DARPA VRC Challenge Results: Here's Who Gets an ATLAS Humanoid

By Evan Ackerman
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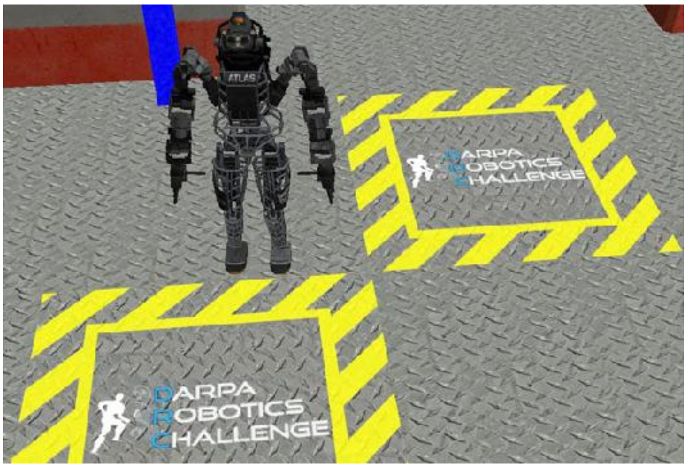
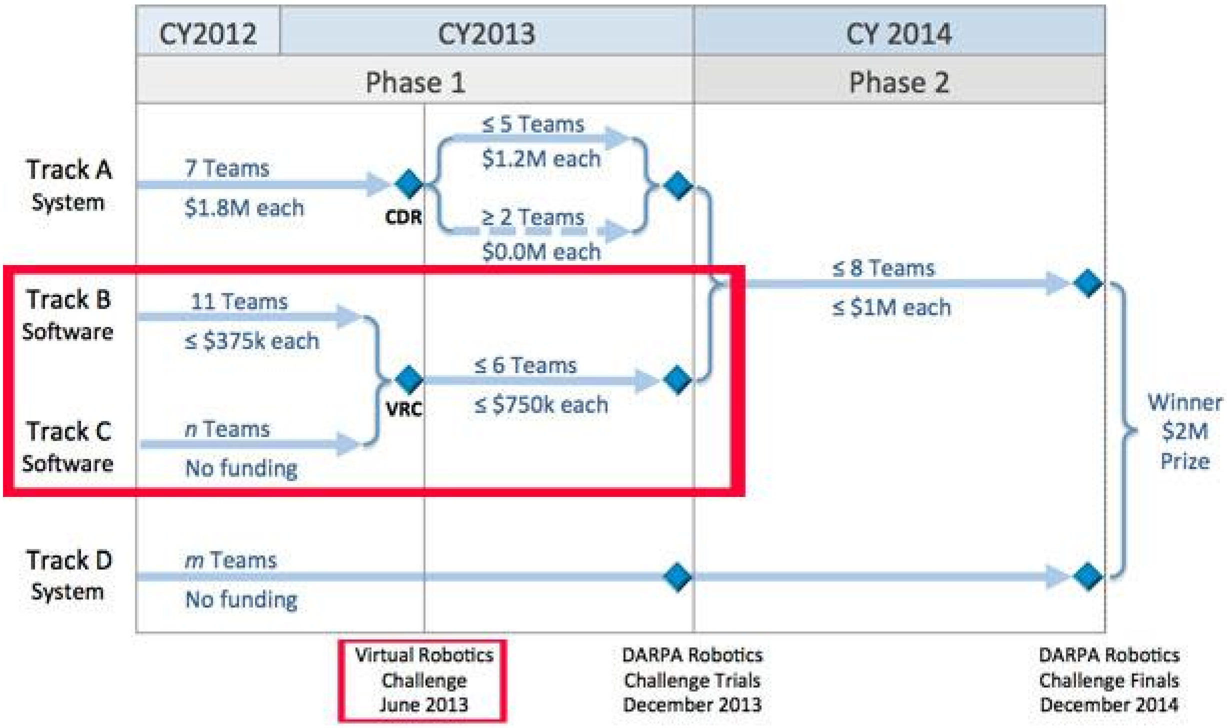


