper. It is now time to attach it to your arm.



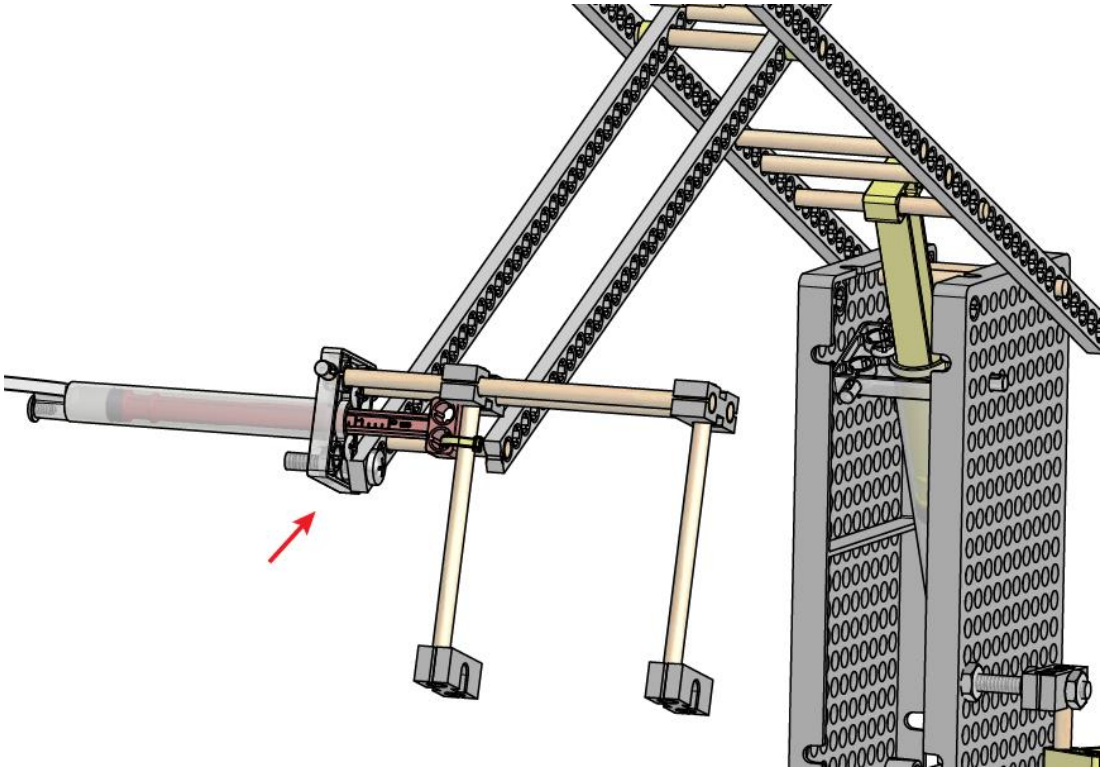
Step #43

Cut the last two holes off one of the strips on the forearm.



