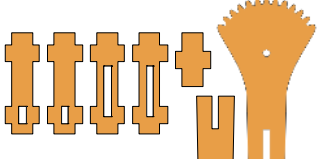# S2 Marauder Assembly Instructions

Kit Contents

Part	Illustration (not to scale)	Quantity
Large Wooden Side Pieces		1 ea. Port side 1 ea. Starboard side
Bag of Small Wooden Pieces		2 ea. Small-slot bulkhead 2 ea. Large-slot bulkhead 1 ea. No-slot bulkhead 1 ea. Mount crosspiece 1 ea. Toothed mount
Bag of Plastic Pieces		1 ea. Small nylon spacer 1 ea. Cam 1 ea. Gear 4 ea. Washers 2 ea. Servo keepers. 1 ea. Star wheel 1 ea. Sliding escapement
Bag of Fasteners		4 ea. 4-40 x 3/8" PHMS 1 ea. 4-40 x 1/2" PHMS 4 ea. 4-40 x 5/8" PHMS 7 ea. 4-40 Hex nuts 2 ea. 4-40 Locknuts 4 ea. #4 Lockwashers 6 ea. #1 x 3/16" Type B SMS
Bag of Rubber Bands		24 ea. Size 16 rubber bands

Additional Components Required

- 1 ea. Parallax Scribbler 2 (S2) Robot (Parallax #28136 or #28336)
- 2 ea. GWS "Naro" Servos (Parallax #900-00014)

Tools Required to Assemble

- Miniature Phillips screwdriver
- ¼" nutdriver, box-end wrench, or crescent wrench

Step-by-step Instructions

1. Take each of the servos and center them to their neutral positions. The best way to do this is to apply a sequence of 1.5ms pulses, 20 ms apart from either a BASIC Stamp or a Propeller chip. If this is inconvenient to do, press one of the servo horns onto the servo, rotate it from lock-to-lock, then position it halfway between the two extremes.

