



# Joint Ground Robotics Enterprise

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## *The Role of Robots in National Security*

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# A New Context



“Army will require leaders of uncommon agility, resourcefulness and imagination; leaders willing and able to think and act creatively and decisively in a different kind of world, in a different kind of conflict than we have prepared for for the last six decades”.

Secretary Robert Gates

“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.”



“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**



# 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

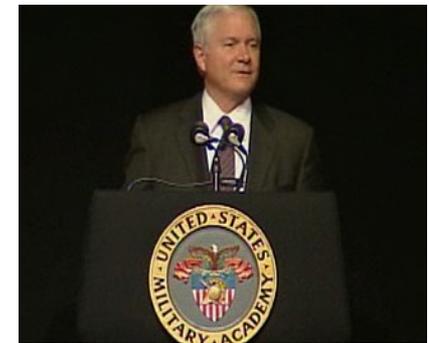


# Partner Nations



**“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...”**

**But what do you do when, as is the case today with NATO in Afghanistan, some of your allies don't want to fight; or they impose caveats on where, when and how their forces may be used; or their defense budgets are too small as a share of national wealth to provide a substantial contribution?”**



**“Eisenhower was a commander who believed that building and maintaining an international coalition of democracies was not a political nicety...but a matter of national survival.”**



# Focusing Beyond Guns and Steel of the Military



**U.S. Army Maj. Nathan Haas greets a local tribal leader at the Mada'in Agriculture and Technology Expo in al-Wahida, Iraq, April 26, 2008. Haas is assigned to the 3rd Infantry Division's 3rd Brigade Combat Team, which developed the expo to revitalize farming in the community. U.S. Army photo by Pfc. David J. Marshall**



**U.S. Army Capt. Christopher Flores examines a 45-day old carp from a fish farm in al-Buaytha, Iraq, April 26, 2008. Flores is fish farm advisor assigned to the Embedded Provincial Reconstruction Team, which provided a micro grant that enabled local fish farmers to buy fish from a Baghdad hatchery to improve his farming capacity. U.S. Army photo**



# 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.

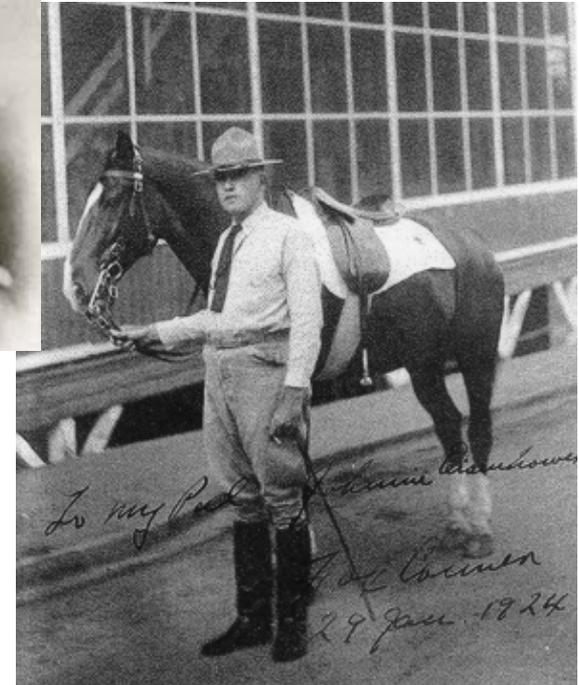
In poor communities it is common for civilians to salvage military debris for saleable scrap metal



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



# From Eisenhower's Inspiration



Never fight unless you have to;  
Never fight alone;  
And never fight for long.

- MG Fox Conner



# 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, Iraqi, 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**



**Robotics can serve as tools for today's warfighter's but you have to ask for it ... then advocate for it!**



# 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?



## Snakebot



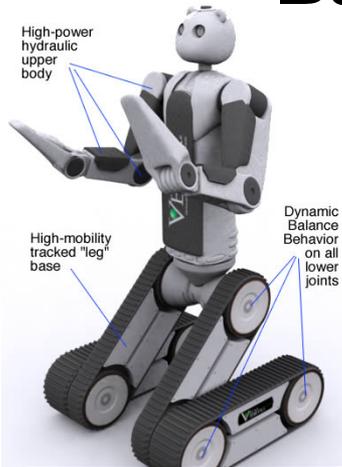
- Provides the ability to navigate over rough, steep terrain where a wheeled robotic vehicle would likely get stuck or topple over
- Recon in severely restricted terrain
- Future software will allow the Snakebot to learn on its own by experience



# What's on the Horizon?



## 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

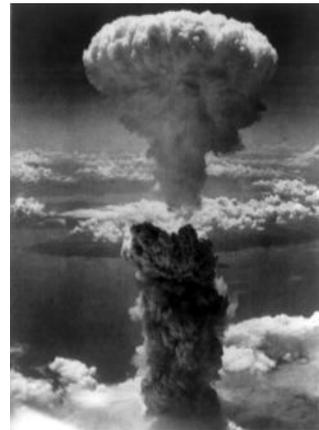




# With a Nod Toward George Santayana...



The history of warfare suggests that every new technological leap - the longbow, the tank, the atomic bomb - outraces the strategy and doctrine to control it.



