Urban Search & Rescue Robotics

Warwick Mobile Robotics

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In a hurry? *The project at a glance:*
The design, manufacture and testing of a robot to locate survivors in disaster zones

Aims

- Deliver a new functional Multi–Terrain Robotic Vehicle
- Exhibit the robot as an educational platform at technology and engineering exhibitions

Objectives

- Benchmark current commercially available Urban Search and Rescue robots
- Design a mobile robot with simple and innovative features
- Adapt the robot design for ease of manufacture and maintenance
- Test the robot in a simulated disaster zone

WMR Search and Rescue

Warwick Mobile Robotics is a research group at the University of Warwick which specialises in the development of novel robotics for a variety of innovative applications including domestic, search and rescue, and surveillance.

The WMR Search and Rescue team comprises of 4th Year Students studying Mechanical, Electrical, Systems, Automotive, Manufacturing and Computing Engineering.

WMR's Unmanned Aerial Inspection Vehicle

Scope

Disaster zones are common place across the world, from hurricanes, tsunamis, floods and nuclear meltdowns. In these circumstances humans are often put in danger in order to save others. This risk can be eliminated with the development of Urban Search and Rescue (USAR) robots.

This year the WMR team are developing a completely new robot, which will traverse a variety of difficult terrains and detect signs of life using sophisticated cameras and sensors.

The Team

Mechanical Team

Paul Martin – Project Manager

Rebecca Saunders – Secretary

Craig Fox – Sponsorship

Leigh Dawson – Media

Mara Nkere – Procurement

Electronics Team

John Strutton – Electronics Coordinator

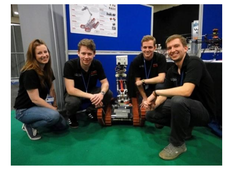
Avnish Popat – Health & Safety

Michele Galbusera – Systems Coordinator

Outreach

WMR exhibit the robot at many events to help inspire the next generation and showcase our hard work on these exciting robots. This year you might have seen the team at:

- Imagineering 2014
- Educational Workshops in local schools
- Engineering Careers Fair
- Warwick Technology Conference



The WMR Team at Imagineering 2014

Project Timeline

Project Commences	Aims and Objectives	Submit Designs	Start Manufacture	Assembly	Outreach Workshops	Testing	Project Evaluation	Final Report	Project Complete
29 Sept 2014	21 Oct 2014	12 Dec 2014	5 Jan 2015	Feb 2015	18 Feb 2015	2 Mar 2015	2 Apr 2015	30 Apr 2015	1 May 2015

Mechanics

Drivetrain

- **Agile** - Angular nose and suspension allow the robot to climb objects and navigate drops
- **Efficient** - High-power brushless motors for best efficiency with long service life
- **Clearance** - High sitting chassis will provide protection from on-coming obstacles and collisions

Suspension System

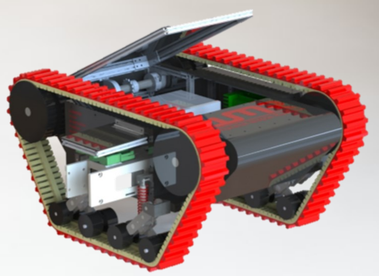
- **Tractive** - Springs give continuous support for the tracks to grip an ever-changing terrain
- **Reliable** - Pivoting arms reduce fatigue in all components
- **Consistent** - Four identical units make assembly easy

Shell

- **Robust** - Aluminium sheet completes chassis for an impact resistant shell
- **Resistant** - Seals internal components from dust and water

