Super-Awesome Sylvia's
WaterColorBot!

Getting Started with WaterColorBot

Evil Mad Scientist

Intro: The Big Picture!

The **WaterColorBot** is a friendly art robot that moves a paintbrush to paint your digital artwork onto paper, using a set of watercolors. It was designed as a collaboration between "Super-Awesome" Sylvia Todd and Evil Mad Scientist Laboratories.

Sylvia with Lenore and Windell from Evil Mad Scientist

How this all got started...

Sylvia Todd, star of Sylvia's Super-Awesome Maker Show (which you can find online at sylviashow.com), came up with the idea for the WaterColorBot because she wanted to create an art robot and enter it in the RoboGames competition. We had met Sylvia at Maker Faire in the previous few years, and she knew us from our Egg-Bot and other kits and projects. She approached us at Evil Mad Scientist Laboratories about collaborating on the project, and *we loved it*.

Together we designed and built our first prototype in February 2013, and had a nicely-working robot about a month later. As we realized that this project had a lot of appeal beyond just a one-off project, we started developing it into a kit. Sylvia exhibited her prototype at RoboGames (and won a Silver medal), and we brought the WaterColorBot to Maker Faire, where thousands of people got to play with it. Sylvia was also invited to the White House Science Fair in April 2013, where she got to demonstrate the WaterColorBot for President Obama.

We launched the WaterColorBot on Kickstarter in July, and the rest is (modern, recent) history.

What's in this guide?

This guide is here to help walk you through the first steps with your new WaterColorBot:

- Making sure that you've got everything
- Assembling the kit
- Going online to get software
- Basics of using the WaterColorBot
- Additional resources: Documentation, forums, and mailing lists

You may also want to watch our 24-minute setup video, which covers much of the same ground as Part I - Part III of this guide: watercolorbot.com/setup.html
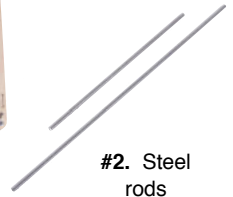
Part I: Checking out your kit

Here's a checklist of what's included with your WaterColorBot kit. In the assembly instructions, we'll refer to these parts by their numbers here, for example, **#1** is the WaterColorBot Chassis.

If anything is missing or broken, please let us know ASAP, and we'll get you squared away.
Contact form: http://shop.evilmadscientist.com/contact / E-mail: contact@evilmadscientist.com

☐ **#1.** WaterColorBot Chassis
(with 2 motors attached)

☐ **#2.** Steel Rods
quantity: 2, different lengths

☐ **#3.** Spoilboard (lower deck)

☐ **#4.** WaterColorBot Carriage

☐ **#5.** EBB (EiBot Board) circuit board,
(may be *red* or *white*)

☐ **#6.** Power Supply

☐ **#7.** USB Cable

☐ **#8.** Winches, pre-wound
quantity: 2

☐ **#9.** Rod-end Sliders
quantity:

☐ **#10.** Cable ties
  quantity: 4

#10. Cable ties

#11. Cable guide screws

☐ **#11.** Screws for cable guide (#2 x 1/4")
  quantity: 4

☐ **#12.** Screws for EBB (#4 x 1/2")
  quantity: 4

#12. EBB Screws &
#13. EBB Spacers

☐ **#13.** Spacers for EBB (#4 x 3/16")
  quantity: 4

☐ **#14.** Binder clip & screw (extra)

☐ **#15.** Spiral wrap tubing for motors
  quantity: 2

#14. Binder clip & screw

#15. Spiral wrap

☐ **#16.** Hex wrench (5/64")

#16. Hex Wrench

☐ **#17.** Velcro stowage straps
  quantity: 2
  (May be gray and/or black.)

#17. Velcro straps

☐ **#18.** Paint set with brush

#18. Paint set

☐ **#19.** Petri dishes, plastic
  quantity: 3

#19. Petri dishes   **#20.** Beaker

☐ **#20.** Beaker, plastic 50 mL

☐ **#21.** Water dropper, plastic

#21. Water Dropper

☐ **#22.** Watercolor paper (9 x 12")
  quantity: 5 sheets

#22. Watercolor paper

#23. Sandpaper

☐ **#23.** Sandpaper (in envelope)
  (*The sandpaper isn't used in the instructions, but if you should find any rough corners on your chassis, you can use this help smooth it out.*)

Part II: Additional Tools & Supplies

Besides what comes in the kit, you'll need a few things of your own:

(A). Small screwdrivers: Phillips #1 or #0, and either a Phillips #00 (for kits with red EBB), *or* a small flathead screwdriver, about 0.1"/2.5 mm wide (for kits with white EBB).

(B). A pair of sharp scissors

(C). A computer with a USB port and internet access to download software

Part III: Let's get building!
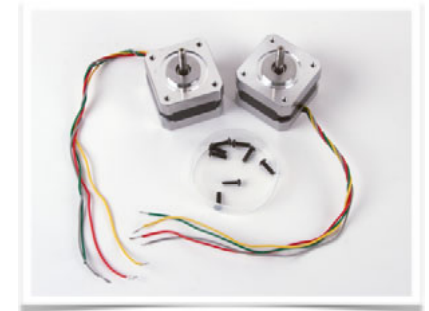
STEP 1: *Unscrew the motors from the chassis.*

The WaterColorBot frame or "chassis" (**#1**) comes with two stepper motors, which come attached to the chassis for shipping. Each motor is held down by four screws.

For each motor: Use the hex wrench to remove the four screws that hold down the motor, and gently remove the motor from the chassis. (And, take care not to lose the screws; we'll need them again in steps 3 and 4.)

**Pro-tip:** the petri dishes that come with the kit are great for storing small parts like screws!

STEP 2: *Spiral wrap the motor cords.*

Each of the motors has four long, color-coded wires. In this step, we will use the spiral wrap tubing (**#15**) to neatly bundle together the wires on each motor.

Before you reach for the motors, first try twisting the spiral wrap tubing between your fingers. If you twist it the right direction, it opens up between the turns.
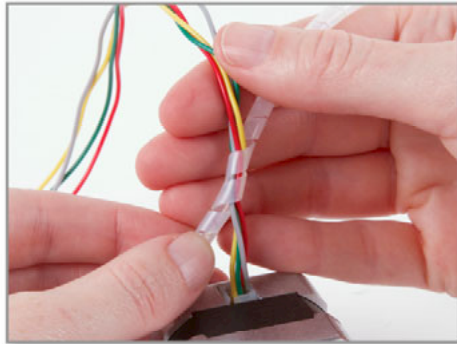
Twist the spiral wrap tubing to open up a bit. Take that opening, and wrap it around the wires from the motor.
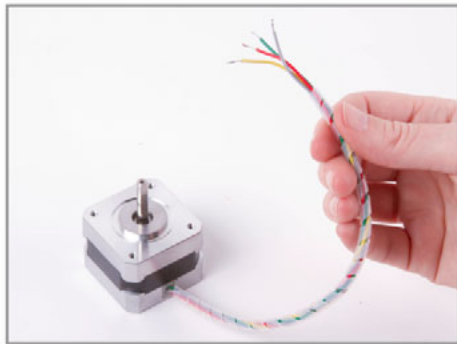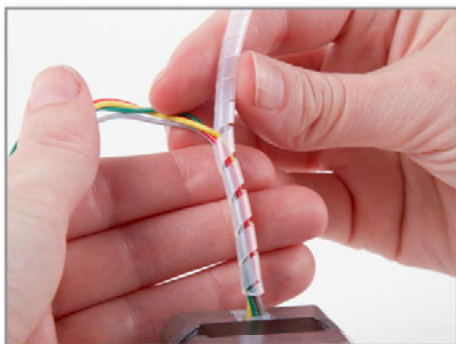
Continue wrapping the spiral down, and try to position one end of the spiral wrap tubing close to the body of the motor. You may need to slide the whole spiral wrap up or down a bit.

Continue wrapping the spiral upwards, making a neat wire bundle. Repeat for the other motor.
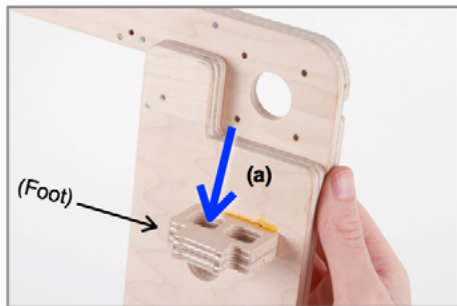
STEP 3: *Install Motor 1: the "X" motor*

In this step, we will re-install one of the stepper motors to the bottom side of the chassis.

