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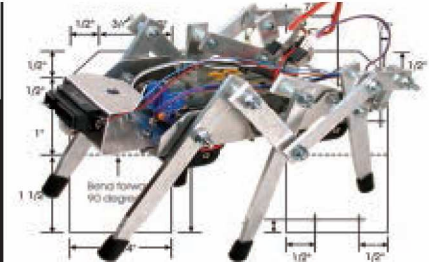**Recycled Electronics**
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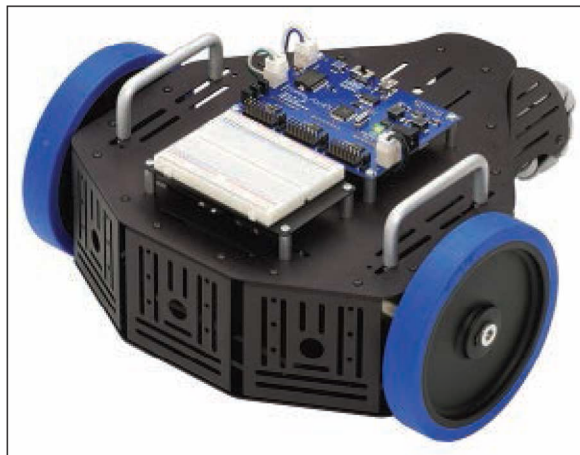
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■ BY VERN GRANER

THE PARALLAX STINGRAY ROBOT

Stronger than a BOEBOT, more powerful than a pen-wielding Scribbler, easier to carry than a QuadRover, the Parallax Stingray mobile robotic platform has landed!

FISHING FOR THE STINGRAY

I first heard rumors about the Stingray in a thread on the Parallax Forums. Someone had noticed a new robot acting as the "Stage" for the Parallax PING)) sensor bracket. With the cat out of the bag, Chris Savage gave everyone some nice sneak peeks at the upcoming robot Parallax was gearing up to produce. After a bit of prompting, he posted some intriguing pictures of the prototypes (**Figures 1A** and **1B**). This bot seemed to really fill a niche as it was larger and stronger than the BOEBOT or Scribbler (**Figures 2A** and **2B**), yet not so big as to require multiple people to lift it and a truck to carry it.

Having built some large robots based on recycled wheelchair chassis (see "Evolution of the Boogiebot," *Nuts & Volts* October '07) I know that, though really big robots can be lots of fun, they are also a pain in the ... back. When you have to lift 100 pounds of solid metal and lead-acid batteries in and out of a car trunk a few times, you really start to appreciate smaller bots.

■ FIGURE 1A. Stingray Prototype "Alpha."

■ FIGURE 1B. Stingray Prototype "Beta 1 and 2."
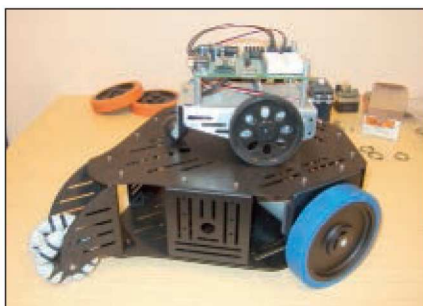
■ FIGURE 2A For scale, a Parallax BOEBOT is perched atop the Stingray.

■ FIGURE 2B. A Parallax Scribbler robot easily fits inside the Stingray's roomy chassis.

PULL THE TRIGGER?

Since I've built both big and small bots, I decided there was room in my menagerie for a Stingray of my own to experiment on. I contacted Parallax to see when they would be available and (most importantly) to find out the price. I was hoping the Stingray would be cheap enough to make them accessible even to folks without deep pockets. I called and found out that the Stingray was already in stock and priced at just under $300. I ordered my Stingray and it shipped the same day.
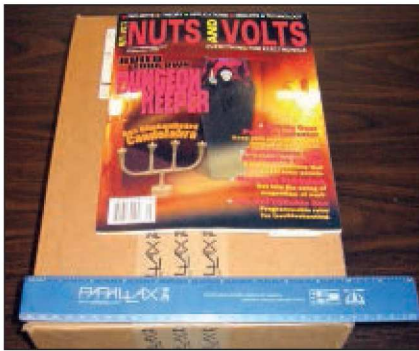
■ FIGURE 3. The Stingray arrives from Parallax (ruler and magazine shown for scale).

■ FIGURE 4. All the parts from the box spread out on a table.
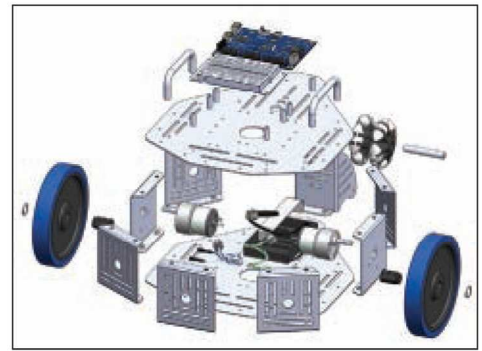
■ FIGURE 5. Exploded view of the Stingray from the assembly documentation.

