



# The State of our Enterprise

Mr. Rob Maline  
Enterprise Director, Joint Ground Robotics  
[robert.maline@osd.mil](mailto:robert.maline@osd.mil)  
24 March 2011

# Agenda

---



- The State of Ground Robotics
- Discussing the Theme
- What's New with JGRE?

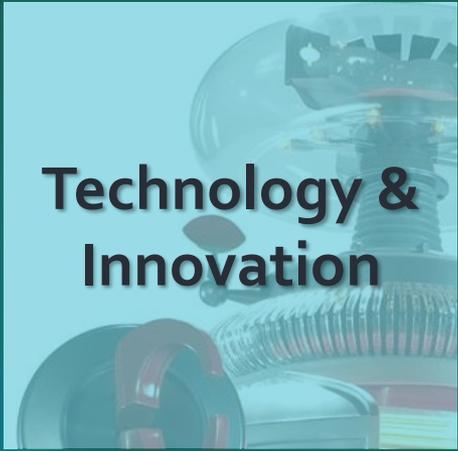
# Robots are Here to Stay...



- Experiences in theater have proven that robotics can satisfy critical operational needs
- We have only just begun to understand how to leverage unmanned systems in the joint battle space...there will be more for robots to do in future warfare
- Robots allow war fighter presence in hostile environments at reduced risk of exposure and loss of life and limb



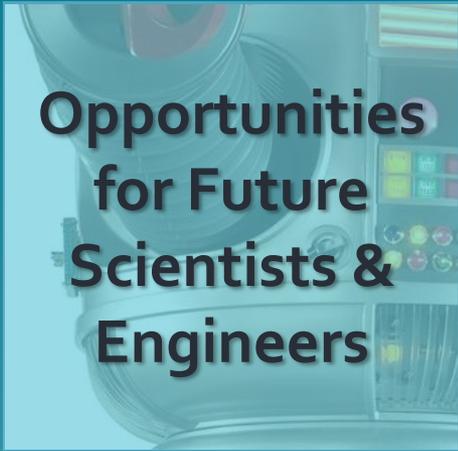
# Our Enterprise is Healthy



**Technology & Innovation**

The background image shows a close-up of a robot's head with a camera lens and various sensors, set against a light blue background.

**Acquisition**

The background image shows a close-up of a robot's head with a camera lens and various sensors, set against a light blue background.

**Opportunities  
for Future  
Scientists &  
Engineers**

The background image shows a close-up of a robot's head with a camera lens and various sensors, set against a light blue background.

**Requirements**

The background image shows a close-up of a robot's head with a camera lens and various sensors, set against a light blue background.

# Technology & Innovation



ATLAS, Cheetah & ARM  
(DARPA)



Urban Environment Modeling -UrbEm  
(JGRE)

Conformal End  
Effector (JGRE)