Place the motor in its location, under where the chassis is marked "Motor 1 (X)." Guide the wire bundle through the hole indicated **(a)** in the chassis foot: the hole closest to the center of the chassis. Bring the cable back up **(b)** through the other hole in the foot.
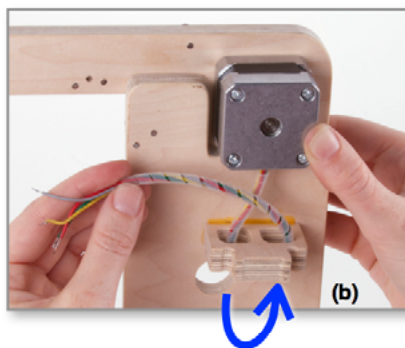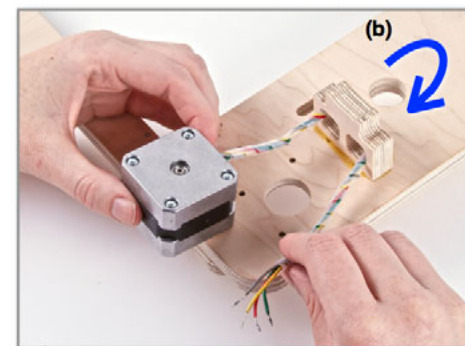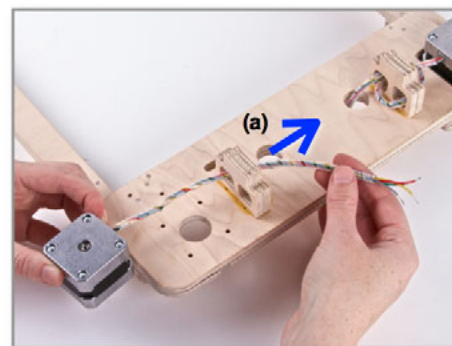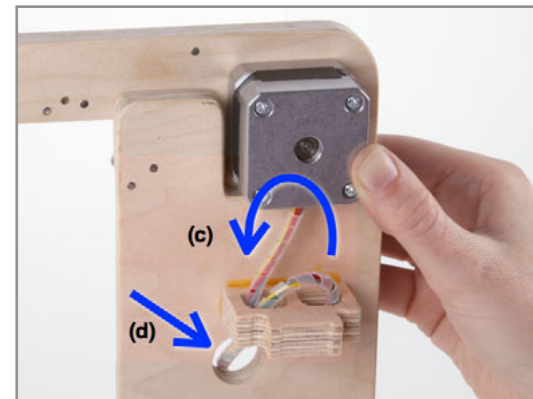
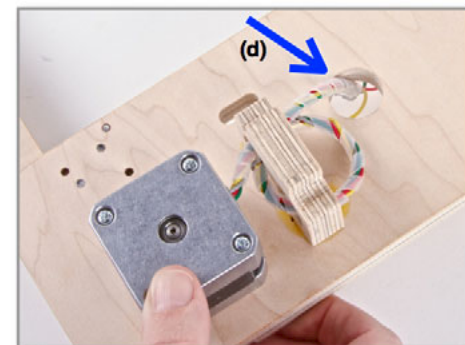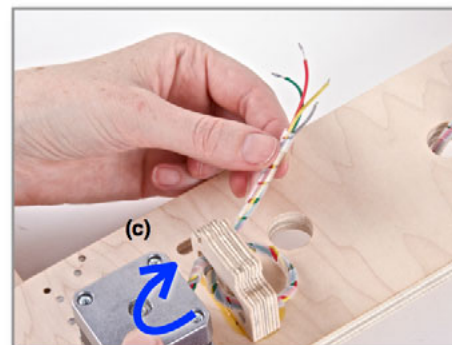Guide the wire bundle back down **(c)** through the same hole in the foot that it went through first.

Then, guide the wire bundle through the hole **(d)** to the top side of the chassis.

Finally, screw down the motor in place from the top side. Use the hex wrench and four screws (left over from Step 1). Tighten the screws well.

STEP 4: *Install Motor 2: the "Y" motor*

Place the motor in its location, below the location marked "Motor 2 (Y)." Guide its wire bundle through the hole in the chassis foot *closest to the center of the chassis* **(a)**. Then, bring the cable back through the other hole in the foot **(b)**.

Guide the wire bundle back **(c)** through the same hole in the foot that it went through first. Then, guide the wire bundle through the big hole **(d)** to the top side of the chassis.

Finally, screw down the motor in place from the top side. Use the hex wrench and the four remaining screws (left over from Step 1). Tighten the screws well.

At this point, flip the chassis back over.

On the top side, you should have two little wire bundles peeking out from the big holes next to the big square location marked "EBB."

In the next step, (surprise!) we'll be installing the EBB— the WaterColorBot's controller board —in that location.
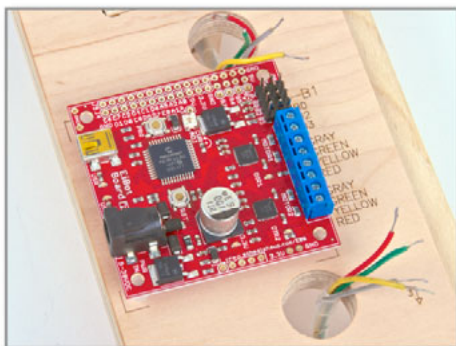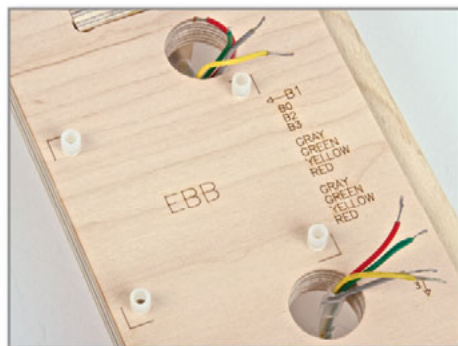
STEP 5: *Install the EBB*

Place the 4 EBB Spacers (**#13**) on top of the four drilled pilot holes in the big square marked "EBB." Then, gently place the EBB (**#5**) on top of those spacers, oriented as shown. The the big plastic screw terminal block faces inwards, towards the center of the WaterColorBot. The four mounting holes in the corners of the EBB should also line up with the spacers and pilot holes below.
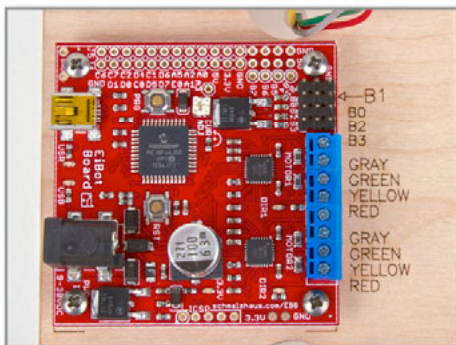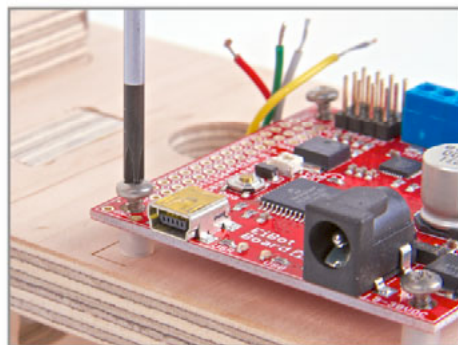
Slip all four EBB screws (**#12**) through the spacers, so that they rest in the pilot holes. Then, one at a time, screw them down to the chassis. Use a Phillips #1 screwdriver. Tighten the screws just enough that the EBB does not slide around; do not over-tighten them.

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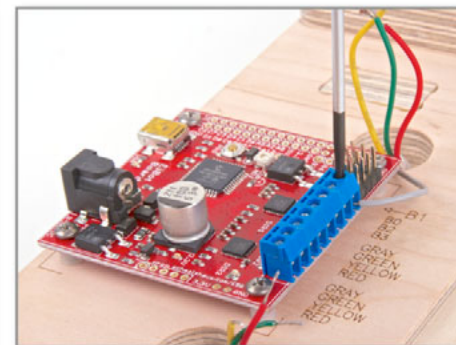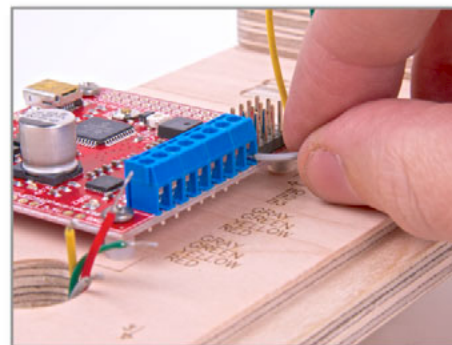
STEP 6: *Connect the motor wires to the EBB.*

First connect the wires from Motor 1. The order is laser engraved into the top of the chassis: Gray, Green, Yellow, Red. Begin with the top (Gray) wire: Insert its end as far as it will go into the first position of the terminal block. Then, tighten that position of the terminal block with a small screwdriver (Phillips or flathead, depending on your EBB) screwdriver, just until the wire is held in place securely.

If the wire cannot be inserted into a position easily, you may need to slightly unscrew that position of the terminal block before sliding the wire in.
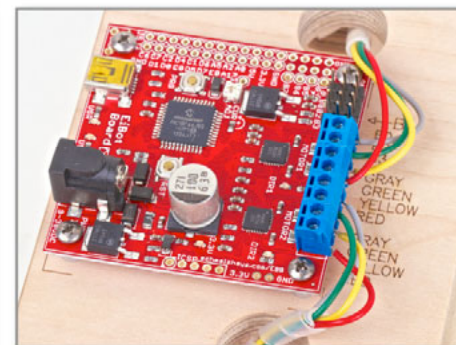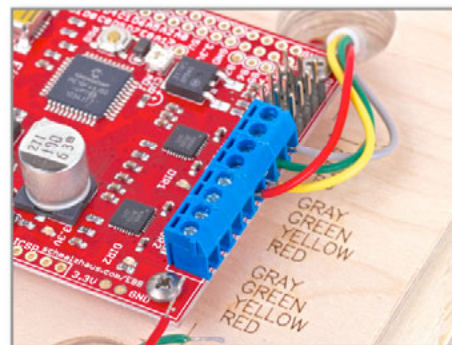
Follow the same procedure for the other three wires from Motor 1, working from the top down.

For Motor 2, go in the opposite direction, first connecting the Red (bottom) wire, and working your way up towards the middle: Red, Yellow, Green, Gray.

STEP 7: *Connect the sliders to the rods*

Locate your two steel rods (**#2**) and the four white Delrin (plastic) rod-end sliders (**#9**).

For each rod: Cap both ends of the rod with sliders. To do so, insert the end of a rod into the big hole on the face of the slider, as far as it will go. It should go in easily, without forcing.
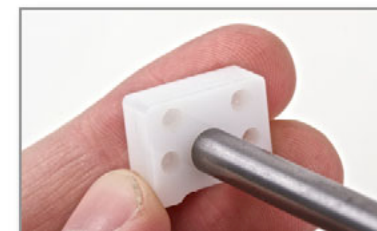
Then, rotate the sliders on the rod ends so that when you set down the rod, all four feet touch the surface.

(Foot)   (Foot)

9
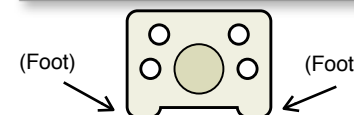
STEP 8: *Test the rods on the WaterColorBot*

Place the long rod on the WaterColorBot chassis, horizontally, in the channels on the left and right sides. Its four feet should ride in the channels, with a little bit of wiggle room, left-to-right.