Before my Stingray arrived, I decided to document every aspect of its journey from shipping box to completed bot. What follows is a front row seat to the complete assembly of the Stingray robot.

UNBOXING DAY

The Stingray arrived in a mid-sized shipping box (**Figure 3**). I opened it and scooped out all the packing peanuts to discovered a shipping manifest, a nice glossy catalog of Parallax products and a smaller white folding box that contained all the Stingray parts. It seemed like a surprisingly small box, but after opening it, I discovered the reason is that the Stingray comes "flat packed" with all the parts in individual plastic bags to keep the anodized aluminum parts from scratching each other in transit. I spread out all the parts on the table (**Figure 4**) and did a quick inventory. Everything was present and accounted for, so it was time to build it.

PUTTING IT ALL TOGETHER

The kit comes with a complete set of printed illustrated instructions including some very nice exploded views (**Figure 5**). It even includes just about all the tools you'll need to put the unit together. I invited neighbor and colleague Marvin "Professor Conrad" Niebuhr over to assist in the robo-build (**Figure 6**).

The build was just about as straightforward as you would expect with the very detailed instructions guiding us along the way. We went from the delivered box to completed bot in about three hours. There were no missing parts and all the holes lined up exactly so we didn't have to drill anything out or modify any of the components. I have to say it's quite nice to get something where the care in the design is so obvious.

After a virtually flawless mechanical assembly (the only goofs were our own!), it was time to install the electronics (**Figure 7**). Though Parallax could have simply used a BASIC Stamp to drive the Stingray, they went all-out and created a brand new robot control board based on their new Propeller chip.
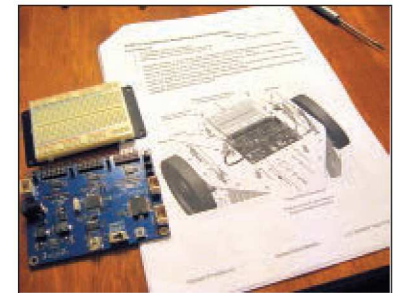
THE MSR1 CONTROLLER

To me, one thing that really sets this bot apart from others is the new MSR1 controller (**Figure 8**). This board really surrounds the Propeller chip with some extremely useful and much needed hardware. Besides including an on-board L6205 H-bridge to control the two gear head motors, they have also placed voltage translators that are used to interface the 3.3V native signals of the Propeller to the more common 5V signals used by many off-the-shelf accessories and sensors. An on-board dual switching
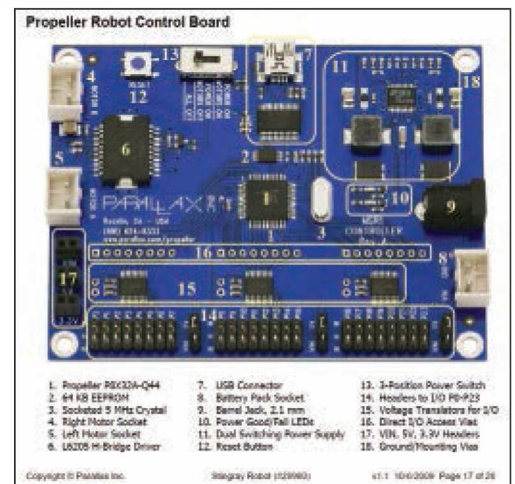
■ FIGURE 6. The main chassis parts laid out and ready to assemble.

■ FIGURE 7. The MSR1 controller and the breadboard ready to be attached to the Stingray.
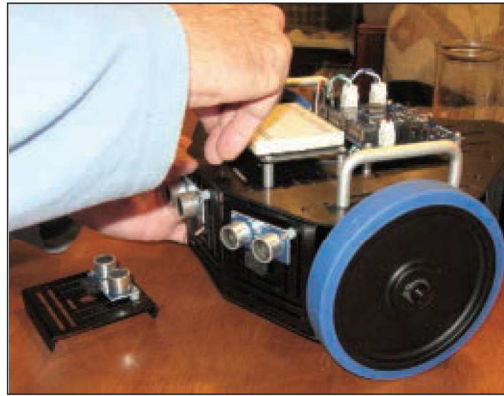

■ FIGURE 8. Detailed view of the new MSR1 robot controller board.

■ FIGURE 9. The mounted MSR1 board and adjacent breadboard ready for experimentation.

■ FIGURE 10. Adding three PING)) sonar sensors to help the Stingray avoid collisions.