2. Using the 3/8" screws, lockwashers, and nuts, attach the servos to the port-side wooden piece as shown below. Make sure that the top and bottom screws are equally snug, but **do not overtighten**.
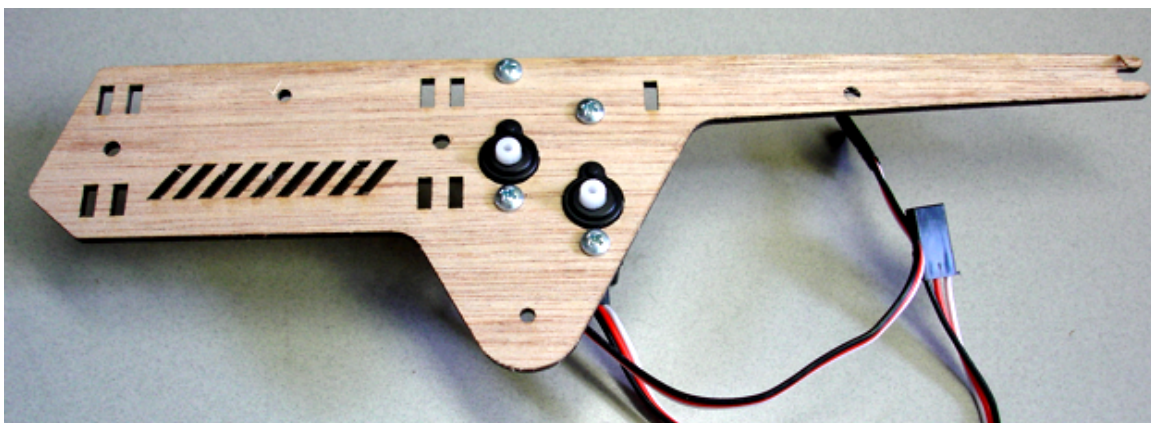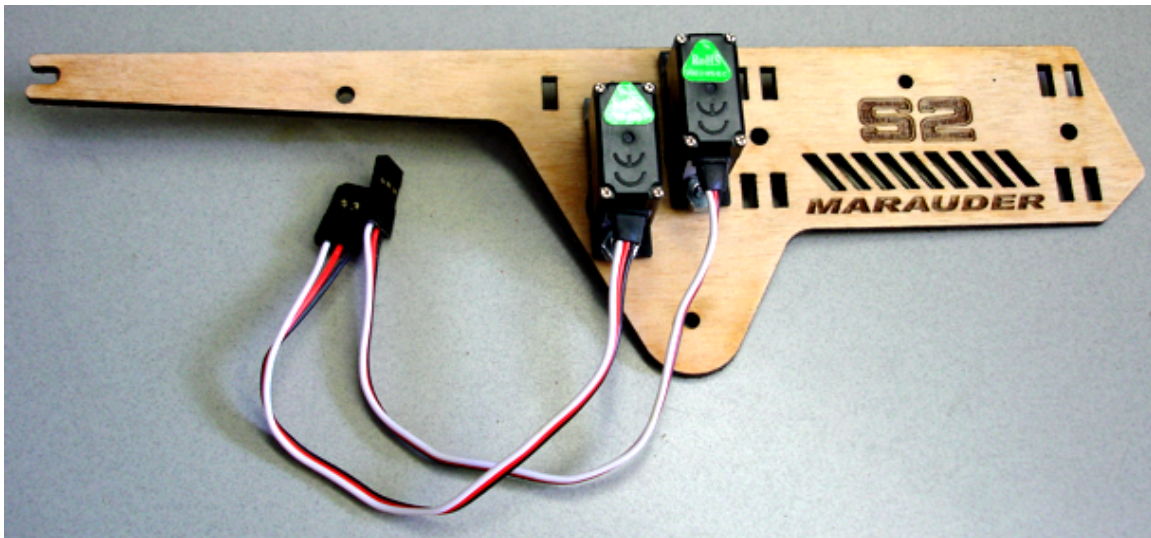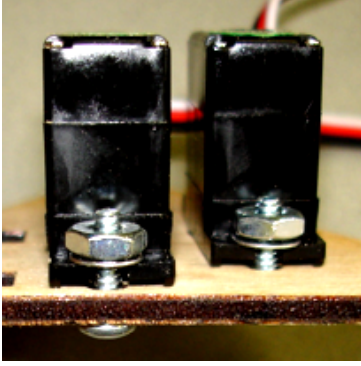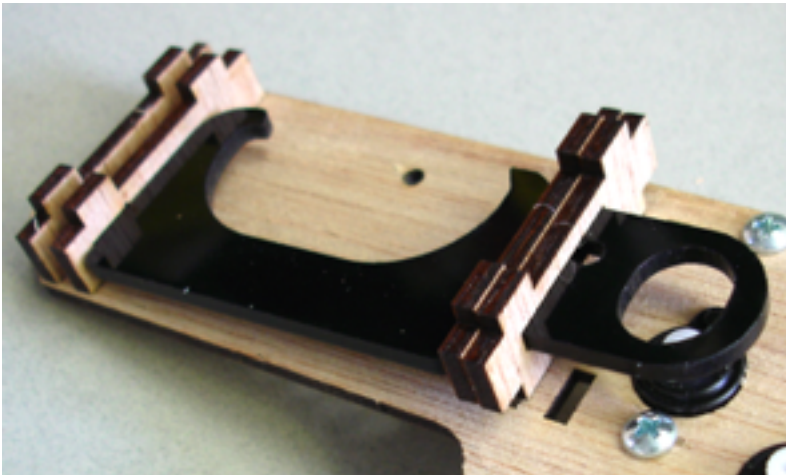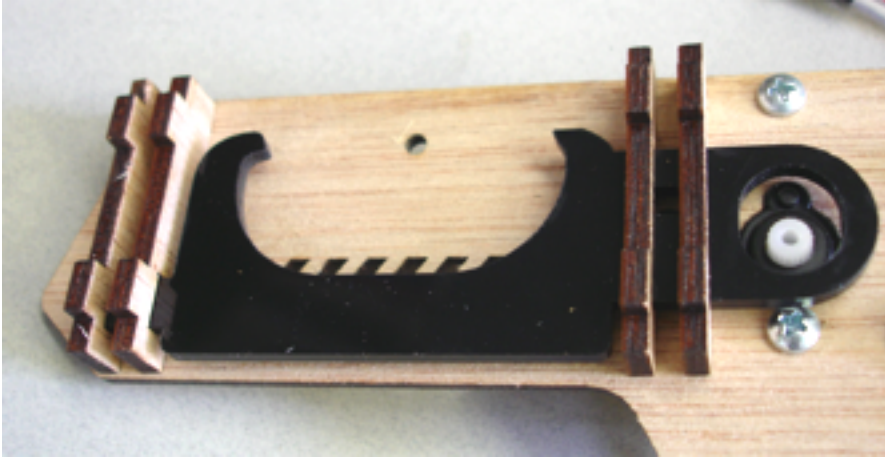
3. Press the small-slot bulkheads into the side piece, with the slots near the bottom.

