“Crossing the Chasm”

Ground Robotics: A DoD & Industry Partnership

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Land Warfare & Munitions

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President, Board of Directors
Robotics Technology Consortium

Partnership Elements

- Joint Ground Robotics Enterprise (JGRE)
- Robotics Technology Consortium (RTC)
- Other Transaction Agreement (OTA)
- FY09-34 Unmanned Systems Integrated Roadmap
- UMS Roadmap Senior Review Committee
- Warfighter Experimentation

Joint Ground Robotics Enterprise

The Joint Ground Robotics Enterprise is that collection of organizations and activities engaged in developing, acquiring, operating, and sustaining ground robotics systems:

- **Office of Secretary of Defense – portfolio manager**
- **DoD Service Laboratories – technology developers**
- **DoD Combat Development Organizations – requirements developers**
- **DoD Program Managers and Offices –system acquirers**
- **DoD Users – soldiers, sailors, airmen, and marines using robots to perform their missions and tasks**

The Enterprise pursues robotics to increase operational capability, reduce exposure to harm, and conducts DoD missions more efficiently (time & dollars)

Other Transaction Agreement

- Terms & Conditions:
  - 7 year period of performance
  - $175M price ceiling
  - Requires significant contribution by non-traditional contractor or 1/3 cost share
- Scope:
  - Technology Development & Maturation
  - Ground Robotic Performance Improvement
  - Autonomous Tactical Behavior Development
  - Standards Maturation and Evolution
  - Mission Equipment Package Integration
  - Technology Transition Preparation