Set down the short rod, vertically, across the channels in the front and rear sides. Similarly, it should have a little bit of front-to-back wiggle room.
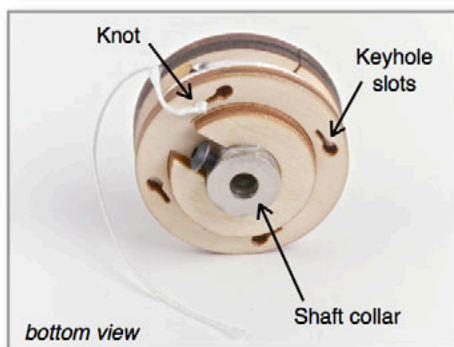

Chassis Left — Chassis Rear — Chassis Right — Chassis Front
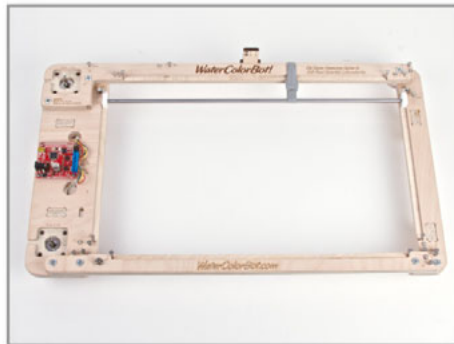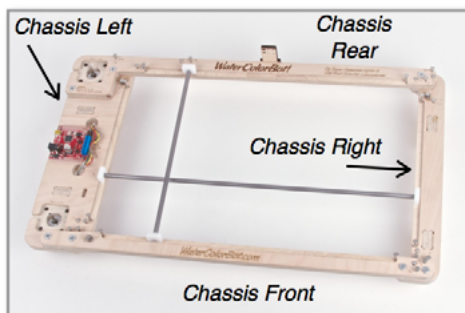
STEP 9: *Strap down the long rod*

Remove and set aside the short rod. Slide the long rod all the way towards the chassis rear, until it comes up against its stops. Loop one of the Velcro straps (**#17**) around the both the chassis rear and the long rod— approximately where shown —and tighten it to secure the long rod in place.
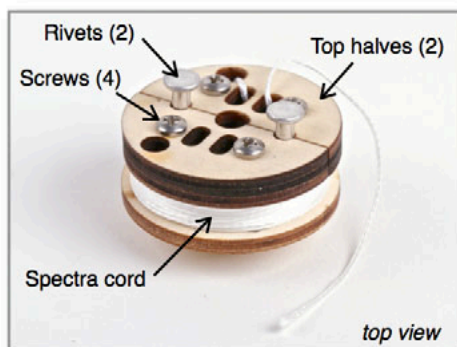
Rivets (2) — Top halves (2) — Screws (4) — Spectra cord — *top view* — Knot — Keyhole slots — Shaft collar — *bottom view*

STEP 10: *Learn about winch anatomy*

There are two winches (**#9**) in the kit, each pre-wound with a length of Spectra cord. The top side is made of two halves that are each held to the body of the winch with two screws.

On the bottom side, the cord is attached by a knot through a keyhole-shaped slot. There is also a shaft collar in the middle that we will use to attach the winch to the motor shaft.

STEP 11: *Prepare a winch for the motor*

Take one of the winches, and look at the top halves. One of those halves is holding down the loose end of the cord. Unscrew and remove that half, with a Phillips #1 screwdriver.

(Save the top half and screws; we'll need them soon.)

Carefully unwind the cord from the winch *until there is only one turn of cord left* on the winch.

Do not unwind the winch all the way, or the knot might come out of the keyhole slot on the bottom.

Flat side — Wrench Slot
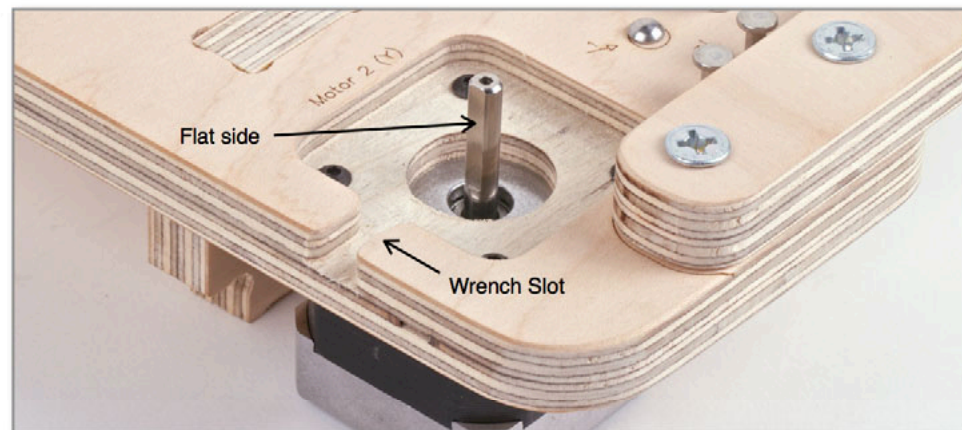
STEP 12: *Prepare the motor for the winch*

The first winch goes on Motor 2 (Y). Rotate the motor shaft so that its flat side is facing directly towards the wrench slot in the edge of the chassis.
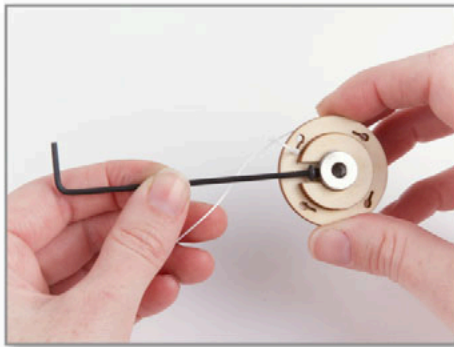
STEP 13: *Add the winch to the motor*

Take the hex wrench (**#16**), and insert its long end into the head of the screw shaft collar (on the bottom side of the winch).

While keeping the end of the wrench in the screw, lower the winch onto the motor shaft, until you can feel where the winch touches bottom. Raise it *just above* that point, and tighten the screw with the hex wrench. Remove the hex wrench.

STEP 14: *Rotate the winch to its initial position.*

Rotate the winch so that the side where the knot comes up and out of the keyhole is facing towards the wrench slot.

In the next few steps, we'll begin guiding the cord around the features on the WaterColorBot. While doing so, take care to keep the winch in this position.
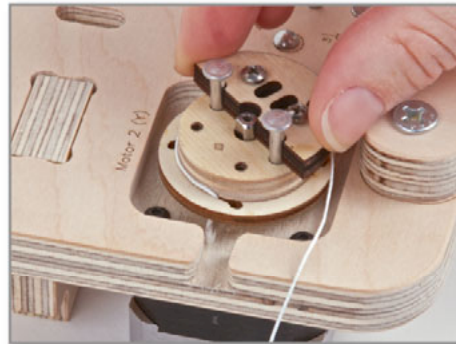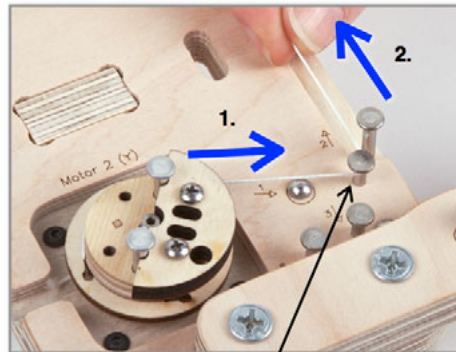
STEP 15: *Begin lacing the cord*

Take the loose end of the cord, and begin guiding it along the path indicated by the numbers and arrows engraved on the chassis, starting at number **1**.

After number **1**, guide the cord around the short flat-head rivet that redirects the cord in the direction marked by arrow **2**.

Next, we'll be guiding the cord through the first of the rod-end sliders.

One of the short, flat-head rivets that guides the cord.
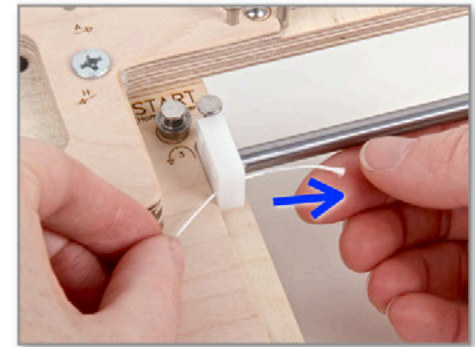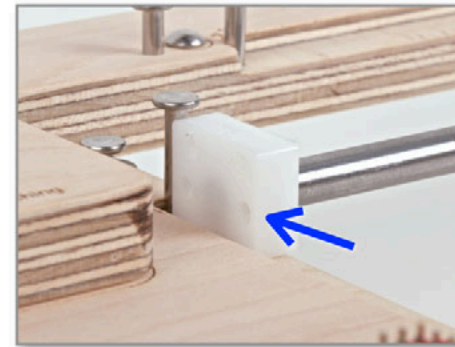
STEP 16: *Route the cord through the slider*

After arrow **2**, the cord comes to the first of the rod-end sliders.

Guide it through the *lower* hole on the near side (the side closer to Motor 2), in from the outside of the frame towards the center.

Pro-tip: the hex wrench is a great tool for pushing the cord through the slider holes.

Once the cord is through, guide the cord back through the slider, through the *upper* hole on the side closer to Motor 2.

Then, pull all of the extra cord through those two holes.
Hold the winch steady so that it stays oriented correctly (as in Step 14), and pull the cord taut.

Pull taut

Feed the cord back in through the other upper hole (further from Motor 2), and then back out through the remaining, lower hole.