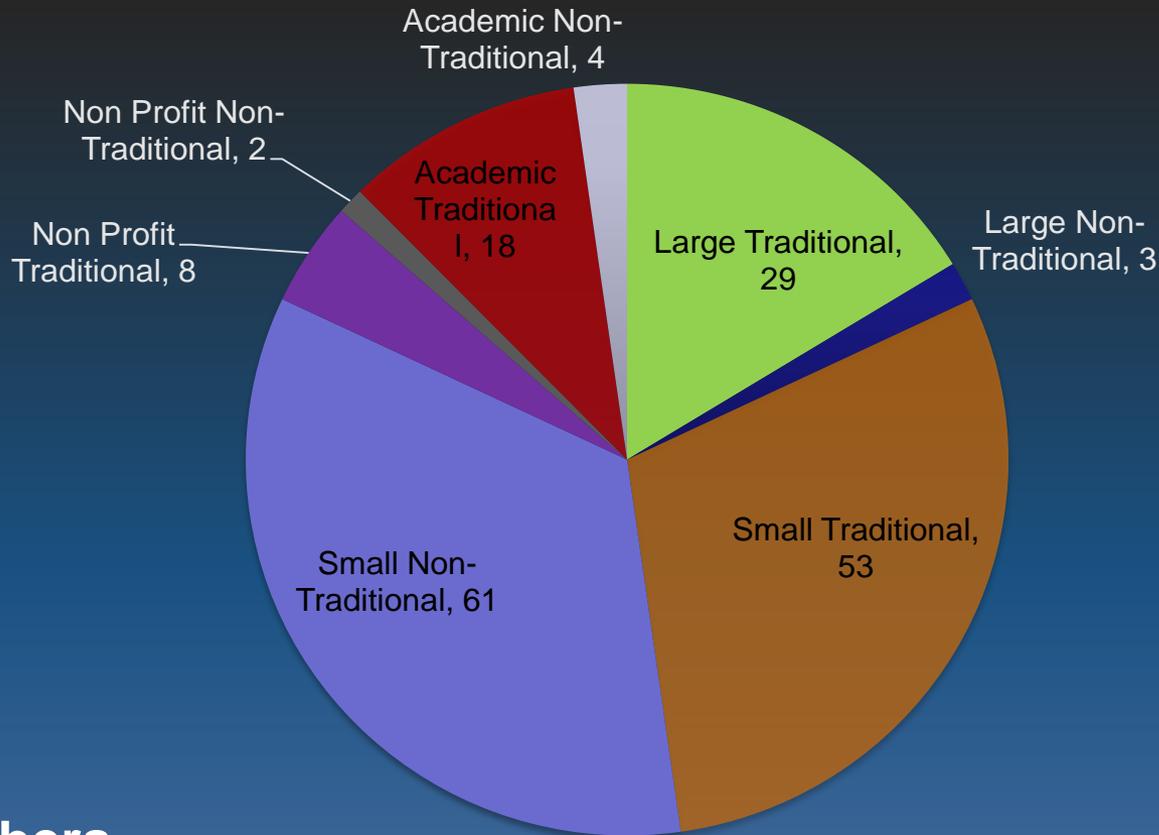
# Robotics Technology Consortium

---



- Non-profit, Industry Organization
- Created in 2008 at the encouragement of the Joint Ground Robotics Enterprise
- Other Transaction Agreement (OTA) in place with LW&M/JGRE
- Consists of 178 large and small commercial companies, academic institutions, and non-profit organizations, both traditional and non-traditional
- Seeks to solicit and engage companies and organizations that may have not historically performed work for the Defense Department and other Government organizations in addition to traditional defense contractors
- <http://www.roboticstechc.org/>