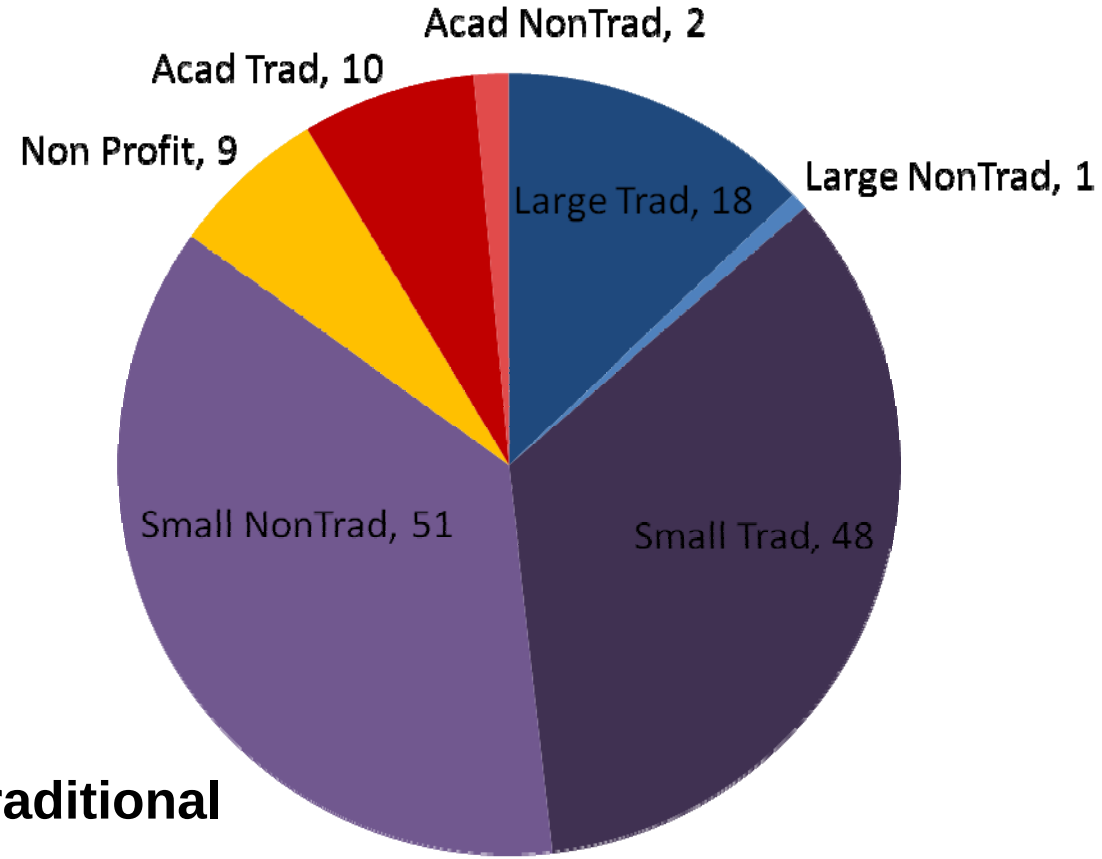
RTC Mission

ROBOTICS TECHNOLOGY CONSORTIUM

- Support innovative research to fill current and future capability gaps identified by the services
- Encourage teaming between military system integrators and robot companies, component providers, universities, and nonprofit organizations inventing the next generation technologies
- Enable nontraditional robotic companies to work with the government in an efficient manner
- Provide Industry and Academia with a voice in the DoD technology direction and road mapping process
- Promote the industry by educating decision makers on the state of the industry and technology