As before, pull the all of the extra cord through, taking out all of the slack between the winch and the slider. When you are done, it should look like it does in the picture above.
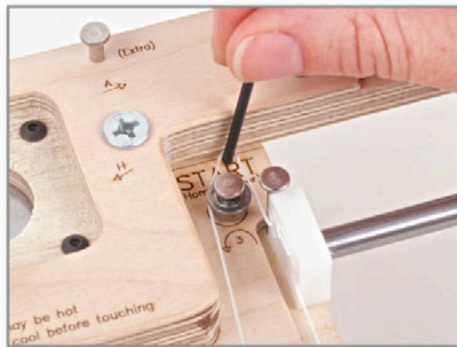
STEP 17: *Guide the cord around the first bearing*

After the slider, the cord goes in a U-turn around a ball bearing. This is shown on the chassis by arrow **3**.

Guide the cord around the bearing. You may find it helpful to use the hex wrench to guide it. Important note: The cord rides *in a groove* just below the top flange on the bearing. Make sure to guide the cord into that groove.
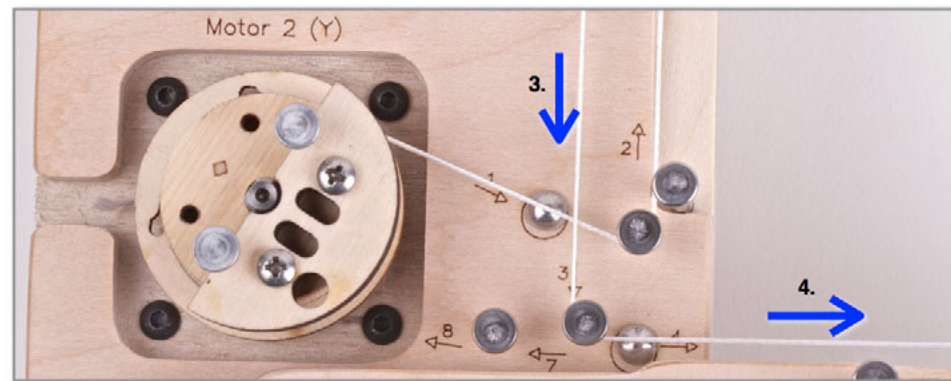


STEP 18: *Finish lacing the cord*

Follow the arrows to guide the cord around the rivets from arrow **3** to arrows **4** and **5**.

This brings the cord to the front-left corner of the chassis, to the front-right corner, and then to the next rod-end slider.
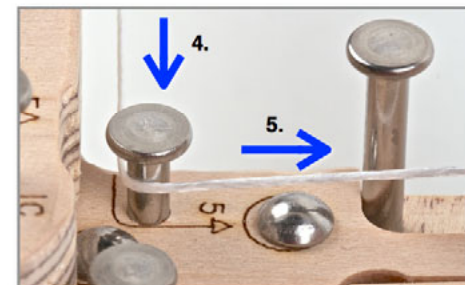

Guide the cord through the second slider, in the same way that we did the first:

 - Go in through the near, lower hole,
 - Out through the near, upper hole,
 - Pull the cord through all the way,
 - Back in through the far, upper hole,
 - Back out through the far, lower hole, and
 - Pull the cord through all the way.
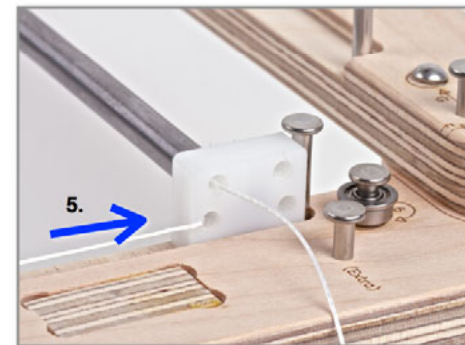
Route around the second "U-turn" bearing at arrow **6**, taking care to ensure that the cord rides in the groove.
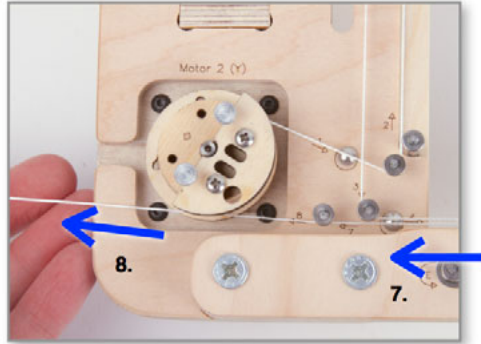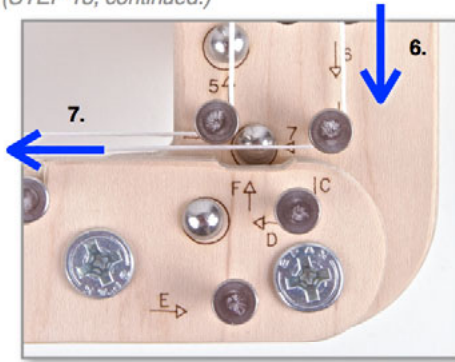
After the bearing, guide the cord following arrow **6** (to the front-right corner of the chassis) and arrow **7** (to the front-left corner of the chassis, and then arrow **8**, which guides it back to the winch.

STEP 19: *Wind the winch*

**(a)** Remove the Velcro strap that has been holding the long rod down to the chassis.

Then **(b)** holding the winch in place, pull the loose end of the cord through to take out any remaining slack.

Hold the loose end of the cord between your fingers. While doing so, turn the winch counter-clockwise to wind the cord around it. As you turn the winch, allow the cord to slip through your fingers, maintaining tension. And, as you turn the winch, the long rod will move forwards, towards the front of the chassis.

Wind the winch until the long rod reaches its endstops **(d)** on the front side of the chassis, about 2 1/4 turns.
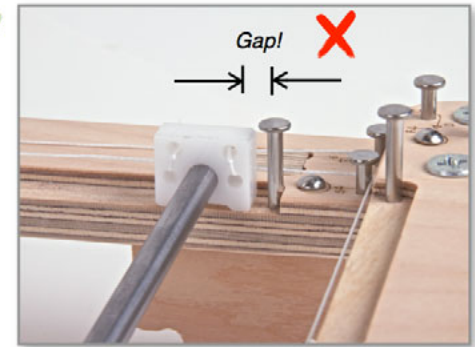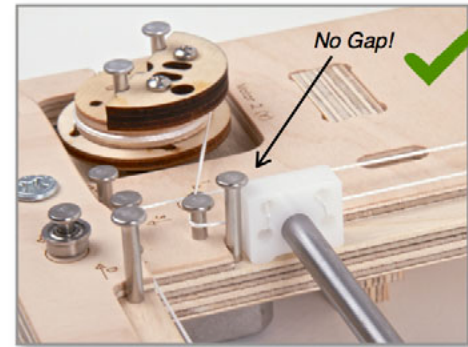
STEP 20: *Square the rod to the frame*

With the rod at the front of the frame, make sure that both of the rod end sliders rest against their stops, without a gap. If the rod is not square to the chassis, there will be a gap one one side.

In the photos above, we do not have a gap on the front-left corner, but we do have a gap on the front-right corner.
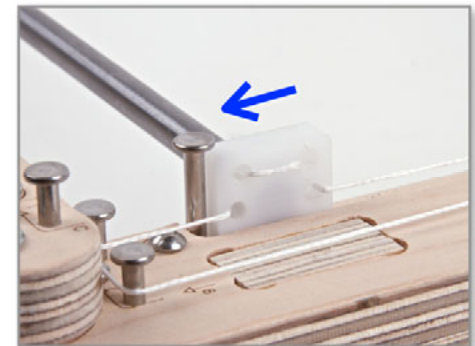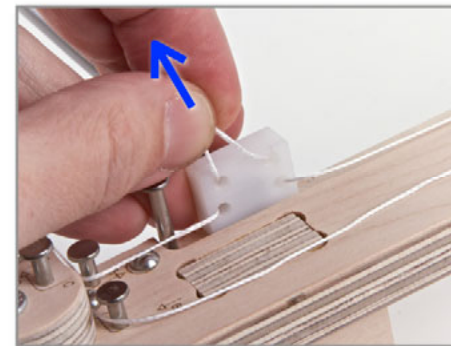
If there is a gap at one of the sliders: Pull a little extra slack up from the center top of the slider. Then, pull the slider where it needs to go, and take out the extra slack in the cord.

STEP 21: *Tension the cord*

In this step, we will clamp down the loose end of the cord, take out the slack, and test the motion.

Begin by taking the winch top half that we removed in Step 11, and passing the loose end of the cord up through the large circular hole near its edge.
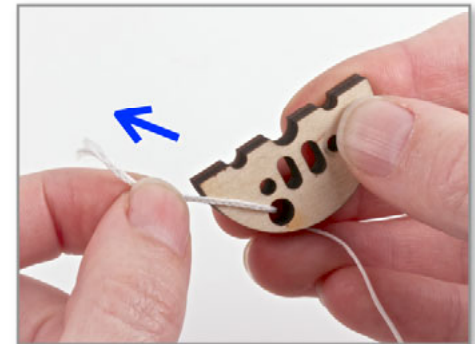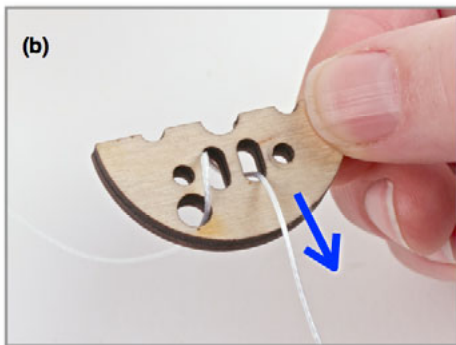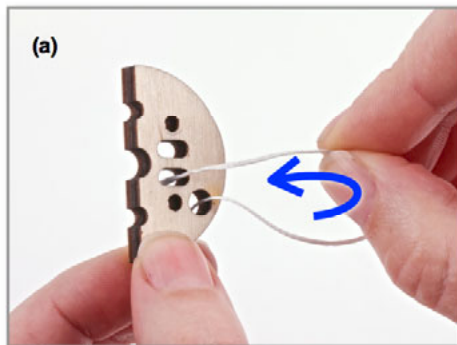
Thread the cord **(a)** in through the closer of the two oblong slots and then **(b)** back out through the other oblong slot.

