Commando-8 CSR Astromech Frame Assembly Instructions

Instructions Version 1.0 – Spring 2016

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The Com8-CSR frame has been designed to be easy to assemble and to be a very rigid and dependable frame for your droid for years to come. Read these instructions completely before you start your build. Follow these instructions carefully and please email me first (maxxius8@aol.com) *before* posting threads on the astromech.net boards, as I answer all questions promptly.

The Com8-CSR frame is designed to be a convertible frame or a fixed leg frame. It can be changed manually from a 3-legged stance to a 2-legged stance for easy storage and transportation of your droid. You can unlock the leg lock plates and straighten out the legs. If you plan to do a manual or a motor driven 2-3-2, you will need to get the ankle lock optional kit, which will keep your ankles locked when standing in two leg stance. Otherwise your droid will fall over. Later you will be able to buy the 2-3-2 automated system to electronically raise and lower the center leg and rotate the outer legs.

The frame pictured in these instructions is plain aluminum. Your frame, or parts of it, may be different (blue, black, orange, etc.). Treat the anodized coating with the same care as you would a painted surface. The anodizing can scratch and scrape away. It makes an excellent primer for painting aluminum.

Some of the screws may encounter resistance. If you insert a screw and meet resistance, back the screw out and make sure you are not cross-threading the screw. The tolerances are very tight on this frame. If the screw is not cross-threaded, you may have to insert it partway, back it out and remove any debris, then advance the screw a little more. Repeat this process until the screw is completely inserted. It may be easier to do this before attaching parts.

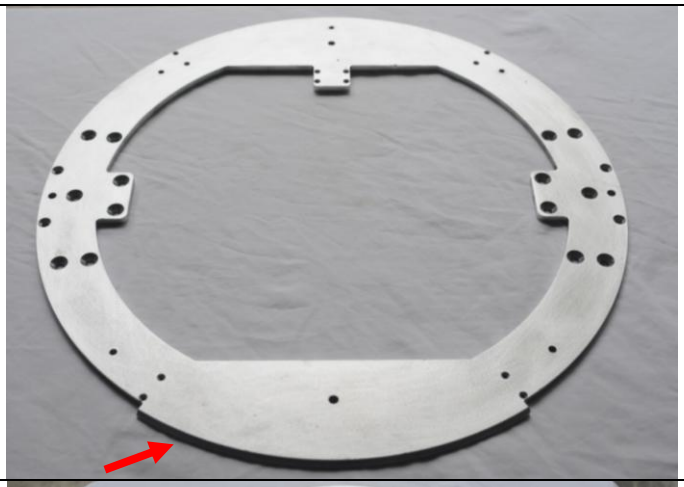
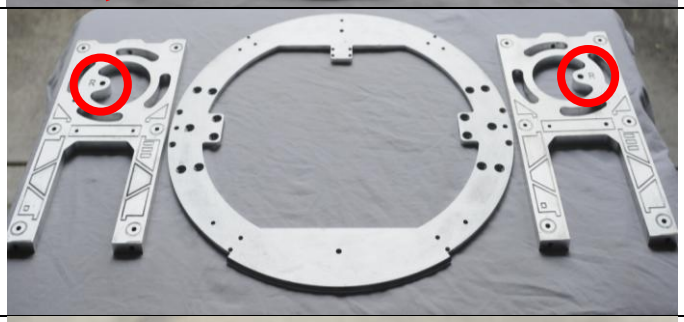
CAUTION: Never assemble your frame using Loctite, Permatex, Vibratite, or any other type of thread-locking fluid! The frame has been designed using the highest quality hardware and precision countersinks to stand up to years of vibrations. Countersunk screws have a larger surface area in contact with the material, and may become impossible to remove later if installed with thread-locking fluid, even to the point of having to drill them out.

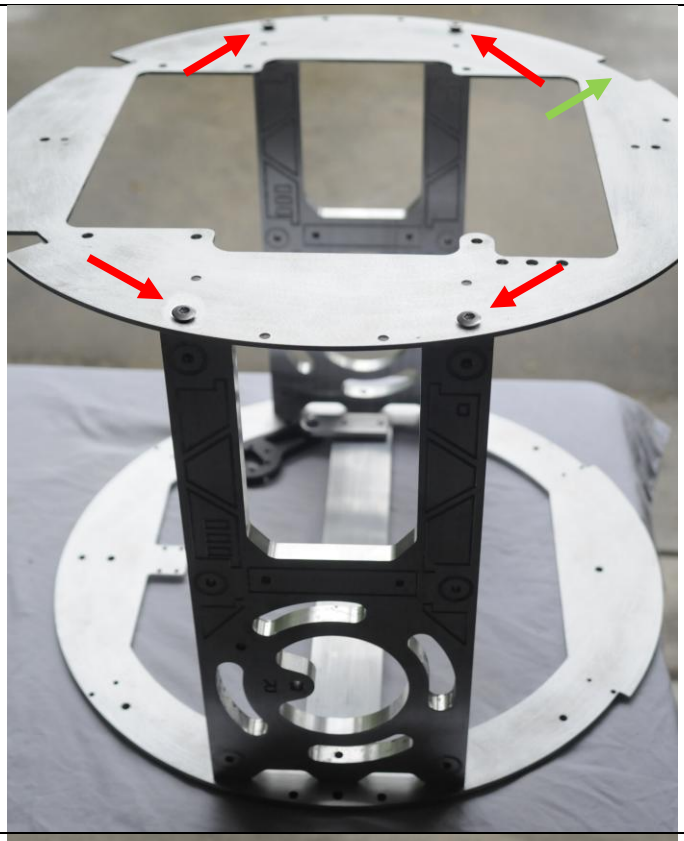
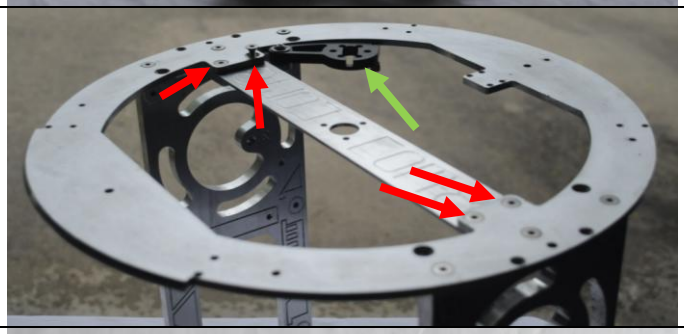
CAUTION: The small 4-40 x 1/2” screws in the utility arm carrier and the skin block set break easily. Do not over tighten them. The heads will shear off more easily than you think!

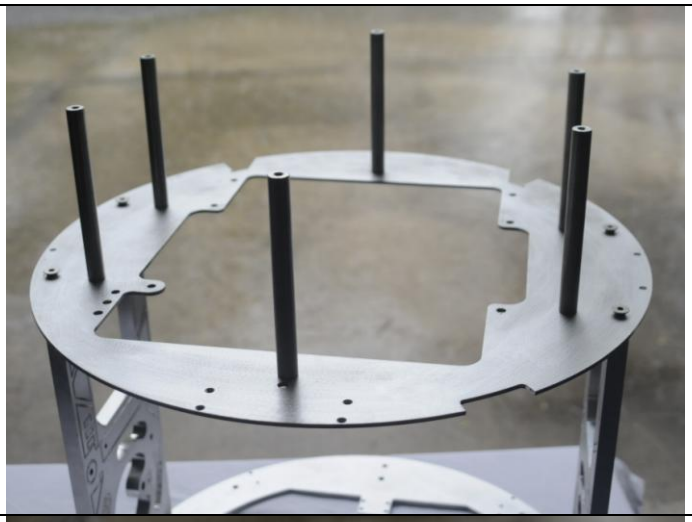
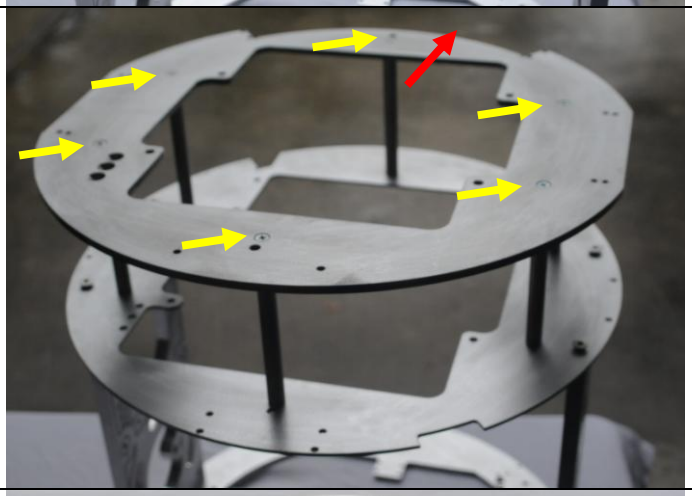
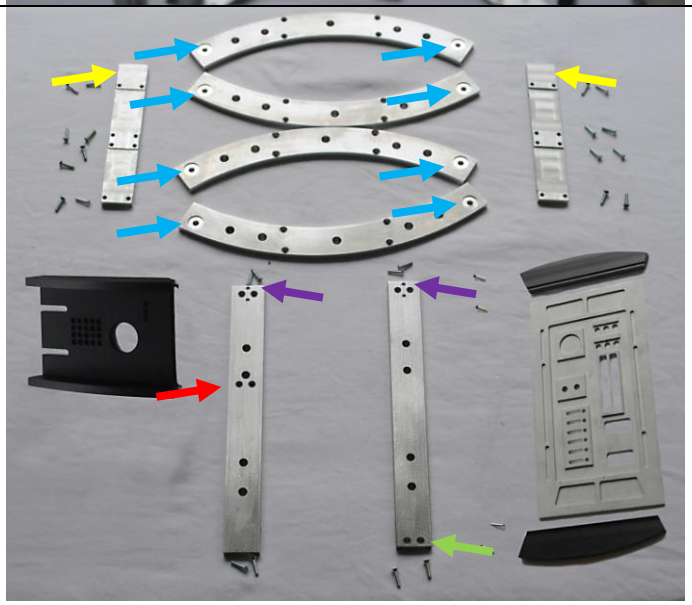
The frame consists of many different parts. The list of available parts is on the following page. Some are optional and must be purchased separately. This instruction set covers all standard and optional parts. All hardware is included. Additional hardware may be required for other club parts (for example, screws must be ordered for mounting the Rockler bearing to the frame). See the Supplemental Build Notes at the end of this instruction set for other details, such as instructions on preparing the Rockler bearing and attaching skins to the frame.