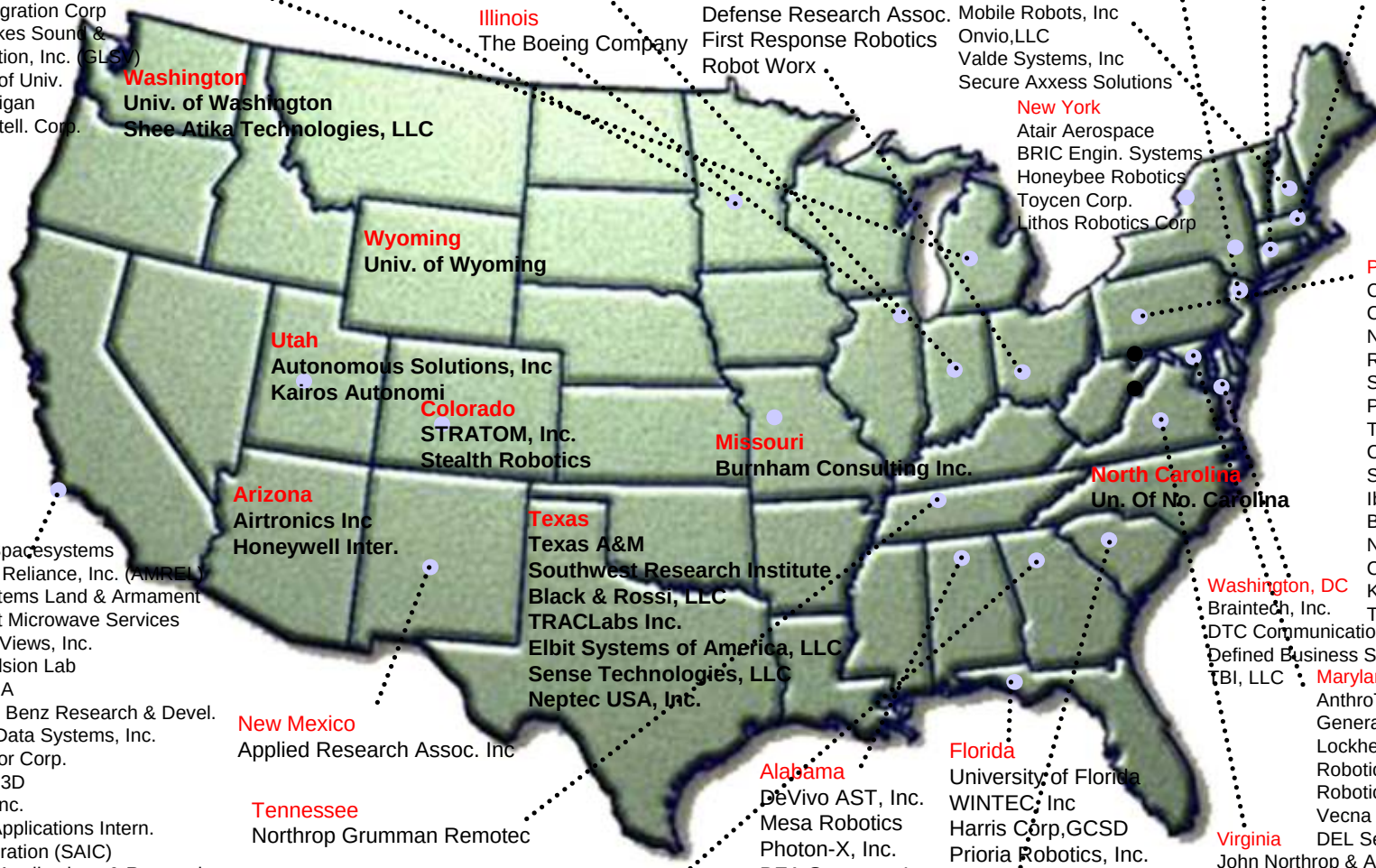
RTC Membership

ROBOTICS TECHNOLOGY CONSORTIUM



139 Members
~40% are Non-Traditional

Joint Ground Robotics Consortium
25 March - 139 Members



Michigan
Cybernet Systems
Soar Technology, Inc.
JADI, Inc
Tech Team Gov. Solutions
iTrack, Inc.
Quantum Signal LLC
Esys Integration Corp
Great Lakes Sound & Vibration, Inc. (GLSV)
Regents of Univ. of Michigan
Mobile Intell. Corp.

Minnesota
ReconRobotics, Inc.
Smart Info. Flow Tech.

Indiana
Next Wave Systems

Illinois
The Boeing Company

Ohio
Battelle Memorial Institute
Think-A-Move
Defense Research Assoc.
First Response Robotics
Robot Worx

Washington
Univ. of Washington
Shee Atika Technologies, LLC

Wyoming
Univ. of Wyoming

Utah
Autonomous Solutions, Inc
Kairos Autonomi

Colorado
STRATOM, Inc.
Stealth Robotics

Missouri
Burnham Consulting Inc.

Arizona
Airtronics Inc
Honeywell Inter.

Texas
Texas A&M
Southwest Research Institute
Black & Rossi, LLC
TRACLabs Inc.
Elbit Systems of America, LLC
Sense Technologies, LLC
Neptec USA, Inc.

California
Alliance Spacesystems
American Reliance, Inc. (AMREL)
BAE, Systems Land & Armament
Broadcast Microwave Services
EmergentViews, Inc.
Jet Propulsion Lab
Macro USA
Mercedes Benz Research & Devel.
Pandora Data Systems, Inc.
PNI Sensor Corp.
Quantum 3D
Robotex Inc.
Science Applications Intern. Corporation (SAIC)
Scientific Applications & Research Association (SARA)
Silvus Technologies, Inc.
SRI International
Sullivan Advanced Technology
TYZX, Inc
Vision Robotics Fed. Sys.
Velodyne Lidar, Inc.

New Mexico
Applied Research Assoc. Inc

Tennessee
Northrop Grumman Remotec

Georgia
Applied Systems Intelligence, Inc.
Georgia Tech Applied Research Corp.

Alabama
DeVivo AST, Inc.
Mesa Robotics
Photon-X, Inc.
BFA Systems, Inc.
Integ. Solutions for Sys.
PERL Research LLC
Polaris Sensor Tech.

Florida
University of Florida
WINTEC, Inc
Harris Corp,GCSD
Prioria Robotics, Inc.

South Carolina
National Robotics Training Center
Advanced Technology Institute

New Jersey
Sarnoff Corporation
SAVIT Corporation

New Hampshire
Mobile Robots, Inc
Onvio,LLC
Valde Systems, Inc
Secure Axxess Solutions

New York
Atair Aerospace
BRIC Engin. Systems
Honeybee Robotics
Toycen Corp.
Lithos Robotics Corp

Connecticut
Ultra Electronics Measurement Systems Inc.

Massachusetts
Barrett Tech., Inc
Boston Dynamics
Black-I Robotics
C-21, Inc
Foster-Miller, Inc.
iRobot Corp
Raytheon Co.
Rep Invariant Systems
Technical Products, Inc.
The Charles Stark Draper Laboratory
Autonomous Exploration
Worcester Polytechnic
Energid Technologies
Textron Systems Corp.
Boston Engineering Corp
RPU Technology, Inc.
Scientific Systems Inc.
Droid Works, Inc.