Replace the top half of the winch, oriented such that the cord is coming UP through large circular hole. Attach it with the two screws **(c)**, but only tighten the strings enough that it barely begins to hold the cord in place.

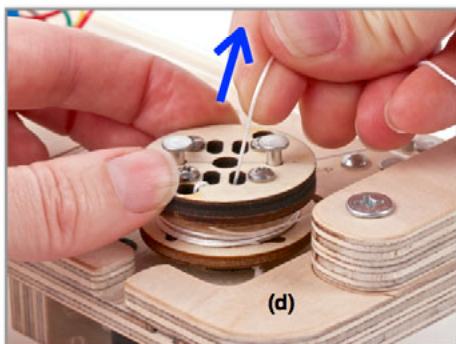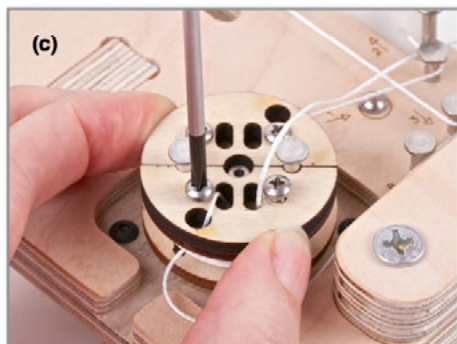Pull the loose end of the string **(d)** upwards, to take out the slack in the cord. Do not pull as hard as you can, but just enough to make sure that the string is held tight, without drooping.

Before you tighten the screws, double-check the routing of the cord. In particular, make sure that the cord is correctly routed around the ball bearings.

Then, tighten the two screws finger tight, so that the string won't slide around any more.
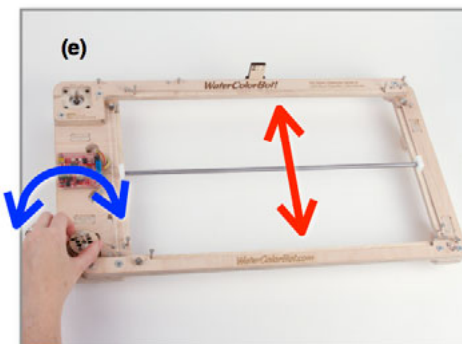
Turn the winch by hand to move the rod all the way to the back and to the front a couple of times **(e)**. The motion should be smooth and consistent.

After bringing it back to the front, check that the rod is still square to the frame (as in Step 20), and remove any new slack (if necessary) by loosening the two screws, pulling out the excess slack, and tightening the screws again.

STEP 22: *Trim the excess cord*

Stretch the remaining cord towards the other motor.

Using sharp scissors, trim the excess cord to about the distance between the two motors.
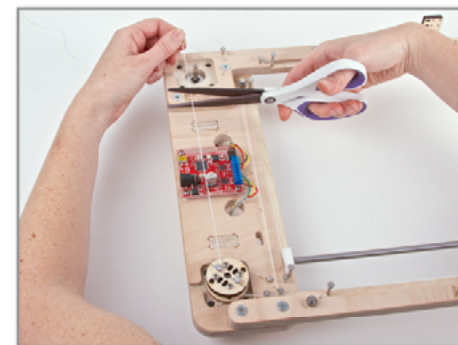
STEP 23: *Tie up the remaining cord*

Next, remove the *other* top-half of the winch (the one that does not already have the cord going through it) by taking out the two screws that hold it down. Set the screws aside for the moment.

Take the loose end of the excess cord, and pass it down through one of the wide oblong slots, and back up through the other.

Screw the top-half back on the winch back, so that it can clamp the string end between the two oblong slots. Do not tighten the screws yet; leave them loose.
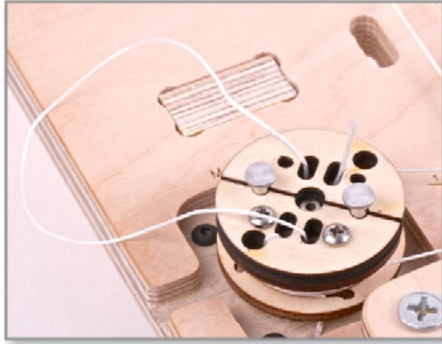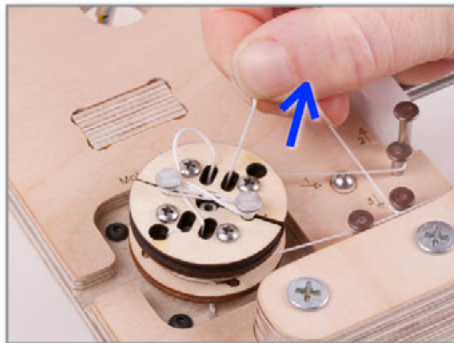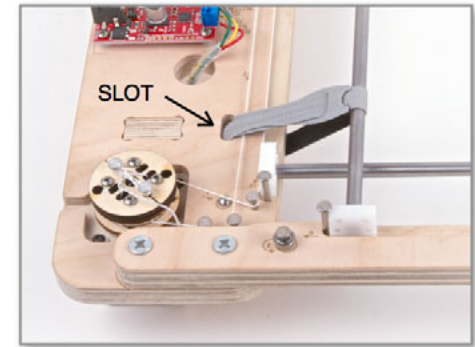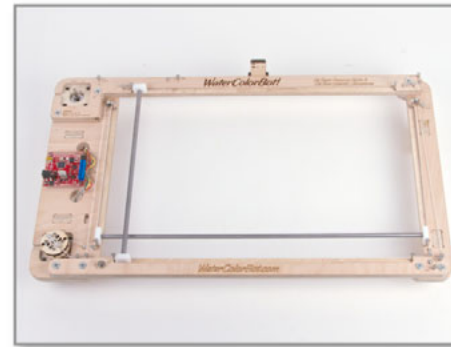
Loop the remaining cord back and forth, as a figure-8, around the two rivets on the top of the winch, as many times as you can.

When there is no longer enough cord remaining to loop around the rivets, pull the short remaining end through to cinch it, and tighten the two screws on that side.

SLOT

STEP 24: *Strap down the short rod*

Place the short rod, with its sliders, back on the chassis. Slide it all the way to its stops on the left, and strap it down to the frame with one of the velcro straps, through the slot in the chassis.

A.

B.

WaterColorBot!

G.

H.

Slider (along 'G')

F.

C.

Slider (along 'D')

D.

Ball bearing

E.
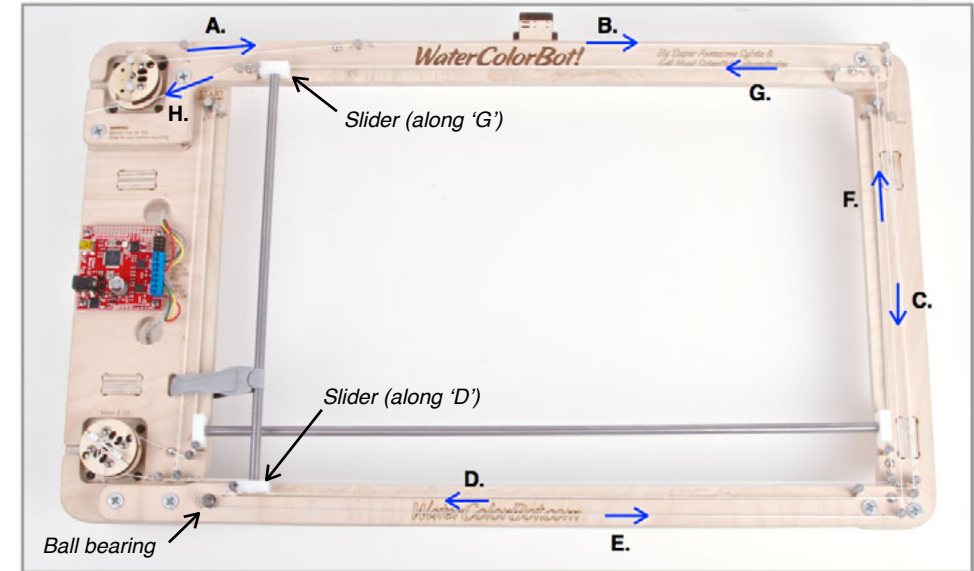
STEP 25: *Lace the other cord through the WaterColorBot*

Prepare the second winch and install it on Motor 1 (X), in the same way that you did in Steps 11-14.

Lace the cord through the chassis, much as you did in Steps 15-18, but this time guiding it along the lettered (not numbered) paths **A** through **H**, as engraved on the chassis. Lace the two sliders (found along segments **D** and **G**) the same way that we did in Steps 16 and 18.

And, thread the cord into the groove of the ball bearing (on the U-turn between segments **D** and **E**) in the same way that we did in Step 17.

STEP 26: *Wind the winch*

Following along with Step 19, remove the velcro strap, take out the slack in the cord, and wind the winch counterclockwise until the rod reaches the endstops at the right side of the chassis–about 4 turns.

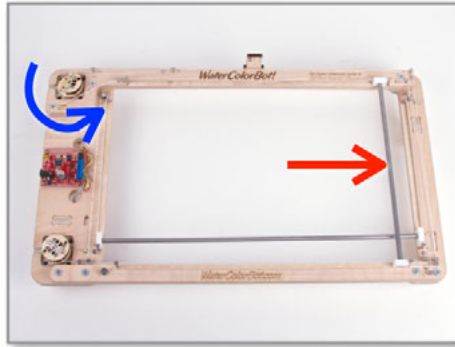Check to make sure that the rod is square to the chassis (as in Step 20), by checking for any gap between the rod and the right-hand endstops.

STEP 27: *Tension, trim, and tie up the cord*

Repeat the procedures of Step 21 to tension the cord and prepare the winch for use.