4. Thread the large-slot bulkheads onto the sliding escapement, slots near the bottom, and slide the escapement into the small-slot bulkheads.
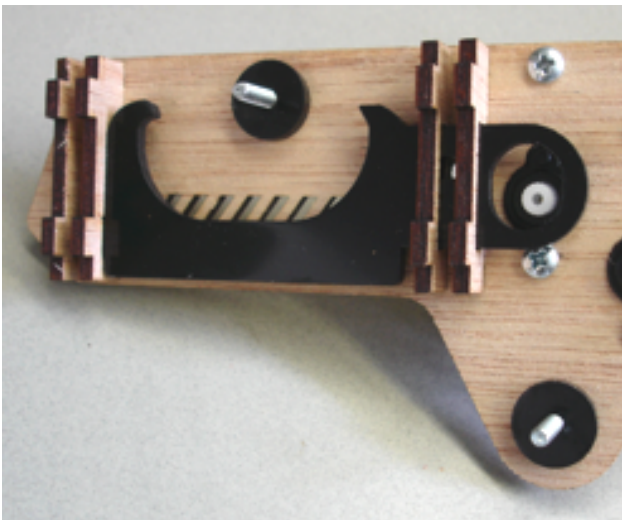
5. Position each large-slot bulkhead over its corresponding slots in the side piece, and press into place.

6. Assemble the mount crosspiece to the toothed mount, as shown.

7. Thread two of the 5/8″ screws into the side piece, as shown, and add one of the black plastic washers to each one.

8. Place the star wheel over its washer, as shown, paying careful attention to the orientation, and add a black plastic washer on top of it. Do the same with the toothed mount, making sure that its points straight down.
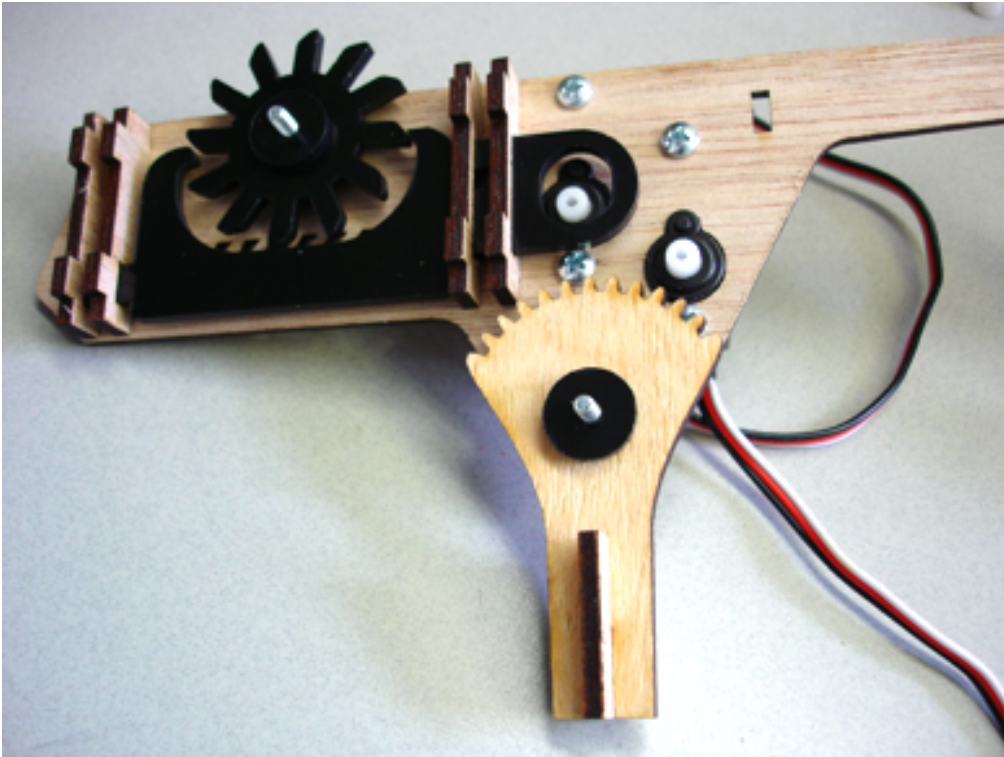
9. Using the #1 sheet-metal screws, attach the servo keepers to their corresponding cam and gear pieces.
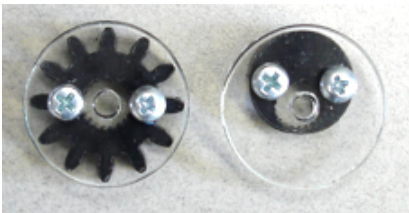
10. Using the remaining #1 sheet-metal screws, attach the cam and gear to their corresponding servos. Pay close attention to the orientation of the cam.

