



Joint Ground Robotics Enterprise



Ground Robotics Update

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Congressional Robotics Caucus

Kick-Off Lunch

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A New Context



“We must focus our energies beyond the guns and steel of the military, beyond just our brave soldiers, sailors, Marines, and airmen. ... I hear all the time from the senior leadership of our armed forces about how important these civilian capabilities are.”



Secretary of Defense Robert Gates

“It is DoD policy that stability operations are a core U.S. military mission that the Department of Defense shall be prepared to conduct and support. They shall be given priority comparable to combat operations and be explicitly addressed and integrated across all DoD activities ...

DoD Directive 3000.05, dated Nov 28, 2005



Recent Metrics



- In 2002, the military's share of US official development assistance totaled 5.6 percent; by 2005, it had quadrupled to 21.7 percent, or \$5.5B. More than \$4B of that money was allocated for projects in Iraq



- Other Defense expenditures in 2005 included:
 - \$447M for counter-drug activities mainly in South America
 - \$844M for civilian reconstruction projects in Afghanistan and Iraq
 - \$117M in tsunami relief
 - \$12M in HIV and AIDS initiatives with African militaries



Center for Global Development



USSOUTHCOM Mission



Vision

A joint and interagency organization seeking to support security, stability and prosperity in the Americas.

Goals

- Ensure Security
 - Secure the U.S. from threats
 - Enhance hemispheric security
- Enhance Stability
 - Ensure cooperative U.S. partner nation relationships
 - Enhance consequence management and disaster response capabilities of our partner nations
- Enable Prosperity
 - Ensure favorable security conditions by enabling effective sovereignty
 - Help ensure political and economic freedom with respect for human dignity





Something to Think About



Casualty figures will rise sharply as villagers begin the harvest, picking olives from trees whose leaves and branches hide bombs that explode at the smallest movement. Farmers are caught in a deadly dilemma: to risk the harvest, or to leave the produce on which they depend to rot in the fields.

In poor communities it is common for civilians to salvage military debris for saleable scrap metal



Scrap metal collection at a Central Demolition Site, Afghanistan © Zak Johnson



What's on the Horizon?



Snakebot



- Provides the ability to navigate over rough, steep terrain where a wheeled robotic vehicle would likely get stuck or topple over
- Recon in severely restricted terrain
- Future software will allow the Snakebot to learn on its own by experience



What's on the Horizon?



Little Dog



- Developed under the Defense Advanced Research Projects Agency's (DARPA) Learning Locomotion program

- Goal is to learn how to traverse large, irregular obstacles with a high degree of freedom robot



- Expected Locomotion Strategy:

- Develop a library of moves to traverse terrain elements
- Recognize similar, already learned elements and modify as required in real time
- Best results will be ported to Big Dog



Boston Dynamics

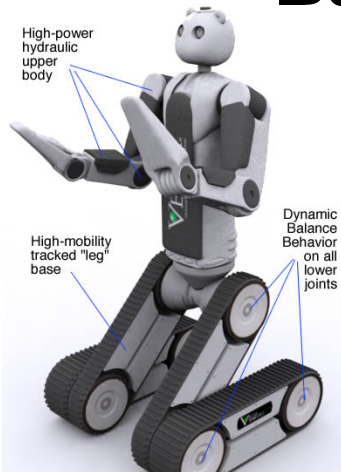
Big Dog



What's on the Horizon?



Battlefield Extraction-Assist Robot (BEAR)



- Currently in the proof-of-concept development phase for US Army's Telemedicine and Advanced technology Research Center
- Designed to find, pick up and rescue people without risking additional human life
- Upper body controlled by hydraulics
- A mobility platform that features two independent sets of tracked "legs"
- Features dynamic balancing behavior (DBB) while on its "ankles", "knees" or "hips"





What's on the Horizon?



- Developed by Carnegie Mellon University to assess the capabilities of large, unmanned ground vehicles operating autonomously in a wide-range of complex, off-road terrains

- Made of high-strength aluminum and titanium to withstand below-hull strikes from boulders and tree stumps, and a nose designed to absorb the impact of major collisions.

Crusher





Convoy Active Safety Technologies (CAST)



- Perception and planning for safe maneuver among people and other vehicles; active safety systems for collision detection and avoidance
- Integration of unmanned systems within the network
- Enhanced tele-operation
- Way point navigation
- Affordability: cost of future systems using projected technology
- System robustness



Combat Autonomous Mobility System (CAMS)



Problem:

- Special Operations Forces personnel are operating for extended periods in wider ranging, increasingly austere, non-permissive areas against larger forces; all with resource constrained manpower.
- They lack robust organic capability to conduct timely tactical insertion, ground-based Intelligence Surveillance and Reconnaissance, and tactical re-supply in these environments, and the technology to effectively force-multiply available manpower.



