and shrapnel out.

There was only one day left before the bots debut at the Schiele Museum back in July, so I quickly put together a wedge using two chunks of 1/2" nutstrip, some UHMW, and a sheet of 1/16" 7075 aluminum. This was attached to the bot using a short length of 1/4" titanium rod. This was a tight fit in the holes and I thought it would hold up alright, but combat was to prove otherwise. The bot — now named Trilobite — was ready to go (**Figure 13**).

The bot performed reasonably well at the event. The wedge proved more a hindrance than a help as it kept getting stuck under the bumpers and the axle came loose. The bot was thrown about by both Weta and Grande Tambor but it suffered no more than a few scratches, A better wedge and some snowplow type attachments are needed, but I think it will perform well at its first big test at the Franklin Museum in October.

Kits of the chassis will be available from **www.kitbots.com** by the time you read this. I hope they help newbies get a good start in the sport. SV

BUILD REPORT:

A Team Building Exercise

● by Pete Smith

My Kitbots bot hockey team "Team Scotch Pies" had competed in one event and taken part in a couple of demonstrations, but the bots were retasked for a summer camp and were less than ideal. The bots were four wheel drive, but only used two cordless drill motors and they only weighed 8 lbs each (rather than the allowed 15 lbs). It was clear when they first met other custom-built hockey bots that they were simply outclassed.

A planned demonstration at the Durham Museum of Life and Science in March '11 gave me the impetus needed to build a new fleet of competitive bots.

To save time, I used as many standard Kitbots parts and familiar processes as I could. The finished design (**Figure 1**) uses template routed polycarbonate panels joined to together with my 3/8" nutstrip and four 18V cordless drill motors in the budget motor mounts, plus 3" Colsons with the standard hubs. The top and bottom are identical as are the two sides and the front and rear panels. This reduced the number of templates required and the work setting each one up. The top and bottom are 1/4" thick while the sides are 3/8".

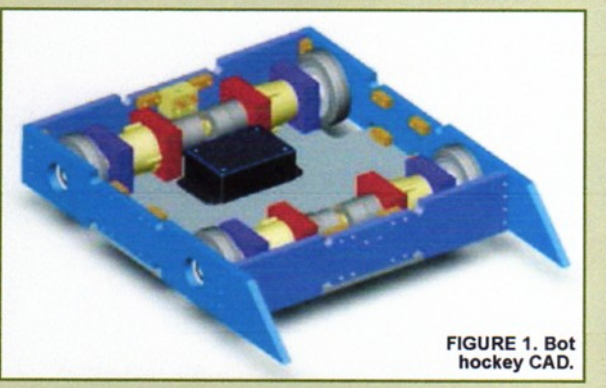

FIGURE 1. Bot hockey CAD.

The watercut templates were ordered from **www.teamwhyachi.com** and once they

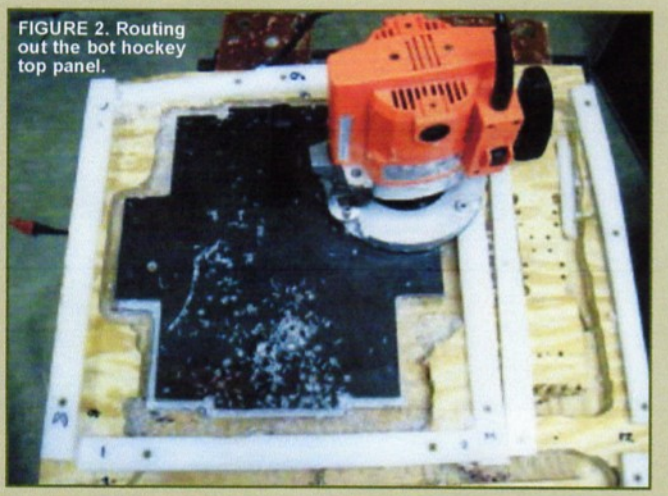

FIGURE 2. Routing out the bot hockey top panel.