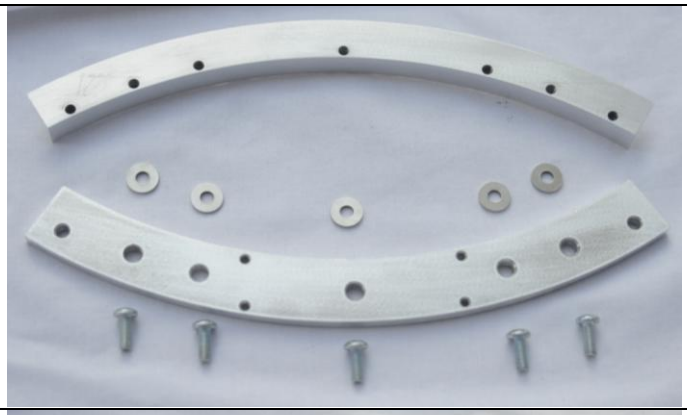
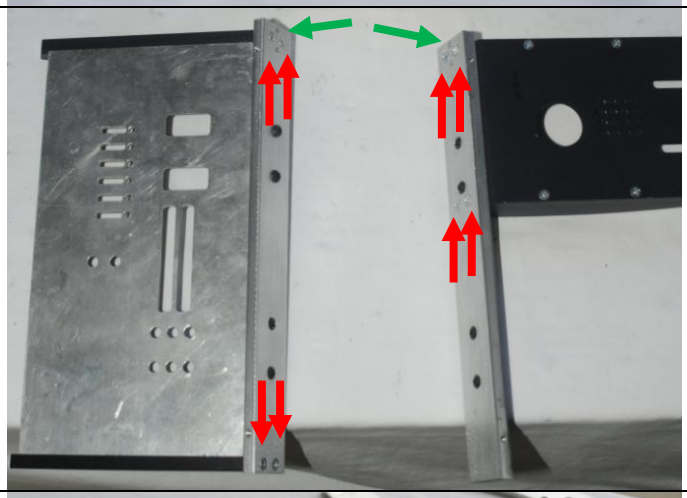
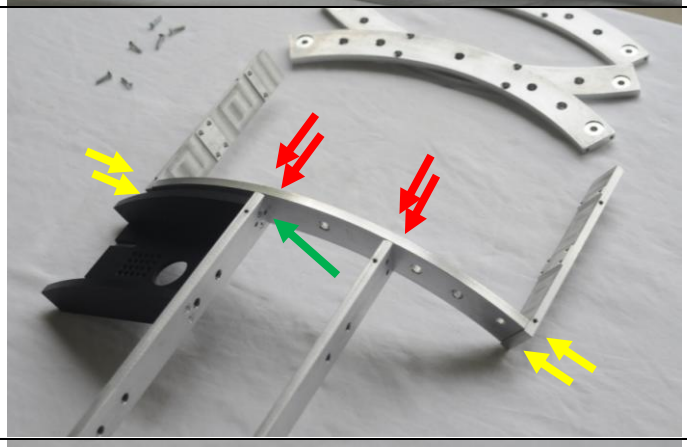
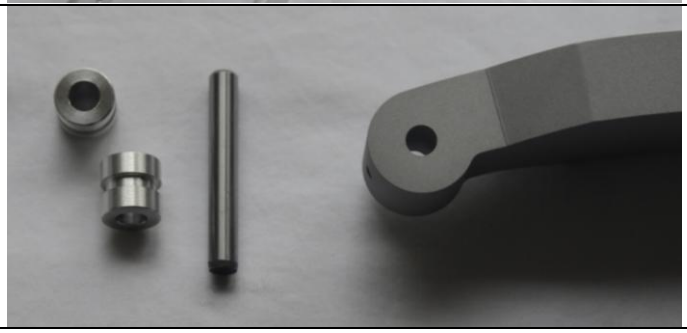
Part	Description	Steps
Standard Frame	The basic skeleton for your droid. Compatible with a huge number of club parts with pre-drilled and pre-tapped mounts for power couplings, octagonal ports, the large data port, the Rockler dome bearing, and many others.	1-8
Utility Arm Carrier	The rectangular spaces in front of the droid that hold the utility arms. This is also the attachment point for the center vents, charging bay, data panel, and speaker mount.	9-17
Rear Door Assembly	The access hatch in the back of the droid. The rear door is the full length of the back of the droid and is held in place with magnets.	22-28
Leg to Body Hubs	The polished aluminum connections between the side legs and the body. These are visible in the final assembly.	45-50
Leg Lock Plates	The plates that allow the droid to lock in the 2- or 3-legged mode. These are installed inside the droid.	45-50
Ankle Lock Rod Set	The rods and aluminum attachment points that fit inside the WORR legs and feet (available separately) to restrict leg motion between vertical (2-legged stance) and angled back to the 3-legged stance. Keeps your droid from falling flat on his or her face!	60-63
Center Foot Plate and Center Ankle Adaptor	The plate which mounts to the center foot and the bottom of the frame. The center ankle attaches to the adaptor which is attached to the plate.	34-38
Skin Block Set	The mounting points for the skins (shell) of your droid. There are six blocks, three for each side along the seam between the front and back skins.	43-44
Rolled Utility Bay Cover	The back of the utility bay. Anodized black to make it less visible when the utility arms are open. Keeps the interior of the droid concealed when the utility arms are deployed.	29-30
Charge Bay	The charging port bay. Visible in ESB when Luke plugs R2D2 in near the campfire while visiting Dagobah. Built to go along with any of the charging bay electronics available.	9-17
Data Panel	The panel behind the large front panel of the skins. Not found in any movies to date but visible in the Visual Dictionary. Available in the forums in multiple designs and with lighting kits.	9-17
Flat Side Battery Plates	The flat aluminum panels at the bottom of each side of the body adjacent to the battery boxes on the legs. Provides clearance for the legs to swing past the body. Painted white on R2 and visible in final assembly.	41-42
Flip-down Electronics Panel	An interior panel hinged at the bottom of the rear door which can be used for mounting electronics inside the droid while providing convenient access for maintenance.	18-19
Auxiliary Side Electronics Panels	Additional plastic panels in the interior below the leg hubs which provide additional space for mounting electronics.	39-40
Dome Drive Mount	The aluminum mount which attaches the dome drive motor to the frame. Includes an extension spring and hardware to hold both motor and wheel at the right level to spin the dome by turning the wheel against the inside race of the Rockler bearing.	51-59

ASSEMBLY

1. Top ring. The flared portion at the bottom of the photo (red arrow) is the upper part of the large data port (LDP) and is the front of the droid. The countersunk openings face upward as shown toward the dome.	
2. Sides and top ring. The sides are labeled "R" (red circle) to indicate which part of the side should face the Rear of the droid (away from the LDP in the top ring).	
3. Attach the top ring to the sides with six 1/4-20 x 3/4" flat head screws (arrows, shown below). Leave all screws slightly loose to allow for play during assembly until otherwise indicated. Take note of the location of the "R" indicator (red circle)! 	

4. Attach the middle ring to the sides with four 1/4-20 x 3/4” pan head screws (red arrows). The frame is upside down in this photo. Take note of the orientation of the middle plate (green arrow). The notch in the upper right corner of the photo provides clearance for the charging bay plug.	
5. Attach the center support for the top ring using four 1/4-20 x 3/4” flat head screws (red arrows). Make sure “COM8” is visible from the top for alignment. Notice that the dome drive mount (green arrow) is already installed to the center support and will rest against the inside of the top ring.	
6. Gather the six support rods and twelve 10-24 x 5/8” flat head screws as shown.	

7. With the frame upside down, start one of the 10-24 x 5/8” flat head screws through the countersunk openings in the middle ring and into each of the support rods. Do not tighten completely yet.	
8. Add the bottom ring with six more 10-24 x 5/8” flat head screws (yellow arrows). Make sure the countersinks on the bottom ring face the correct direction, and that the opening for the rear door aligns correctly (red arrow). Tighten all screws. Basic frame is complete.	
9. Exploded concept view. Utility arm carrier, charging bay (optional), data port (optional). All assembly will be performed with 4-40 x 1/2” flat head screws except where noted. Use caution – these screws will shear if overtightened. Data panel pictured upside down, sorry… Take care to identify and orient parts as shown. The charge bay support has two extra holes near the middle (red arrow). The data panel support has two extra holes near the bottom (green arrow). Both struts have a dot marker at the top on the inboard face (purple arrows). The utility arm carrier sides have a smooth portion at the top that creates the sides of the LDP (yellow arrows). The large shallow pockets of the utility arm carriers must face each other (blue arrows).	

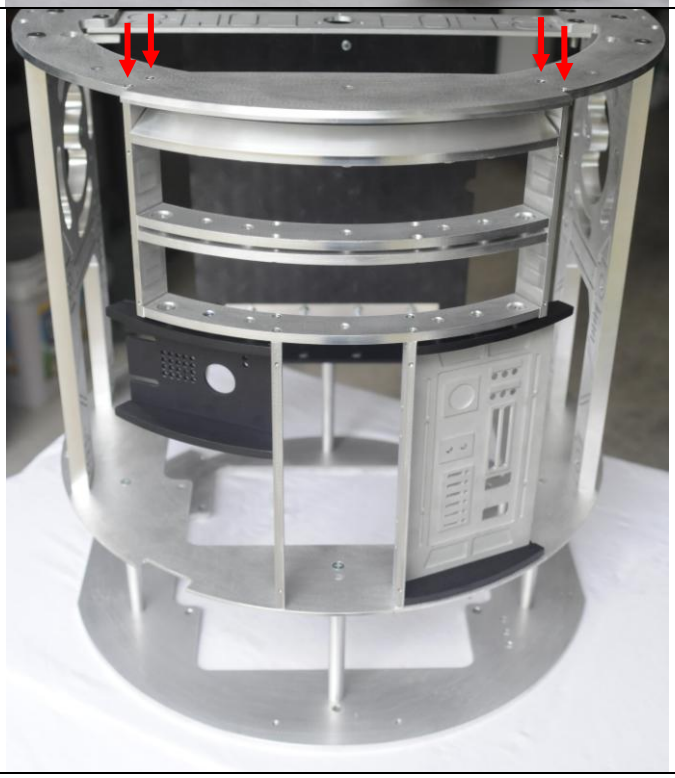
10. Large data port (LDP). The bottom of the LDP is shown at the top (red arrow). The washers will sit between the LDP and the top of the utility arm carrier to bring the edge of the lower half of the LDP above the skins. The five pan head screws are inserted from the bottom of the utility arm carrier, through the washer, and into the LDP.	
11. LDP assembly completed. Side view shown below. 	
12. Charging bay and data port, viewed from the back. Attach each with four 4/40 x 1/2" screws (arrows). The data panel slides into the grooves on the support pieces. The charging bay will ship already assembled. Note again the dot marker at the top inboard side of each center vent strut (green arrow).	
13. Begin assembling the utility arm carrier by attaching the charging bay strut and data panel strut *(data panel not pictured for clarity)* to the bottom of the curved arm carrier piece with four 4/40 x 1/2" screws *(not seen but indicated by red arrows).* Next, attach the two vertical uprights, maintaining the correct orientation, with four 4-40 x 1/2" screws *(not seen but indicated by yellow arrows).* Note again the dot marker at the top of the center vent strut (green arrow).	
14. Utility arm mounting. *Utility arms not included but they should be inserted during this portion of the assembly*. The steel dowel pin passes through the arm and is capped on each end by the aluminum 1/2" by 1/2" spacer. This entire subassembly is then captured in the counterbores (step 9, blue arrows) between the utility arm carrier pieces during assembly.	

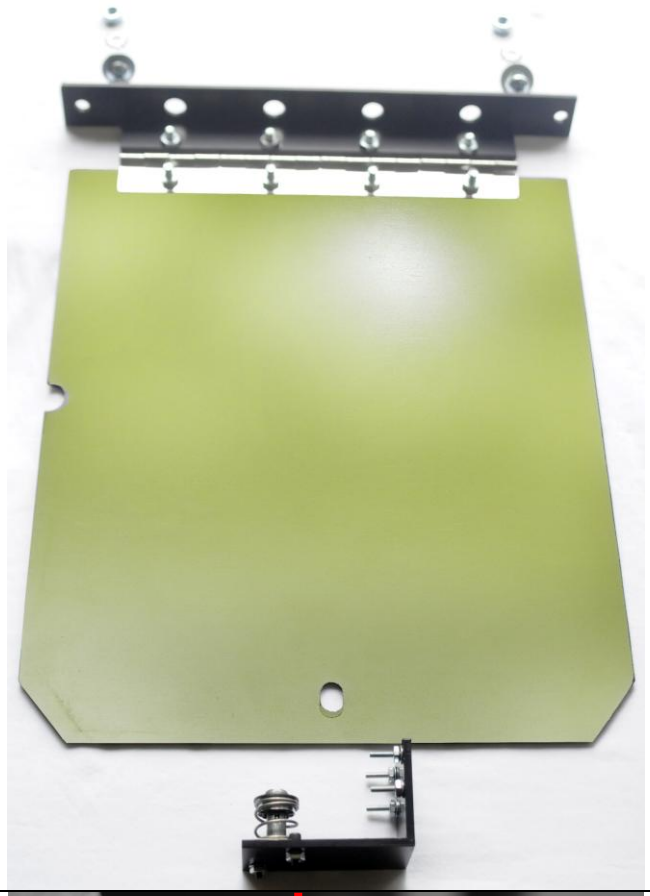
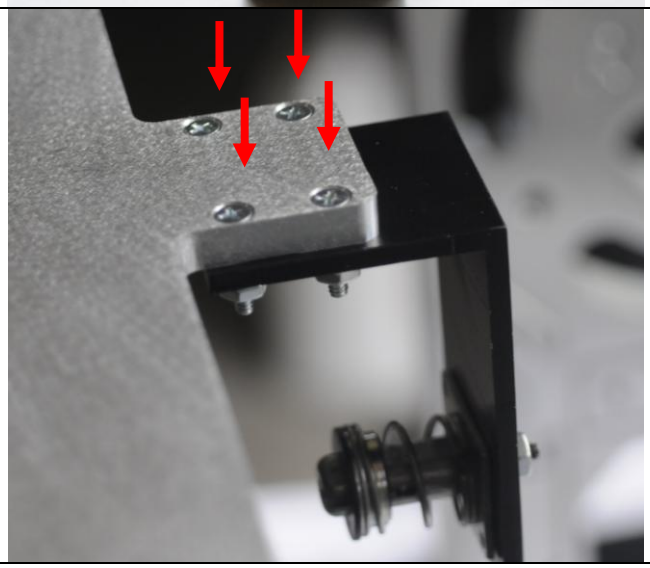
15. Utility arm carrier (data panel not pictured for clarity). Make sure the utility arms (also not pictured) are attached correctly – the upper arm hinges from the right, the lower arm from the left, when your droid is viewed from the front. The remaining curved pieces are attached as shown.

