



# ***Futures Directorate***

**NDIA Ground Robotics Conference**

**17 September 2013**

***Brigadier General Kevin Killea, USMC***

Director, Futures Directorate

Vice Chief of Naval Research

Executive Agent, USMC S&T

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Commanding General, Marine Corps Warfighting Lab



# Agenda



- MCWL
  - Core Responsibilities
- Current Environment
  - A Decade of Change
- What has our attention
  - Pacific AO
- What are we doing
- Unmanned Systems
  - Ground Autonomy Vision
  - MCWL UxS Focus
  - Initiatives
- Unmanned Medevac/Casevac
- Experimentation Observations
- Focus Areas for Industry
- Future Experimentation
- Questions



# Five Hats – One Office!



VCNR  
ONR

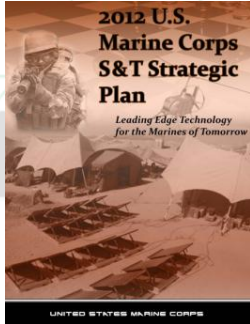
CG  
MCWL



 Director   
Futures Directorate

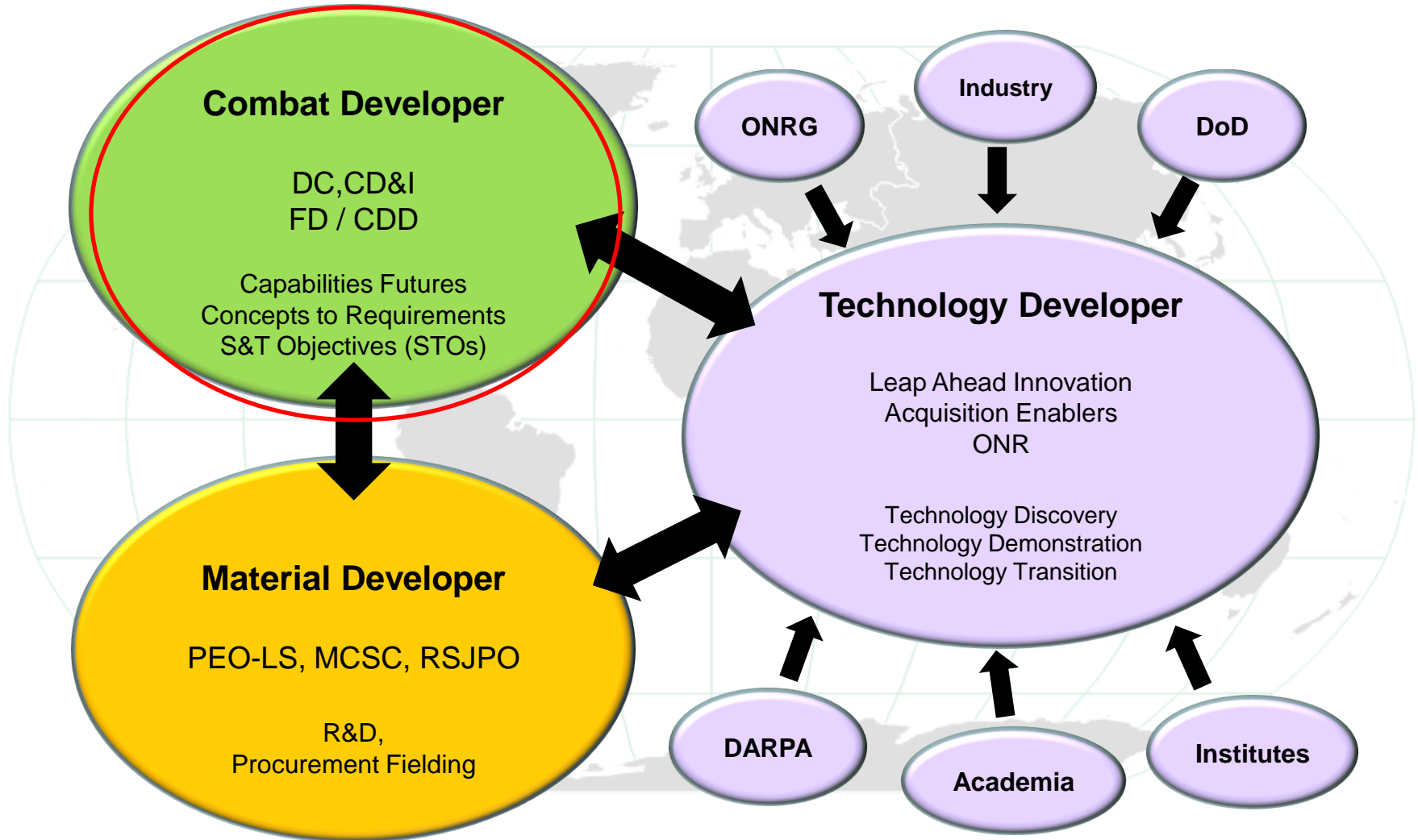
EA  
USMC IEDD

EA  
USMC S&T





# S&T Development - Three Circles



**Focusing S&T investments on Marine Corps needs in coordination with our Acquisition and Requirements Partners**



# Marine Corps Warfighting Laboratory



## *A Balance Between "Thoughts and Things"*

Wargaming

Science & Technology

Experimentation

Counter IED

Enhance the current and determine the future Marine Corps strategic landscape by defining the Marine Corps' next warfighting concepts and capabilities via development and evaluation of innovative tactics, techniques, procedures, organizations and technologies using an integral combination of wargaming, technology assessments, concept based experimentation and analysis.  
Serve as the USMC Executive Agent for Marine Corps Science and Technology (S&T), Counter Improvised Explosive Devices (CIED), and as the Marine Corps' liaison to the Joint Staff for Joint Concept Development and Experimentation.



