Ground & Sea Platforms Community of Interest

Dr. Jennifer Hitchcock
Ground and Sea Platforms COI Lead

NDIA 18th Annual Science & Engineering Technology Conference
18-20 April 2017

Ground & Sea Platforms COI Portfolio Overview

Steering Group
Dr. Jennifer Hitchcock **(Army)**
Dr. John Pazik (USMC)
Dr. Thomas Fu (Navy)

Deputies
Mr. Robert LaPolice **(Army)**
Mr. Sam Kirby (USMC)
Mr. Troy Hendricks (USMC)

Survivability
Dr. Thomas Meitzler **(Army)**
Mr. Roshdy Barsoum (Navy)
Mr. Rod Peterson (USMC)

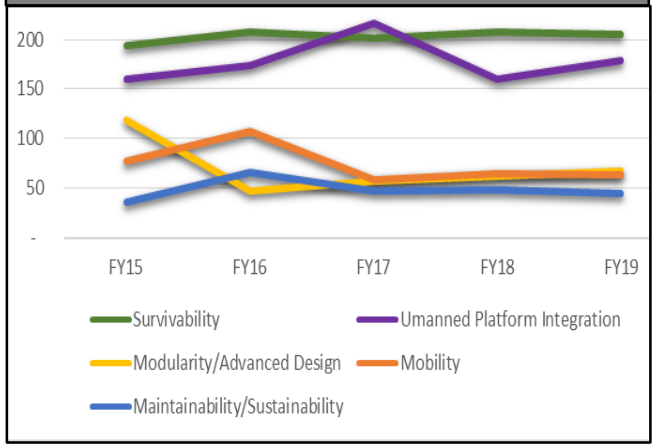
Unmanned Platform Integration
Dr. Bob Brizzolara
Mr. Matt Deminico **(Army)**
Mr. "Mike" Bruch (USMC)

Modularity / Design & Integration
Mr. Ken Essig **(Army)** **Current Lead**
Mr. Jeff Smith (Navy) Previous Lead
Mr. Jeff Bradel (USMC)

Mobility
Mr. Dale Martin **(Army)**
Mr. Don Hoffman (Navy)
Mr. Jeff Bradel (USMC)

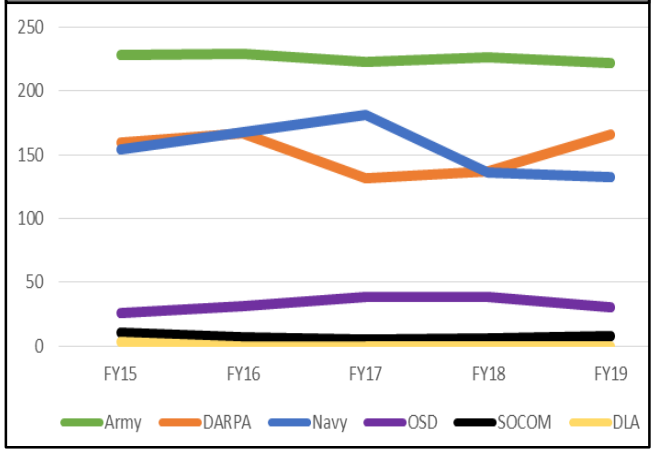
Maintainability / Sustainability
Mr. Billy Short **(USMC)**
Mr. Adam Brennan (Army)
Dr. Airan Perez (Navy)

Taxonomy Area Funding FY15-19



FY	15	16	17	18	19
(M)	$606	$613	$579	$543	$558

Organizational Funding FY15-19



G&SP COI Taxonomy

Taxonomy Areas	Technology Sub-Areas
Survivability	Ballistic Protection
	Hit & Kill Avoidance
	Blast Protection
	Signature Management / Directed Energy
	Lightweight Platform Structures/Materials
Unmanned Platform Integration	Autonomy
	Platform Enablers
	Capability Enablers
	Usage Enablers
Modularity / Design & Integration	Mission Modularity
	Production Modularity
	Software Modularity
	Maintenance Modularity
Mobility	Fuel Economy
	Terrain Maneuverability
	Powertrain
	Seaworthiness/Stability
	M&S Capabilities
Maintainability / Sustainability	Plan and Direct Logistics Operations
	Efficient & Responsive Force Sustainment
	Logistics Demand Reduction
	Fleet Maintenance

Ground & Sea Platforms COI Technical Challenges

Taxonomy Areas

Survivability | Modularity / Design & Integration | Mobility | Unmanned Platform Integration | Maintainability / Sustainability

Scope and Technical Challenges

1.0 Platform Protection

Capabilities that allow a platform and its crew to remain functional and mission capable in a hostile threat environment. This includes denying the adversary the ability to target and successfully engage a platform (susceptibility), withstanding the weapon effects of a successful attack (vulnerability), and restoring functionality after sustaining damage (recoverability).