The LDP is not shown in this photo.

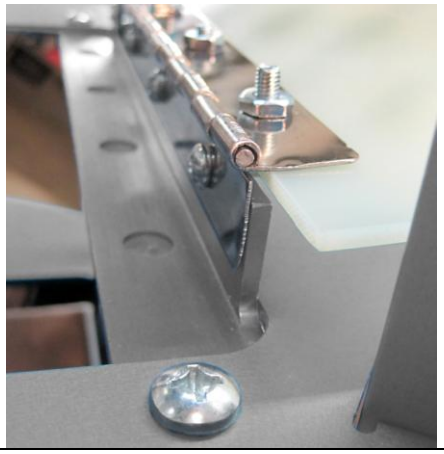
16. Utility arm carrier, with LDP, charging bay, and data port (utility arm pins removed). Final assembly. With the data panel still upside down. ☺

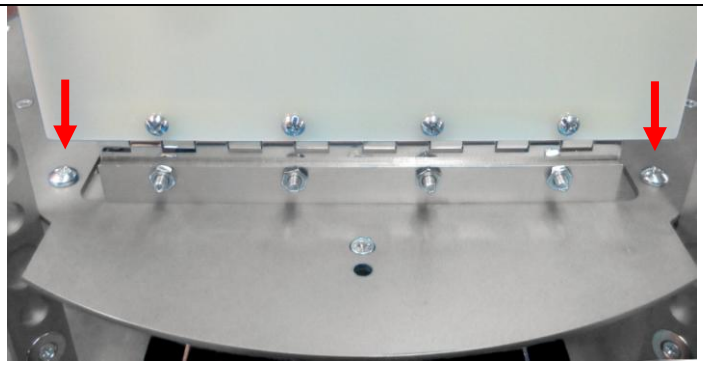
17. Install the entire utility arm carrier, LDP, charging bay and data panel assembly as shown using eight 4-40 x 1/2" flat head screws (arrows) – four through the top ring next to the LDP and four through the middle ring as shown below.



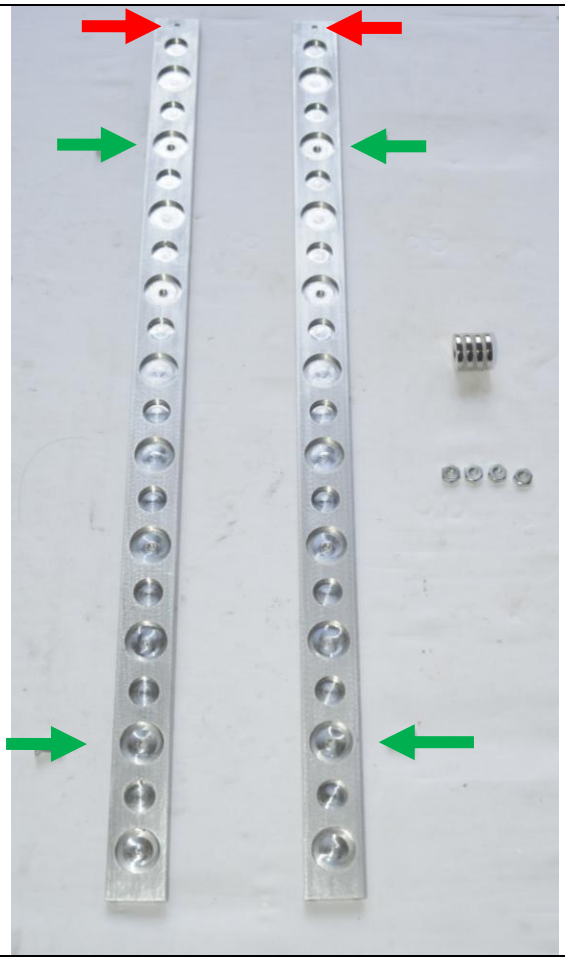
18. Option: Flip down electronics panel. This will ship partially assembled as shown. Remove the two screws and washers from the hinge bracket (top of photo) and remove the four small nuts and washers from the latch bracket (bottom of photo).	
19A. Option: Flip down electronics panel. Install the latch bracket under the top ring using the four screws, nuts and washers (arrows). The plate will lock into place and release with a push on the latch. Do not use excessive force. The latch may need realignment if excessive force is used.	

19B. Option: Flip down electronics panel. Install the hinge bracket on the bottom of the middle ring using the two pan head screws, washers, and nuts as shown (arrows). The bracket side view is shown below.

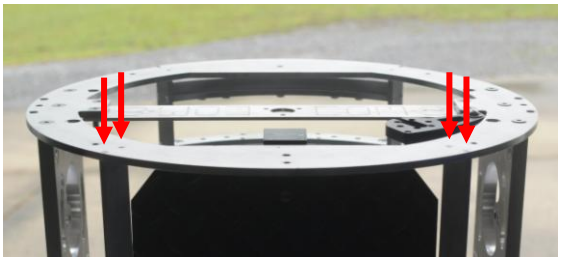


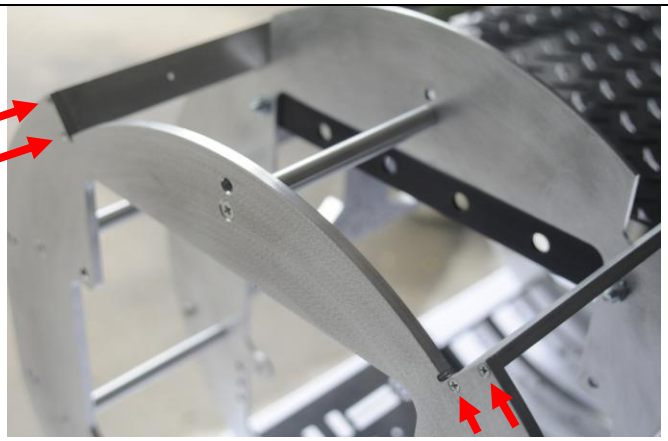


20. Door frame. The two longest straight beams will create the sides of the door frame and are the attachment points for the magnets on the frame side. Orient the beams as shown so that the small drill mark will be at the top of the frame (red arrows). In the four recesses indicated by green arrows, you will install one of the NORTH POLE magnets using a 8-32 x 3/8" flat head screw and nut. The magnets are shipped separated by plastic spacers to make handling easier. BE CAREFUL when pulling a magnet free of the stack; the pulling force is quite strong and can pinch your fingers. Make sure the magnet sits in the recess so that the countersink is visible to receive the screw as shown below.

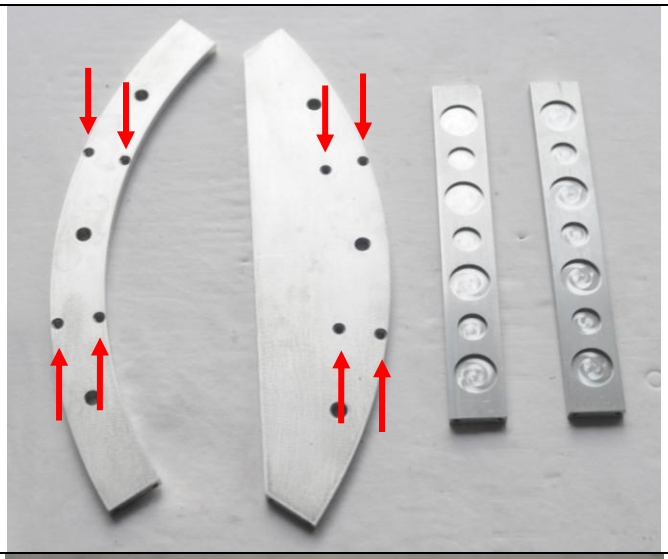


21. Install the door frame pieces using four 4-40 x 1/2” screws, two through the top ring (shown below) and two through the bottom ring (right) at the red arrows.



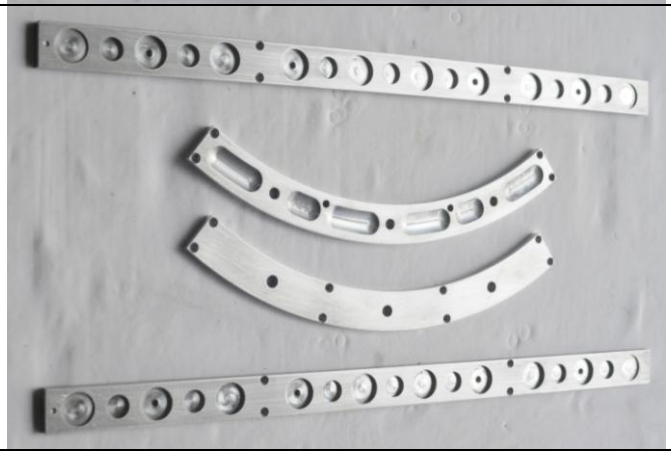


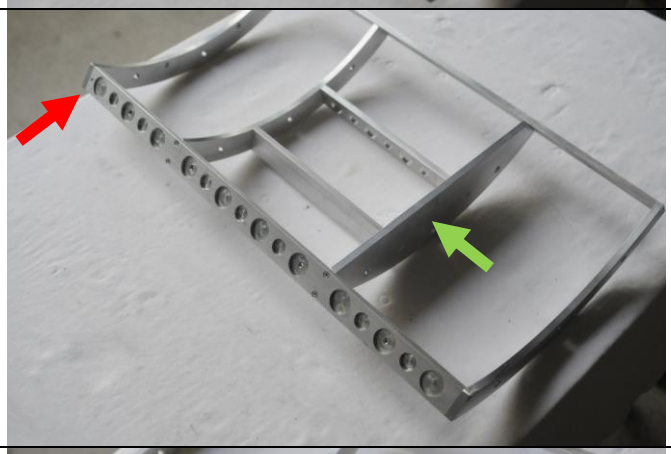
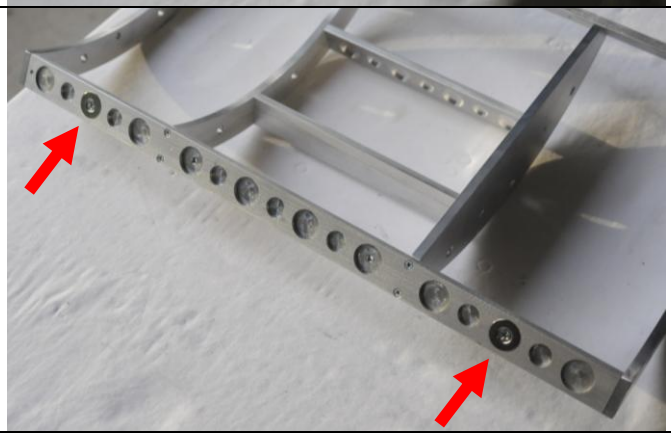
22. Rear door. Assemble the pieces shown and eight 4-40 x 1/2” flat head screws. Take note of the correct orientation for the countersinks on the two arc shaped pieces (arrows).