FIGURE 3. Routing out the bot hockey side and front rear panels.

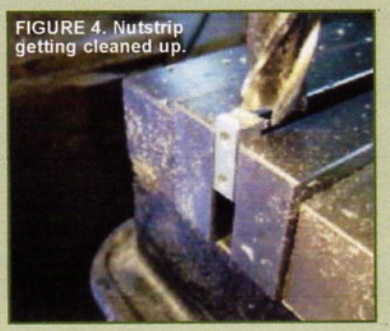
FIGURE 4. Nutstrip getting cleaned up.

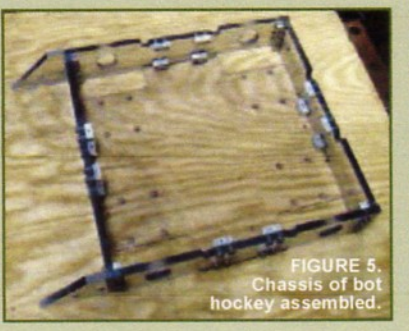
FIGURE 5. Chassis of bot hockey assembled.


FIGURE 6. Drivetrain components for bot hockey bot.

arrived, I set them up pretty much as I described in an article in the March '10 issue of *SERVO*. I could quickly produce multiple copies of the top (**Figure 2**) and side panels (**Figure 3**). I found that it is necessary to cut the polycarbonate blanks close to the correct size with a jigsaw before routing to the final profile. If you try to route the full width of the cutter, it proves too much for the guiding bearing and it quickly fails. All the required screw holes are also in the templates, so they are drilled before the part is removed.

A bot hockey (**www.bothockey.com**) team consists of only three bots, but it is wise to have at least four so that you can swap out any bots that develop problems. The routing process allows one to mass-produce the parts easily, so making four bots is not that much more work than building a one-off design.

Sections of 3.8" nutstrip were cut off using a chopsaw and then trimmed to length using my mill (**Figure 4**). One can use a file to smooth each end or even leave them rough, but the mill makes quick work of it, especially when so many parts are required. The screw holes in the bottom panel were countersunk and then the chassis assembled (**Figure 5**) using Phillips head screws that have a locking patch (similar to McMaster part 96562A245) to ensure they do not vibrate loose.

Similar templates were used to produce the 32 separate motor mounting blocks which are used to fit the modified cordless drill motors and wheels. The parts required to produce just one drive assembly can be seen in **Figure 6** and the assemblies required for just one bot in **Figure 7**.

The drive assemblies are fitted to the baseplate (**Figure 8**) using four #10 Plastite screws, but one can use #10 sheet metal screws instead if the Plastite ones prove hard to find. The design allows them to be quickly replaced in the event of a failure since only very minimal disassembly is required, and each drive can be removed and replaced as a complete unit. The old bots would require at least 10 minutes' work to do what can be done in two in the new design. Reducing complexity also reduces the opportunity for mistakes to be made and this can be important in a competition environment.

I fitted Team Whyachi MS05 power on/off switches to each bot (**Figure 9**) so that they can easily be powered up and down without removing the covers. Since a special tool is required to operate them, it prevents unauthorized power-ups. This is useful at events where there are a lot of kids, some of whom — like me at that age — have difficulty stopping themselves from touching buttons!

Three of the bots were fitted with the latest Scorpion XXL ESCs from **www.robotpower.com** (on the left in **Figure 10**) and two 6S A123 battery packs in parallel. The fourth uses a pair of Victor 833s I had left over from our old 30 lb combat bot, together with 24V packs I assembled using the batteries from the dismantled cordless drills. These are much bigger and heavier than the A123 packs and have only half the capacity and twice the charge time, but since I was able to have three complete sets, this was not an issue. I found the two packs (about 2,400 mAH combined) lasted just long enough for the 10 minute matches without a noticeable drop in performance. The 24V does give a slight speed advantage over the


FIGURE 7. Four completed drivemotors for bot hockey.