# Marine Corps Warfighting Laboratory



- Core Responsibilities

- To identify capability gaps, training deficiencies, and/or deficiencies within current PORs
- Concept Based Experimentation, Emerging Technology Assessments (DoD & Commercial), Wargaming, and C-IED
- Respond to select urgent and compelling needs
  - Direct support to the warfighter
- To inform the requirements process and influence the material developer

- What we don't do.....

- Material developer
- Training Command
- Company sponsor





# Current Environment



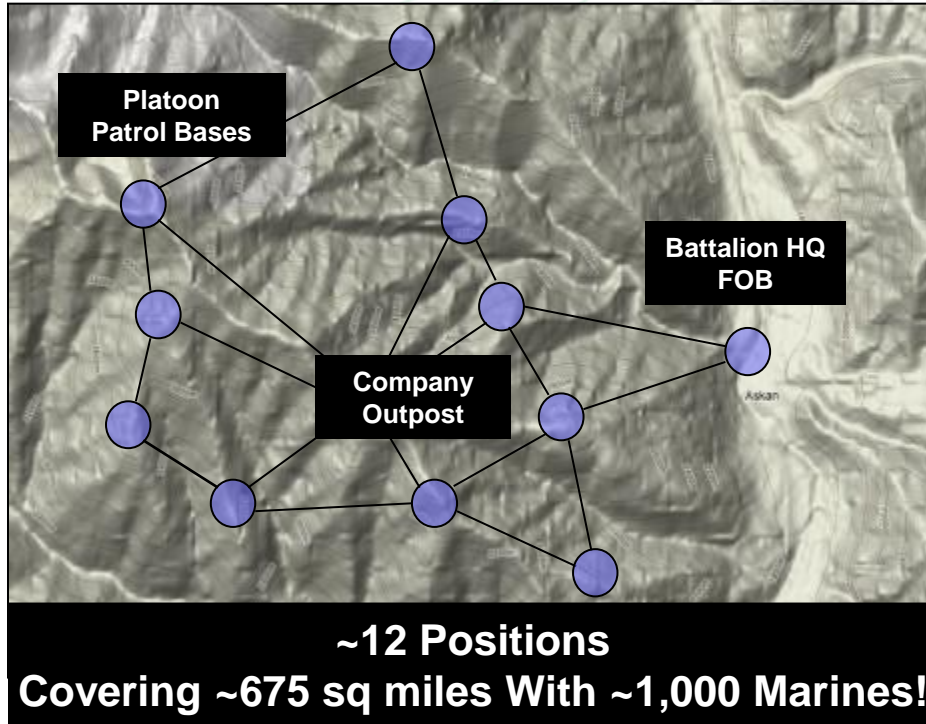
In order to meet the challenges associated with counterinsurgency and stability operations during the past ten years of war, the Marine Corps evolved skill sets, training, and equipment. The result is a Marine Corps that is fundamentally different from the combined arms force of the 1990's. As Marine commitments to Afghanistan decline, senior leadership wants to rebuild atrophied capabilities. Coinciding with rebuilding skills, the Marine Corps is drawing down end strength and planning for significant budget cuts.

*This triumvirate of events – rebuilding skills, reducing end strength, and smaller budgets – mandates that we look at alternative ways to more efficiently perform our mission.*



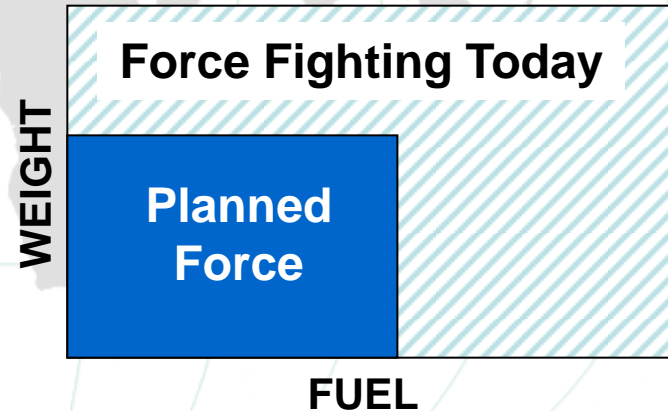
# A Decade of Change

## “Since 9/11”



### USMC Battalion since 2001

- 250% Increase in Radios
- 300% Increase in IT/Computers
- 200% Increase in # of Vehicles
- 75% Increase in Vehicle Weight
- 30% Decrease in Miles Per Gallon



**More Lethal, but...Increased Logistics Risks Comes at a Cost !**





# Bang for the Buck\$

## Cost to Equip a Marine

After accounting for inflation the cost today is 6.4 times the cost of equipping an individual Marine in 2000.