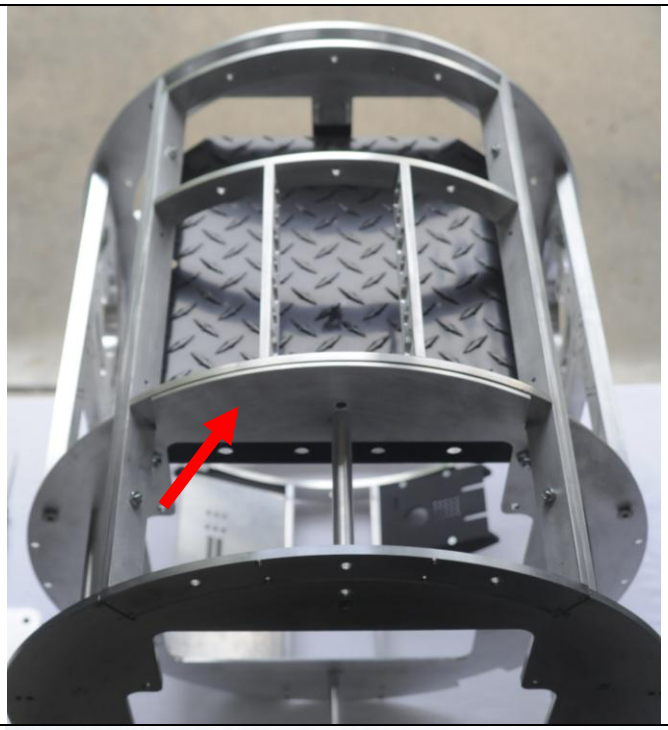
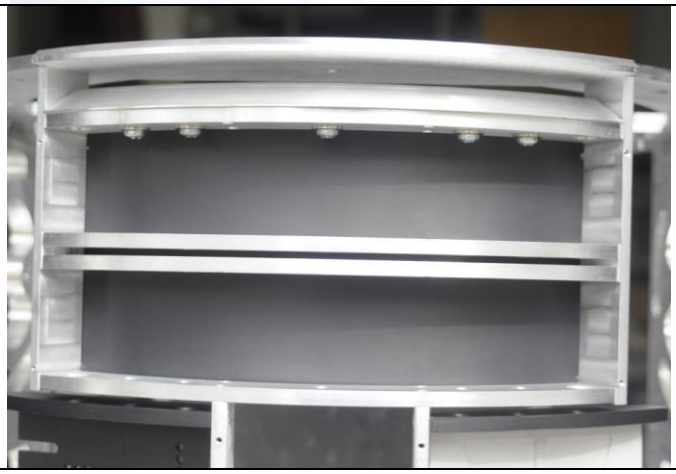


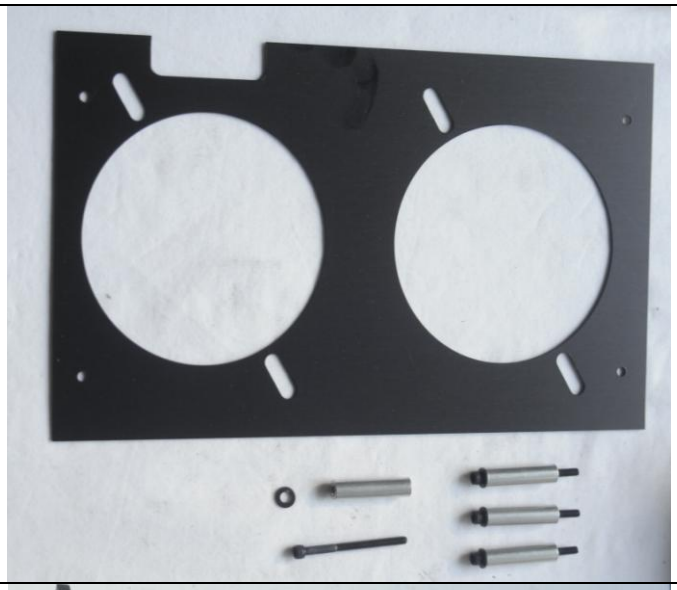
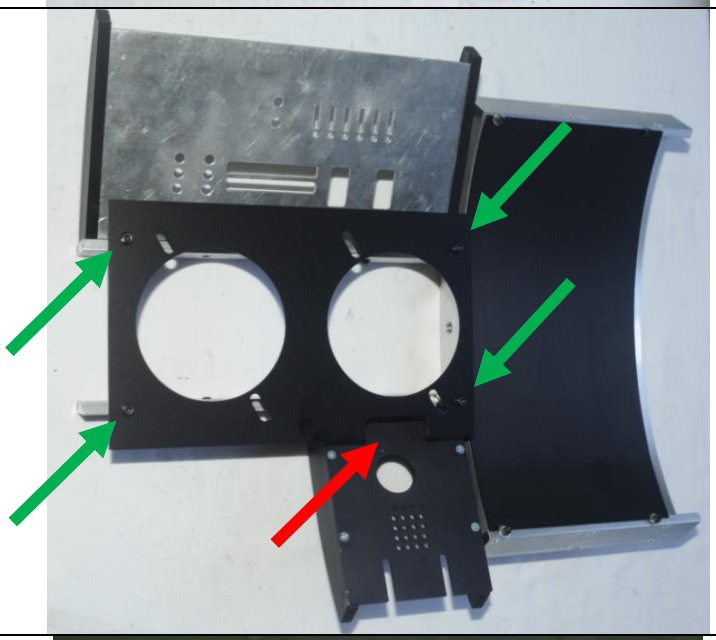
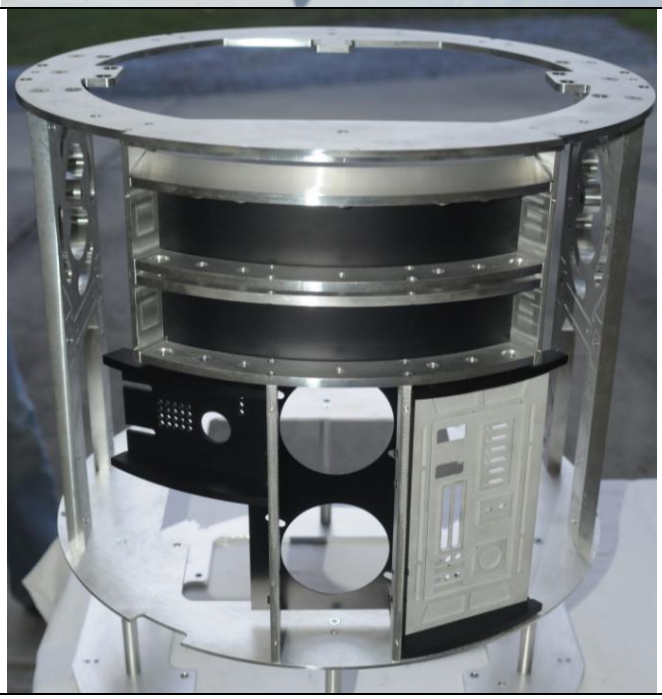
23. Rear door. First subassembly.

24. Rear door. Outer frame. Assemble the following pieces along with eight 4-40 x 1/2” flat head screws. The arc shaped piece with the relief cutouts will become the bottom of the door and provide a way to grasp the edge.



25. Rear door. Outer frame subassembly.	
26. Rear door. Assemble the first two subassemblies as shown using eight 4-40 x 1/2” flat head screws. Note the orientation of the larger arc with the flat back (green arrow) which becomes the shelf that the door rests on while attached to the frame. Keep the correct orientation in relation to the marks at the top of the door uprights (red arrow).	
27. Rear door. In the recesses indicated by red arrows, install one of the SOUTH POLE magnets using a 8-32 x 3/8” flat head screw and nut. The magnets are shipped separated by plastic spacers to make handling easier. BE CAREFUL when pulling a magnet free of the stack; the pulling force is quite strong and can pinch your fingers. Make sure the magnet sits in the recess so that the countersink is visible to receive the screw as shown.	

28. Rear door. Rear door mounted in frame. The door arc with the flat side rests on top of the middle ring for support (arrow).	
29. Option: Rolled utility bay cover. The cover hides the interior of your droid when the utility arms are extended. Attach the panel with four 4-40 x 3/8" socket cap screws with washers.	
30. Option: Rolled utility bay cover. Shown installed from the front of the frame. See below for photo of the back side (with speaker mount).	

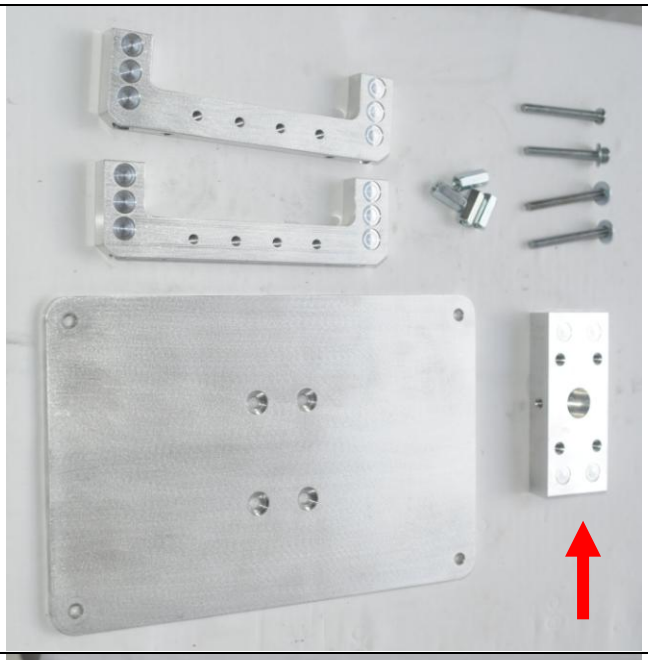
31. Option: Speaker mount. The notch on the side of the panel provides clearance for the charging bay connector adjacent to it and should face the droid's right leg. The mount is attached using the long 4-40 socket cap screws and washers. Insert the screw through a washer, through the speaker plate, through a standoff, and into the frame. See next photo for more detail.	
32. Option: Speaker mount. Shown installed from the inside of the utility arm carrier for clarity. The rolled utility bay cover is also seen. Note the orientation of the notched side of the speaker mount for the charging bay socket (red arrow). The four mounting screws for the speaker plate are indicated by green arrows.	
33. Option: Speaker mount. Utility arm carrier and speaker mount shown installed in frame. Good looking frame!	

34. Option: Center foot and skirt mount.

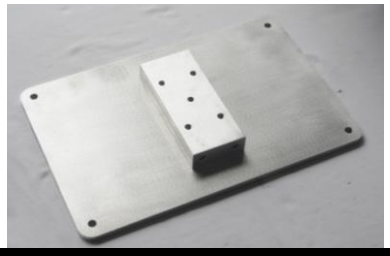
The block of aluminum pictured at far right is the center ankle mount (red arrow). The narrow ends of the block on the left are drilled and tapped for mounting screws for club center ankles.

The U-shaped frames will secure the skirt to the bottom of your frame.