Today, DARPA is announcing the results of the Virtual Robotics Challenge (http://spectrum.ieee.org/automaton/robotics/robotics-software/osrf-prepares-for-darpa-virtual-robotics-challenge) (VRC) portion of the DARPA Robotics Challenge (http://spectrum.ieee.org/automaton/robotics/humanoids/darpa-robotics-challenge-here-are-the-official-details) (DRC). The six top teams will each be receiving a bunch of money, plus a Boston Dynamics ATLAS robot (http://spectrum.ieee.org/automaton/robotics/humanoids/iros-2012-darpa-robotics-challenge-update) of their very own, which they'll use to compete in the DRC trials later this year. Let's see who won!

The VRC is just the first stage of the DRC, which runs through the end of next year. By running an initial challenge in a virtual environment, DARPA was able to make the DRC accessible to lots of people who'd otherwise be unable to participate due to the cost and complexity of the required hardware. This handy chart gives a breakdown of where we're at right now:



- **Track A** is for teams proposing to develop their own robot and software, and if selected, they'll receive funding from DARPA.
- **Track B** is for teams proposing to develop control software (no hardware) to compete in a computer simulation, and selected teams will be funded by DARPA.
- **Track C** is for teams developing, at their own expense, control software (no hardware) to compete in the simulation part

of the challenge.

- **Track D** is for teams developing, at their own expense, both a robot and software to enter in the competition.

The VRC is a match-up between Track B and Track C teams, and any Track C team who places in the top six spots will get an ATLAS robot to use for the physical challenge. So, even though Track B teams got some initial funding from DARPA, that may not be enough to assure them a robot, if a Track C team gets a better score in the competition itself.

Each team had to complete three different tasks as part of the VRC, including a walking task, a driving task, and a manipulation task. We covered these tasks in detail in a previous post (http://spectrum.ieee.org/automaton/robotics/robotics-software/osrf-prepares-for-darpa-virtual-robotics-challenge), but DARPA's got a new video overview of everything:

Here are the Track B and Track C teams who competed in the VRC:

Track B (Funded) Teams:

- Lockheed Martin's Advanced Technology Laboratories
- RE2
- University of Kansas
- Carnegie Mellon University (Team Steel)
- Massachusetts Institute of Technology
- TRAC Labs
- University of Washington
- Florida Institute for Human and Machine Cognition (Team IHMC)
- Ben-Gurion University (Team ROBIL)
- NASA JPL CalTech
- TORC Robotics

Track C (Unfunded) Teams:

- SARBOT
- OU Robotics
- Team K
- nodein
- Red Sky
- Team Case
- Robot-nicy
- WPI Robotics Engineering C-Squad (WRECS)
- Team Buckybots
- Gold Team
- TROOPER
- Intelligence Technologies
- Mimesis
- Br Robotics Team
- Team ELEX

VRC Winning Teams:

- **Team IHMC (http://robots.ihmc.us/drc/), Institute for Human and Machine Cognition, Pensacola, Fla. (Track B, 52 points)**
- **WPI Robotics Engineering C Squad (WRECS) (http://robot.wpi.edu/drc/), Worcester Polytechnic Institute, Worcester, Mass. (Track C, 39 points)**
- **MIT (http://drc.mit.edu/), Massachusetts Institute of Technology, Cambridge, Mass. (Track B, 34 points)**

- **Team TRACLabs (http://traclabs.com/blog/), TRACLabs, Inc., Webster, Texas (Track B, 30 points)**
- **JPL / UCSB / Caltech (http://www-robotics.jpl.nasa.gov/tasks/showTask.cfm?FuseAction=showTask&TaskID=252&tdaID=700058), Jet Propulsion Laboratory, Pasadena, Calif. (Track B, 29 points)**
- **TORC (http://www.torcrobotics.com/drc/), TORC / TU Darmstadt / Virginia Tech, Blacksburg, Va. (Track B, 27 points)**
- **Team K, Japan (Track C, 25 points)**
- **TROOPER, Lockheed Martin, Cherry Hill, N.J. (Track C, 24 points)**
- **Case Western University, Cleveland, Ohio (Track C, 23 points)**