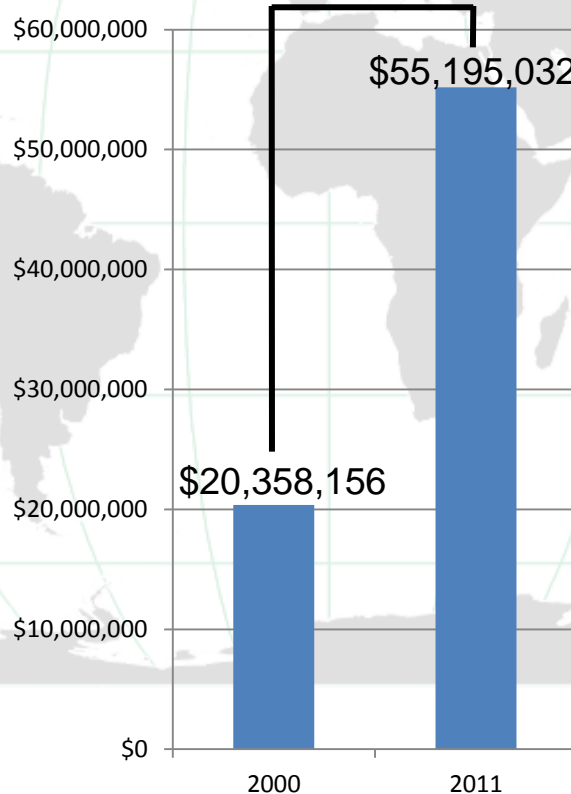
CY 2011 Dollars

Year 2000	Year 2010
	
<b>Basic Rifleman's Clothing &amp; Equipment Cost</b>	
~\$2,346	~\$12,731

## Cost to Equip Inf. Bn

After accounting for inflation the cost today is 2.7 times the cost of equipping an Inf. Bn. in 2000.

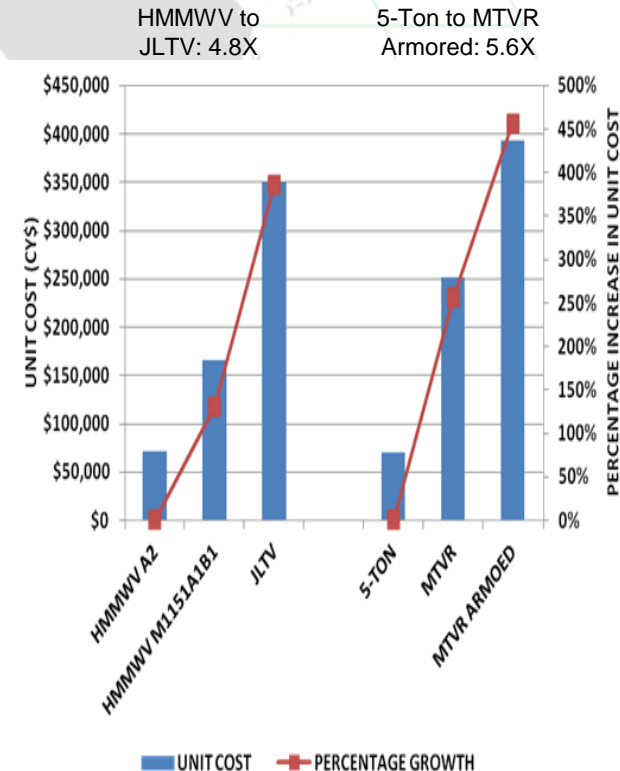
CY 2011 Dollars



## Cost of Tactical Vehicles

After accounting for inflation the cost today is 5.2 times the cost of acquiring combat/tact vehicles in 2000.

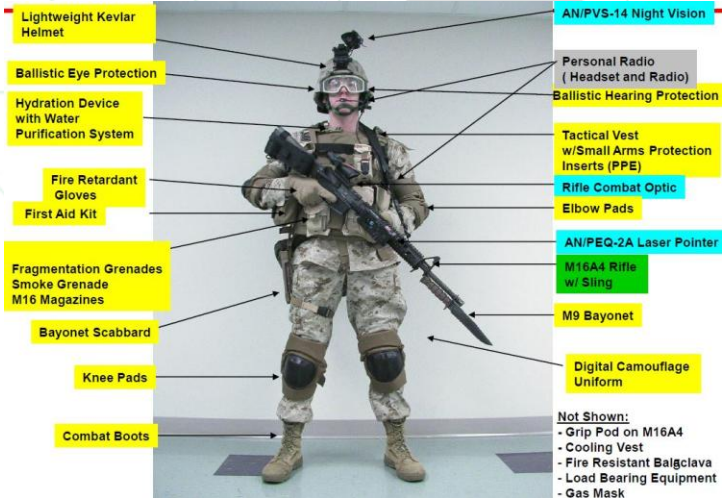
CY 2011 Dollars





# A Decade of Change

BLUF: 120 lbs. of “lightweight gear” still weighs 120 lbs.