- 1.1 Improved Blast Protection
- 1.2 Directed Energy Threat Mitigation
- 1.3 Enhanced Ballistic Protection
- 1.4 Hit and Kill Avoidance
- 1.5 Detection Avoidance (Signature Management)
- 1.6 Enhanced Cyber Defense

Cyber Defense of Vehicle Networks


Hard & Soft Kill Options for Counter-Unmanned Aerial Systems (UAS)


Adaptive Armor

Active Protection Systems


Directed Energy Defeat

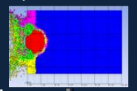
2.0 Lightweighting the Platform

Capabilities that reduce the weight of a platform and its systems to allow the force to be more lethal, expeditionary, and agile across the full range of operations. In addition to structural and material science advances, Lightweighting will consider advanced propulsion and alternative power systems, active protection techniques, and advanced weapons and electronics.

- 2.1 Reduced Weight of Armor and Structure
- 2.2 Reduced Weight of Mobility Systems
- 2.3* Reduced Weight of Armaments
- 2.4* Reduced Weight of Electronics, Sensors, and Other

*Coordinated with other COIs

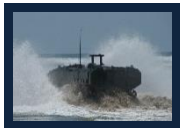
Lightweight Track, Suspension, Powertrain, and other Mobility Systems


Low Cost, High Mass Efficiency Passive Armor

3.0 Platform Maneuverability

Capabilities that provide an agile, mobile, and survivable platform and force to extend the operational reach across all potential battlefield environments. The force must maintain a high operational tempo while maneuvering in space and time and minimizing the logistics burden.

- 3.1 Unconstrained Mobility
- 3.2 Improved Design for Higher Speed
- 3.3 Enhanced Propulsion
- 3.4 Enhanced Energy Efficiency


High Water Speed for Amphibious Combat Vehicles

Fuel Efficiency and Power Enhancements

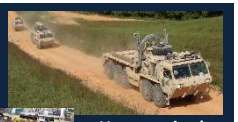

Higher Power Density and Onboard Power Sources

Single Cylinder Engine

4.0 Manned Unmanned Teaming

Capabilities that effect operational and tactical mobility and maneuver through the use of unmanned systems. Includes unmanned ground vehicles, robots, sea vehicles, UxV swarms, etc. that work collaboratively with the Warfighter. These act as force multipliers, able to collaborate and share information while reducing operator workload by relieving the individual Warfighter of physical and cognitive burdens.

- 4.1 Enhanced Platform Autonomy
- 4.2 Optimized Platforms by/for Unmanned Operations
- 4.3 Enable Configurable Autonomous & Unmanned Payloads
- 4.4 Enhanced Assured Trust in Unmanned Systems


Autonomous Logistics & Convoy Operations


Unsupervised Unmanned Surface Operations

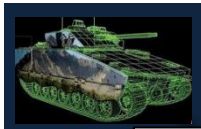

Autonomous Navigation in GPS denied, degraded visual, and complex terrain

Enhancing trust in Unmanned Systems

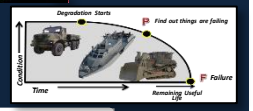
5.0 Enhanced Platform Maintenance

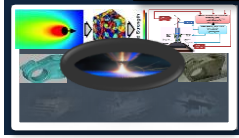
Capabilities that reduce the total ownership costs to maintain ground and sea vehicles and equipment. This includes increasing the operational availability of platforms while decreasing the maintenance cost and man-hours required to maintain and repair these platforms.