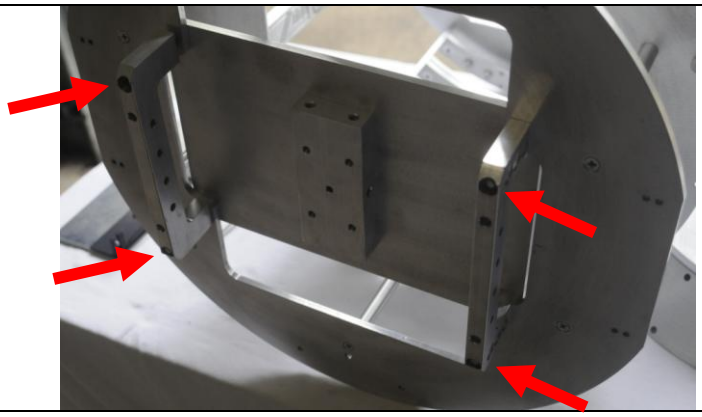
Assemble the block to the plate with the central bored space facing the plate. Use four 1/4-20 x 3/4" flat head screws.

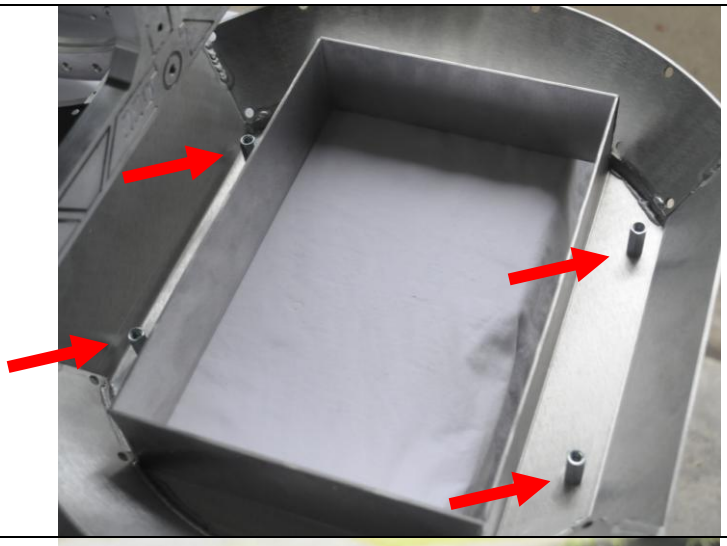
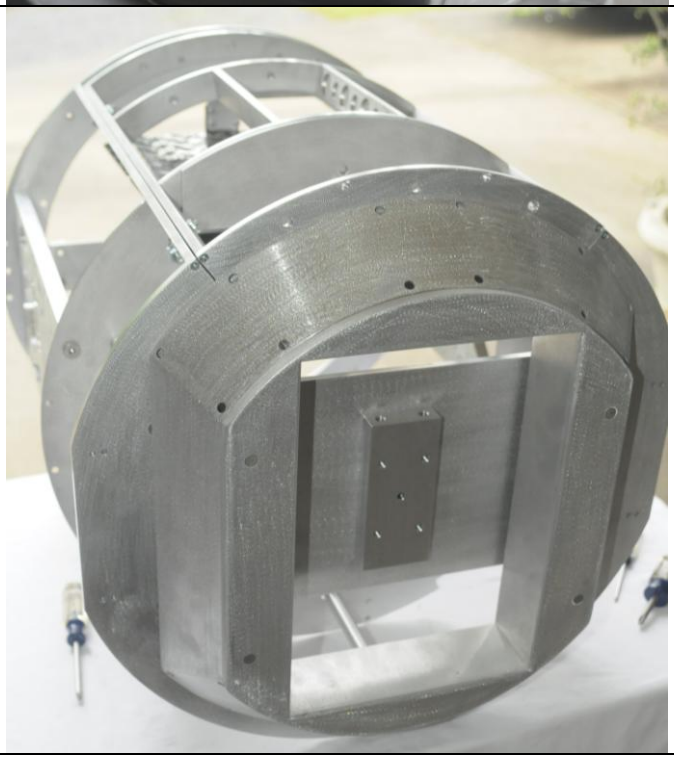
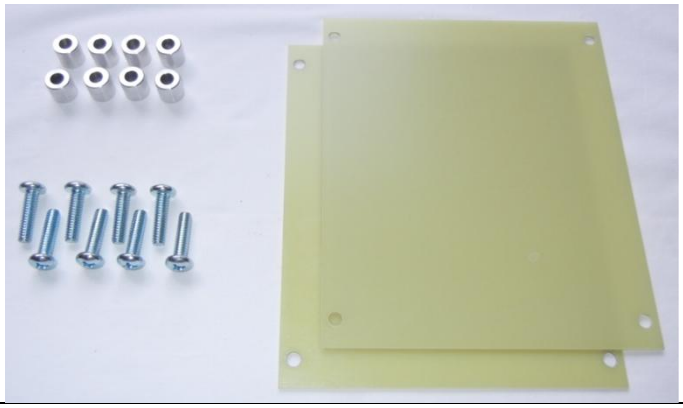


35. Option: Center foot and skirt mount.
Center foot mount shown assembled, top and bottom.



36. Option: Center foot and skirt mount.
Center foot and skirt mounting. The long 1/4-20 x 2" pan head screws with washers pass through the center foot plate, through the bottom frame ring, and through the U-shaped frames as shown (arrows indicate the end of each screw).



37. Option: Center foot and skirt mount. Skirt. The four 1/4-20 x 7/8” coupling nuts are shown attached to the four studs in the frame (arrows).	
38. Option: Center foot and skirt mount. Skirt installed. By aligning the coupling nuts with the recessed portion of the U brackets, the skirt should align correctly. Drive each machine screw from inside the frame to draw the skirt up to the bottom ring of the frame. If the long screws bottom out on the coupling studs before the skirt is tight, add an additional washer above the center foot mounting plate to compensate.	
39. Option: Side auxiliary electronics panels. Gather the hardware and two panels shown.	

40. Option: Side auxiliary electronics panels. Two views from inside the frame. The holes for mounting the side electronics panels are inside the leg plate of the frame. Pass the pan-head screw through the 1/2” aluminum standoff and screw each one into the frame. It is easier to place the two bottom screws first and leave them loose until the top two are in place, then tighten everything down. Repeat on the other side.

Note: If you plan to use the leg to body hubs and locking plates, wait to attach the side electronics plates until after the legs are attached. The clearance between the lowest leg pivot arc and the top of the panel is very tight and makes it difficult to get the locking plate in place.

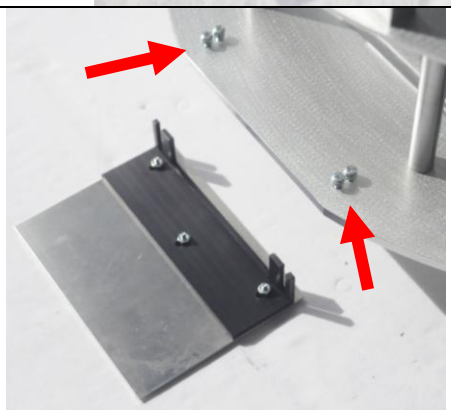
41. Option: Battery side plates. Gather the hardware shown (one plate and four screws with washers for each side). The screws are 6-32 x 3/8” pan head screws with split lock washers.

42. Option: Battery side plates.

Left photo: First, start the four screws with lock washers into the holes as shown (red arrows). Leave them loose.

Right photo: Slide the battery side plate into place under the screws and tighten. You will need a short screwdriver or offset drive.

The skin patterns include a rectangular cutout that matches the edges of these plates.



43. Option: Skin block set. The skin blocks ship with all necessary hardware. Gather the blocks and screws as shown.

Top: The narrow blocks with the rectangular reliefs sit above the leg hub and mount with two 10-32 x 1/2” flat head screws down through the top ring.

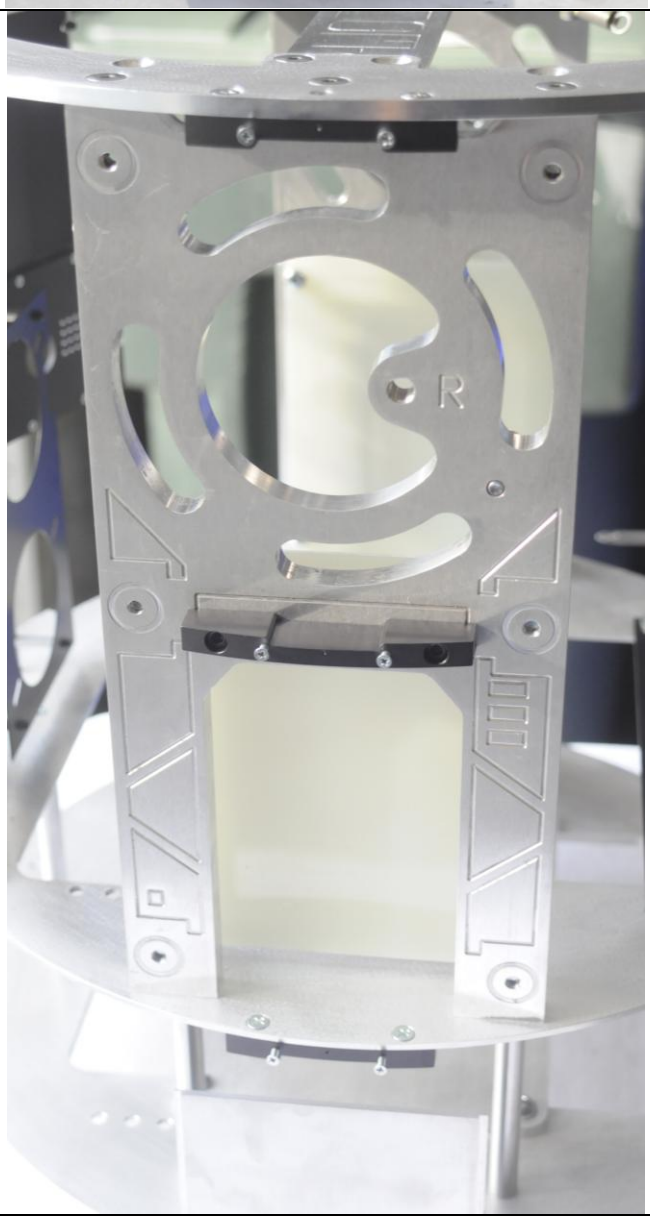
Middle: The wider blocks drilled to accept the 10-24 x 3/4 socket head screws sit below the leg hubs and mount to the leg plate. The notch should be positioned upward to provide clearance for the hub.

Bottom: The narrow blocks with rectangular reliefs attach with two 10-32 x 1/2” flat head screws down through the middle ring. These are the same as the top blocks.

44. Option: Skin block set. Skin blocks are shown installed from top to bottom. Note the orientation of the rectangular cutouts on the top and middle blocks, which provide space for the hub to rotate.

Once you have skins for your droid, refer to the Supplemental Build Notes at the end of this instruction set for advice on mounting the skins. You will use the 4-40 x 3/8” screws (shown screwed into place – 2 per skin block) that shipped with the skin blocks to anchor your skins in place.

See supplemental build notes for skin attachment advice.



45. Option: Leg mounting hubs and leg locking plate. Gather the pieces shown. This is all of the hardware for one side.

Shown here are the shoulder hub, the shoulder locking plate, four 3/8-16 x 2.5" shoulder bolts (2" shoulder), four 3/8 flat washers, four 3/8-16 nylon-insert hex locknuts, four 1/2" shaft diameter bronze bushings (1/2" long, 5/8" outer diameter), and four custom made plastic spacers (ID 1/2").