# RTC Membership

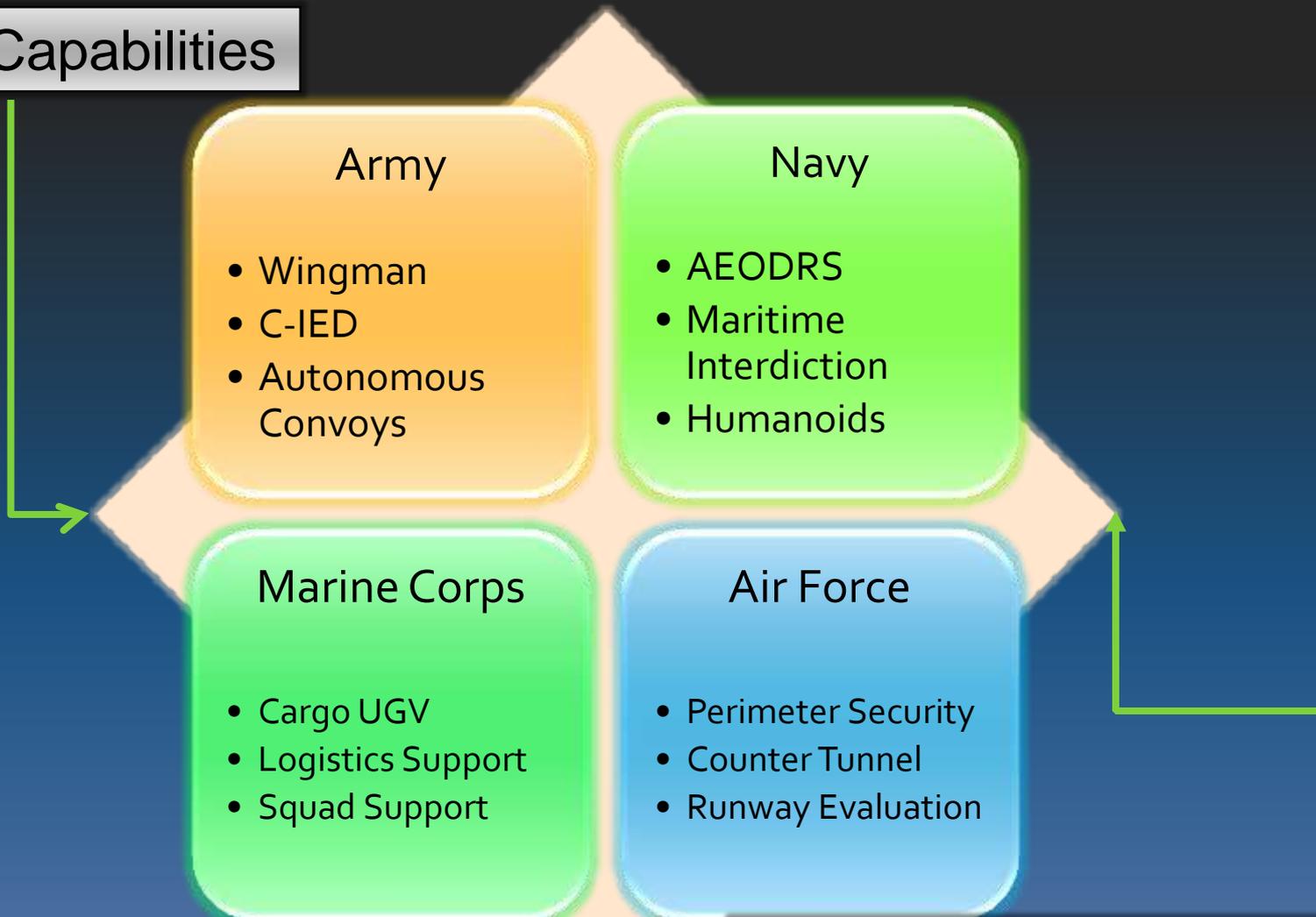


**178 Members**  
**~39% are Non-Traditional**



# Requirements

Desired Capabilities



Fieldable Technologies

# Requirements – Our Goal

---



- Right now, requirements under development call for doing the same things we normally do, only with unmanned systems
  - Counter-IED
  - Autonomous Convoy OPS
  - EOD missions
- Eventually, we hope to do more than just extend the reach/sight of our Warfighters
  - Robots as Teammates/Co-workers/Co-inhabitants

# Acquisition



- Although few formal programs of record exist, the community is starting to address traditional acquisition impediments:
  - Testing
    - Developmental, Operational, Safety → TRUST
  - Reliability, Maintainability, Supportability
  - Match operational benefit with deliverable capability
    - Are the benefits worth the investment?
  - Appropriate strategies given optempo and rate of technology maturation

# Opportunities for Future Scientists and Engineers



## Intelligent Ground Vehicle Competition

- Challenges college student teams to develop an Intelligent Vehicle to navigate a complicated obstacle course – includes extensive list of mobility and design requirements
- All levels of undergraduate and graduate education
- Students solicit and interact with industrial sponsors who provide component hardware and advice



## Military Academies

- Establish communications between service academy professors and service labs
  - Air Force Academy Senior Design Project modeled on AFRL Counter Tunnel Project
- Provide access to current service inventory platforms
  - RSJPO Robotics Pool provided robots for training & educational tools