Then, follow along with Steps 22 and 23 to trim and tie up the excess cord.
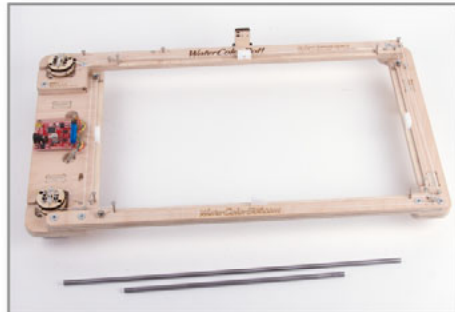
STEP 28: *Install the carriage*

In these last couple of assembly steps, we'll install and connect the WaterColorBot carriage.

Move the two rods to the center of their travel, by turning the winches as needed.

Then, remove both rods from the chassis. In order to do so, you will need to lift the rod-end sliders slightly out of their channels.

Carriage top

Side 1 (front)
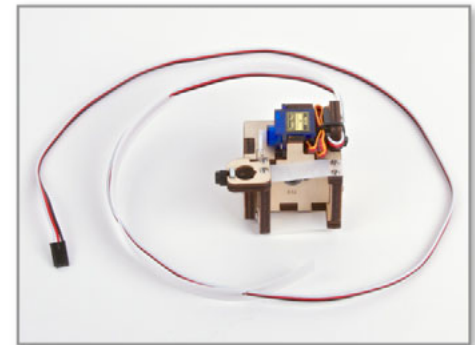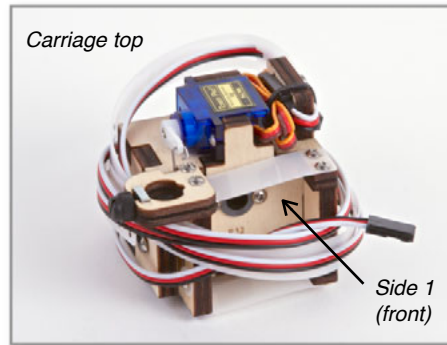
The carriage (**#4**) comes preassembled, and wrapped in its cable. Part of the cable is laced through a plastic *cable guide* that we'll be attaching to the chassis in the next step.
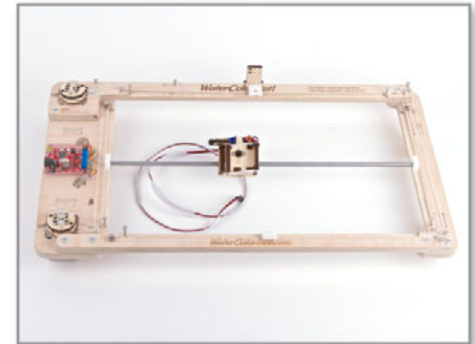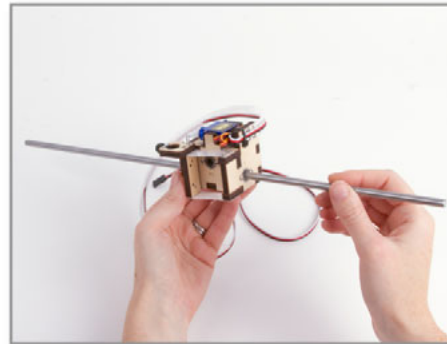
The sides of the carriage are numbered 1 through 4. Carefully insert the long rod into the hole on Side 2 (the side where the cable guide is attached), and guide it out through the opposite hole (on Side 4).

Orient the carriage with Side 1 facing towards the front and Side 2 to the right. Re-install the long rod on the chassis, by hooking it into the sliders on the left and right sides.
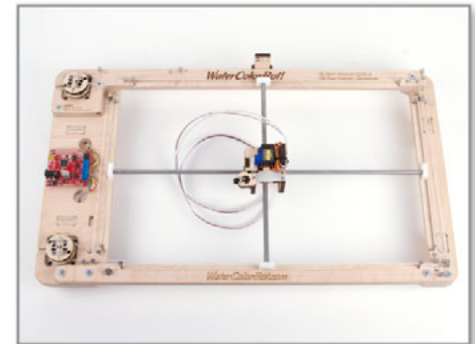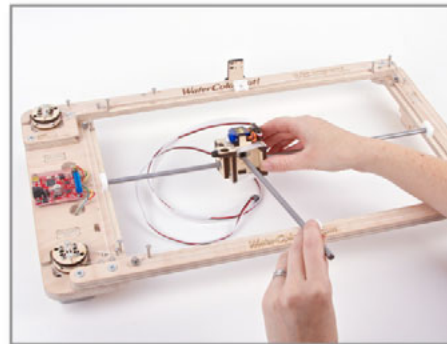
Insert the short rod into the hole on the front (Side 1) of the carriage, and guide it out through the back side (Side 3). Hook the ends of the rods into the sliders, to attach it to the chassis.
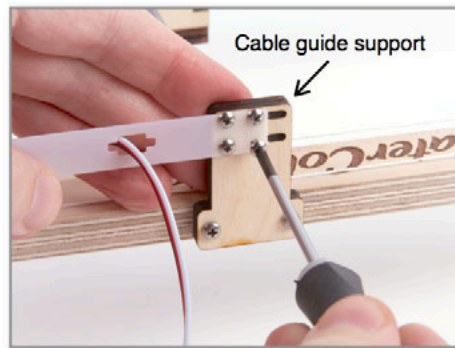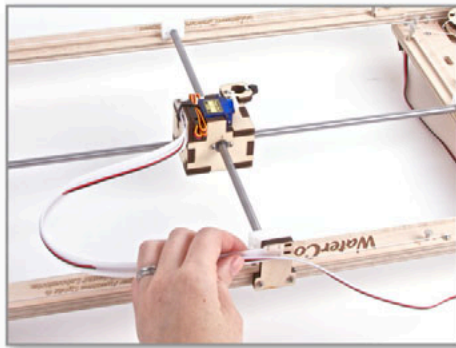
STEP 29: *Route and connect the servo motor cable*

Turn the WaterColorBot around, so that you're facing it from the back side, and bend the cable guide over to reach the cable guide support, on the back of the chassis. Make sure that the cable and cable guide form smooth curves from the carriage to the support, without any twists.

Match up the four little holes at the end of the cable guide to the four pilot holes in its support. Screw the cable guide down with the four little screws (**#11**), using a #1 or #0 Phillips-head screwdriver.
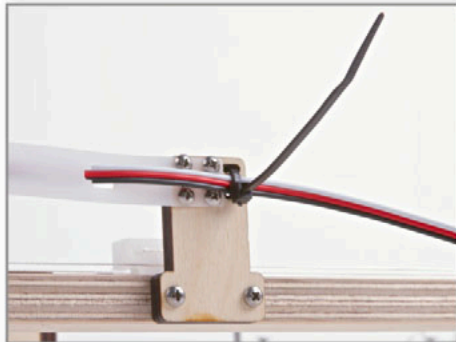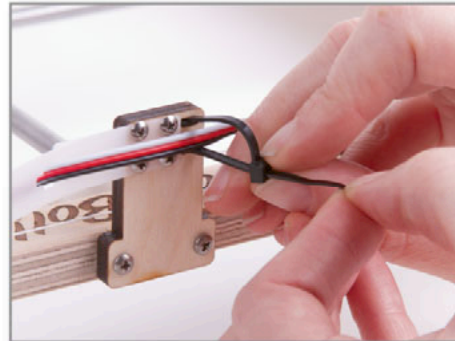
Insert one of the cable ties (**#10**) in through the upper slot in the support, and back out through the lower slot. Cinch the cable tie around the motor cable to hold it in place, and trim off the loose end of the cable tie (not the cable!) with scissors.
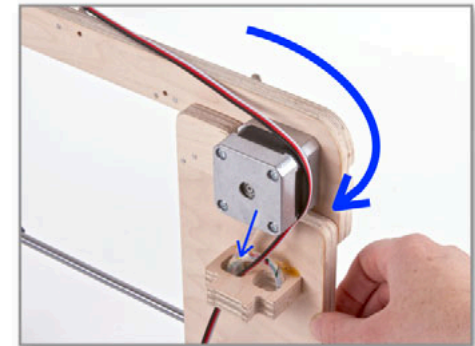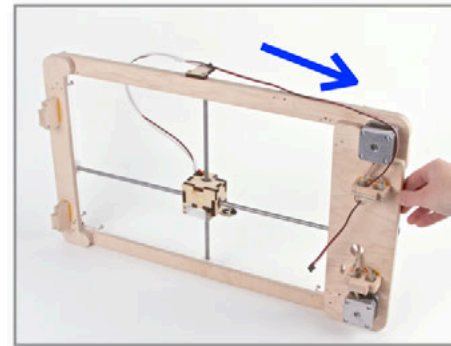
Guide the cable around the edge of the WaterColorBot, around the recessed center part of Motor 1 (X), and through the hole in the foot that is closest to the center of the chassis.
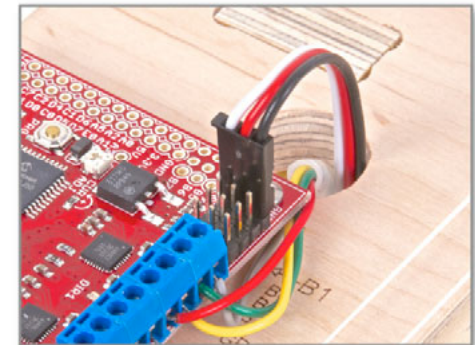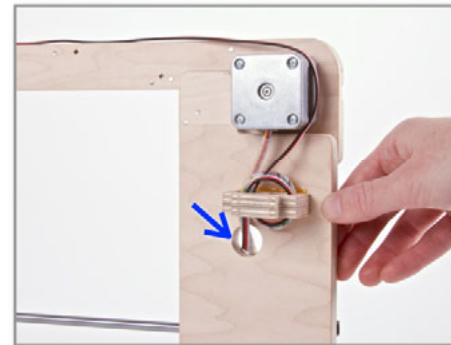
Just as we did for the stepper motor cable in Step 3, guide the cable up through the other foot hole, back down through the first hole, and then up through the big hole to the top of the chassis.

On the top side, connect the cable to the EBB. The connector is a 3-pin "servo cable" type, and it connects at position B1, the last row of 3 pins, with the black wire towards the edge of the EBB.