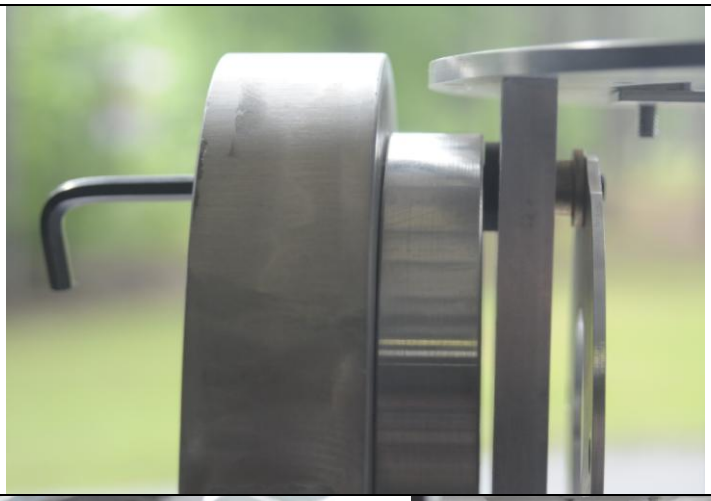
This mounting system is made to work with WORR or comparable club legs (available separately), which are shown with this instruction set. If you are using different legs, you may have to adapt your legs to use this mounting system.

46. Option: Leg mounting hubs and leg locking plate. Insert the shoulder screws through the leg and shoulder hub as shown.

Place one plastic washer over each shoulder screw as shown.

47. Option: Leg mounting hubs and leg locking plate. Advance the shoulder bolt through a brass bushing in the frame as shown (the Allen wrench indicates the head of the shoulder bolt inside the leg). The flange of the bushing is oriented toward the interior of the droid. Start the shoulder bolt into the threaded holes of the locking plate.

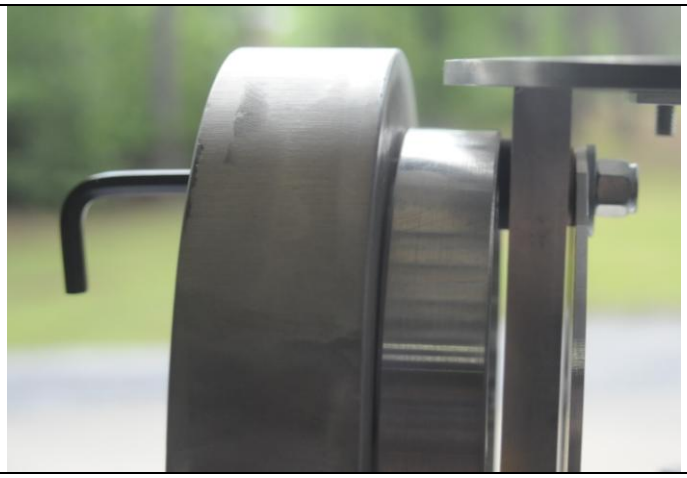
See the following steps for clarity before beginning!



48. Option: Leg mounting hubs and leg locking plate. Inside view of leg and shoulder. The brass bushings and shoulder bolts are shown in the left photo. The red arrow indicates the tapped hole for the leg brake.

In the right photo, the leg locking plate has been added. Make sure the arc-shaped cutout faces down and to the rear of the droid to align with the threaded hole for the leg brake (red arrow).

49. Option: Leg mounting hubs and leg locking plate. The leg locking plate is threaded for the shoulder screws, so you will need to advance each screw 1-2 turns, then move to the next one, gradually pulling the plate down onto the screws. Once the screws are completely seated on the locking plate, add the washer and nyloc nut to lock everything together as shown.

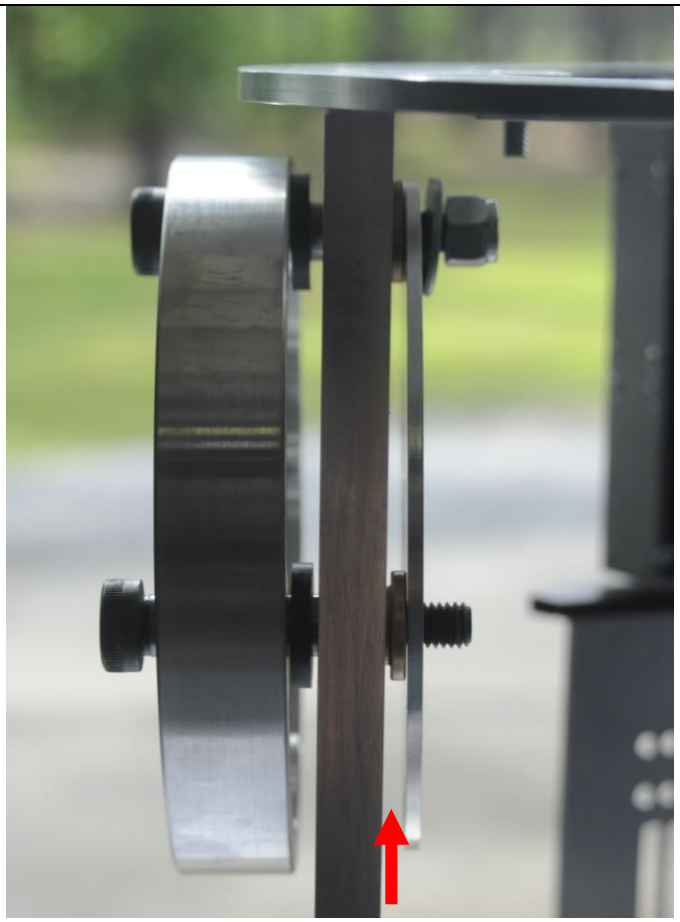


50. Option: Leg mounting hubs and leg locking plate. The photo shows the order of hardware without the leg for clarity. At top, the shoulder bolt passes through the hub, plastic spacer, frame, brass bushing, locking plate, washer, and nylon locknut.

The lower shoulder bolt has the washer and locknut removed.

In the photo below, the correct location of the leg brake is shown without the leg for clarity.

The brake consists of a bolt, fender washer, and custom plastic spacer. The plastic spacer should sit between the frame and leg locking plate in the space indicated by the red arrow. The fender washer and bolt then pass through the leg locking plate, through the plastic spacer, and screw into the frame.

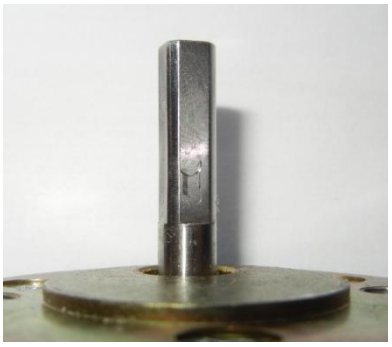


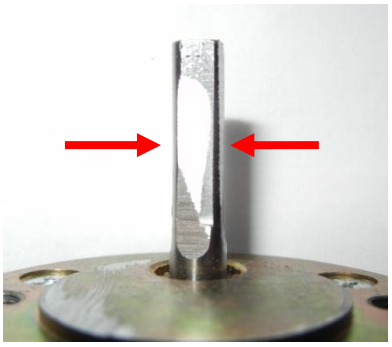
51. Option: Dome motor mount bracket and wheel. This set is for the Pittman motor shown. If you use a different motor such as the Banebot, you will need a different bracket (also available). (Your dome drive may ship already attached to the frame bracket – if so, proceed to the next step).

Gather the hardware shown. The mounting hardware comes with the bracket. The set screws for the wheel are 10-32 x 1/4” socket head set screws.

52. Option: Dome motor mount bracket and wheel. The shaft needs two flat faces on opposite sides to match the two set screws that hold the wheel onto the drive shaft. Grind the two faces of the drive shaft as close as possible to the housing as shown. The set screws need a flat surface to prevent slipping. When the wheel is installed it will sit right on top of the housing.

Left photo: Before grinding
Right photo: After grinding – the new flat faces are indicated by the red arrows.

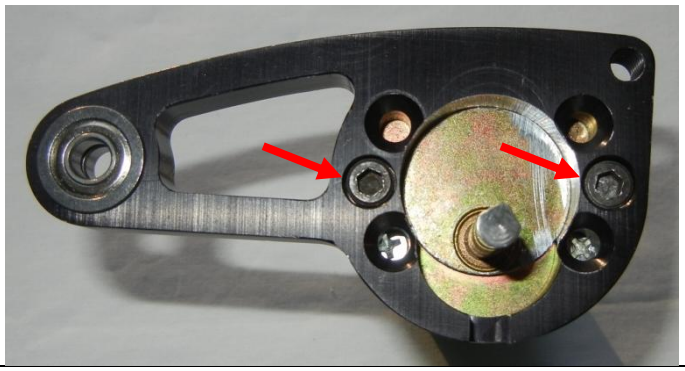




53. Option: Dome motor mount bracket and wheel. Insert the socket cap screw through the extension spring and into the corner of the motor brack from the bottom (the side without the countersinks) as shown.

54. Option: Dome motor mount bracket and wheel Attach the bracket to the motor housing using the two 10-32 x 1/2" socket head cap screws provided (red arrows).

Note the alignment of the drive shaft relative to the bracket. If you need the wheel closer to the Rockler bearing, you can reverse this orientation.



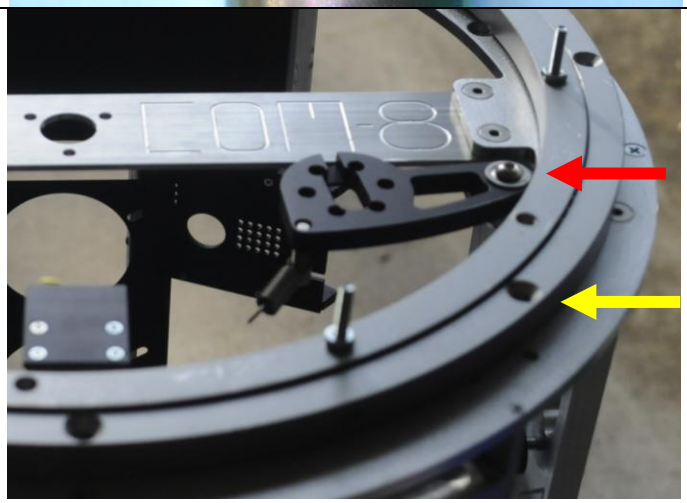
55. Option: Dome motor mount bracket and wheel. Start the two 10-32 x 1/4" set screws into the dome drive wheel as shown (yellow arrows).

56. Option: Dome motor mount bracket and wheel. Attach the drive wheel to the axle. Make sure you align the flat portions of the axle with the set screw holes. The wheel should ride just above the motor bracket as shown.

The motor bracket has a notch (red arrow) for access to the set screws. Tighten the set screws.

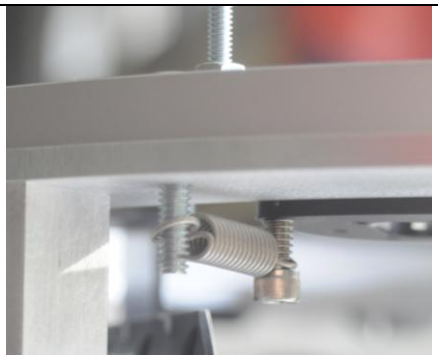
57. Option: Dome motor mount bracket and wheel. This photo shows the motor mount without the motor attached, for clarity. Make sure your drive wheel is attached first (it is very difficult to turn the set screws after the bracket is mounted to the frame). The bracket can be removed by backing out the pan head screw shown by the red arrow. The dome bearing is shown installed (see supplemental instructions for more detail).