- 5.1 Condition Based Maintenance
- 5.2 Advanced Manufacturing for Rapid Component Replacement
- 5.3 Advanced Corrosion & Wear Resistant Systems

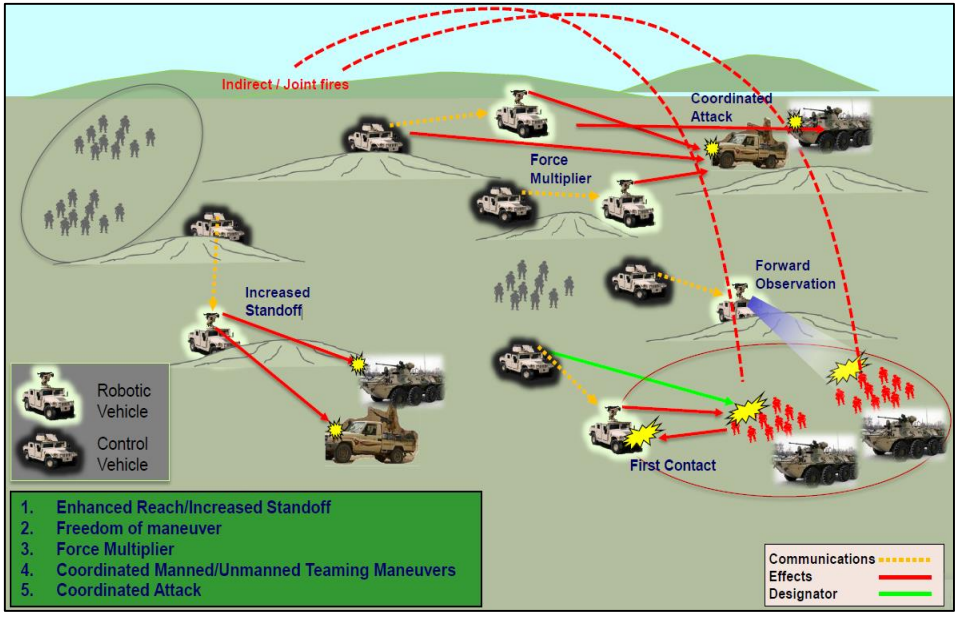

Improved Chemical Agent and Corrosion Resistant Coating Techniques

Condition-Based Maintenance




Additive Manufacturing for Replacement Parts

GSP COI Activity
- JCTD Proposal -



Wingman
FY17-19

Objective: Develop an effective weaponized robotic system by integrating robotic controls, target acquisition, and remote weapon system (RWS) onto a HWWMV. Program will develop manned/ unmanned teaming behavior and shared controlled behaviors to automate operation for Person-on-the-loop operation. System will be scalable and portable for other mounted and dismounted platforms.

Deliverables:

- Remote, mobile Lethality
- Manned - Unmanned Teaming (MUT) Behaviors
- Testing and Safety Protocols for Unmanned Weaponized Platforms
- Verification of controls in an EW challenged environment

Participants

- **Oversight Executive:** OASD(R&E), Ms. Lenny Lopez
- **CCMD Sponsor:** US CENTCOM
- **Operational Manager:** US CENTCOM, Thomas Smith
- **Technical Manager:** USA RDECOM TARDEC, Thomas Udvare
- **Transition Manager:** PM Force Projection / PdM Applique and Large Unmanned Ground Systems (ALUGS), Bryan McVeigh / LTC Cory Berg
- **Other participants / partners:** PEO Land Systems Marine Corps, A. D. Bianca; ONR Naval Surface Warfare Center, Ben Wheeler; USA RDECOM ARDEC, James Giacchi; Army Research Laboratory Human Research and Engineering, Dr. Bill Evans; USA RDECOM CERDEC Seth Spoenlein; USA TRADOC MCoE

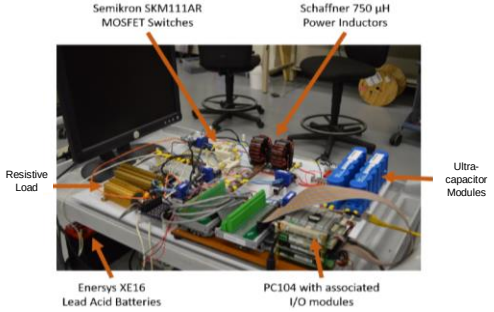
GSP COI Activity
OECIF Proposals

Specified Focus Topics:

- Far-Field Wireless Energy Transmission
- Thermal and Power Management for High Pulse Power Systems

Submissions developed by Mobility Taxonomy Area

- **Selected: Ultra High Density Hybrid Energy Storage Module for Laser Weapon System and Electronic Warfare Operations** (Navy lead, Army/AF support): This program builds off of the OSD funded HESM program to develop a hybrid energy storage system that will support the power and energy demands for robust mobile platform DEW. This effort will be run by the Navy and includes funding for demonstration units will be built and delivered to the USAF and Army for testing as part of the program.