STEP 30:

Pour yourself a tasty beverage to celebrate, because you just finished building your WaterColorBot!

Part IV: Basics of using the WaterColorBot

The Spoilboard:

The "spoilboard" (**#3**) is the lower deck of the WaterColorBot, which holds the paint palette, water dishes, and the paper. The standard-issue spoilboard is made of MDF (fiberboard), and is designed to hold paper with one or more clips. It has engraved or etched marks to help you center the paper.

The paint set (**#18**) indexes into the long slot.

When using the standard Crayola paint set, orient black at the top and brown at the bottom.

There are also 3 round recesses, to fit the little water dishes. Always install all 3 dishes.

The water dishes are *the lids* (the shallow, larger diameter halves) of the plastic petri dishes (**#19**). They are made of washable plastic.

The small plastic beaker (**#20**) is also made of washable plastic. It has three little spouts, and is very helpful for pouring water into the dishes.

When you pour water into the dishes, fill them only about halfway, to help avoid splashing and spilling.

The paper is normally held in place by a single binder clip in the center.

You can also hold down the paper by other traditional means, such as with masking tape.

An extra clip and screw (**#14**) are provided in case you would prefer to hold down your paper with clips in the left and right instead of center. (That gives more "rigidity," but it is harder to insert and remove paper.)

The WaterColorBot is designed to fit 9x12" watercolor paper (one of the most common sizes), and to paint up to within 1/2" of the edges.

Overall paper size: 9x12"
(22.8 cm x 30.5 cm)

Margin width: 1/2"
(12.7 mm)

Painting area (inside margins): 8x11"
(20.3 cm x 27.9 cm)
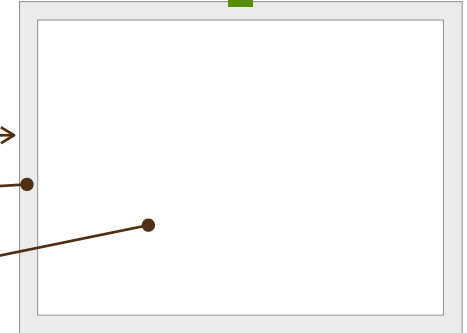
For US Letter and A4 paper sizes— both a little smaller than 9x12" —align the paper to the top, and center it, using the marks provided on the spoilboard.

The chassis of the WaterColorBot indexes into the spoilboard with its feet. This "upper frame" is removable for easy access to paint, water, and paper.

When removing the upper frame from the spoilboard, take care to lift it *directly upwards,* so that it comes off cleanly, without spilling your water or paints.
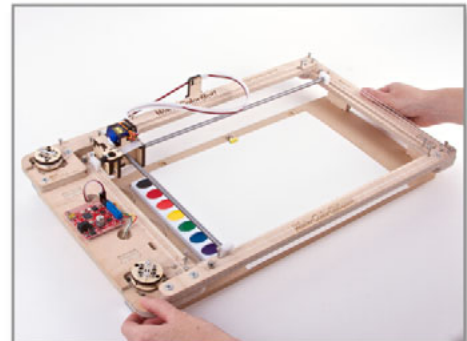
USB and Power:

The WaterColorBot comes with a universal-input power supply (**#6**) that takes worldwide voltage (although it will need a plug-shape adapter in some countries).

It also comes with a USB cable (**#7**) to connect to your computer.

USB cable (#7)

Power supply (#6)
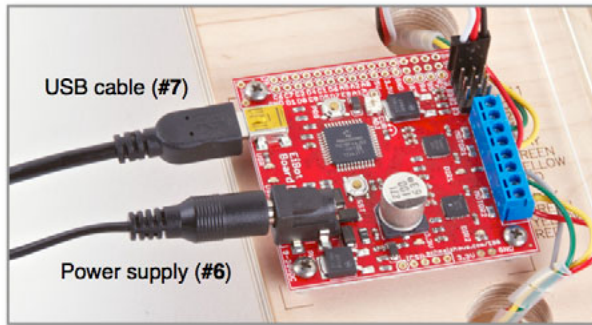
If your computer is running Windows, install the software (as described in Part V: Software) before hooking the WaterColorBot up to your computer.

Inserting the brush and setting the height:

The brush holder is located at the front-left corner of the carriage. A black plastic thumbscrew holds the brush in place.

The brush holder can fit any brush or writing implement up to about 0.42", or 10.6 mm in diameter.

To insert a brush, loosen the thumbscrew enough that the brush can fit through, lower the brush into place, and tighten the thumbscrew by hand.

"Brush Up"

"Brush Down"

The brush holder moves up and down, driven by the little servo motor on top of the carriage.

In the "Brush Up" position, the brush needs to be high enough to clear the lip of the water dish, the top of the paint pans, and to travel over the paper without dragging. In the "Brush Down" position, it needs to be low enough to paint on the paper, dip into the water, and get paint from the palette. There is also usually a "Wash" position, even lower than the Down position, for washing the brush in the water dish.
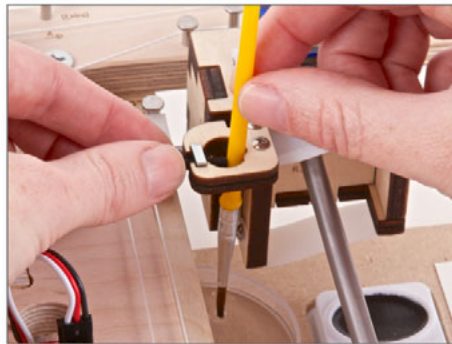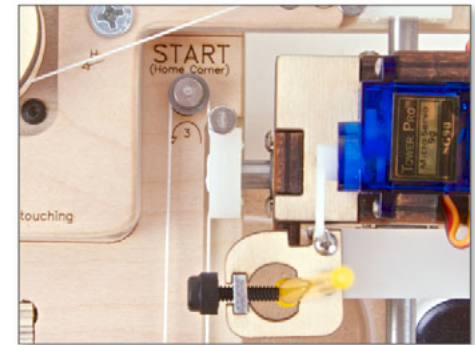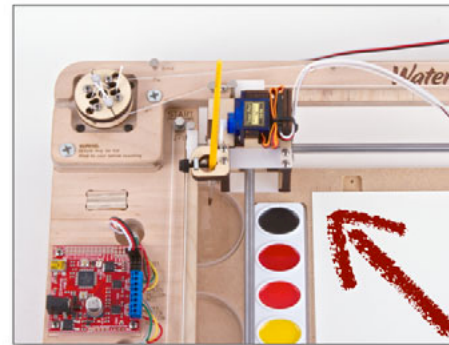
The easiest way to get the brush at the right height is to use the software to raise and lower the brush, and to insert the brush by hand while the carriage is in the "brush down" position.

START
(Home Corner)

START (The Home Corner):

Before running the WaterColorBot, always position the carriage in the aptly-named **START (Home Corner)** position: As far to the left, and as far back as it will go.

When automatically painting, the carriage will normally return to this position when the painting is complete, leaving it ready for the next painting. In some cases, you may need to use the "Park" (AKA "Move Home") command to send the carriage back to its home position.

If you need to move the carriage by hand (for example, before your first painting), make sure to turn off the stepper motors first, so that you are not forcing them under power. (The command to do so may read as "unlock motors," "motors off" or "turn off motors.")

SUMMARY (Basics of setting up the watercolorbot for use):

1. Load your paint set, water dishes (with water) and paper on the spoilboard.
2. Lower the upper frame (main chassis) of the WaterColorBot onto the spoilboard
3. Move the carriage, by hand, to the upper-left (Home) corner, marked START
4. Connect power and USB cables
5. Insert the brush and check the height
6. Begin painting from the software

Before every subsequent painting, make sure that the carriage is back in the Home Corner. And, if you need to move the carriage by hand, first make sure that the motors are off.

Part V: Software

In order to begin using your WaterColorBot, you'll need to download and install software. There are, at present, three different programs that you can use to control the WaterColorBot, each of which has unique advantages. All of our software is free to download and open-source in nature.

For software download links and instructions, please visit:

watercolorbot.com/software
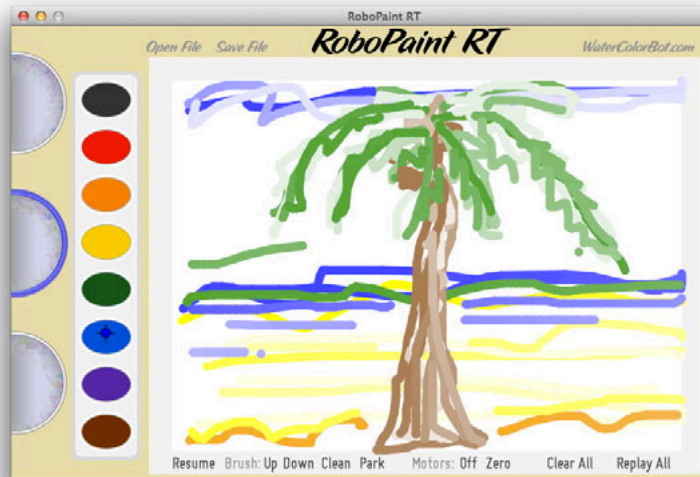
RoboPaint RT

Robopaint RT is a "real time" application that allows you to paint with the WaterColorBot. It's straightforward and manual: Click on a color in the paint palette to change to that color, click on the water to dip the brush in the water, and drag the brush to paint on your paper.

With RoboPaint RT, you can also replay your drawing to make multiple copies, and save the file to open up and print again later. This program can be *a lot* of fun to play with and is a great way to get acquainted with the WaterColorBot. For those with good artistic skill, it can also be a remarkably powerful program.

