Mohamed bin Zayed International Robotics Challenge (MBZIRC)

• The MBZIRC is intended to be a prestigious, top end, international robotics competition.

• It will be held every two years, with total prizes of USD 5 Million.

• The MBZIRC aims to provide an environment that will inspire the future of robotics.
Mohamed Bin Zayed
International Robotics Challenge
MBZIRC
The MBZIRC aims to

• Provide a technologically demanding set of challenges in Robotics

• Attract the best international teams

• Showcase the current state of the art in robotics, while performing a set of challenging tasks

• Provide an environment that harbours innovation and technical excellence in robotics
MBZIRC

Expected Outcomes

• Foster the UAE robotics eco-system and provide it an international dimension

• Promote robotics within local industry

• Bring robotics talent to the UAE and showcase the state of the art in robotics in the UAE and

• Attract students to STEM disciplines
The Challenge
The Challenge

For the inaugural competition, the following challenge has been identified:

- **Ground and Aerial Robotics Challenge in a disaster response scenario** - based on networked UAVs and UGVs cooperating and acting in an outdoor arena to autonomously locate, track and manipulate moving targets, in a disaster response scenario.

This challenge addresses a set of key research and development problems critical for future progress in robotics.
Challenge Overview

The challenge tasks will take place in a simulated humanitarian disaster response scenario.

The challenge will involve

• **Autonomous Navigation** in a *dynamic environment* (moving targets and obstacles)

• **Collaboration** between a group of robots (UAVs and UGVs)

• **Physical Interactions** with the environment.
Challenge Scenario

- The competition will simulate a disaster response scenario resulting from an explosion in a moving vehicle.

- The competition will take place in an outdoor open arena with an area not exceeding $100mx60m$.

- The arena will have a predefined track with a moving vehicle(s), and a set of static and moving obstacles.

- An emergency event(s) will occur on board the vehicle at a predefined interval(s).
Challenge Scenario - Sequence of Events

- An emergency event will happen onboard a moving vehicle, producing visible signals (e.g. smoke and flames in case of a fire)

- The first mission of the robot team is to locate and stop the vehicle soon after the emergency event by landing on top of the moving vehicle and operating an emergency switch located on top of the vehicle

- The second mission for robot team will be for an UGV to reach the vehicle and operate a valve on a side of the vehicle.
Challenge – Sequence of Events

• A group of static and moving objects will appear in the arena (e.g. simulating humans escaping from the disaster area). The team of UAVs and UGVs will then collaborate to locate, track, pick and re-locate these moving objects.

• The robots will be required to navigate by avoiding static and moving objects. The arena will contain complex structures requiring the UAVs to perform some complex maneuvers to accomplish the tasks.

• Additional events like
  stopping a second moving vehicle from colliding with the stationary vehicle, dropping supplies to the moving objects, and
  UAVs carrying out complex motions (e.g. entering the vehicles, moving through tunnels) may also be introduced during the challenge.
Challenge Tasks

A Team of Robots (3+ UAVs and 1+ UGVs) will attempt some of the following tasks:

(a) Locate moving vehicle, and detect the event
(b) Navigate amongst obstacles to track the vehicle
(c) A UAV to land on the moving vehicle
(d) The UAV to then operate a switch on the vehicle to stop the vehicle
(e) The UAV to issue commands to a UGV to further intervene
(f) The UGV to navigate avoiding obstacles, approach the vehicle, identify a valve located on one of its sides and close the valve
Challenge Tasks

(g) The robots to collaborate to locate, track, pick and re-locate moving targets
(h) UAVs to perform some complex maneuvers (e.g. enter vehicle, acrobatic moves, move through a tunnel etc.)
(i) UAVs to detect and stop two vehicles from colliding
(j) UAVs to drop supplies to the moving targets
(k) UAVs entering the vehicle and
(l) UAVs to interact with other flying objects in the arena

The difficulty level of each task maybe gradually increased during the competition in order to evaluate and select the best teams.
Technical Challenges

To perform the competition tasks, the robots are expected to have skills such as

- **Autonomous navigation** in a dynamic environment (moving targets and obstacles),

- Efficient **collaboration** in sharing information and assigning tasks among the robotic team.

- Physical **interactions** with static and dynamic targets.
Timelines
Timelines

- Press Conference
- Call for Proposals
- Submission of Proposals
- Selection of Finalists
- Preparation Camp
- **MBZ-IRC**
- February 2015
- May 2015
- September 2015
- November 2015
- May 2016
- November 2016
THANK YOU
Challenge Scenario
# Technology Challenges

<table>
<thead>
<tr>
<th>Events/Tasks</th>
<th>Perception &amp; Mapping</th>
<th>Navigation</th>
<th>Manipulation &amp; Grasping</th>
<th>Collaboration</th>
<th>Decision Making</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locating and tracking the moving vehicles and targets</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Detecting emergency events occurring on-board a moving vehicle</td>
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<tr>
<td>UAVs landing at a target location on a moving vehicle</td>
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<td>UAV physically intervening by activating emergency switches</td>
<td>X</td>
<td>X</td>
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<tr>
<td>UGV moving to stationary vehicle and closing a valves attached to the vehicle</td>
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<tr>
<td>UAVs and UGVs cooperating to locate, track, pick and relocate a set of moving and static objects</td>
<td>X</td>
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<tr>
<td>UAVs interacting with other flying objects in the arena</td>
<td>X</td>
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<td>Complex aerial manoeuvre to be performed in the arena</td>
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<td>Drop supplies to static and moving targets</td>
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<tr>
<td>To detect and stop two vehicles from colliding on the track, by operating switches on the vehicles.</td>
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Technical Advisory Committee
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Carnegie Mellon University, USA
Distribution of Prize Money
Distribution of Prize Money

Sponsorship of the top ranking finalists (in November 2015)

$500,000.00

Prize(s) for winner(s) in the Finals (in November 2015)

$2,000,000.00
Targeted Groups
Target Audience for the Challenge

We intend to target the following Groups encouraging them to submit proposals:

- CMU
- MIT
- Stanford
- Georgia Tech
- University of Pennsylvania
- University of Berkeley
- University of Sydney, Australia
- QUT, Australia
- NUS Singapore
- KAIST Korea
- University of Tokyo, Japan
- Tohoku University, Japan
- Tsinghua University, China
- Beihang University, China
- Northwestern University, China
- LAAS-CNRS, Toulouse, France
- Imperial College London, UK
- University of Oxford, UK
- University of Seville, Spain
- EPFL Switzerland
- ETH Switzerland
- University of Delft, Netherlands
- TUM Germany
- University of Karlsruhe, Germany
Global Reach and Presence
Global Reach and Presence of the Challenge

• Local and international media updates
• Active Social Media presence
• Direct communications (Robotics Worldwide, EURobotics, KU lists, etc)
• International presence (UK Robotics Symposium, European Robotics Forum, DARPA Grand Challenge, Rock-In Challenge, Euralthon Challenge, Robocup, Visits to Labs (USA, Europe, Australasia)
• Attendance of robotics related conferences to promote the event globally (ICRA, IROS, etc)
• Advertising campaigns depending on budget (radio, billboards, targeted journals, newspapers, etc)
Disaster Response Scenario

The car ferry Norman Atlantic burns in waters off Greece December 28, 2014 in this handout video grab of the Italian Coast Guard. (Reuters / Guardia Costiera)