# Opportunities for Future Scientists and Engineers (Cont'd)



## FIRST Robotics

- Comprised of over 90,000 volunteers
- Supported by a network of more than 3,500 corporations, educational and professional institutions, and individuals
- Programs include:
  - FIRST Robotics Competition for Grades 9-12 (ages 14-18)
  - FIRST Tech Challenge for Grades 9-12 (ages 14-18)
  - FIRST LEGO League for Grades 4-8 (ages 9-16; 9-14 in the U.S. and Canada)
  - Junior FIRST LEGO League for Grades K-3 (ages 6-9)
  - FIRST Place for ages 6 to adult
  - FIRST Scholarship Program

## Robotics Innovations Competition and Conference

- Supported by the National Science Foundation
- Challenge university-level students to engineer robotic solutions to real-world problems
- Stimulate students to imagine new robotics applications and encourage them to develop their ideas into working prototypes

## Student Ground Robotics Demonstration on the National Mall

- Held by AUVSI Foundation during National Robotics Week
- Demos of student-built ground robots on the National Mall, in front of the U.S. Capitol in Washington, DC

# Agenda

---



- The State of Ground Robotics
- Discussing the Theme
- What's New with JGRE?

# Saving Lives - Saving \$

## Are Robot Recruits the Answer?

---



- Yes!
- Well, probably...
- It depends...
- I don't know, can you prove it?

# EOD Robots Save Lives



# FY12 Robotics Cost Benefit Analysis



- The JGRE will be funding a CBA in FY12 to investigate the benefits of manned versus unmanned ground systems
- To date there has not been a formal Return on Investment of the life cycle costs of a manned system versus a unmanned alternative
- Potential missions being considered for the CBA include Convoy Operations, Logistics Support and Base Security
- Analysis will consider the full range of DOTMLPF\* impacts.

\*Doctrine, Organization, Training, Materiel, Leadership and education, Personnel, and Facilities