OSD HESM Benchtop Setup

- **Not Selected: Continuous Lasing Power for Contingency Base High Density Threats** (Army Lead, Navy support): Demonstrate a 300 kW import supply from Vehicle-to-Grid array with Microgrid support for continuous operation of a vehicle's energy weapon system to defeat multiple large threats (multiple missiles) or many-many small threats such swarming UAVs.
- **Not Selected: Far-Field Wireless Energy Transmission Capability for Military Vehicle Support and Fuel Logistics Improvement** (Army Lead, Navy support): Improve the fuel logistics tail with wireless power transfer technology to provide power for vehicular propulsion, for far distances (also applicable to near ones as well), extending eventually to FOB and utility level power.
- **Not Selected: Cryo-cooler for DEW thermal management** (Navy Lead, Army/AF support): Low thermal efficiency of laser weapons (less than 30%) requires system to absorb most of the energy as waste heat, greatly limiting sustained weapon shots. This thermoelectric cooler will permit a much greater laser magazine capability.

GSP COI Activity
New areas of collaboration

- Cross-COI Exchange Meeting with Cyber and Materials & Manufacturing Processes COIs Feb ‘17
- Army attended ONR Autonomous Swarming and Amphibious Platform demonstrations
- New 6.2 initiative on Protection for Unmanned Ground Combat Platforms. It will combine concepts for enhanced survivability with M&S vetting.
- Army Signature Management lead met with ONR 30 Survivability lead to discuss detection avoidance technologies.
- ONR will be participating in Army (ARL) consortium on Materials in Extreme Dynamic Environment.
- OECIF proposal development effort brought Air Force collaboration into the Mobility Taxonomy Area, which is noteworthy because that Service does not have resources binned in the G&SP COI.
- Condition Based Maintenance: New research efforts in CBM Prognostics and Platform Health Management for Marine Corps and Navy Platforms
- Multi-Service participation in the Shock and Vibration Symposium, Oct 2016
  - Resulted in ONR use of Army (ERDC) test range for a test series on underbody blast testing in FY17-18.
  - The ERDC facility and range provides ONR the ability to conduct a greater number of tests at lower total costs.
  - This leveraging of Service assets was specifically made possible by the conference attendance.

Accomplishments

- Sharing Unmanned System Swarming applications (Navy/Army)
- Collaboration to bring Modular Active Protection System (MAPS) and the Expedited APS capabilities for use across the Services (Army/USMC)
- Tactical Vehicle Electrification Kit (TVEK): Start of Work, using the HEMTT and LVSR (Army/USMC)
- Renewable Sustainable Expeditionary Power (RSEP): Successful demo with Fuel Cells, solar panel, and AC generator (Navy/USMC)
- NATO Reference Mobility Model is being updated by ERDEC by integrating the efforts from ONR 30 - Mobility Trafficability and Mobility Analysis from Remote Sensing program (USMC/Army)
- Integrated Mobility Dynamics Control (IMDC): Demonstrated at Aberdeen on M1151 HMMWV, development of an ECP kit (USMC/Army)
- Robotics Technology Kernel (RTK): Leveraging ONR 30 autonomy/vision algorithms, and co-developing methods to share resources between the robotic and targeting systems (Army/Navy)
- COI Seedling – Situational Awareness and Active Countermeasures for the Soldier-Ground Vehicle System using Quadrotors (Army/Navy)
- Initiated FY17-20 Advanced Topcoat System for Ground Vehicle S&T program with NRL, NSWC-Carderock and ARL for Joint source selection (USMC/Army)
- Joint source selection for FY18-21 Quality Metal Additive Manufacturing (USN/USMC)
- Completed phase 2 of Vehicle Agnostic Modularity (VAM) virtual framework (Navy/Army)

Engagements with organizations, individuals, entities outside DoD

• Survivability Taxonomy Area initiated collaboration with Los Alamos National Laboratory (LANL), a Federally Funded Research and Development Center (FFRDC), on countermeasure approaches to newly identified emerging threats.

• Leveraged novel LANL superluminal polarization-current broadcast components for basis of a G&SP COI ARAP proposal on Armor Embedded Technologies.

• The Technical Cooperation Program (TTCP)

• NATO

• Surface Ship Hydrodynamics Information Exchange Agreements (IEAs)

• US/UK Project Agreement (MVDC Architecture)

• ONR-NICOP (Naval International S&T Cooperative Opportunity Program)

• US/Japan Collaborative Programs

• Potential Co-operation with German MoD under existing Data Exchange Agreement (DEA)