Chassis

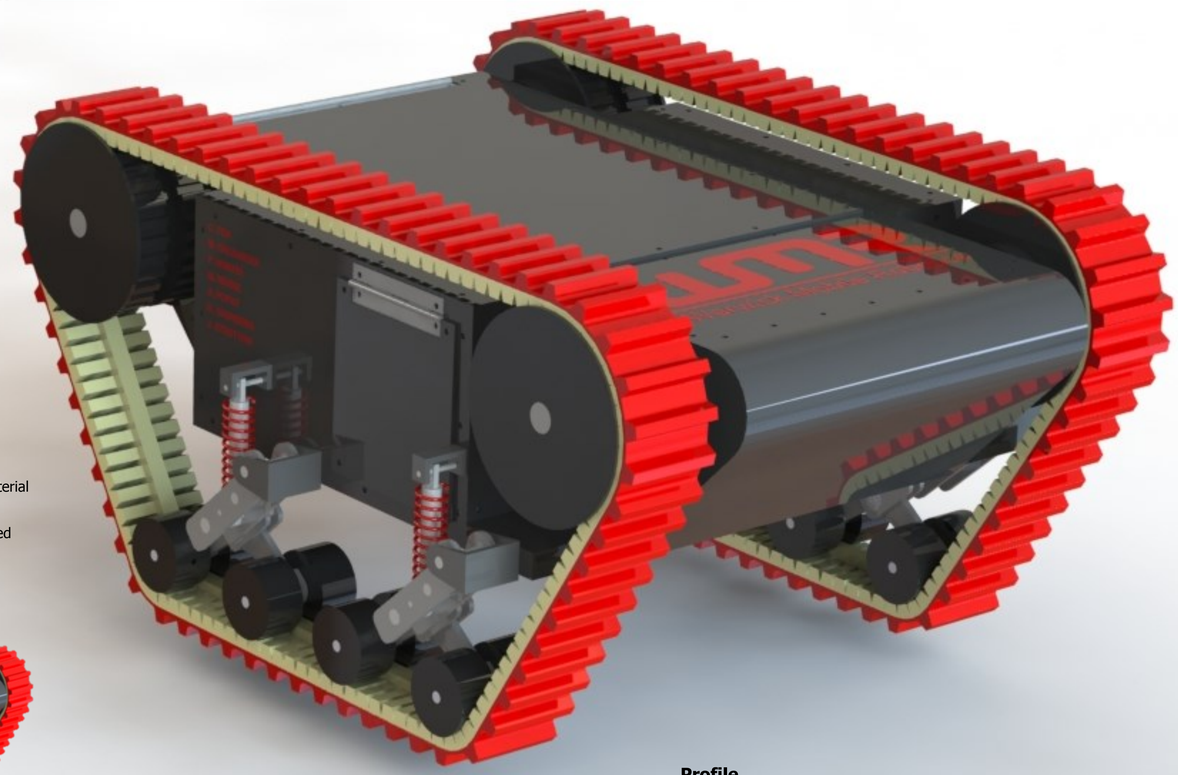
- **Adaptable** - Makerbeam® is a flexible design material and is easy to assemble
- **Accessible** - Internal components can be accessed quickly for maintenance and repairs



Access panels for easy maintenance of internal components

Completely New Robot!

It will handle difficult terrains better than any of the previous WMR robots with its high clearance and innovative suspension system!



Profile

Height: 266 mm Length: 508 mm Width: 393 mm

Mass: 20.4 kg

Electronics

Power System

- **Reliable** - There is over-current protection integrated into the system to prevent damage
- **Precise** - Speed, current and power availability are monitored for complete control

Computing

- **Low Cost** - A microprocessor (Arduino) and a minicomputer (Pico-ITX) manage the computing requirements
- **Structured** - The Arduino is used primarily for controlling the sensors
- **Capable** - The Pico-ITX will do the complex analysis from the LiDAR (Light and Radar) data

LiDAR Mapping at the RoboCup Competition

Mapping

- **Comprehensive** - LiDAR technology creates a high resolution map of the environment
- **Targeted** - Target is illuminated by a laser and the reflected light is analysed by the Pico-ITX
- **Cutting Edge** - NASA has identified LiDAR technology as key for safe landing of future robotic lunar-landing vehicles

Sensors

- **Intuitive** - Front and rear mounted cameras allow for complete tele-operated drive
- **Insightful** - Innovative 360 degree camera gives a complete view of the surroundings
- **Detecting** - Life detection sensors include Infra-red

Further Work

Development for further USAR capabilities have been provisioned for in the design, including:

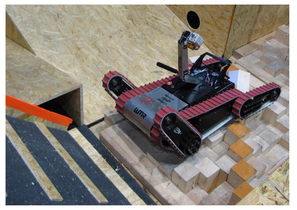
- Electronic framework and power supply for further sensors and servos
- Platform for a mechanical arm and end effector
- Integration of control technology such as Oculus Rift for an insightful user interface

Oculus Rift by Oculus VR

Competition

Competitions are a good platform for development of new robots. Internationally organised events provide an opportunity for teams from universities and research centres to meet with the best in the field and share leading technology.

WMR often attends the RoboCup competition, where robots compete over obstacle courses designed to test their performance in disaster zones. The WMR team's future goal is to compete in this competition and the robot has been designed with the RoboCup regulations as a guideline.



WMR at the RoboCup 09 Hanover

Contact

@WMRobotics
www.facebook.com/WMRobotics
www.mobilerobotics.warwick.ac.uk

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