# A Decade of Change

## “Increasing Logistical Demand”



### Logistics Casualty Study, 24 Mar '10 - 30 Jun '10\*

- 299 Fuel/Water Convoys (98 Days)
  - 1 IED Incident per 17 Fuel/Water Convoys
  - 1 Marine WIA per 50 Fuel/Water Convoys



**We Have Become More FOB Centric**



# What Has Our Attention?

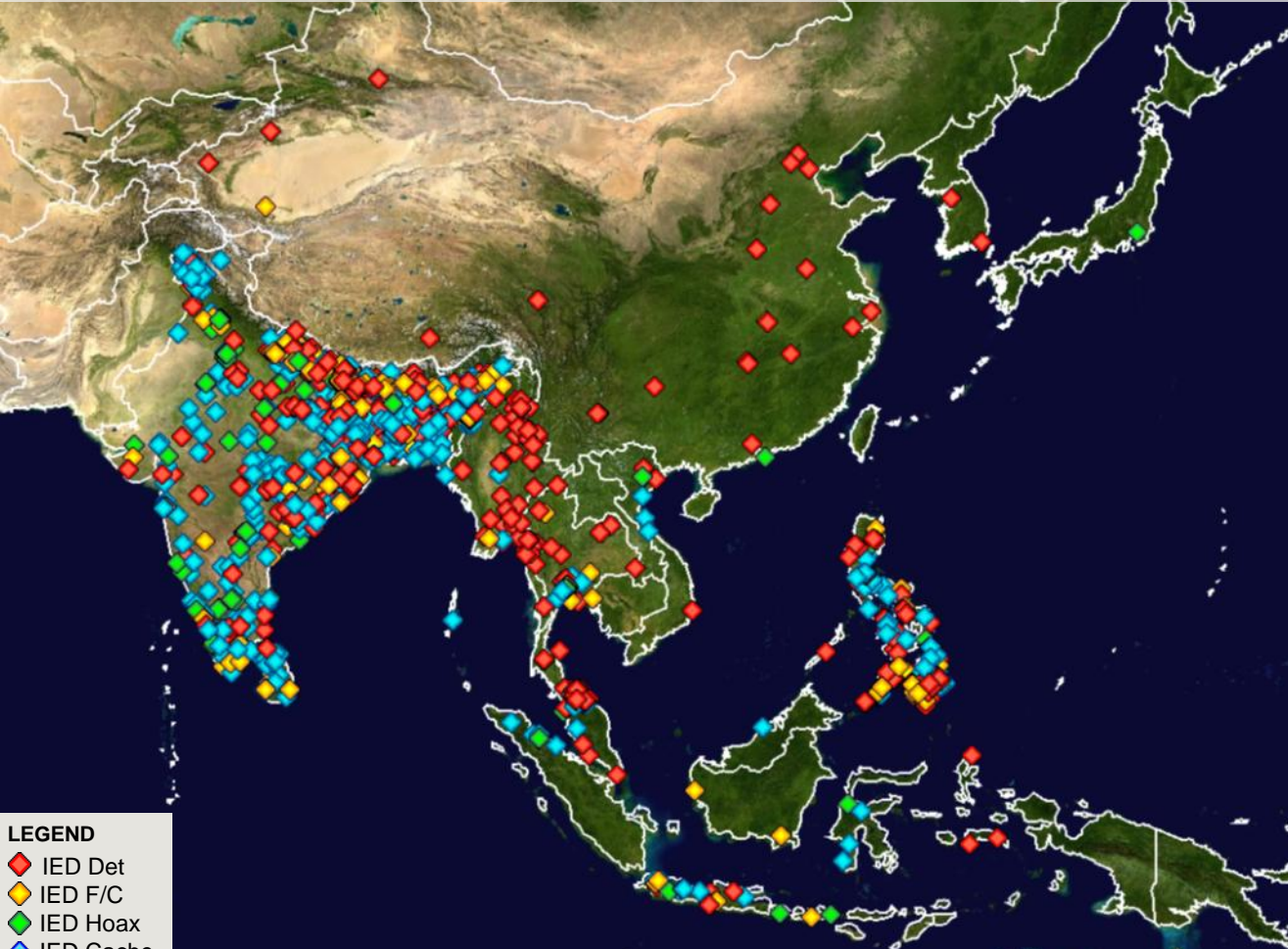




# Asia Pacific AO



The average number of monthly IED events over the past two years rose to **97**; **90** events this month



- LEGEND**
- ◆ IED Det
  - ◆ IED F/C
  - ◆ IED Hoax
  - ◆ IED Cache

Dots depict events from July 2010 to July 2012; occasionally overlay occurs



An IED Event involves one or more actions/activities: explosion, found and cleared (F/C), hoax and/or cache

An IED:

- Is a device placed or fabricated in an improvised manner
- Incorporates destructive, lethal, noxious, pyrotechnic or incendiary chemicals
- Is designed to destroy, incapacitate, harass or distract

The AP IrWAC does not track conventional landmines, hand grenades, and Molotov cocktails

*IED reporting and casualty statistics derived from OSINT are not confirmed; statistics are presumed to be approximations*