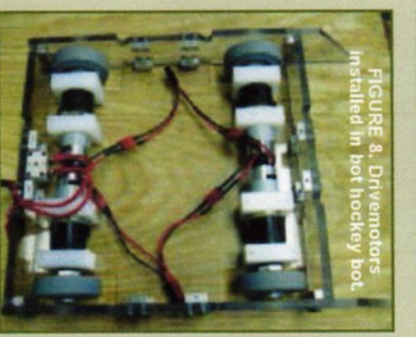
FIGURE 8. Drivemotors installed in bot hockey bot.

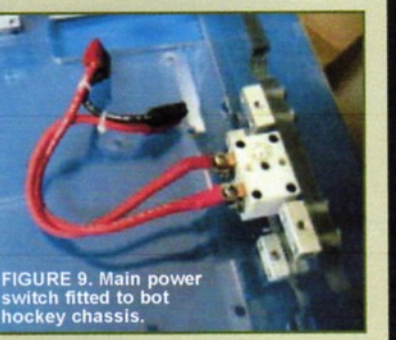
FIGURE 9. Main power switch fitted to bot hockey chassis.

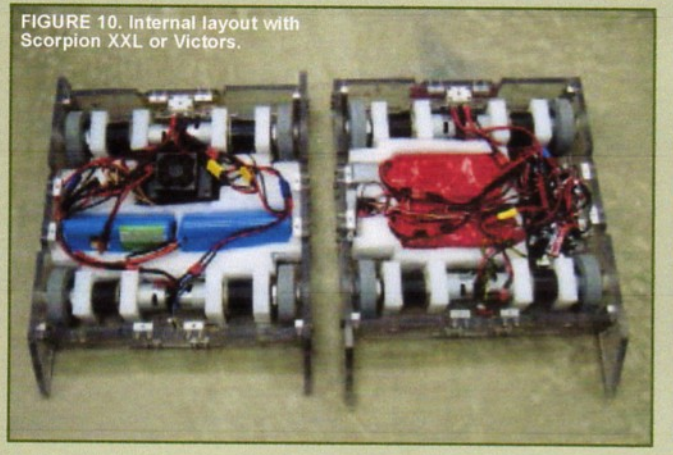

FIGURE 10. Internal layout with Scorpion XXL or Victors.

FIGURE 11. Team Scotch Pies with trophy.

19.8V of the A123s, but their poorer current sourcing ability makes them a pretty close match.

I also added a pair of color coded 10 mm LED "eyes" to the front of each bot so that it's easier to identify your bot in a melee (and because it just looks cool!). A 1K ohm resistor in series with each LED ensures good light output but also a long life at the voltages used in the bots.

The new team had its first real trial at the Schiele Museum Event in July '11 and they proved equal to the task. With a good driver, the bots proved to be more than a match for the competition and they can be seen a little tired but happy with their first place trophy in **Figure 11**.

Further events are in the planning stages and perhaps include a trip to RoboGames next year. SV

EVENTS

Completed and Upcoming Events

Completed Events for July-August 2011

Gulf Coast Robot Sports-8 was presented by Gulf Coast Robot Sports in Bradenton, FL on August 6th.

Schiele Museum Clash Of The Bots 2 was presented by Carolina Combat Robots in Gastonia, NC on July 23rd.

PA Bot Blast 2011 was presented by D.W. Robots in Bloomsburg, PA on July 16th.

Upcoming Events for October-November 2011

Franklin Institute 2011 will be presented by the North East Robotics Club in Philadelphia, PA on October 15th. Go to **www.nerc.us** for more information.

ComBots Cup VI will be presented by ComBots in San Mateo, CA on October 29-30. Go to **http://robogames.net/registration/event/view/11** for more information.

Mecha-Mayhem 2011 will be presented by the Chicago Robotic Combat Association in Rosemont, IL on October 22-23. Go to **www.thecrca.org** for more information. SV