Ease of use: *Easy*
Level of control: *Very manual*
Under the hood: *Java, in Processing*
Note: *Requires a recent version of Java on your computer*
Recommended for: *Artists, beginners, younger audiences, hands-on demos*
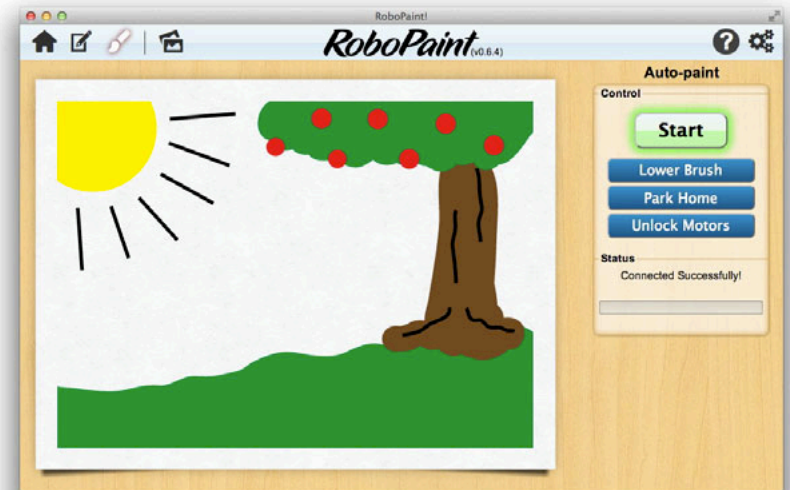
RoboPaint

Robopaint is another application written by the WaterColorBot team. In RoboPaint, you can open existing artwork in SVG format, snap the colors to your paint palette, and paint the document. It also has a rudimentary edit mode that lets you create new drawings to print.

If you're starting with existing SVG artwork, RoboPaint is generally the best of the three programs to use for a few different reasons. Most importantly, it's good at automatically filling in large solid regions of a painting.

We recommend that all WaterColorBot users download and install RoboPaint.
Windows users should download and install RoboPaint prior to the other programs, as it also installs the WaterColorBot's USB driver.
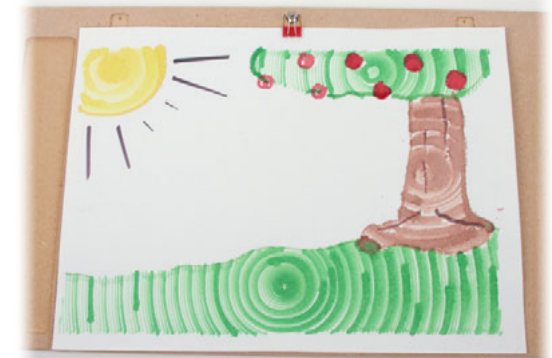
Ease of use: *Easy to Medium*
Level of control: *Very automatic*
Under the hood: *Javascript, plus the WaterColorBot's API*
Recommended for: *All users*

Inkscape w/ WaterColorBot Extensions for Inkscape

Inscape is a superb, free vector graphics editor, for which we have written an extension (a plugin) to control the WaterColorBot.

Our extension provides a fine grain level of control over exactly what will be painted, but more-or-less requires that you create the artwork within Inkscape to take full advantage of the features.

Inkscape is also capable of importing artwork in PDF format (as well as tracing bitmap graphics to some extent), and saving as SVG graphics that can be used with RoboPaint.

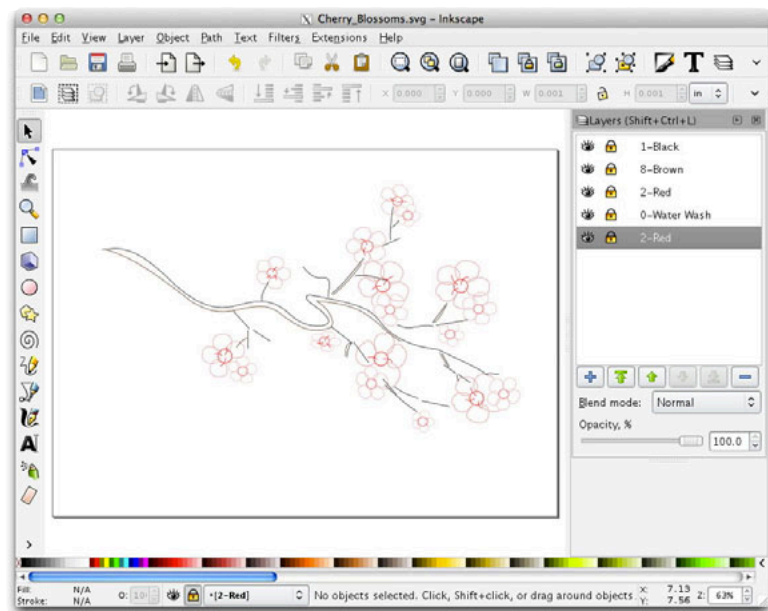Users who have experience with the Eggbot (and its Inkscape based driver) may wish to start with this application, before trying the others.

Ease of use: *Medium to challenging*
Level of control: *Very high*
Under the hood: *Python (for the WaterColorBot extensions)*
Note: *Requires you to install Inkscape. Mac users will also need to install XQuartz first.*
Recommended for: *Artists, those seeking a finer level of control, those wishing to import graphics into RoboPaint.*

Part VI: Additional Tips, Tricks, & Hints

Paint:

• A high-end set of watercolor paints can cost hundreds of dollars. That said, there is more difference between a $5 Crayola paint set and a $20 Cotman set than there is between a $20 set and a $200 set. We recommend splurging on a $20 set, once in a while, if you're so inclined.

• When learning to use the WaterColorBot or giving demos, low-end watercolor paints (Crayola, Prang, etc) are generally the best choice.

• When your Crayola paint palette is empty, wash it out gently with cold water: it can be reused as a palette for tube-based watercolor paints.

Paper:

• You can slide paper in and out, under the front side of the chassis, without removing the upper frame from the spoilboard.

• You can use smaller-yet paper (e.g., notecards) on the WaterColorBot, even if they don't fill up the spoilboard. The best ways to do so are to either affix it to a larger sheet of paper (9x12", US letter or A4) with masking tape, or to clip it above larger paper on the spoilboard.

• Other types of paper not intended for watercolor often work quite well. We're particularly fond of painting on "bristol board" drawing paper.

• Paper tends to warp as it gets wet, particularly with uneven wetting and lower grades of paper. Methods of dealing with this include pre-wetting and stretching paper, as well as holding paper down with tape or in blocks. Watercolor painting is an old art, and people have been solving these problems for hundreds of years; read up on the subject online or in books.

WaterColorBot performance:

• If the motors have trouble turning the winches, or the carriage does not slide smoothly, the *first thing to check* is to see if the two rods are square to the chassis, for example by looking to see if all four rod-end sliders are up against their stops when the carriage is in the home corner.

• If the motors seem way too weak or way too jumpy, or are getting very hot, you probably need to adjust the current setting on the EBB.

• Make sure that the power supply is plugged in. If it's connected by USB but the power supply is not plugged in, the WaterColorBot will act normally except that the motors do not move. (No fun!)

Painting style:

• Watercolor painting is unusual versus other painting techniques in that paint colors are frequently mixed *on the paper*, rather than in a palette. While there are only 8 colors in the palette, you can have a continuous range of colors in your completed painting.

• When making your drawings on the computer, exaggerate your motions to compensate for the way that a brush bends and flexes when painting. A square will have rounded corners. A small circle may end up as just a dot. When painting by hand you compensate naturally, since you watch the tip of the brush. But when asking a robot to paint for you, you may want to think about it in advance.

• You get very different effects and more paint mixing on the paper if your paint has more water in it. You can use the water dropper (**#21**) to add a drop of water to pre-wet your paint pans– which can have a dramatic effect on painting style.

• The WaterColorBot is not limited to working with watercolors, nor even to using a brush. Some of the WaterColorBot software interfaces provide options for regular pencils and pens, watercolor pencils, dip pens, and painting with water alone.   (Below: Stipple drawing made with a pen, WaterColorBot, and Inkscape, created with the help of our StippleGen software.)
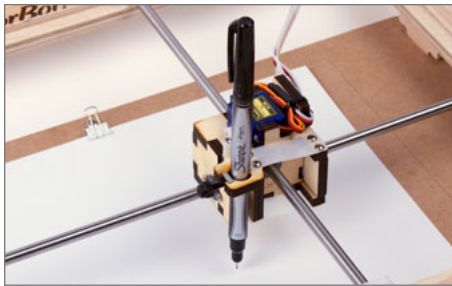

Storing and shipping the WaterColorBot

• The WaterColorBot comes in a sturdy, reinforced carrying case that is suitable for long-term use. For shipping, put the case in an external box that offers impact and scuff resistance.

• Make sure that the paint brush, spoilboard, water dishes, dropper, beaker, and paint set are fully dry before packing the WaterColorBot for long-term storage.   (Moisture can damage the wood, electronics, and other components in long-term storage.)

• When preparing to move or store the WaterColorBot, move the carriage to the upper left (Home) corner, and strap both rods down to the frame with the two velcro stowage straps (**#17**). Doing so will anchor both the rods and the carriage in place.
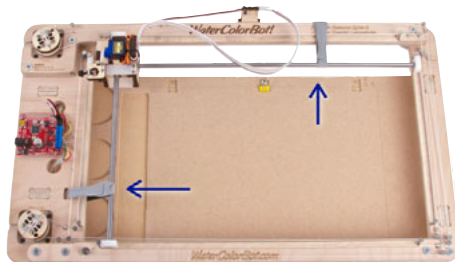
Part VII: Further Exploration & Support

If you've just finished building the WaterColorBot, your next step should probably be to download and install software, and get started trying it out:

WaterColorBot Software: watercolorbot.com/software

We also have a growing library of additional resources and documentation about the WaterColorBot, including information for developers and links to places where you can share your WaterColorBot artwork:

WaterColorBot Documentation: watercolorbot.com/docs

We recommend all WaterColorBot users to sign up for the WaterColorBot mailing list, and you may want to browse or participate in our tech support forums as well:

Mailing list: watercolorbot.com/mail
Forum: watercolorbot.com/forum

If your kit has missing or damaged parts, or if you need spare parts support for any reason, please contact our store directly, by e-mail or using our web contact form:

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