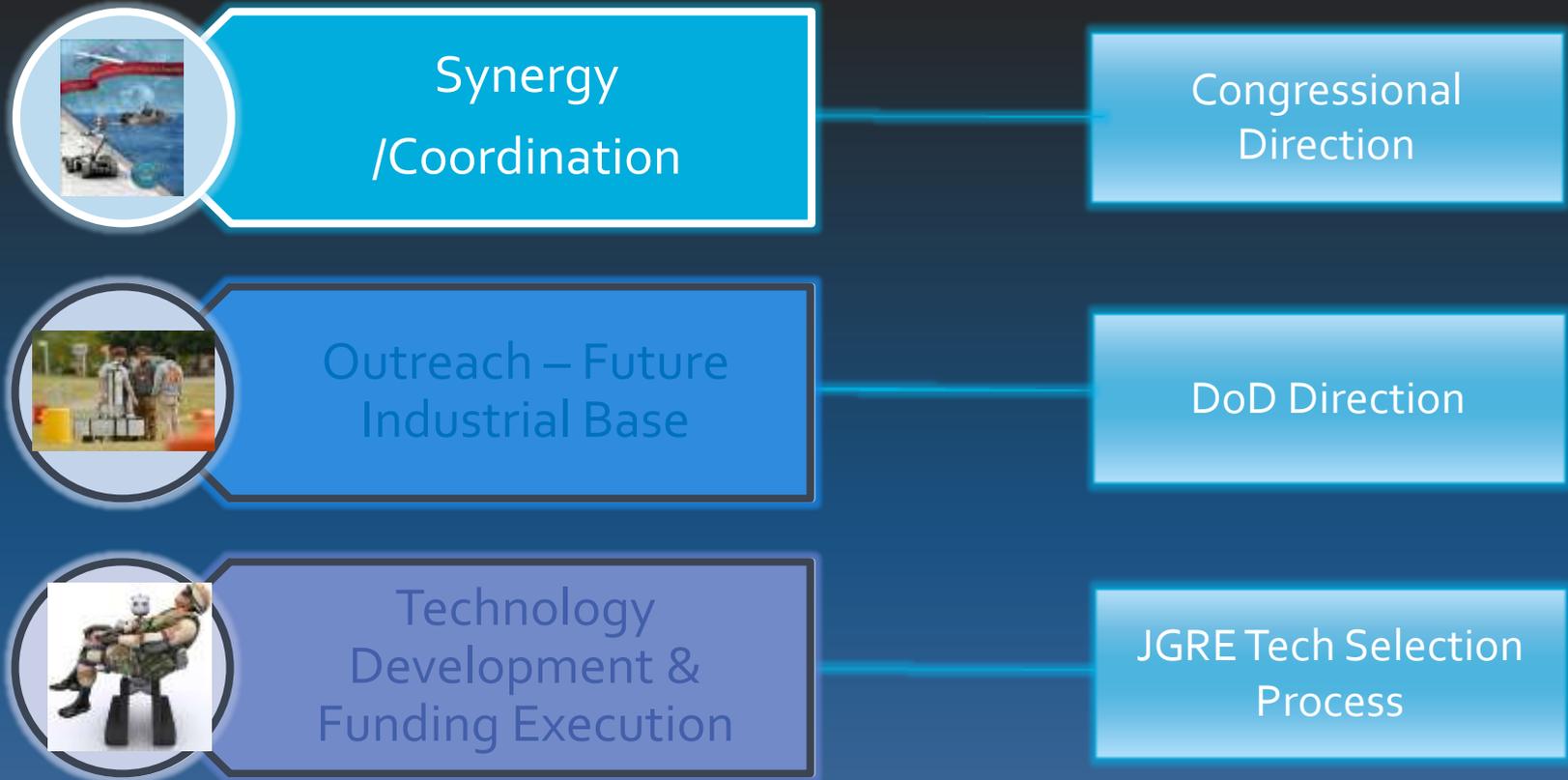
# Agenda

---

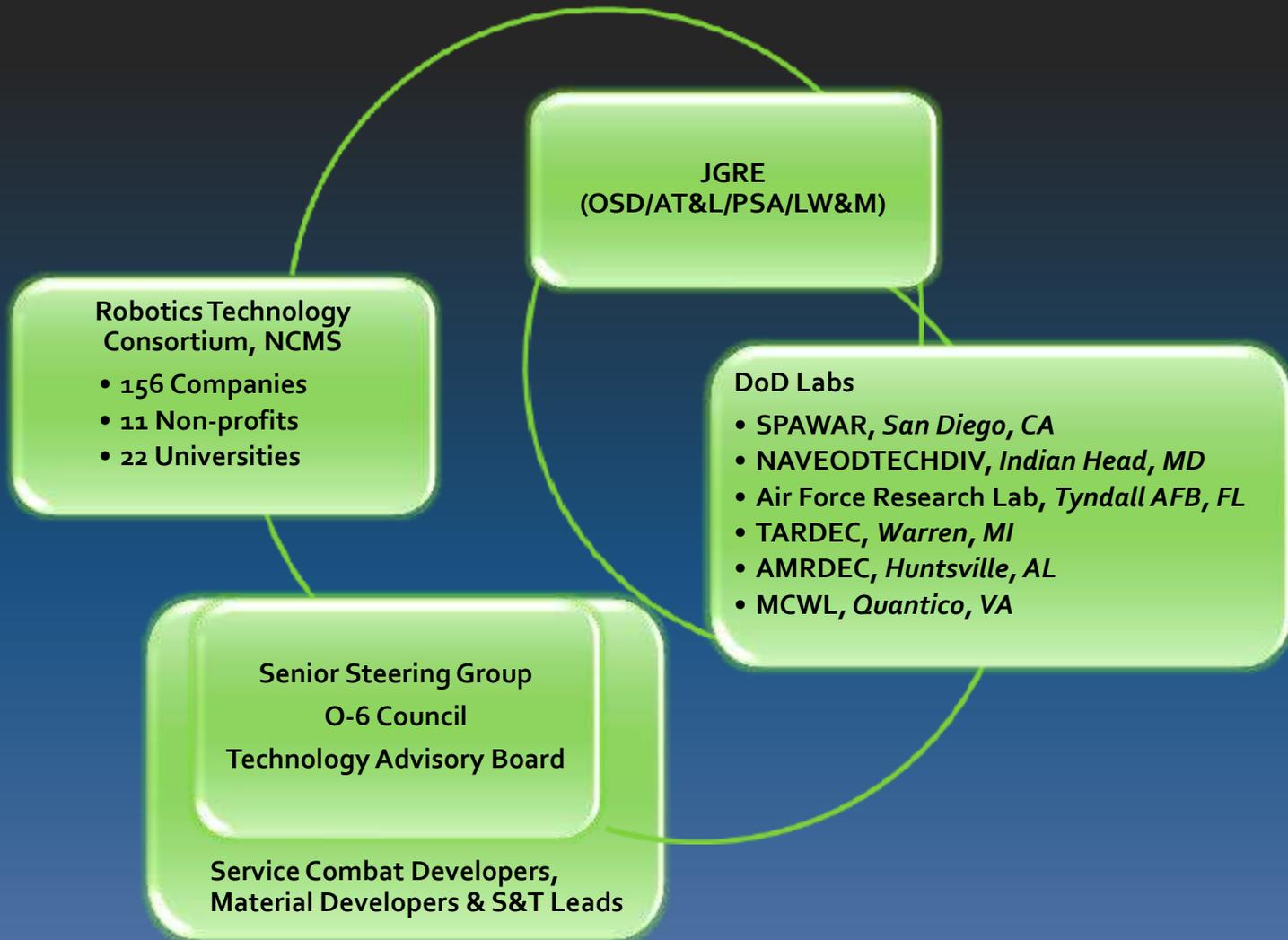


- The State of Ground Robotics
- Discussing the Theme
- What's New with JGRE?