# Asia Pacific Operating Environment



- **Dominating Features**
  - Hot and humid
    - Relative humidity (65-70% day / 90% night)
  - Heavy rainfall
  - Dense jungle - miniature micro climate
- **Combat in the jungle is almost blind**
  - Ground observation limited to 30' feet
- **Degraded C2**
  - Transmissions are limited due to the atmospheric characteristics
- **The Jungle favors surprise**
  - Unlimited concealment
- **The jungle is the domain of the infiltration and the ambush**
  - Similar to street combat in urban population centers
  - Paths and trails become highly susceptible to a variety of IEDs
- **Orientation is difficult**
  - More difficult at night and/or during monsoon season
  - Use of robotic systems becomes even more challenging





# What Are We Doing?

## Middle Weight Force

- Capability Based – Evolves with the threat - open architecture mindset
- Must leverage the newest technologies - with which Marines are familiar



## Individual Marine

- Capable & Survivable
- Light enough to fight in any climate and place (jungle)



Plat / Squad  
Digital Device

## Seabasing - Back to our Roots

- Shipboard compatible - must be embarkable and employable from a seabase
- Must facilitate a swift build-up of combat power at locations of our choosing



## Lighten the MAGTF

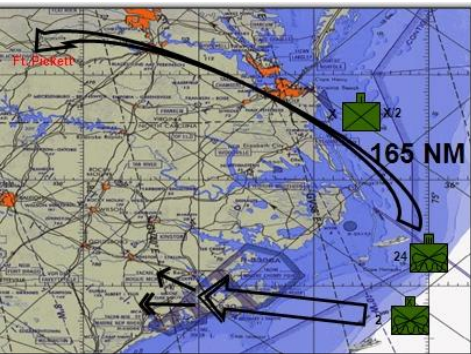
- Reduced footprint
- Reduced Logistics Demand
- Multifunctional equipment





# What Are We Doing?

## Enhanced MAGTF Operations



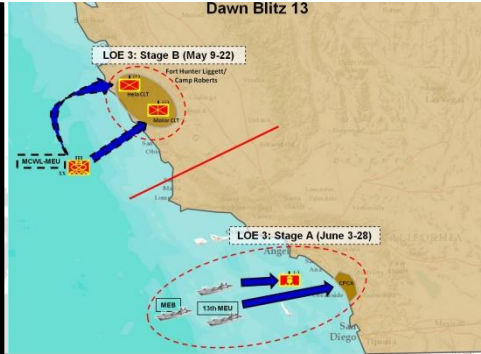
### LOE #1 (Command and Control)

- The V-22 -- a true “game changer”
- MAGTF C2 from 170-185 nm → STOM RQMT
- **ITV capability critical in dismantled formations**
- TAK-E: Strategic sustainment asset with a tactical formation ashore
- Logistics Demand Reduction:
  - Tactical water purification eliminates H2O resupply
  - Mini solar panel to power radios for dismantled ops
- **Challenge of casualty handling & movement**



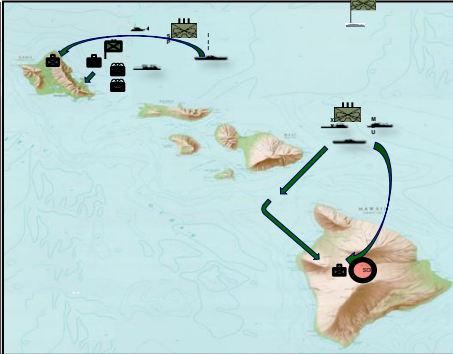
### LOE #2 (Logistics)

- Improved timeliness and accuracy, especially in TACLOG
- LCE is capable of conducting sustainment operations as independent maneuver element
- **Autonomous vehicles are effective tools for the provision of logistics**
- Logistics enablers such as ECCC and SUWP enhance EMO-type operations
- Need clear understanding of TAK-E’s mission: MPF vs MAGTF
- **T-AKE is capable of supporting TSC operations; however, requires connectors.**
- T-AKE is MEB FICE capable, but with challenges



### LOE #3 (Fires)

- **Digital Fires / FSC / Armed UAS capability to Company.**
- TACP equipment set with and without Technology enhancements (i.e. HART/SL, GUSTO, JFO Equipment, and ICA).
- Fires request and approval process.
- HIMARS in an amphibious environment
- ESG/MEB/MEU C2 issues during distributed amphib ops
- MEB staff processes.
- SOF integration processes.
- **Sea based sustainment techniques and procedures**