If you're counting, that comes out to **NINE TEAMS**, not the six that DARPA allocated funding and robots for! Here's what happened:

> In a demonstration of good sportsmanship, Jet Propulsion Laboratory, which also has a DARPA-funded Track A effort with its own robot, decided to merge its two efforts and offer the bulk of the resources it earned in the VRC to other teams. DARPA split the freed resources between the next two teams:

> - The robot associated with the JPL win and some funding now goes to TROOPER (Lockheed Martin).
>
> - Additional funds are being allocated to a newly formed team of Team K and Case Western. That team, now known as HKU, will use an ATLAS robot generously donated to it by Hong Kong University to participate in the DRC Trials in December.

Each one of these teams is going to get a cool $750,000 of funding from DARPA. Also, they're going to get one of these:

The three VRC tasks are a subset of the eight tasks that will be a part of the disaster scenario challenge trials, scheduled to take place in December with the real robots. Here are the rest of the tasks that we'll be seeing at the end of the year:

1. Drive a utility vehicle at the site - In this event, the robot has to enter the vehicle, drive it on a travel course, and exit the vehicle. The robot has to operate the vehicle controls, including steering, throttle, brakes, and ignition. The vehicle is expected to be an unmodified utility vehicle such as a John Deere Gator or Polaris Ranger.

2. Travel dismounted across rubble - Now the robot has to cross terrain ranging from smooth and level to rough and sloped, with some loose soil and rocks. A human would easily traverse the terrain. In addition, the terrain will include discrete obstacles such as rocks, bushes, trees, and ditches that the robot must avoid.

3. Remove debris blocking an entryway - Here the robot has to move an object blocking an entryway. The object will have size, weight, and other properties to be movable either by a person or by the robot. The object is expected not to exceed 5 kilograms and be solid like a rock or a cinder block, and may have an irregular shape.

4. Open a door and enter a building - In this event, the robot has to operate a door handle and have the strength to push the door open. The door and door handle are expected to be standard, commercially available items.

5. Climb an industrial ladder and traverse an industrial walkway - The robot has to traverse an industrial elevated walkway (also known as a catwalk) with a grated surface and handrails. As part of this task, the robot has to climb an industrial ladder. It is expected that a person would need to use both arms and legs to climb the ladder.

6. Use a tool to break through a concrete panel - Next the robot has to use a power tool to perform “forceful manipulation.” The power tool will likely be an air or electric impact hammer and chisel, or an electric reciprocating saw. The task is to break through a concrete panel (with no rebar) or through a framed wall. (Pictured above, robot on the right.)

7. Locate and close a valve near a leaking pipe - In this event, the robot has to find a leaking pipe and a nearby valve, which it needs to close. The facility will contain multiple pipes, but only one will be leaking, visible as smoke and audible as the hiss of escaping gas. It is expected that a person would need to use two hands to close the valve. (Pictured above, robot on the left.)

8. Replace a component such as a cooling pump - Finally, the robot has to locate the pump and be able to loosen one or more fasteners to extract the pump from its fittings and reverse all steps to replace the pump. It is expected that the pump will be small and compact enough that a human could handle it with a single hand.

While the robots will be teleoperated up to a point, DARPA is going to mess with the latency and bitrate of the teams' connection to the robots, with the goal of forcing teams to equip their robots with a great level of autonomy. And the more autonomy the robot is capable of, the more efficient it will likely be. The term for this is "supervised autonomy," meaning that humans will be getting sensor data and will make the high-level decisions, but that the robot will be doing most of the low-level tasks itself. So, rather than (say) manually moving the robot's joints to open a door, its controller will need to just send an "open door" command.

As for the robot itself, the official ATLAS rollout is going to be sometime in July. We've heard that development of the platform is on schedule, and we'll be getting more details on that later.

Between July and December, we're looking forward to all sorts of craziness as the DRC teams get their ATLAS robots and start messing with them.

[DARPA Robotics Challenge (http://www.theroboticschallenge.org/)]