10a. **Special note:** If you are assembling one of the sample units or a unit won from the Parallax EXPO raffle, remove the two outer screws from the cam, leaving the center screw in place.

11. Press the small non-slotted bulkhead into its slot.

12. Position the starboard side piece over the screw tips and bulkhead tabs. Working slowly and meticulously, position each tab beneath its associated slot until they all line up and the side piece can be pressed into place. Start the two locknuts onto the two screw ends but do not tighten. Take the remaining two 5/8″ screws, thread them through the holes between the two bulkhead pairs, attach the nuts, and tighten. Now tighten each locknut, then back it off one-half of a turn. You should be able to rattle both the star wheel and the toothed mount without their binding.
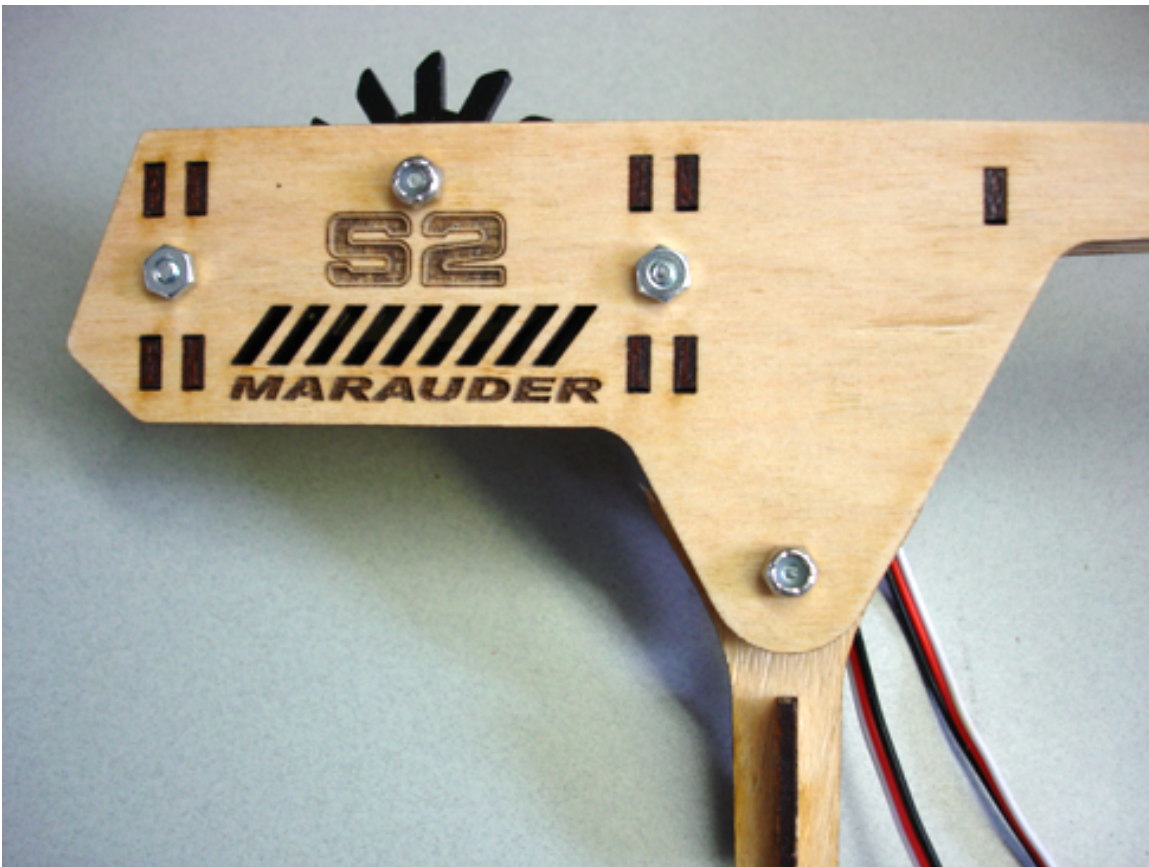
13. Install the 1/2″ screw, the small nylon spacer, and the remaining nut as shown.
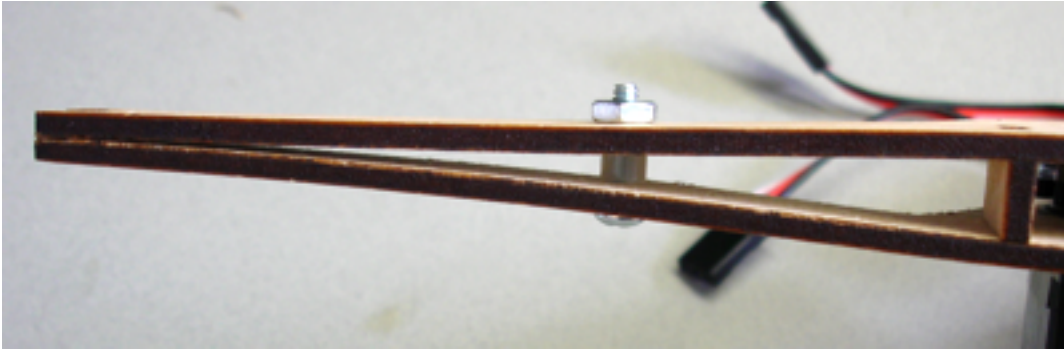
14. Align the two servo cables along the toothed mount and crosspiece, as shown.
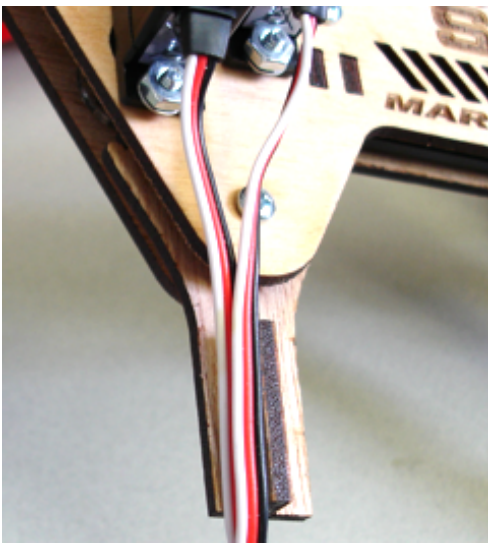
15. Remove the six housing screws from the bottom of the S2 Robot, set the S2 upright, and lift the top half of the housing. Fish the servo cables through the S2's pen hole, and plug the longer one (gear servo) into the P1 position on the S2's "hacker port" and the shorter one (cam servo) into the P0 position, as shown, paying close attention to the black-red-white orientation.
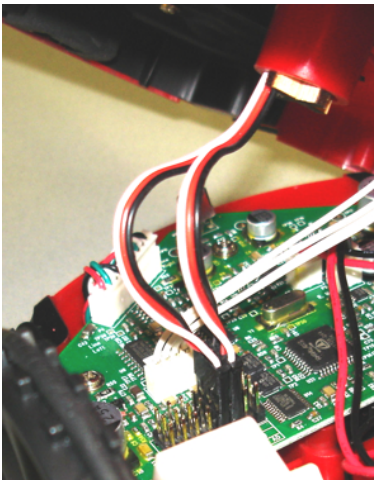
16. Replace the S2's top shell and refasten with the six screws.