### Advanced Warfighting Experiment (AWE)

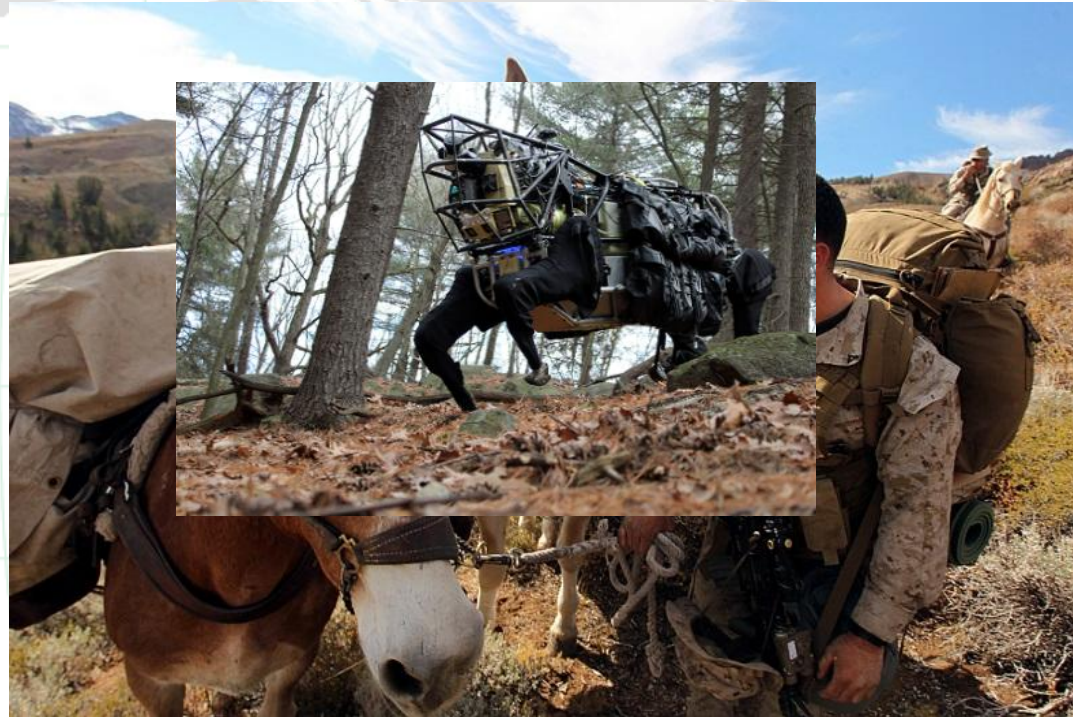
- Culminates “EMO Series” and initiates transition to “Future Maritime Operations”
- Functionality, organization and C4 for Blue/Green fly-in command element (FICE)
- SOF and Non-DoD entities
- **Sea based logistics support with a T-AKE**
- **Energy Efficiency and Logistics Demand Reduction**
- **Casualty care and evacuation**
- **Alternative ship to shore connector(s)**
- **Advanced warfighting technologies**