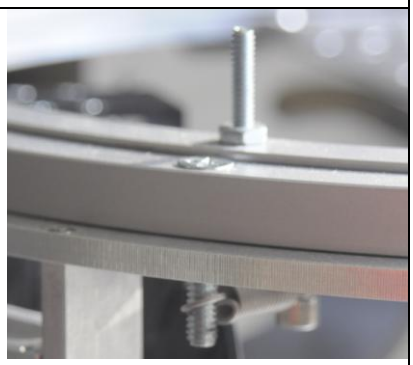
The yellow arrow indicates the hole for the dome bearing that will also anchor the extension spring for the dome drive bracket. This screw is a 1/4-20 x 1.5" flat head screw. The extra length will pass through the top ring to the next step…

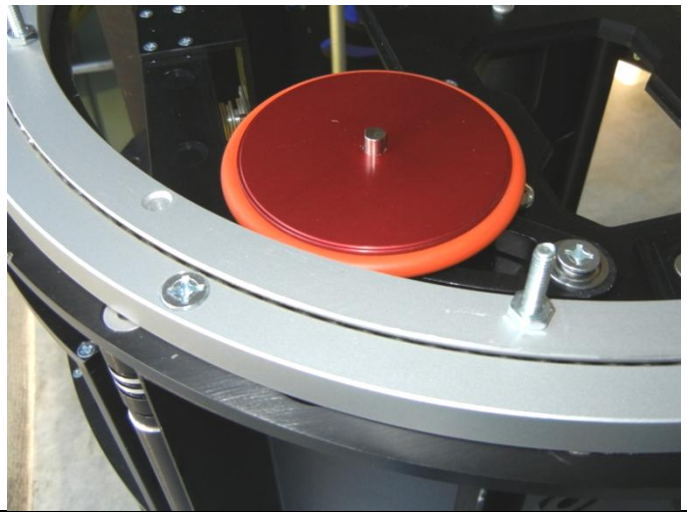
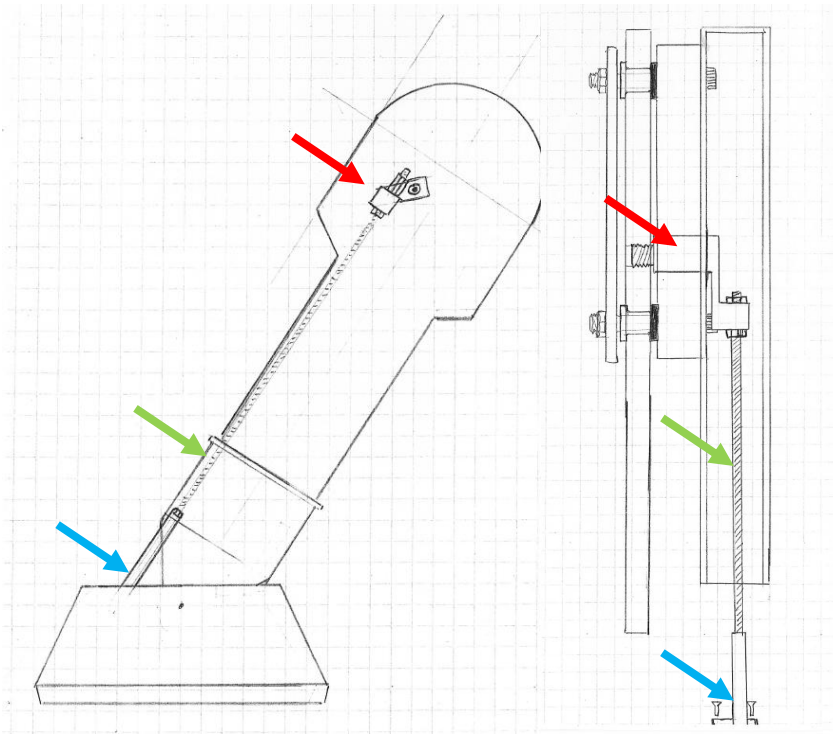
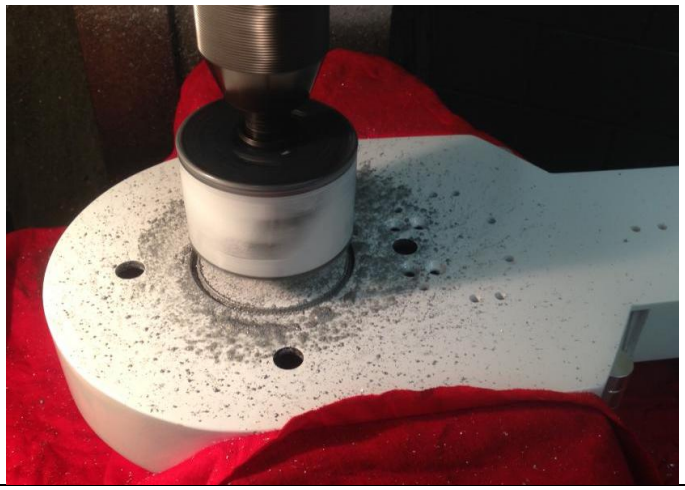


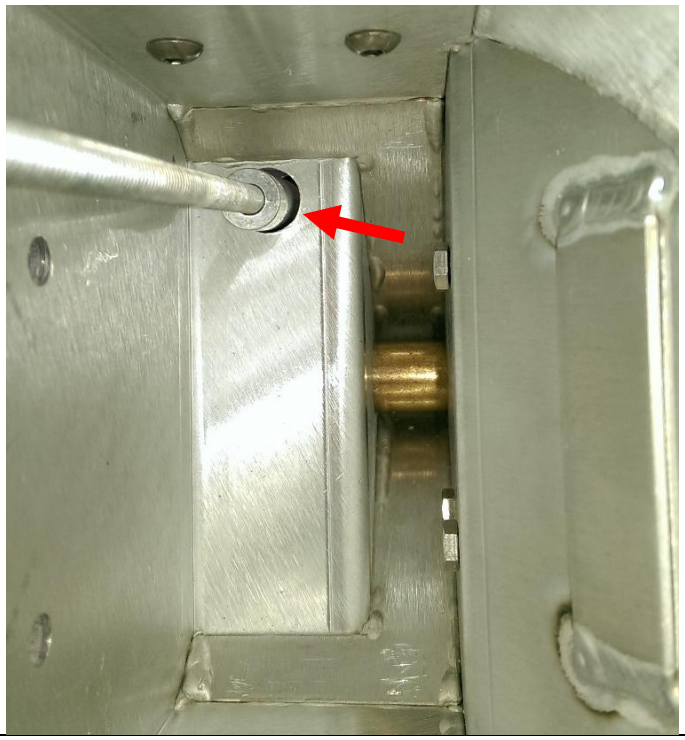
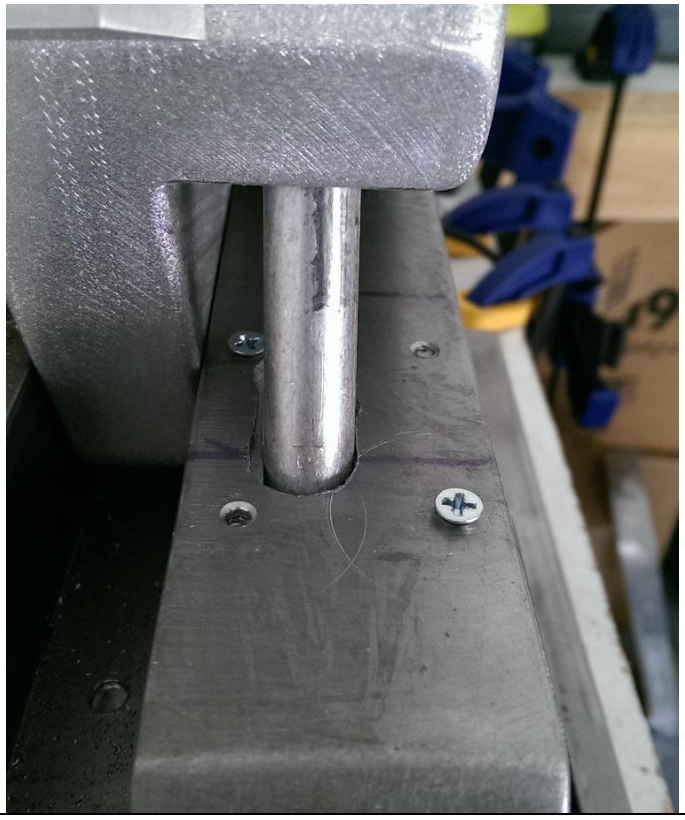
58. Option: Dome motor mount bracket and wheel. Make sure the extension spring loops around the 1/4-20 x 1.5" flat head screw as shown once the dome bearing is installed.

Left: view from under top ring
Right: view from above top ring and bearing



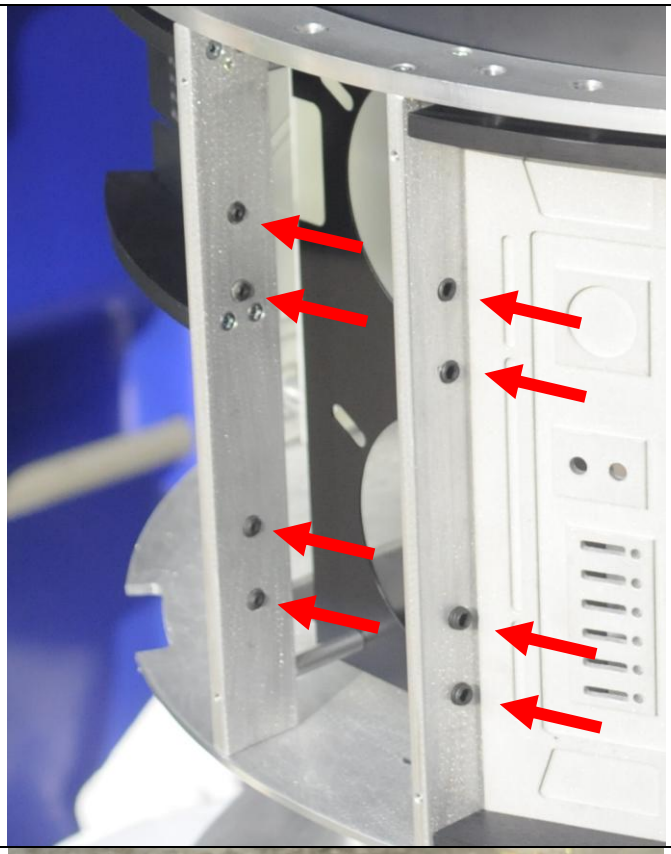


59. Option: Dome motor mount bracket and wheel. Final assembly view. If desired, you can trim the excess length from the axle of the Pittman motor to make it flush with the drive wheel to provide clearance for a dome plate, if you use one. (Frame pictured is not CSR)	
60. Option: Ankle lock rods. This schematic shows the rods installed from the side and in profile. Each ankle bracket (red arrow) is labeled L or R for left or right. The ankle lock rods (green arrow) are threaded rods that will connect to the brackets and ankle blocks. The ankle blocks (blue arrow) are inserted under the foot shells. An opening in the top of the foot shell allows the block to connect to the ankle lock rod. See following steps.	
61. Option: Ankle lock rods. Some legs will need to have a 3” circular opening cut into the panel closest to the body. The opening is centered around the original pivot point opening. Use a hole cutter and drill press to make sure the cut is clean and perpendicular to the leg. The L-shaped brackets will be bolted to the frame through this opening once the legs are attached.	

62. Option: Ankle lock rods. The interior of a WORR ankle is shown. The ankle lock rod will require a hole in the ankle (red arrow) toward the rear of the droid, through which the ankle block from the foot will pass to connect to the threaded rod.	
63. Option: Ankle lock rods. This view from the rear of the foot shows the ankle block rod coming up through the top of the steel foot and passing into the WORR ankle. The centerline of the ankle lock rod is 1.750" to the rear of the droid from the centerline of the pivot point of the foot. The four screws are holding the ankle block in place under the foot shell. The opening is oval, not circular, to allow movement of the rod between 2 and 3 legged mode. The slot should be about 9/16" wide x 3/4" long. Once the connections are made, adjust the length of the threaded rod to maintain a 90 degree angle with the foot when the droid is in two-legged mode. This adjustment will require trial and error and will be made by adjusting the nuts at the ankle bracket (red arrow in first diagram, step 78).	

64. Option: Center vent mount. The set screws are included to install the center vent set available separately. The eight 1/4-20 x 3/8” socket head set screws are indicated by the arrows.