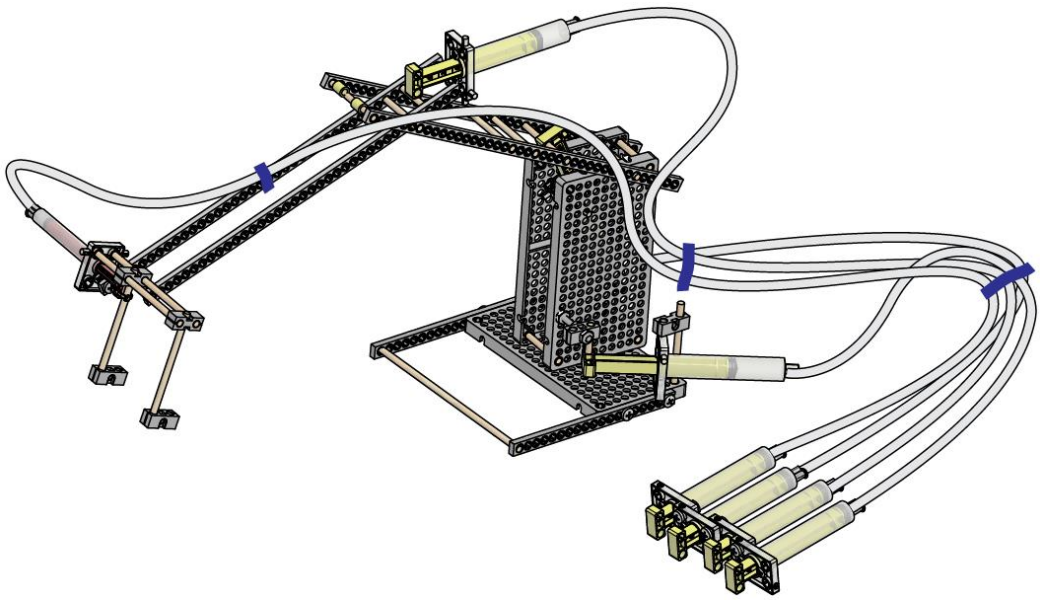
Step #44

Use a screw and nut to attach the gripper to the forearm.



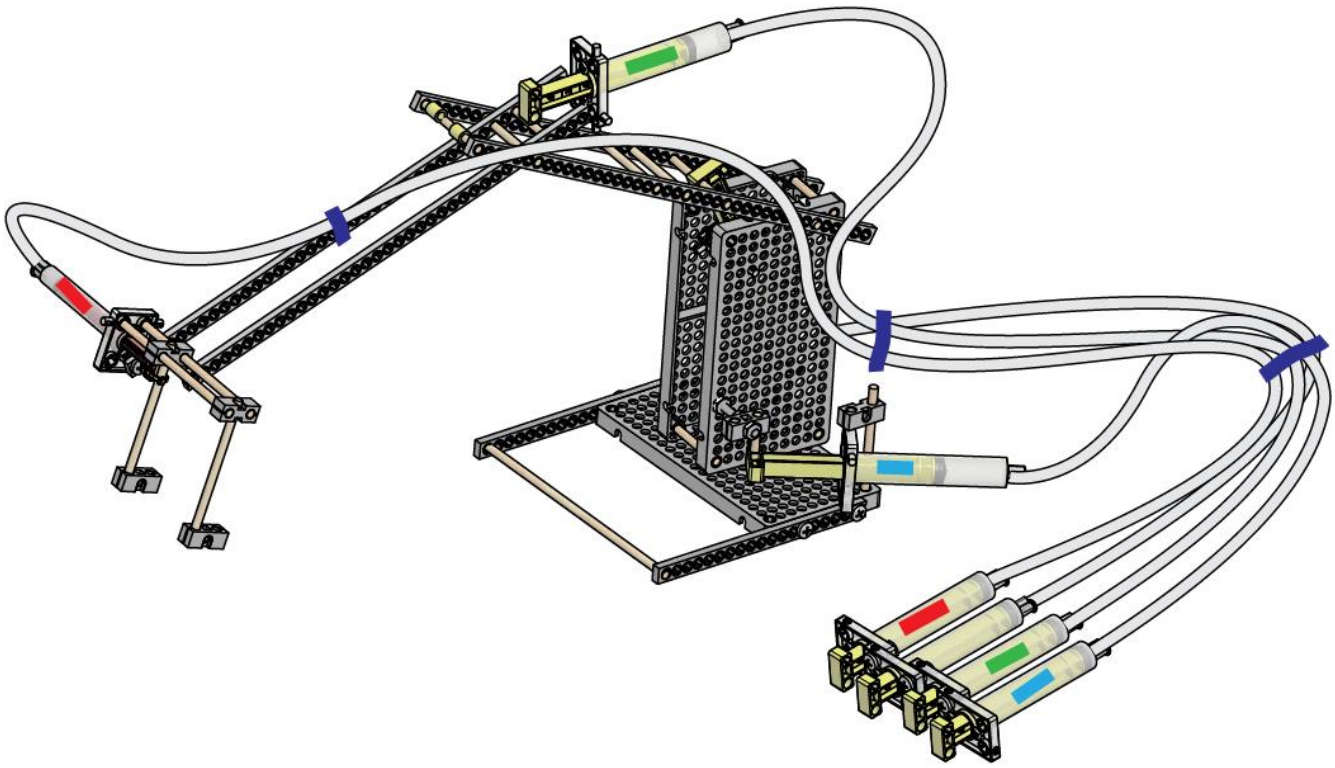
Step #45

a) Screw the loose gripper cylinder to the control panel.
b) Use tape to attach the tubing to the arm. Make sure you do not crimp (smash) the tubing.



Step #46

Use different colored permanent markers or tape to identify what control panel cylinders connect to what arm cylinders.



Your example arm is finished.
It is your turn to play with it, improve it, and change it into your own design.