Those who do not remember the past are doomed to repeat it.  
– George Santayana



# Will We Repeat History on the Ground?



**“I will give up a tank battalion for a UAV company,”**

**- MG Paul J. Kern, CDR, 4th ID, 1997**



**“Because people were stuck in old ways of doing business, it's been like pulling teeth.”**

**- Secretary Robert Gates**

Gates said in a speech at Maxwell Air Force Base, Alabama, that getting the military services, largely the Air Force, to send more unmanned surveillance and reconnaissance aircraft to Iraq and Afghanistan has been "like pulling teeth."



# What Does it Take to Lead Technology Adoption?

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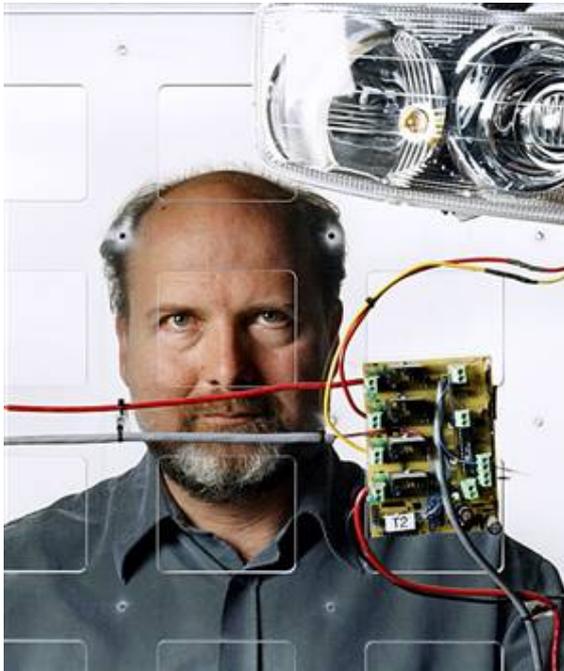


- **Leadership cannot be confined to one larger-than-life individual who charms thousands into being obedient followers.**
- **Modern organizations are far too complex to be transformed by a single giant. (This goes double for DoD!)**
- **The leadership effort must have support from many people who assist the leadership agenda within their sphere of activity.**

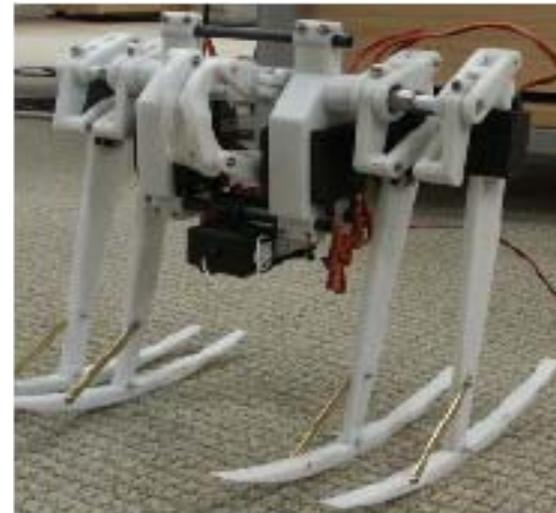
- P. Kotter, professor of leadership at Harvard Business School



# A Discussion With Danny Hillis\*



**“Leap Ahead Technologies are tough to pursue because surrounding technologies haven’t leaped. All components in the system must be leap ahead for real transformational change.”**



\* Danny Hillis developed parallel processing and is co-founder of Applied Minds which is currently working with Northrop Grumman to develop a robotic “MULE” for dismounted soldiers.



# For example...



We tend to think of Countermine, Explosive Ordnance Disposal, and Range Clearance Systems in terms of Combat Service Support...

What about as tools for National Security:

- unmanned to enable the few troops deployed in partner nations to do more
- unmanned to reduce the risk to our own and partner nation troops

Shouldn't we have the technology to robotically conduct countermine, IED defeat, and range clearance in all COCOM Areas of Responsibility?





# What Are *You* Going to Do?



**Robotic Technology is only a promise...for it to provide military worth, it must be deliberately managed in a larger context.**

**Leaders intent on introducing robots to war fighters must:**

- **Manage expectations – leap ahead is easy to say but hard to deliver**
- **Account for context – robots are perceived as eliminating jobs or enabling one community to do another community's job**
- **Ensure robotic development is underpinned by sound operational concept (quality, integrity) – it's a brave new world...we do not have a history of military robotics...that is what you will invent!**

**“We may not be interested in the long war, but the long war is interested in us.”**