



# Joint Ground Robotics Enterprise



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## ***Emerging Robotics Technologies: Implications for the Future Warfighter***

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# Today's Context



**“Just about every threat to our security in the years ahead will require working with or through other nations. Success in the war on terror will depend less on the fighting we do ourselves and more on how well we support our allies and partners... “**



**“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, Nov 28, 2005**



# What is the Relevance to Robotics?



**U.S. Army Spc. Jacob Miller uses a hooligan tool to hit a wall suspected to hold a weapons cache during a house search in Amariyah, Iraq, on April 30, 2008. Miller is assigned to the 4th Infantry Division's 10th Cavalry, 4th Squadron. U.S. Air Force photo by Staff Sgt. Manuel J. Martinez**

**UGV TRAINEE - Defense Secretary Robert M. Gates learns how to operate an unmanned ground vehicle, or UGV, during a tour of the future combat systems facility on Fort Bliss in El Paso, Texas, May 1, 2008. Defense Dept. photo by Cherie Cullen**



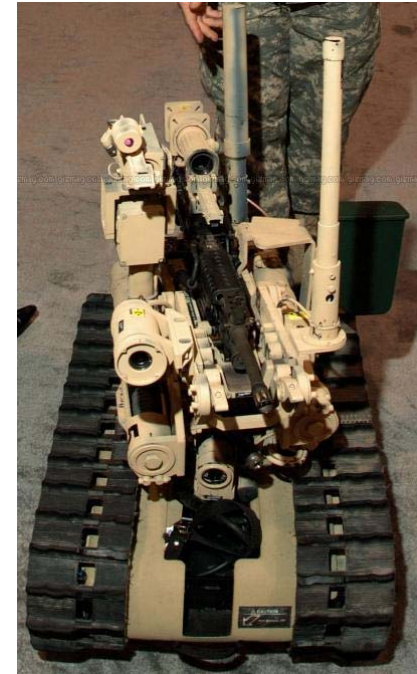


# In Theaters Near You



## MDARS

- planned for 6 sites
- 1 system per site (4 MDARS, Control Console, and ASIOE)



## SWORDS

- 3 deployed to theater
- 8 to be procured by SOCOM



## FIDO/PackBot

- 6 currently in operation
- Planned procurement; approximately 100



# In Army Labs Today



## Robotic Convoy/Leader-Follower



- Perception and planning for safe maneuver among people and other vehicles
- Integration of unmanned systems within the network
- Safe remote weapons operation
- Behaviors (intelligence) required to successfully operate with troops to accomplish assigned missions
- Affordability: cost of future systems using projected technology
- System robustness



# What's on the Horizon?



## Robotic Snakes



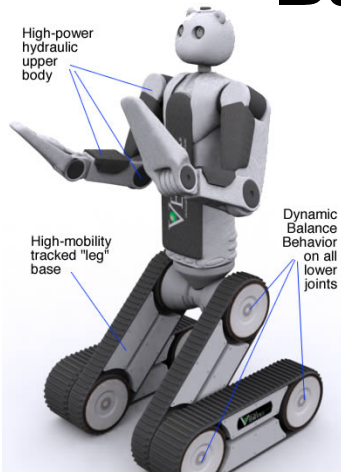
- Provides the ability to navigate over rough, steep terrain where a wheeled robotic vehicle would likely get stuck or topple over
- Recon in severely restricted terrain
- Future software will allow the Snakes to learn on its own by experience



# 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?



## Little Dog



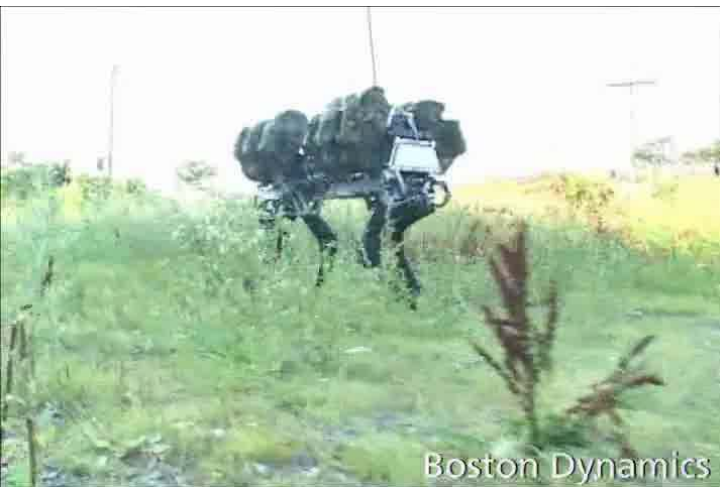
- Developed under the Defense Advanced Research Projects Agency's (DARPA) Learning Locomotion program

- 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



## Big Dog





# 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





# Cobra Gold 09 Warfighter Experiment



**US PACOM Mission: ... promotes security and peaceful development in the Asia-Pacific region by deterring aggression, advancing regional security cooperation, responding to crises, and fighting to win.**



**Challenge: Individuals must carry a range of equipment including armor, ammunition, electronics and batteries to sustain a battle and maintain personnel safety into complex terrain, in harsh weather. Many systems require a team of personnel to pack equipment. An unmanned systems to transport gear may address this capability need.**



**This Experiment will include a Limited Utility Evaluation (LUE) of potential platforms supporting this mission area via the Coalition Partner Exercise, Cobra Gold 2009. The user assessment will result in refining requirements and focusing the development of complex terrain traversability of unmanned systems.**



# Wrap-Up



- **Nearly \$2B is being invested in ground robotics by the Department of Defense**
- **Statutory mandate that the Department of Defense pursue use of unmanned systems**
- **Warfighter Experiments enable concurrent operational concept, requirements, and technology maturation**

**Joint Ground Robotics Enterprise is committed to ensuring those investments are responsive to Warfighter needs.**