



## World Rescue Robot Competition – First for UK team

maxon motor uk have been working with the Warwick Mobile Robotics team on their entry for the World RoboCup Rescue Championships 2013. Of the 2500 individuals participating in this competition, from 40 countries, this is the only UK entry.

Warwick Mobile Robotics (WMR) is an undergraduate student project run by the Warwick Manufacturing Group (WMG) at the University of Warwick. As part of their BEng MEng Manufacturing and Mechanical Engineering degree, students must master modern technologies and skills such as robotics. Each year a team develops a rescue robot to navigate a simulated collapsed building locating and helping victims autonomously and using tele-operation. As such, WMR have been participating in the European RoboCup Rescue event since 2007, but this is the first time that the team has entered the worldwide event. Each year the challenge is to deliver a greater level of performance. The 2013 team of six engineering students are building on the success of previous years that include achieving second place in 2012, first place in 2010 and Best in Class for Mobility for 2012, 2011, 2010 and 2009.

The aim of the contest, being held on the 24-30th June 2013 at the University of Technology in Eindhoven, is to promote research and development into physical robotic agents for disaster search and rescue. The competition helps to increase awareness of the challenges involved in search and rescue applications, provide objective evaluation of robotic implementations in representative environments and promote collaboration between researchers. The competitors are given a scenario, such as a devastated building, and the

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driven by precision

robot has to scout out the area and find as many victims as possible. They have to find their targets, determine their situation, state and location and then report back their findings. Points are scored through victim identification using visual, thermal and audio. The robots have only 20 minutes to complete their mission.

maxon motor's senior sales engineer, Paul Williams, has been advising the WMR team on the use of maxon products. A highly dexterous arm is an essential component for a successful teleoperated rescue robot. The arm controls the position and orientation of the head and manipulator. Using maxon's high powered RE30 DC motors, combined with the GP32 gearhead, gives a powerful solution with low weight and low backlash drive. maxon modified the output stage of the gearhead, to allow an additional worm and wheel to be fitted, to stop the arm back driving when the power was switched off.

The main chassis drive uses the RE50 DC motors fitted with GP 52 gearheads with encoder feedback, the 200w motors are highly efficient (94%) making the maximum use of the limited battery power.

The 2013 WMR team have made the following improvements to the 2012 robot:

- The new chassis is 5 times thicker than the old design, however, using aluminium 6082-T6 (heat treated and aged) has reduced the overall weight by 35% and increased strength significantly
- The team improved the flipper clamps design by using a higher tensile strength material and eliminating stress raising geometry
- The head circuit board has been improved to include a new microcontroller and a CO<sub>2</sub> filter to remove high frequency noise
- The head itself has been redesigned to reduce weight (approx. 600g) by using a 3D printed shell and removing unnecessary devices. The new design also allows for quick and easy access to key components / electronics
- 3D representation has been implemented which will provide feedback information to the driver such as the current position of the robot arm, flippers, Centre of Mass and the robot's current orientation in space
- Inverse kinematics have been introduced to allow the user to 'fly' the head – where the movement of the arm is based upon where the head is looking
- A warning system is now in place to provide collision detection, toppling prevention and notify of device errors
- The LIDAR sensor is now used to help create a map of the robot's surroundings, which could be used by emergency responders to locate victims marked on the map by the robot
- A more compact power board has been created, that uses high reliability Harwin connectors and clearly labels the available voltages and polarities to make connecting devices simple. The power supplies have also been upgraded to ensure reliability under heavy load
- A new battery management circuit has been designed which will protect against both over- and under-voltage, short-circuit and excessive discharge current. The circuit also includes a fuel-gauge that tells the robot how much charge remains in the battery
- A new battery pack has been designed which allows batteries to be easily inserted and removed from the robot. Batteries are now located at the front of the robot rather than the sides, allowing it to safely traverse puddles and loose dirt.

The robot has recently been tested in Coventry at Northrop Grumman – Remotec UK's training ground for remote control military robots, where it performed well in the majority of tests for mobility, manipulation and manoeuvrability. The most significant improvement on last year's design was the developed GUI, which allowed the blind tasks (where the operator was in a remote location to the testing area) to be completed quickly and more easily than before.

WMR team member, Rachele Williams said 'We chose to use maxon products for their highly recognised reliability, which is important in a system such as our search and rescue robot. We have also established a supportive relationship and have appreciated maxon's expertise over previous years. Paul has been a great help to the team, with his quick and expert support.

We are really looking forward to taking part in the competition and competing against other world class search and rescue robotics teams. We've worked really hard and so it would be great to win Best in the World, but however we perform - the experience will be hugely valuable to the progression of the Warwick Mobile Robotics robot.'

Sponsors this year have included the Institute of Mechanical Engineers ([www.imeche.org](http://www.imeche.org)) , as well as maxon motor uk ([www.maxonmotor.co.uk](http://www.maxonmotor.co.uk)). Supporters are required for next years team and if you would like to offer some expertise or funding, please get in touch with the team by emailing [warwickmobilerobotics@gmail.com](mailto:warwickmobilerobotics@gmail.com).

Further information can be found here:  
Warwick Mobile Robotics Rescue Robot Capabilities  
<http://www.youtube.com/watch?v=surTv37p8Oo>

### **About maxon motor**

maxon motor is the world's leading supplier of DC motors, brushless motors, gearheads and controllers. We offer high quality, innovation, competitive pricing and highly specialised solutions.

Where are maxon products used today?

- Aerospace
- Robotics
- Medical science
- Industrial automation
- Instrumentation & inspection
- Communication
- Surveillance cameras
- Automotive
- Consumer applications

maxon's motors, gearheads, encoders, brakes and controllers are all perfectly compatible and offer an almost unending number of possible combinations. The maxon modular system gives the ideal combination for the required application.

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