Pennsylvania
Carnegie Mellon Univ.
Chatten Associates, Inc
NuVision Engineering, Inc
RE2, Inc.
SkEyes Unlimited, Inc.
Pennsylvania State Univ.
The Tech. Collaborative
Concurrent Technologies
Seegrid Corp
Ibis-Tek
Butterfly Haptics, LLC
Nomadio, Inc.
Concurremt EDA
Kuchera Def. Sys.
Three Rivers 3D

North Carolina
Un. Of No. Carolina

Washington, DC
Braintech, Inc.
DTC Communications
Defined Business Solutions
TBI, LLC

Maryland
AnthroTronix, Inc.
General Dynamics Robotic Syst
Lockheed Martin
Robotic Research, LLC
Robotic Technology, Inc.
Vecna Technologies, Inc.
DEL Services, LLC

Virginia
John Northrop & Associates, Inc.
Klett Consulting Group, Inc
Oceana Sensor Technologies, Inc.
Old Dominion University
SET Corporation
TORC Technologies
Virginia Tech
Rababy & Associates, LLC

RPP #1 Selectees

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Research Area 2.1: Non-Line-of-Sight (NLOS) Tele-operation

Project Awardee: Silvus Technologies, Inc.
Proposal Title: “MIMO-Enabled Communication Links for NLOS Robotic Tele-operation Missions”

Research Area 2.2: Improved Depth Perception to Aid Tele-Operation

Project Awardee: Chatten Associates
Proposal Title: “Improved Depth Perception to Aid Tele-Operation”

Research Area 2.3: Rapid Structure Characterization

Project Awardee: Sarnoff Corporation
Proposal Title: “Modular Software Architecture for Rapid Multi-robot Coordination, Mapping and Structure Characterization”

Research Area 2.4: Unmanned Sniper Detection

Project Awardee: iRobot Corporation
Proposal Title: “Sniper/Hostile Fire Defeat”

Research Area 2.5: Force and Tactile Sensing Based Manipulation

Project Awardee: iRobot Corporation
Proposal Title: “RTK-Remote Touch Kit”

Research Area 2.5: Force and Tactile Sensing Based Manipulation

Project Awardee: RE2, Inc.
Proposal Title: “Force and Tactile Sensing Based Manipulation”

Research Area 2.6: Mapping in Urban Terrains

Project Awardee: Sarnoff Corporation
Proposal Title: “Mapping in Complex Terrains”

RTC STEM Mission & Vision

ROBOTICS TECHNOLOGY CONSORTIUM

Mission:

To invigorate and educate our youth for next generation STEM professions by injecting intellectual and financial capital from nationwide robotics experts and leaders

Vision:

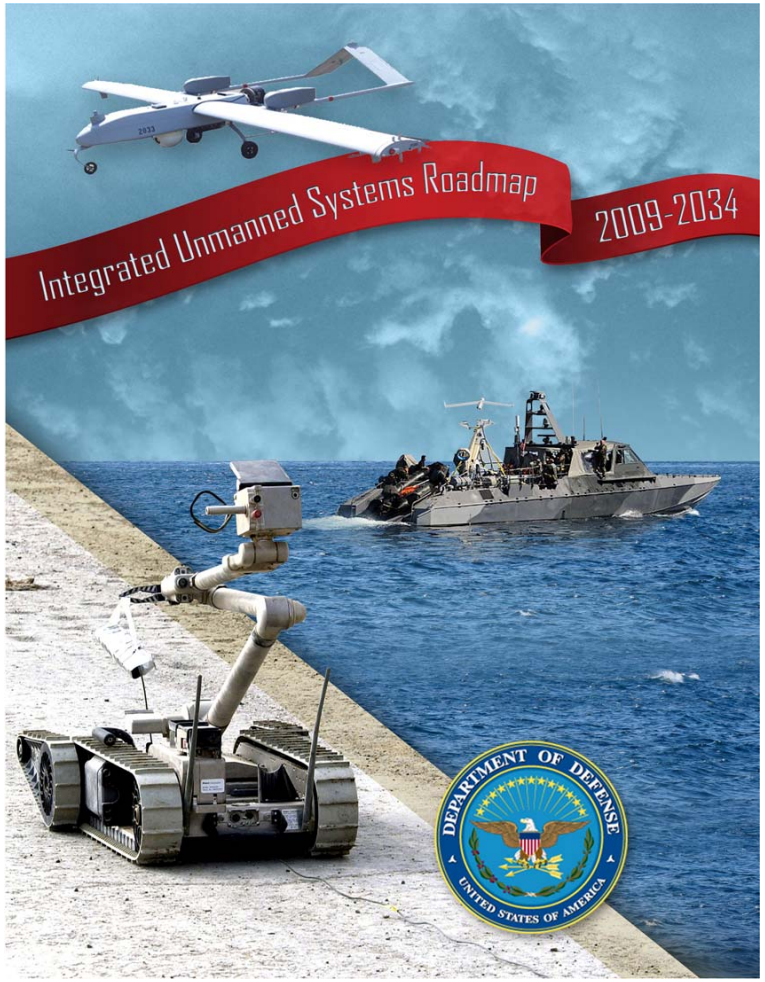
Engage our youth in STEM education by integrating robotics into their curriculum. Provide our youth and educators access to robotics experts to provide exciting applications of STEM and use robotics technologies to elevate and enrich nationwide STEM curricula. Demonstrate through robotics that STEM is exciting and rewarding and create a learning environment where robotics enforces this excitement.

RTC Membership Survey

ROBOTICS TECHNOLOGY CONSORTIUM

- More positive view of RTC value since October survey, but challenges remain
  - 85% of respondents see some value from RTC, with 47% seeing good or great value
  - Slight improvement since October
- Highest focus for RTC management, according to survey respondents, should be to assist members in obtaining new business . . . *stated more strongly in March than in October*
  - Increasing ground robotics funding
  - Working beyond JGRE
  - Opening USG channels outside DOD
  - Facilitating teaming and subcontracting

Unmanned Systems Integrated Roadmap



- **Applies a capabilities based approach to how we leverage unmanned systems technologies**
- **Will inform future capabilities and requirements based decisions (compatibility, material availability, standardization, etc.)**
- **Establishes a common vision for the Department of Defense and as a basis for shaping the DoD/Industry partnership**

UMS Integrated Roadmap Senior Review Committee

- **Senior Roadmap Committee Ensures:**
  - **Future vision satisfies DoD needs**
  - **Department activities accomplish recommended actions and satisfy goals and objectives in the roadmap**
  - **Roadmap evolves as needs become clearer and technology matures**
  - **Roadmap informs senior leadership decision making**

- **Committee Membership:**
  - **Office of Under Secretary of Defense (Acquisition, Logistics and Technology)**
  - **Office of the Joint Staff**
  - **Office of Under Secretary of Defense (Intelligence)**
  - **Office of Networks and Information Integration**
  - **Office of Program Analysis and Evaluation**
  - **Office of the Acquisition Executive - Army**
  - **Office of the Acquisition Executive - Navy**
  - **Office of the Acquisition Executive - Air Force**
  - **Office of the Acquisition Executive - Marine Corps**

Warfighter Experiments

- **Simultaneous Combined Approach between Combat and Material Developers**

- **Team must include:**
  - **Material Developer (DOD Laboratory)**
  - **Industry Partner (commercial source of technology)**
  - **Combat Developer**
  - **Transitioning PM**

- **Short Term Effort (1-3 years)**

- **Outcomes = maturing operational concept, technology maturation, draft requirements**

How do Warfighter Experiments Help RTC Members?

- Better understanding of operational environment
- Better understanding of how users would like to employ robots
- Focus on problems important to users, vice guess on what is important
- Users identify new applications not originally envisioned by RTC member
- …

A Construct for Partnership

- JGRE partners with RTC to inform decision making and develop technologies
- The Warfighter Experiments leverage the technical developments to refine concepts and requirements
- The results of the Warfighter Experiments inform the Senior Steering Committee
- The Senior Steering Committee accounts for progress against the Roadmap and ensures its proper evolution
- The Roadmap provides continued direction for JGRE and the Consortium