The Challenge

A Small Business Perspective on Entering an Unmanned Systems Competition

By Paula Brooks

Editor's Note: Teams from the United States, Turkey and Australia were finalists in the first Multi Autonomous Ground-robotic International Challenge 2010 (MAGIC 2010), held in November 2010 and sponsored by Australia's Defence Science and Technology Organisation (DSTO) and the U.S. Army's Research Development and Engineering Command (RDECOM). The challenge was to create ground robots able to operate fully autonomously to reduce operator workload by allowing small robots to be controlled with minimal supervision. The story below is a first-person account of the competition from Team RASR of the U.S., which finished third; in next month's issue we'll take a look at the top two finishers, the University of Michigan and the University of Pennsylvania.

The RASR team with their Talon platforms in Australia.

When your company is in the business of autonomy for unmanned systems, does it make sense to enter a contest? Universities routinely enter competitions as an opportunity for hands-on experience for students but what are the advantages for a small business? Robotic Research LLC lead the RASR (Reconnaissance and Autonomy for Small Robots) team for MAGIC 2010. Here we share our experience and reasons for competing — beyond a desire to see kangaroos.

Decision to Try MAGIC

From the first reading of the rules, we knew that the MAGIC 2010 competition would be difficult. It required a coordinated team of autonomous ground robots to search an area, both indoors and outdoors. Simulated IEDs and enemy combatants needed to be "neutralized" without harming non-combatants. Each team had to map a portion of the Adelaide Showgrounds (an area the size of 25 football fields), in 3.5 hours but with only 10 minutes of operator time to enter commands, validate IED detections and all other functions. We knew that fielding a credible team of robots would require a substantial financial investment and long nights and weekends.

On the plus side, the competition would encourage a leap-forward of technology, fuel development of innovative products and provide interaction with major players on two continents. In addition, it seemed like a fun project and we would get to go to Australia. Sleep is overrated — we entered the contest.

Gathering the Team and Resources

The first person on board was friend and colleague Mark Del Giorno, chief scientist at General Dynamics Robotic Systems (GDRS) who also had his own consulting business, Del Services. He is a renowned expert in autonomous ground robotics. He helped to gain support from GDRS for sensor technology. QinetiQ-North America joined the team and contributed significant technical and material support, including the loan of eight Talon robots. For communications, Lee Converse of Cedar Creek Defense was a dependable communications expert who knew both defense and unmanned systems requirements. Our university partner was professor Charles Reinholtz of Embry-Riddle Aeronautical University (ERAU). He had been the driving force for autonomous unmanned systems entries in the DARPA challenges when he was at Virginia Tech. Two of his ERAU students joined Robotic Research as interns for the summer and, again, for the competition.

In the fall of 2009, the government received 23 entries from the USA, Canada, Poland, Japan, South Korea, Turkey and Australia. Our team made the first cutoff — the top 12 teams. After a kick-off meeting in December, we were ready to start work. In June, we would face the next down-select.

Making MAGIC

The officers of Robotic Research, Alberto Lacaze and Karl Murphy, wanted our work on MAGIC to result in products for small ground robots. The army uses primarily tracked robots. Thus, we chose QinetiQ-NA Talon over a wheeled platform even though it would be more difficult to automate. As it turned out, our team was the only one to use a tracked vehicle.

We built sensors systems, including: an in-house INS/GPS unit, a 360-degree camera system and a 360 LADAR scanner. This provided maximize coverage to allow for obstacle detection and 3-D mapping. The result of months of hard work was a completely new autonomous system for small robots, including the sensors, power distribution boards, e-stop system, ethernet radios, control computers and the code for running the system Our systems were mounted on three Talon robots.

All competitors were required to construct a demo site for the June down-select. The June challenges were only a sample of what we would see in November: obstacle detection and avoidance, path planning, map building (2-D and 3-D), and IED detection and neutralization. During the last week of June, the MAGIC committee arrived to review our progress. As the Talons sped through the course, up ramps, around obstacles, over paper, all the while mapping every detail, we felt like proud parents.

An anxious wait ended a few weeks later, when we were notified of our selection as one of the top finalists. Celebration was brief as the pace of work went into an even higher gear as we started building five more team robots.

Competition in Australia

In October, we shipped the robots to Australia. A few engineers arrived early to unpack and check out the equipment. The rest of the team arrived a week before the competition. There was not much sightseeing as the week became a blur of no sleep, massive liters of coffee and endless testing. The competition itself was incredibly difficult. It was an impressive course, spread-out in sheds, grounds and buildings of the Adelaide Showgrounds. In the end, our RASR Team was awarded third place. Of course we wanted first place, but to put this in perspective, our company of 14 people, using tracked vehicles, was among the top three winners in an international competition, competing against the top universities in the world.

Two RASR robots with an "object of interest" — a red trash can playing the role of an explosive device.

Was it a MAGIC Moment?

Was it worth it? Yes. The competition gave us the opportunity to test our technology on eight Talon vehicles. Our prior research translated to a creation of a slew of new products, including an inexpensive camera system that creates 360-degree images, an after-action visible review system, a navigation system and a complete autonomous mobility system for small robots. Our company goal is to transfer robotic technology for practical use to the warfighter, and this has certainly been accelerated by our participation in this contest.

Paula Brooks is director of business for Robotic Research LLC and the Team RASR business manager. She can be contacted at pbrooks@roboticresearch.com.

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