# Unmanned Systems (UxS)

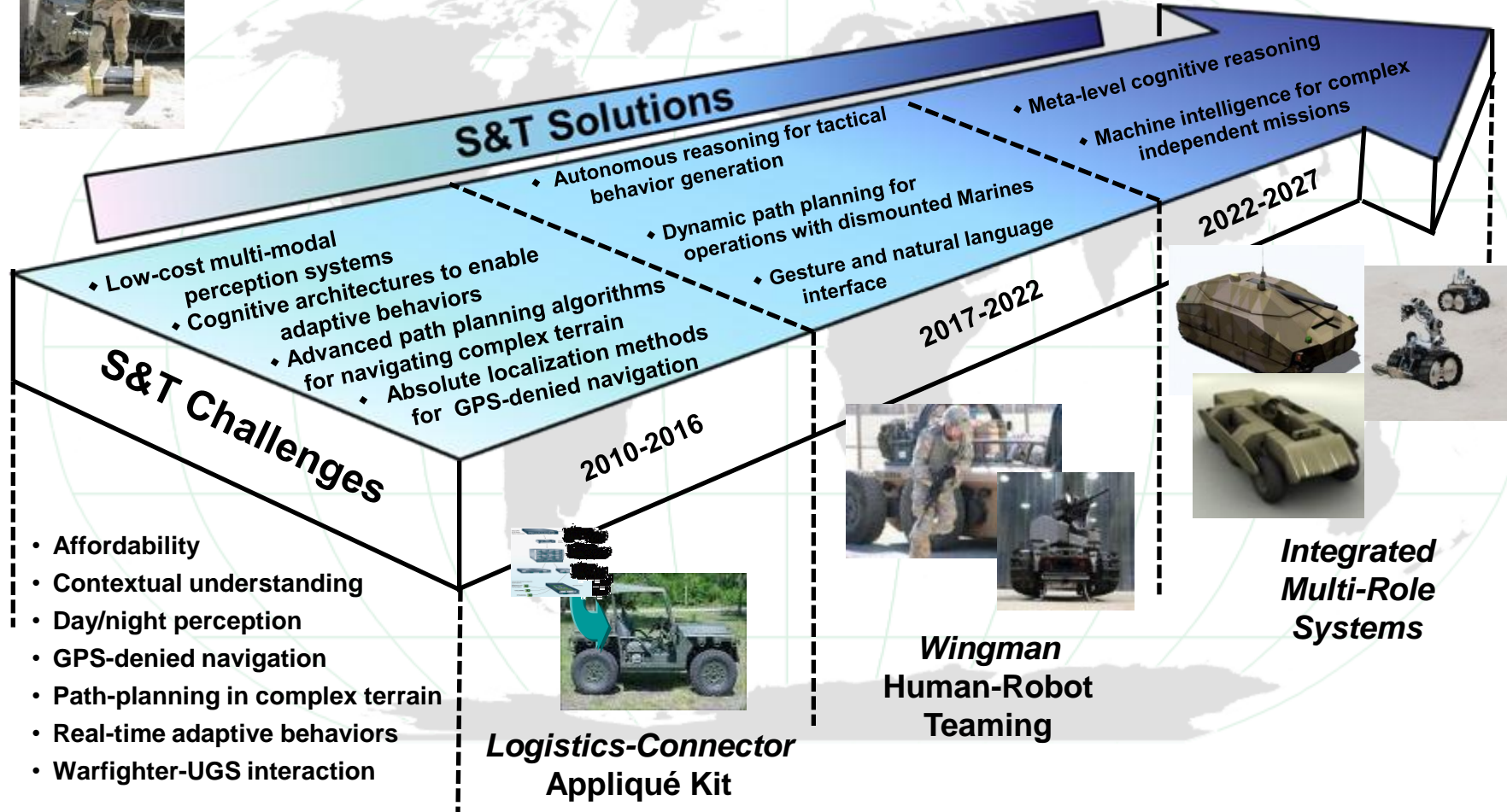


***“We need unmanned systems to be effective team members with no-controller hardware or displays needed so the operator is heads-up and hands-free.”***



# Ground Autonomy Vision

**Current Capability:** Remote control single purpose platform; line-of-sight operations; all manipulation and decisions made by the operator



**Objective:** Provide the USMC with affordable technologies that enable revolutionary advances in vehicular autonomy.



# MCWL UxS Focus



- **Priorities**
  - Explosive Hazards (Detect, Interrogate and Neutralize)
  - Reconnaissance and Surveillance
  - Enhance Target Identification
  - Lightening the Marine's Load
- **Core Characteristics**
  - Expeditionary
  - Modularity
  - Multifunctional / Multi-Mission
  - Manned & Unmanned Teaming
    - Robotic Wingman
- **Desired Traits**
  - Automatic person detection, tracking, and following
  - Speech / Facial recognition for vocal C2
  - Gesture recognition for physical command and control
  - Advance autonomous behavior





# MCWL Initiatives



**DARPA Legged Squad Support System (LS3)**

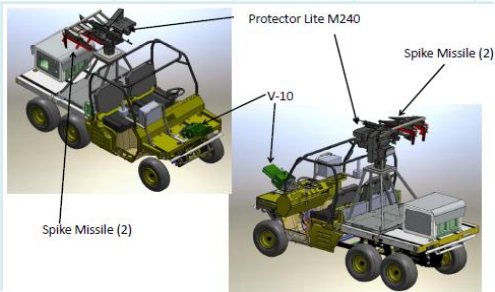
**Ground Unmanned Support Surrogate (GUSS)**



**Tactical Robot Controller (TRC)**



**Combat Robotic System (CRS)**



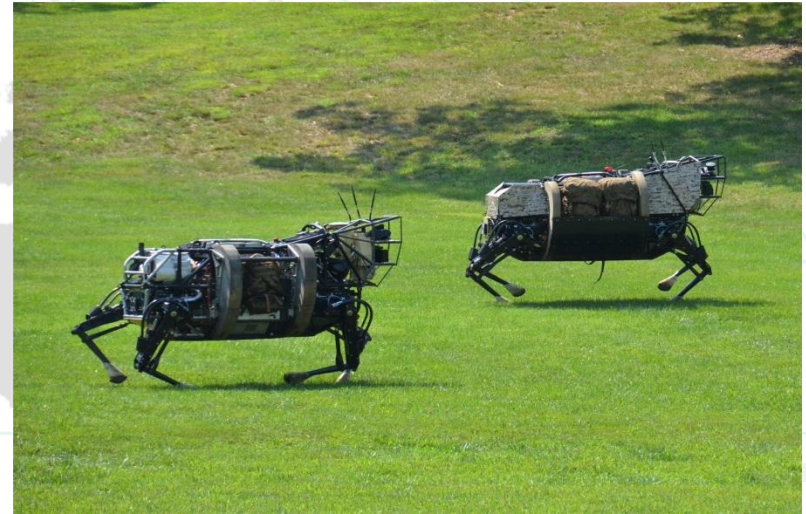
**Robotic Weaponized Vehicle (RWV)**



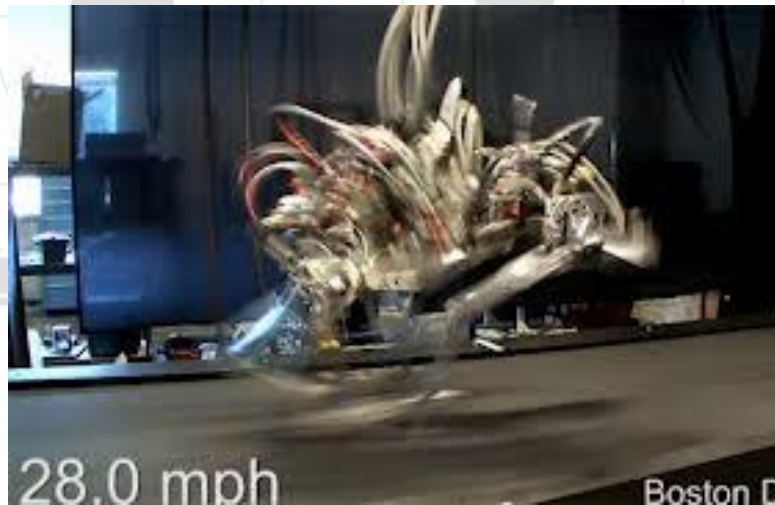
# Logistical Support / RSTA



## Legged Squad Support System (LS3)



Cheetah



UNCLASSIFIED





# LS3 Video



Boston Dynamics





# Autonomous Ground Vehicles



## Ground Unmanned Support Surrogate (GUSS)



## Cargo UGV - MTRV





# Unmanned CASEVAC

“It’s Time To Have the Discussion”