Now if someone would just turn that data panel right side up…

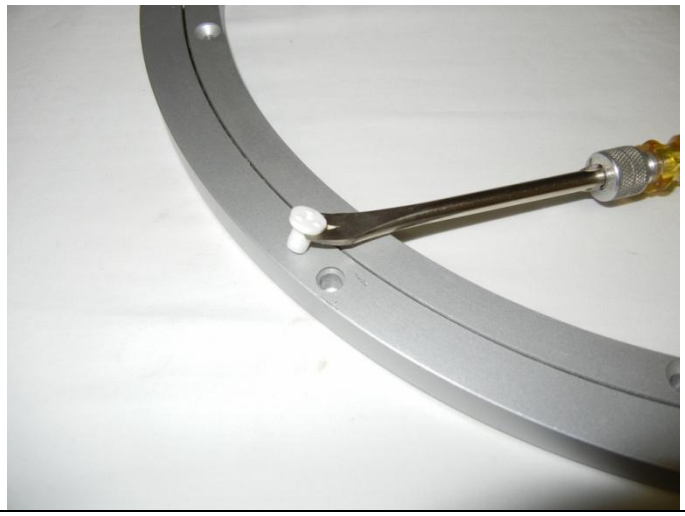


65. Finish. Now step back and admire that awesome frame!

Supplemental Build Notes – Com8 CSR Astromech Frame

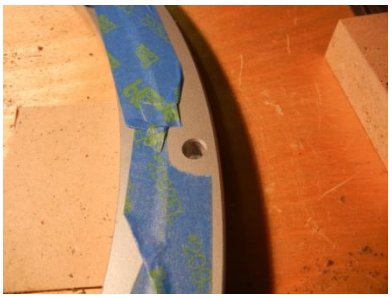
Rockler Bearing

This is the recommended solution for attaching the dome to the body. It is driven by the dome motor. The recommended part is the McMaster Carr part number 18635A54, the 17.4" diameter turntable with 275-pound capacity.

1. Rockler bearing prep for attaching to Com8 CSR frame. Left photo: The top of the bearing as used for the droid. The inner race (ring) has the plastic feet upright. Right photo: The bottom of the bearing. The outer race has the plastic feet.	 
2. Remove the plastic feet. This prying tool was very useful but pliers work too. Be careful not to scratch the surface of the bearing.	
3. Tape over the races on both sides with blue painter's tape. This will keep aluminum shavings out of the ball bearings inside the turntable.	

4. The outer race holes for the feet need to be drilled through completely. Use a 1/4” drill and drill the rest of the way through from the bottom.

Left photo: Before
Right photo: After

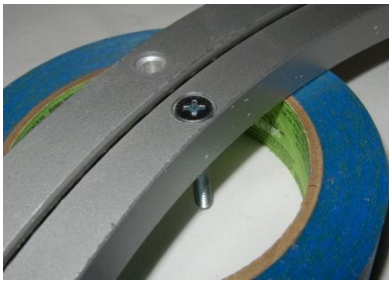



5. **Turn the bearing over!**

From the top, use a 5/8” 82-degree (or 41-degree, same thing) countersink bit (shown) to countersink the outer race holes for mounting. The finished countersink should allow the 1/4-20 x 7/8” flat head screws to sit flush with the surface of the outer race.


6. **Turn the bearing over again!**

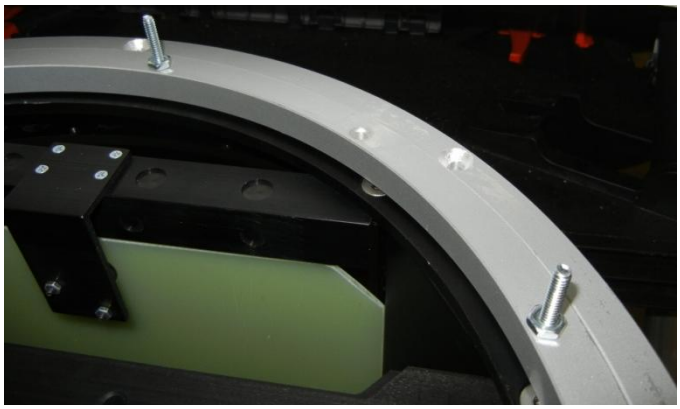
The countersinks on the inner race may need to be fixed with the countersink bit. In this case, they were already a perfect fit for the 10-24 x 1.5” flat head screws so no adjustment was required. The right photo shows one of these screws inserted through from the bottom of the inner race.

7. **Turn the bearing over one more time.**

Place six of the 10-24 x 1.5” screws through the inner race from the bottom and add a 10-24 hex nut to each one to hold it in place. These will be the mounting points for your dome. Holes in the plastic ring of the dome should line up with these screws. With the dome in place, you can use a pair of 10-24 wing nuts and reach in through the open rear door to lock the dome in place if needed.

If the dome ride height needs adjustment, you can add washers or additional hex nuts to these screws.

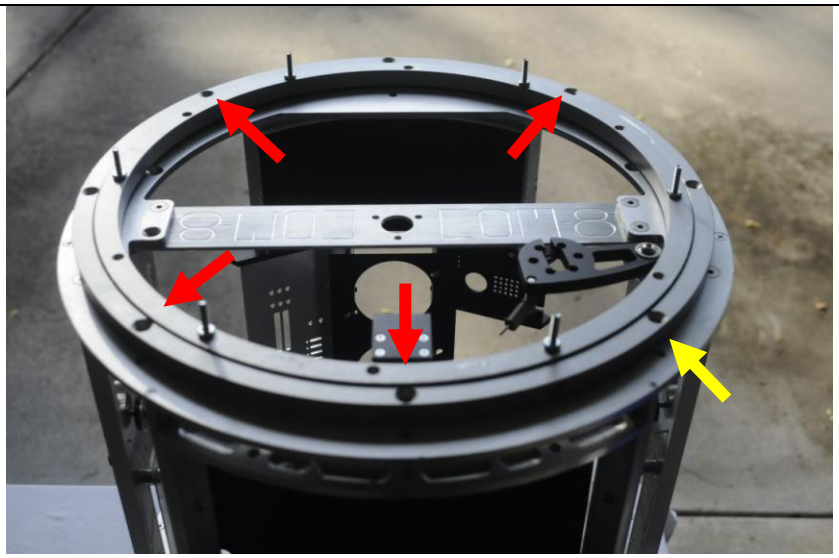


8. To attach the bearing to the frame, use 1/4-20 x 7/8" flat head screws. These may have to be specially ordered (McMaster Carr part number 90273A541). You will need four total. You also need one 1/4-20 x 1.5" flat head screw.

The four 7/8" long screws go in the holes marked with a red arrow. The front of the droid is toward the top of the picture.

The single 1.5" long screw is used in the hole marked with a yellow arrow. The extra length will pass through the cutout in the bread pan and provide an anchor point for the extension spring with the dome drive bracket (see instructions).

Sand the inner face of the inner race to give the drive wheel more traction. Some builders also replace the ball bearings with acetal bearings and polish the bearing runs inside the races. Check out the astromech.net forums for details.

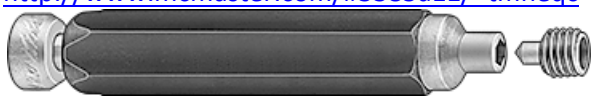


Power Coupler

The club CSR power coupler is made to fit this frame. The hole pattern is already drilled and countersunk from the bottom to fit. The mounting should be very secure.

Skin Mounting

I recommend you first bond your inner and outer skins together with clear silicone. Use a bunch of little clamps to squeeze them tight. Clean up all of the squeezed-out silicone. Start with rear skins first. You may have to tweak the fit left or right to get the rear door opening right. I have found the skins are not super accurately cut, and the rear door opening is not always dead center. Keep testing your fit until you get it right. Then, find this tool at McMaster Carr (part number 3385A11):
http://www.mcmaster.com/#3385a11/=tmneqc



This is a 4-40 threaded-hole-location transfer punch. This set comes with six pointed set screws in the tool handle, which doubles as a wrench. Screw each set screw into the rear holes of each skin block with the point protruding about 0.010 inches (10 thousandths of an inch). Use bungee cords or straps to hold the rear skin tightly to the frame (don't attach the front skins during this step).

Tap above each set screw with a light hammer blow to transfer the hole location to the skins. Remove the skins and drill each hole from the inside with a 0.106" drill bit. Don't countersink the heads yet. Remove the transfer punches.

Reattach the rear skins with the 4-40 x 1/2” screws. Repeat this process for the front skins but leave the rear skins in place so you get a good fit along the seams. The large data port can be tricky so keep test fitting until you get it right. Once the skin fits, replace the transfer punches into the front holes of the skin blocks, put the skins in place with bungee cords or straps, and repeat the marking process. Remove the skins and transfer punches.

Again, drill the holes and remount the skins using 4-40 x 1/2” but don’t countersink the heads yet. There is still some room to adjust the holes with a Dremel or rat-tail file if needed. Once the holes are all confirmed, use a countersink bit (41 or 82 degree – same thing, but not a 45 or 100 degree bit) to countersink each hole.

Go slowly! If the countersink is too large, you have ruined that attachment point for your skins. Remember that the direction of the hole for the 4-40 x 1/2” screws is not directly at the center of the circular frame but perpendicular to the flat surface of the leg mount plate.

For more details and pictures, see this thread:
http://astromech.net/forums/showthread.php?p=220519#post220519

And these two posts in particular:
http://astromech.net/forums/showpost.php?p=220518&postcount=9
http://astromech.net/forums/showpost.php?p=220519&postcount=10

Hardware

This is a partial list of some of the more common hardware needed for this frame and some accessories. The part number for the hardware is for McMaster Carr (http://www.mcmaster.com) but they are not the only source for parts such as these.

Frame assembly screws WORR ankle adapter	1/4-20 x 3/4" flat head screws	91500A540 (pkg of 25)
Utility arm carrier	4-40 x 1/2" flat head screws	91500A128 (pkg of 100)
Utility arm carrier rolled cover Rolled cover to side vents Rolled cover to pocket vents	4-40 x 3/16" pan head screws	91735A101 (pkg of 50)
Power coupling bracket Flat side battery plates	6-32 x 3/8" pan head screws with split washers	96909A446 (pkg of 10)
Skin blocks	10-32 x 1/2" flat head screws for frame attachment (top and bottom blocks) 10-32 x 3/4" socket cap head screws for frame attachment (middle block) 4-40 x 3/8" flat head screws for skin attachment	91500A242 91251A245 (pkg of 100) (see utility arm carrier)
Large Data Port (David Shaw) Horseshoe to shim Under shoulder details, new style	10-32 x 3/8" pan head screws	91735A827 (pkg of 50)
Rockler bearing to frame	1/4-20 x 7/8" flat head screws plus 1/4-20 x 1.25" flat head screw (one)	90273A541 (pkg of 100) 91500A544 (pkg of 10)
Rockler bearing to dome ring	10-24 x 1.5" flat head screws	90273A251 (pkg of 100)
Center vent set screws	1/4-20 x 3/8" socket head set screw (used to be 10-32)	94105A535 (pkg of 50)
Horseshoe shim to WORR leg	8-32 x 1/2" flat head screw	90273A194 (pkg of 100)
Leg strut to ankle bracelet Shoulder buttons Booster covers to WORR leg	10-32 x 1/2" pan head screw	90272A829 (pkg of 100)
Hydraulics	10-32 x 1/2" flat head screw	90273A829 (pkg of 100)
Knurled hose fittings	5/8-18 threads	
Ankle details	10-24 x 3/8" flat head screw	90273A240 (pkg of 100)
Octagon port, new style	Metric screw	
Radar eye, new style	Metric screw	
Leg and shoulder hardware	1/2" shoulder bolts, 2.0" shoulder, 3/8-16 thread (quantity 8)	91259A720
	1/2" shaft diameter bronze bushings, 1/2" long, 5/8" outer diameter (quantity 8)	6338K418
	3/8-16 nylon-insert hex locknuts (quantity 8)	90630A121
	3/8 flat washers (quantity 8)	91081A130
Leg hubs	1/2-13 x 2.0" socket head screws	
Dome drive O-rings	Old version 1/8 x 2.5 x 8" inner diameter	9464K231
	New version 1/4 x 2.1 x 2" inner diameter	9452K233