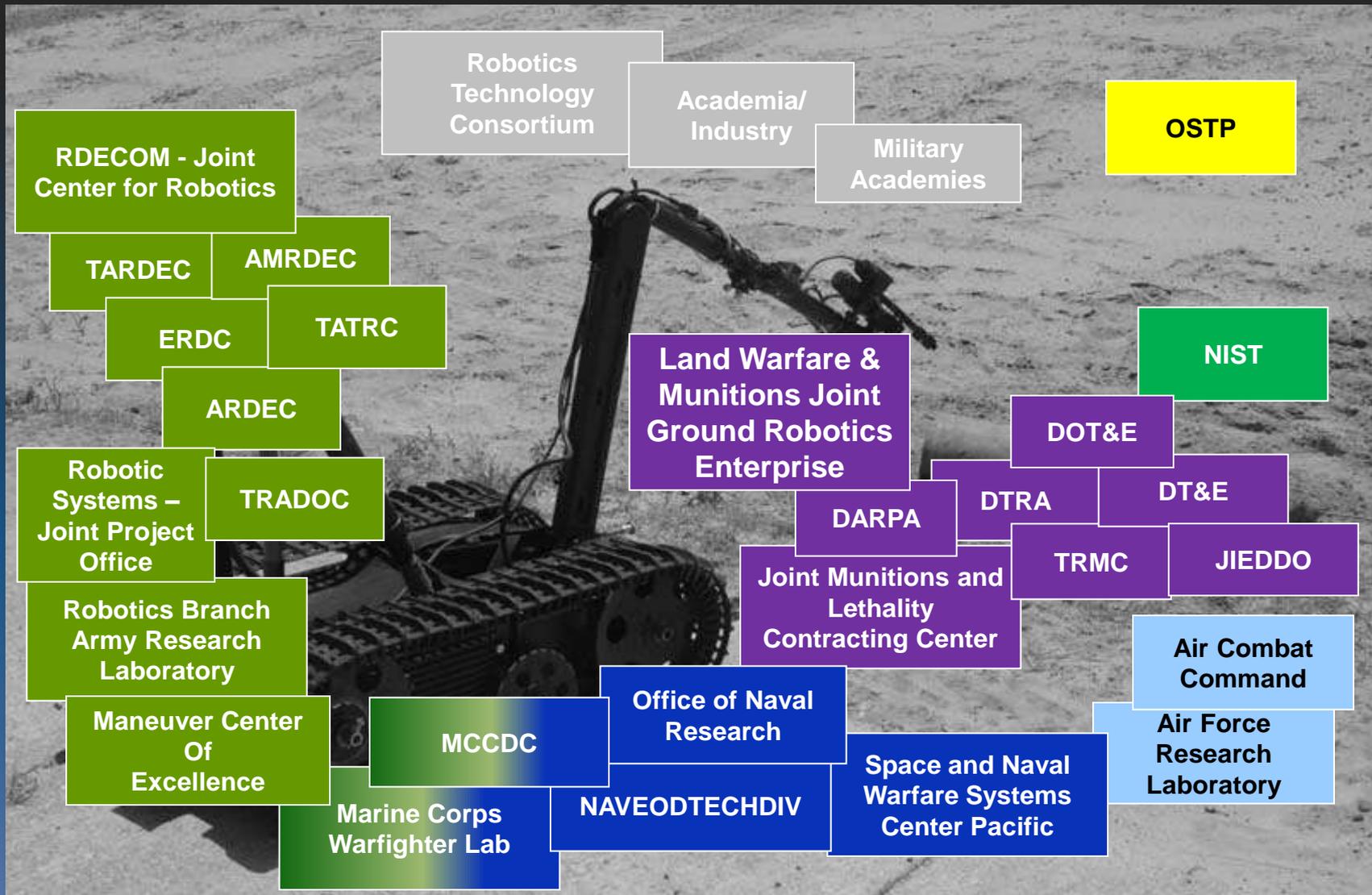
# JGRE Roles/Missions



# Enterprise Constituents



# Enterprise Constituents



# Enterprise Roles



Synergy/  
Coordination



Outreach – Future  
Industrial Base



Technology  
Development &  
Funding Execution

# Robotic Range Clearance Competition (R2C2)



- Goal
  - Advance the state of the art in robotics thru range clearance technologies
  - \$2 Million in cash prizes
  - G3/5/7 releasing an IDIQ
- Why Range Clearance?
  - Currently there are millions of acres encumbered with spent training rounds and munitions debris
  - The competition will help provide a safer, more timely, and more cost effective way to return the land to productive use

# Why Compete?



- OSD is offering prize money for the system that is most advanced and scores the highest
- Army Corps of Engineers in conjunction with the Army G3/5/7 will be releasing an IDIQ contract
  - Procure Services for Robotic Range Clearance
  - Participation in the competition will give competitors an opportunity to show the government success of their systems
  - Data collected for the competition can be used as test data to demonstrate capabilities for the IDIQ

# R2C2 Summary



- DoD is looking for the Robotics Range Clearance Competition to:
  - Advance the state of the art in robotics range clearance technologies
  - Foster opportunity for COTS procurement for Robotic Range Clearance
  - Provide the best balance of efficiency and innovation in robotic technology development