Solution:

Develop an integrated, autonomous, tactical ground-based system to leverage current Special Operations Forces manpower.



Ground Robotics Technology Consortium



Ground Robotics Enterprise

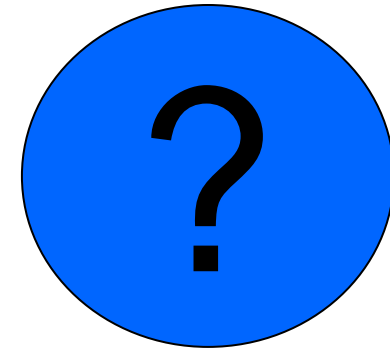


Joint Ground Robotics Enterprise

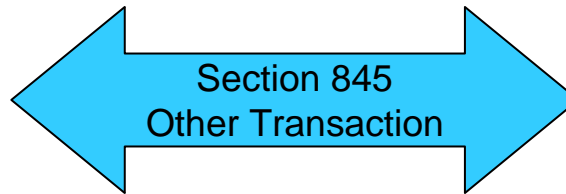


- OUSD(AT&L) PSA/LW&M
- Department of the Army
- Department of the Navy
- Department of the Air Force
- Defense Treat Reduction Agency
- J8
- Other Agencies and Departments

Ground Robotics Consortium



- Defense Contractors
- Small Businesses
- Academic Institutions
- Non-Profit Organizations
- Not-for-Profits Organizations



DoD and GRC ... Partnering to Leverage Capabilities and Investment



Purpose of the Consortium



- **Provide opportunity for non-government organizations to participate in DoD research planning, resulting in a plan based on industry expert knowledge of evolving technologies**
- **Allow for better leveraging of IR&D funding through insights gained as a result of this mutual planning process**
- **Lower the entry barriers for small companies to enter into the government acquisition process**



Scope



- **The OTA will encompass**
 - Technology Development and Maturation
 - Performance Improvement
 - Autonomous Tactical Behavior Development
 - Standard Maturation and Evolution
 - Mission Equipment Package Integration
 - Technology Transition Preparation
- **The OTA will not encompass**
 - Policy Development
 - Operational Concept Development
 - TTP Development
- **Only US firms as members of the Consortium**



Roles and Responsibilities



- **Joint Ground Robotics Enterprise (JGRE)**
 - Provides Oversight and Guidance
 - Conducts Planning and Budgeting
 - Manages Acquisition Process
 - Liaison with Other Organizations
 - Ensures Development of Annual Research Plan, Requirements and Source Selection Plan
 - Conducts Source Selection
- **Ground Robotics Consortium (GRC)**
 - Liaison among Industry and with JGRE
 - Participates in Development of Annual Research Plan
 - Conducts Technology Development and Maturation, Performance Improvement, Autonomous Tactical Behavior Development, Standards Maturation and Evolution, and Mission Equipment Package Integration



Keeping it in Perspective



Now is a crucial time for ground robotics:

- **Ground robots have proven their military worth in combat environments**
- **Despite the flaws in the existing systems today, Warfighters are adamant they will not give them up**
- **We need to do better ... we will invest where it does the most good and work with the user to solve the hard problems.**



One Last Thought: Let's not fall into the trap of thinking robotics have to be better than or replace humans to have military worth... they give us better than the status quo when they reduce exposure to loss of life and limb.



Wrap Up



- A greater awareness of ground robotics is forming across the DoD:
 - PACOM interested in legged robots for transport in complex terrain
 - SOCOM – CAMs JCTD
 - NORTHCOM looking to robotic tunnel exploration for border security
- Interest in ground robotics is world wide, no longer at the periphery of future planning
 - UK – Grand Challenge
 - Germany ELROB – European Land Robotic Competition
- Technology is beginning to outpace concept development – experimentation is key
 - CAST War fighter Experiment
 - Exoskeleton Experiment
 - ARC 2 Countermine War fighter Experiment
- Power continues to be a constraint, tech base investments still needed
- Sensors are starting to exhibit the needed capabilities to enable the next step towards full autonomy

There is much to be done, and DoD is organized and committed to do it