■ FIGURE 11. The multi-directional tail wheel can roll in any direction.

power supply and 24 three-pin "servo" style headers (broken up into three banks of eight) make plugging in components a snap. To top it off, they doubled the amount of memory that is typically available on most Propeller prototyping boards. Parallax also includes a nice-sized breadboard so the Stingray is ready for experimentation right away (**Figure 9**).
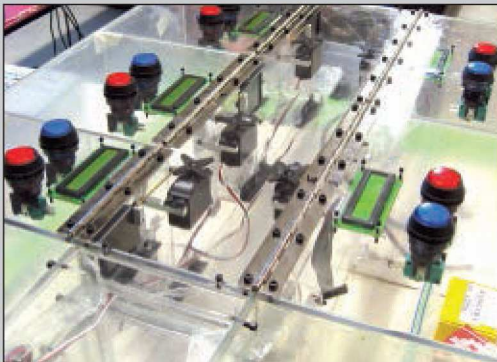
"TWEEN" BOT

To me, the Stingray fits perfectly between the big bots and the plethora of small table-top robots driven by continuous-motion servos. Not only does the Stingray posses wicked head-turning good looks, its gear head motors are both quite strong and fast. I was rather

Speaking of Propellers ...

If you find the Parallax Propeller chip is interesting and you'd like to get a bit more info about it and how it can be used, there's a new book that you might be interested in reading. Though I only had a small part in its creation (1/12th part to be exact!), I am honored to be included with the likes of Chip Gracy, Andre' Lamothe, Hanno Sander, and other notable Propeller heads in the creation of "Programming and Customizing the Multicore Propeller" from McGraw Hill. The book is available for pre-order from: **www.amazon.com/ Programming-Customizing-Multicore-Propeller-Parallax /dp/0071664505** and should be available soon at other technical book stores around the country. The section I authored explores using the Propeller as the center of an intelligent HVAC "green house" design. If you read the book, please feel free to let me know what you think by sending an email to vern@txis.com.

surprised the first time I let this thing run around on the floor (it almost took out my cat)! One of the things I did was add three PING)) sonar sensors (**Figure 10**) so the bot would have a chance of detecting and avoiding walls (and cats) because when it gets moving, it builds up a goodly amount of kinetic energy.

The included BaneBots rubber wheels are a good compliment to the gear head motors as they are very "grippy." The bot can literally turn on a dime. The multi-directional tail wheel is not only cool to look at, but it feels like it's almost friction free. I've had other "tail dragger" style mini robots and not only does the tail wheel impact battery life, it can also alter dead-reckoning navigation if the extra friction causes the drive wheels to slip. The multi-directional tail wheel (**Figure 11**) is a very cool improvement.

ITS ALL GOOD ... OR IS IT?

Though I am obviously smitten with my new Stingray bot, you have to be thinking, "There's got to be something you would improve, right"? Okay, I'll admit there are a couple of minor things I would love to see improved. For starters, the battery box is pretty much unreachable once it's screwed down in its default location in the inside/center of the bot. This makes removing the batteries for charging rather difficult. Though I was able to both extract and insert batteries using just two fingers and quite a bit of patience (and maybe a few mumbled words), I ended up leaving out two of the screws on one of the mount plates so I could more readily get to the batteries by swinging open my makeshift "door" (**Figure 12**).

The batteries called for in the assembly sheet are 1.2V rechargeable NiMh AA cells. I would love to see the MSR1 contain a battery charging circuit designed to charge this style of battery directly. As it stands, when you plug in the external power 2.1 mm plug, it bypasses the batteries instead of charging them.

So, be aware that you can't charge up your Stingray by plugging it into a wall wart overnight. On the upside, the bot is designed to run from a 7.2V power source. So,

if you plan to use your Stingray for extended periods of time (for example, in a classroom setting), you might want to swap the NiMH AA cell pack for some more readily-available 7.2V RC car rechargeable packs with higher amp-hour ratings and external chargers. This way, you could have one pack in the bot and one on standby being charged.

SUMMING IT UP

I feel the Stingray is an amazing piece of engineering and will enjoy great success. It's just a solid feeling robot with excellent looks and lots of room for expansion and experimentation (**Figure 13**). The dual aluminum carry handles on the top make it easy to bring along with you. I've carried it into restaurants and other places where my robo-buds hang out, and I've already had three people on three separate occasions stop me and ask about it.

With its torquey gear-head motors, grippy rubber wheels, sleek all-metal dual-deck chassis with loads of attachment points, the sexy multi-directional tail wheel and the high-powered multi-core processor, the new Parallax Stingray just oozes style! If you end up with a Stingray, please let me know as I'd love to hear how you like it and put it to use. As always, you can reach me via email at vern@txis.com. **NV**

■ FIGURE 12. With two screws removed, a battery access door is created.

■ FIGURE 13. A test-fit of an accessory I plan to add to my Stingray to give it some STING!

RESOURCES

Parallax Stingray Robot:
www.parallax.com

Stingray discussion on Parallax Forums
http://forums.parallax.com/forums/ default.aspx?f=10&m=391099

Evolution of the Boogiebot, *Nuts & Volts* October 2007:
http://nutsvolts.texterity.com/ nutsvolts/200710#pg84

Marvin "Professor Conrad" Niebuhr's site:
www.professorconrad.com

Programming and Customizing the Multicore Propeller
www.amazon.com/Programming- Customizing-Multicore-Propeller- Parallax/dp/0071664505