8-19 August 2011 – Final Competition

# Enterprise Roles



Synergy/  
Coordination

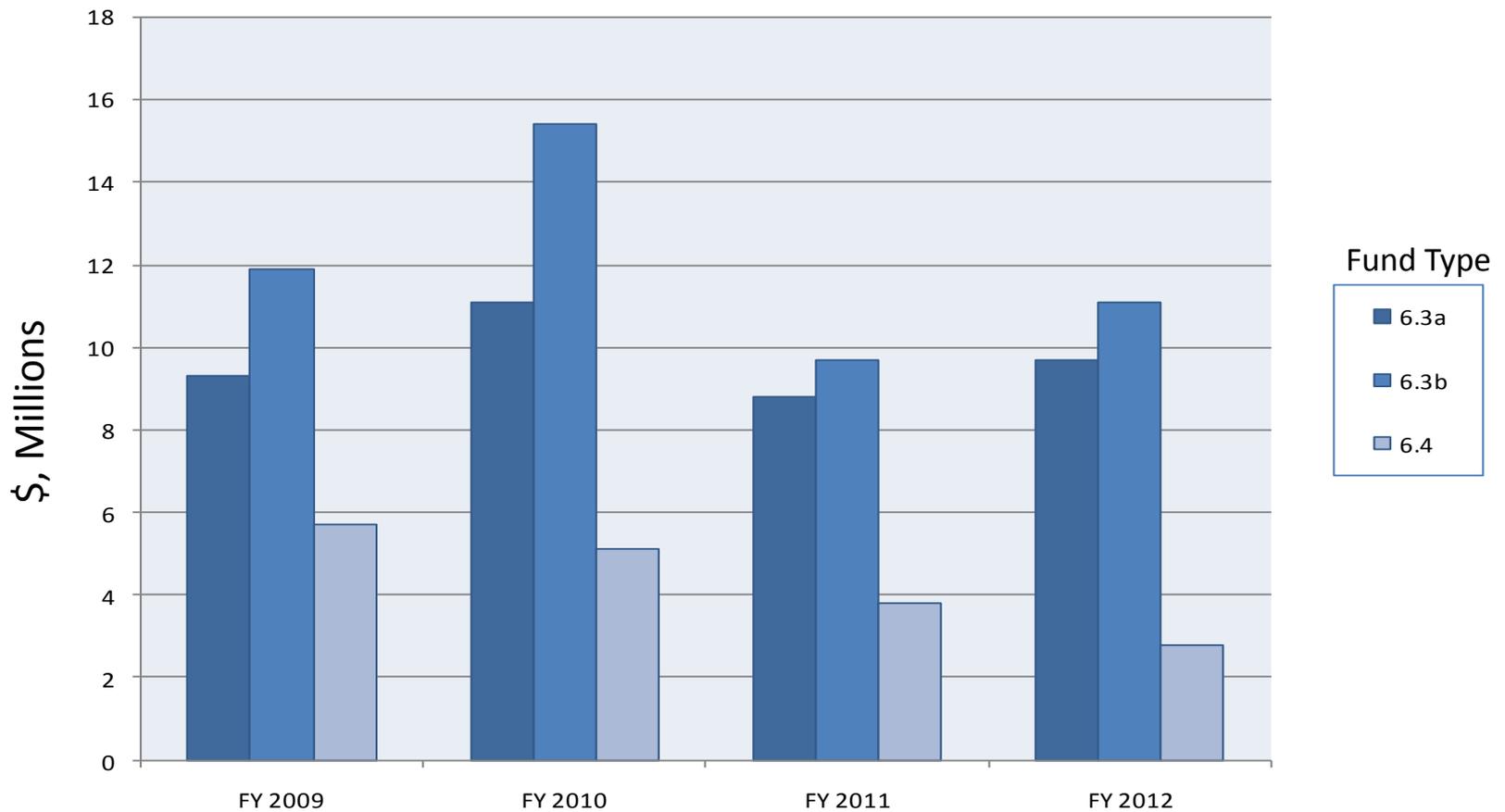


Outreach – Future  
Industrial Base



Technology  
Development &  
Funding Execution

# JGRE Funding Trends



# Technical Challenges

---



## Robots have limited ability to:

- Perceive and understand situations under all conditions
- Predict behavior of teammates or aggressors
- Collaborate with humans and other robots
- Learn tasks and adapt to new situations
- Move at near human speeds over any terrain
- Communicate effectively with other team members
- Lift, maneuver, and interact with physical objects

# Some Things to Consider...



**Ground Robotics are still newcomers to the fight, e.g. a technology leap/innovation.**

**Accepted theory suggests Technology Innovation will experience an increased rate of adoption if\*:**

- **It can be tried on a limited basis - “Trialability”**
- **The innovation offers observable results - Observability**
- **It offers an advantage over the status quo - Relative Advantage**
- **It is not overly complex to employ - Complexity**
- **It is compatible with existing practices and values - Compatibility**

\* Theory of Perceived Attributes (Rogers, E.M., Diffusion of Innovations 4<sup>th</sup> Ed., New York: The Free Press, 1995)



---

# Questions?

[robert.maline@osd.mil](mailto:robert.maline@osd.mil)

703-693-9414