17. Load the sample program from the S2 Marauder forum thread into the S2's EEPROM using the Propeller Tool's F11 command shortcut. When it starts, the tilt mechanism will go through its range of motion and stop at what is supposed to be horizontal. If it's a little bit off, you can adjust it by modifying the **HORIZ** constant at the beginning of the program.

18. Now you're ready to load some rubber bands. The ones included with the kit, and the only ones recommended, are Sparco brand, size 16. **Do not be tempted to use stronger or shorter rubber bands.** Loading twelve of the Sparco #16 bands will put enough force on the star wheel as it is, and you don't want it to bend from anything stiffer.

To load a rubber band, hook it over the front, then hook the other end over the farthest-back star-wheel tooth that you can reach. Repeat with the next band, hooking the back part one tooth forward from the previous one. You should be able to load three bands in this fashion before retracting the star wheel.

Now, with the S2 powered up, press the blue button twice in rapid succession. This will cause the S2 to reset and enter load-and-test mode, once the blue light comes back on. While pulling back on the star wheel against the escapement, press the button once. This will toggle the escapement, allowing you to retract the star wheel by one click. Do this two more times. Now you can load three more rubber bands. Repeat for the remaining six if you want to load all twelve.

Note: If you are using an early sample version of the S2 Marauder or a unit won from the Parallax EXPO raffle, make sure that the cam servo operates the escapement over its full range of motion. If it does not, simply loosen the screw between the small-slot bulkheads a little to relieve pressure on the servo screw.

In this same mode, you can now test fire the gun. **Be sure always to aim the gun away from people and pets, especially at close range.** Press the button once, and the first rubber band will rotate into firing position. After that, each successive button press will fire another rubber band until the start wheel has emptied.