# Graphkit Assembly Instructions
Version 5.12.2016
With Special Guest Appearance By: Zane's Hands

1. **Start with two Hapkits plus additional Rapkit parts.** Tools, including Allen wrenches, screwdrivers, and hammers will be provided. The Rapkit parts are listed below. These are in addition to the Hapkit parts you already have.

- Two 3D-printed base holders. These are mirror images of each other.
- Two 3D-printed handle links to replace the regular Hapkit handles. These are mirror images of each other.
- Two 3D-printed arm links to connect to the handle links and to each other. One of the arm links has a pen holder at the end.
- Two long bearings and two short bearings.
- Two shoulder screws.
- Two shaft collars.
- Two steel Phillips Head screws and two steel hex nuts.
- One plastic screw and one plastic hex nut.
- One Sharpie pen.
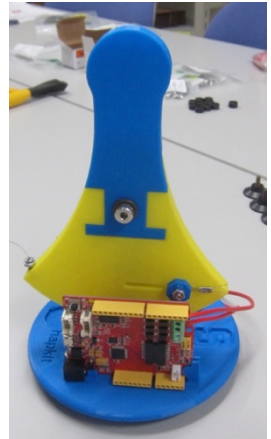
2. **Remove the original handle from each Hapkit**: You can do this without unwinding your Capstan drive, but you should remove the Hapkit board to get it out of the way. (a) Unscrew the shoulder screw that attaches the Sector Pulley to the Base. (b) Remove the shaft collar. (c) Now you can separate the Handle from the Sector Pulley. (d) Remove the short bearing from the handle. You may find a screwdriver useful in this endeavor.
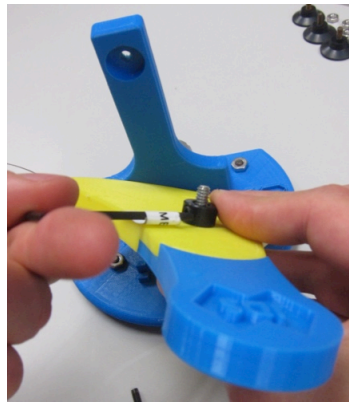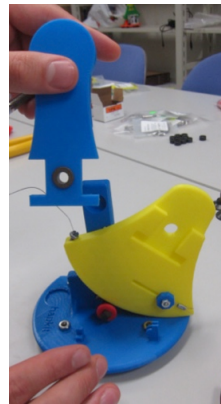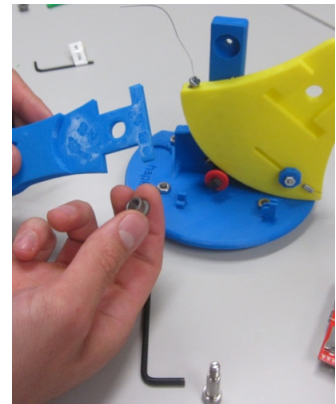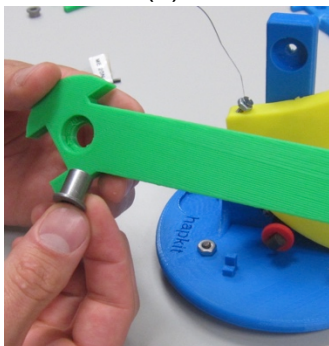

| (a) | (b) | (c) | (d) |

3. **Add the new handle link to the Sector Pulley and reattach to the Base.** (a) Place a *long* bearing into each of the handle links on the end that fits the Sector Pulley. Place a *short* bearing into the other hole on each handle link (not shown). (b) For the Hapkit with the handle laying across the side of the Sector Pulley with the Capstan tightening mechanism, you need to flip the tightening screw so that the nuts are on the backside of the sector pulley as shown. (c) Assemble the shoulder screw, bearing, handle link, and sector pulley of each Hapkit. You may need to tap the pieces with a hammer to get them to fit. (d) Reattach the shaft collar. (e) Screw the shoulder screw into the base. (f) Final view.
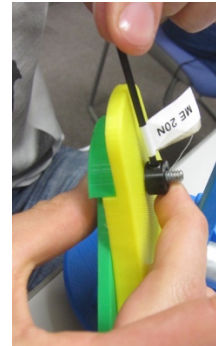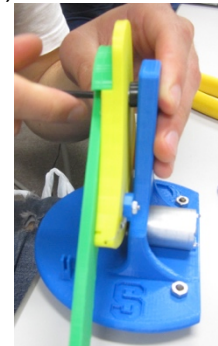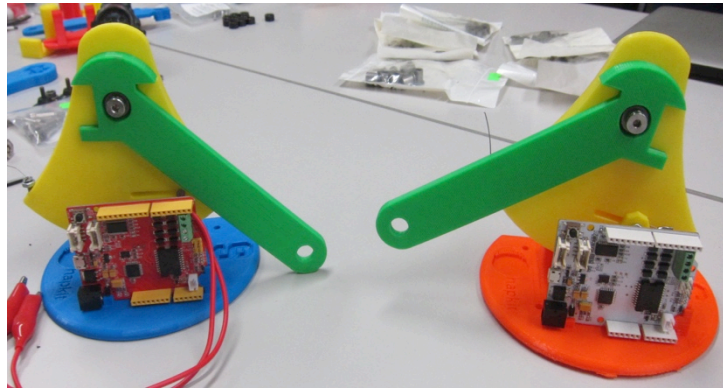

