National Institute of Standards and Technology
U.S. Department of Commerce

Standard Test Methods for Response Robots
ASTM International Committee on Homeland Security Applications;
Operational Equipment; Robots (E54.08.01)

ROBOCUPRESCUE
RAPIDLY MANUFACTURED ROBOT LEAGUE

The RoboCupRescue Rapidly Manufactured Robot League (RMRL) focuses on small, expendable robots, and task-specific robotic components for existing robots, that can be produced on demand during deployments with emergency responders. This will enable responders to more safely and effectively perform hazardous mission tasks. These include search and rescue, hazardous materials handling, explosive ordnance disposal and others. This competition makes use of recent advances in low cost additive manufacturing, electronics and sensors to lower the barrier of entry into robotics research.

The Challenge:

This competition will utilize innovations in additive manufacturing (AM) and common components (motors, controller, sensors, radio, etc.) to allow competitors to develop and share open hardware designs and software algorithms for robots and modular components. These common components, plus winning designs and algorithms, will form an online library of robots that can be manufactured rapidly in the field. Robot designs and components will be evaluated using the DHS-NIST-ASTM International Standard Test Methods for Response Robots. This new competition creates a pathway from the designer to the user that has been missing in the past. The online library acts as an app-store like interface that allows version control and sharing between designers and users.
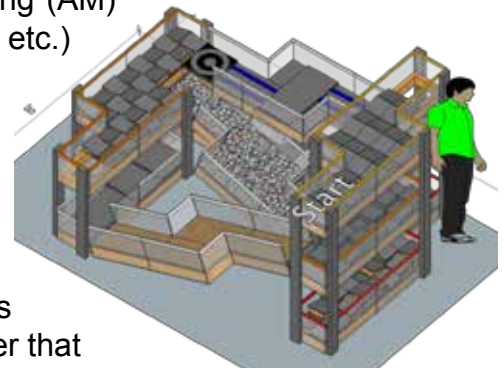
The Community:

The RoboCupRescue Robot League is an international community of teams that use competitions and teaching camps to advance the state of the science in response robotics. This competition supports continuous collaborative development from high school through PhD level, hobbyists, makerspaces and vocational schools, across regions and countries. Robots developed through this competition include the Japanese Quince robots that were crucial in the response to the Fukushima Dai-ichi Nuclear Power Plant disaster.

Robots:

Sharing of capabilities and joint development between teams and the wider community is crucial. The Open Academic Robot Kit (OARKit) is a low cost (starting at $500 USD), highly capable teaching and research robot for this application. These are baseline robots that competitors may choose to use as-is or modify. The kit may also be purchased with all parts ready to assemble. Competitors may also choose to make completely new designs using the same parts.

Getting involved:

Pilot competitions start in 2016 at the RoboCup World Championship in Leipzig, Germany and also around the world. For more information and to get involved, please visit **www.oarkit.org**.

Robolt

ROBOTIC RESEARCH

Curtin University

DEPARTMENT OF COMPUTING
INTELLIGENT ROBOTS GROUP
Developing artificial intelligence for the robots of tomorrow
intelligentrobots.org

RoboCup Rescue

20160626

ROBOCUPRESCUE
RAPIDLY MANUFACTURED ROBOT LEAGUE

The Open Academic Robot Kit:

The designs in this kit follow three basic principles.

- All mechanical components can be rapidly manufactured, using low cost 3D printers or laser cutters.
- A common kit of parts such as motors, sensors, electronics and fasteners make up the remaining parts.
- All designs, source code and instructions necessary to build and run the robots and components are shared, in a readily editable form, under an Open Source license.

This kit covers the spectrum of robotics research and development including mechanical design, electronics, algorithms and artificial intelligence, user interfaces and more. Versions of these robots can be controlled by computer, smartphone or custom controllers. Ease of sharing allows all members of the community to benefit from each other's specializations and for new teams to build on the best performing robots and subsystems of previous years.

Arena of Standard Tests:

The arena for complete robots is made up of standard test methods with a 30 cm (12 in) lateral clearance. Robotic components are tested in their relevant scales. These enable repeatable, quantifiable evaluation of robot capabilities, reliability and operator proficiency. Tasks include mobility, manipulation, sensing and autonomy with varying levels of difficulty to measure basic skills and inspire breakthrough capabilities. Teams are encouraged to practice and build their own versions.

The Rules:

- Two classes of robots exist. Complete robots and robotic components that augment existing robots.
- Robots may be autonomous (no operator) or remotely controlled.
- Teams collect points for completing the different challenges within the allowed time.
- Teams first demonstrate reliable capabilities in each test separately.
- Teams then perform a series of interconnected tests that describe mission requirements.

20160626