# MCWL Experimentation Observations



- Method of control is a critical enabling function
  - Streamlining control hardware will be a crucial step in main-streaming UGS
- Integration into combat formations
  - May require a shift in unit structure and organization
- Material condition of UGS needs to be sufficiently durable
  - Ruggedization is critical
- Mobility in changing terrain
  - Can the UGS adapt, or does it become a liability?
- Improvements in autonomy
  - Necessary to interact with the UGS more in the manner of commander/leader to team member, vice human-to-machine

- A systematic MAGTF approach to UxS is ultimately more important than a single system



# Future UxS Experimentation



- Sea Connectors
  - Autonomous resupply from the sea
- UxS Logistical Resupply
  - Selective, Timely, Accurate, Long Distance
- Counter UxS Operations
  - Sense, capture, or neutralize
- Target Acquisition, Designation
  - Acquire, IFF, Designate
- Reconnaissance and Surveillance
  - Short / Long duration
- Jammers, Decoys, Deception, Cyber
  - Deceive and Defeat
- MCM (Surf zone & ashore)
  - Identification and Clearing
- UxS CASEVAC / MEDEVAC





# Focus Areas For Industry

- **Affordability**: Bring low-cost autonomy for tactical ground vehicles to Technology Readiness Level (TRL) 6

*Low-cost autonomy* → *ubiquity* → *operational innovation*

- **Platform independence**: Develop enabling technologies and design concepts that can be adapted to existing vehicle platforms.



- **Expeditionary focus**: Concentrate test and development efforts on complex, highly cluttered, unimproved off-road, and austere environments.



- **Diverse participation**: Open, modular architecture with Government ownership/rights.





# QUESTIONS



UNCLASSIFIED



# Combat Robotic System (CRS)



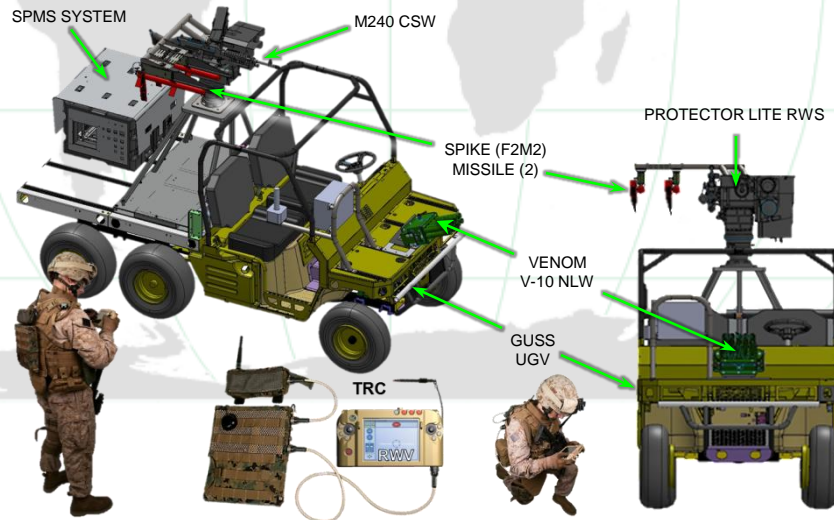
- Objective
  - Determine the limitations and requirements associated with arming a medium unmanned ground vehicle that is operating in direct support of dismounted infantry
  - Operated the CRS as an effective “wingman”
  - Assess the limitations of one-operator to control the UGV.
  - Evaluate the targeting capability, ISR value, and escalation of force capability
  - Force protection “watching their six”
- Capability Payoff
  - Common controller for tactical systems broadens applicability of autonomous platforms
  - Experimentation with weaponized platforms defines the realm of the possible, the practical, and the acceptable





# Robotic Weaponized Vehicle (RWV)

- Objective
  - Operate UGV with weapons using a single handheld controller from a remote location
  - Develop and assess TTPs and ConOps by assessing and understanding man-machine interactions
  - Evaluate the effectiveness of a handheld controller for a remote weaponized UGV
- Capability Payoff
  - Multi-Mission, Weaponized UGV controlled by Dual Screen TRC, with C4 architecture capable of interfacing and operating the UGV with a wide variety of ISR and Weapons systems capable of target detection, prosecution and engagement ranging from close-in support to long-range precision standoff





# Reducing Operator Workload



- Objective
  - Tactical Robotic Controller
    - Common robotic controller for both UGV's and UAV's
    - Enable the small unit to display and control multiple sensor inputs in a fused network on a common controller for target identification and prosecution
- Capability Payoff
  - Common controller for tactical systems
  - Air/Ground collaboration
  - Multiple Distributed UGV collaboration
  - Minimal operator workload