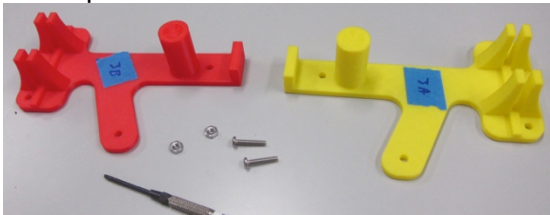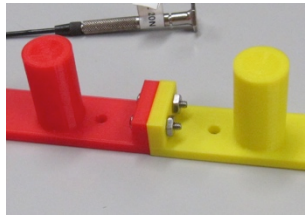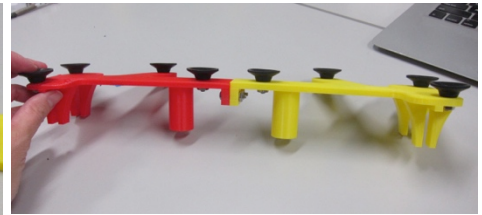| (a) | (b) | (c) | (d) | (e) |

(f)

4. **Assemble the 2-dof robot base.** Remove the suction cups and nuts from the bottom of each Hapkit. (a) Lay out the two halves of the robot base as shown. (b) Attach the two halves with the steel screws and nuts. (c) Attach the eight suction cups and nuts to the bottom of the robot base. (d,e) Slide the Hapkits into the two sides of the base as shown.
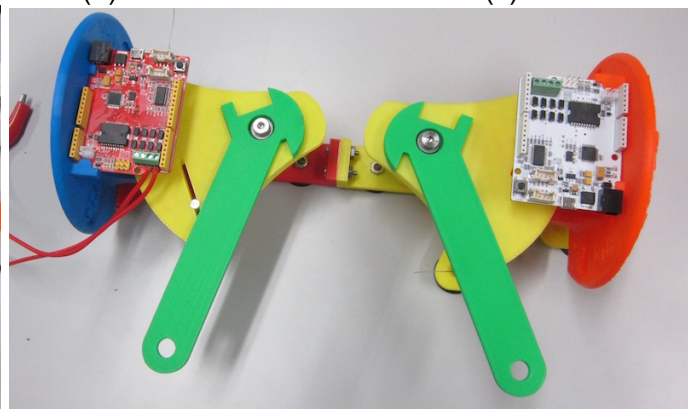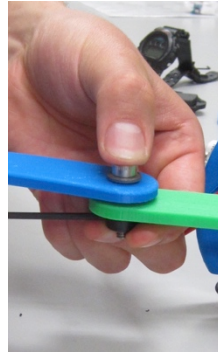

(a)

(b)

(c)

(d)

(e)

5. **Assemble the arm links.** (a) Place a *short* bearing into each hole of the arm links. (b) Use a shoulder screw to connect each handle link / arm link pair, and (c) fasten with a shaft collar. (d) Attach the plastic screw and nut to the end of the arm link with the pen holder. (e) Slide the pen into the pen holder and hole in the two arm links.
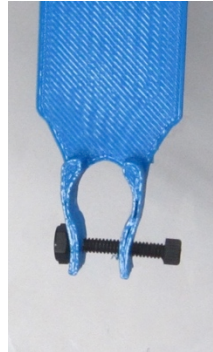

(a)

(b)

(c)

(d)

(e)