EXPEDITIONARY ADVANCE BASE OPERATIONS

WARGAME TOOLKIT & FUTURE OPTIONS
Wargame Tool-Kit (November 2016)

(Disclaimer: The content presented is provided to illustrate the art of the possible and does not imply DOD endorsement)

Due to the amount of quad slides contained in this toolkit, not all capabilities are annotated in this contents page.

**CROSS-FUNCTIONAL:**
- Company Landing Team
- GuSS
- ARES
- TERN
- ASW/ASUW Hunter Killer / Pouncer Team
- MK VI Patrol Boat
- MQ-9E Predator UAS
- MV22 Weaponized Hunting Osprey
- Seaplane
- Maneuver Support Vessels US Army MSV (Surf Connector)
- Autonomous Littoral Connector
- Ferret
- SWARM

**C2:**
- Laser communications
- Light communications
- Stalker
- AN/TPS-80 G/ATOR
- Bi/Multi-Static Sonar
- Bi/Multi-Static Frequency Sonar
- UTAC
- Covert AUV Ghost Swimmer
- Low signature intra-base WANs
- Solar powered UAS (“router in the sky”)
- Remote Control of EAB Nodes
- STALKER

**FORCE PROTECTION:**
- GBAD
- Point Air Defense Battery
- EX MCM Company
- USV
- Counter UAS
- Containerization of assets
- Joint MILDEC
- Cover / Conceal / Decoy applications

**FIRES:**
- Compact Laser Weapon System (CLWS)
- Laser Weapon Module
- High -powered microwave
- ASCM battery (floating or ashore)
- TLAM
- Tethered ASROC, ASW
- Box O’Rockets
- Rail-gun battery (floating or ashore)
- HIMARS Battery (w/ATACMs)
- Multi-missile HIMARS

**MANEUVER:**
- Airships
- US Army connectors (MSV)
- US Navy connectors
- Host Nation connectors
- JHSV (Heavy)
- Submersible Support Vessel
- LARC-XV (Modified)
- STOVL and RW FARP Barges

**LOGISTICS:**
- Floating KMAX
- Picatinny Pallet
- Motorized Floating Containers
- Water Purification System Barge
- Supply Glider
- Hybrid Energy Trailer ITV
- Autonomous Littoral Connector
- Additive Manufacturing
- GPS Air-drop for austere sites
- STUFT
- Barges
- Ground Renewable Expeditionary Energy
- Foot Mobile Battery Charger
- RE-Arming Barges
- Repair Barges
- SeaMod (floating concrete platforms)
Expeditionary Advance Base Operations
Notional Operational View
Company Landing Team

Attributes
- Organic ISR/self defense/mobility
-Digitally interoperable
- Capable of integrating with host nation forces
- Sustainment augmented through foraging, host nation support
- Extended duration operations

Concept of Operations
- EAB Ops transcends weapons and platforms
  - These “things” must be manned and protected - even in Phases 0 and 1
- Distributed general purpose tactical formations must contribute to the achievement of strategic objectives
- Marines on the ground carry the nation’s message
- A reinforced rifle company might not always be the answer....
- Fires Landing Team?
- Logistics Landing Team?

Footprint

UNCLASSIFIED
**RVM / GuSS**

**Description:** GUSS is fitted with electro-optics, lasers, and navigation sensors, which provide navigation and obstacle sensing for autonomous missions. GUSS is controlled by GPS guided pre-determined waypoints, a “follow me” mode in which it shadows a warfighter, direct tele-operation or can be man-driven. GUSS can navigate through wooded areas, urban or open-terrain and has a cruising range of 482km without refueling and carry 1,700lbs of cargo, (2) passengers and (1) litter patient. The project consists of development and testing of an infantry support Unmanned Ground Vehicle (UGV) to support multiple resupply, CASEVAC, and reconnaissance type missions.

**S&T Thrust Areas:** C4ISR, MAGTF Fires, Expeditionary Logistics, Autonomy/Robotics, Maneuver, Expeditionary Medicine, Force Protection

**EF-21 Linkages:**
- “New ground maneuver platforms that can be transported internally via MV-22 or CH-53.” (p. 34)
- “Supporting the Expeditionary Force 21 global laydown of forward-deployed forces with improved logistics responsiveness and agility while sustaining equipment readiness of disaggregated units.” (p. 41)

**Goal(s)/Objective(s):**
- Deliver quiet (hybrid electric) autonomous solutions for logistics
- Provide dismounted units semi-autonomous resupply and CASEVAC capabilities.
- Enable an organic semi-autonomous ground vehicle to “lighten the load” on the warfighter and increase a units’ ability to self-sustain themselves.
- Provide on board battery recharging capabilities
- Extend the time on station of the warfighter.

**Performer:** NSWC-DD, Torq Robotics, Virginia Tech
Autonomous Shallow Water Mine Breacher

**Objective:** Demonstrate the remote firing of a M58 line charge to clear amphibious assault lanes or remove obstacles using a supervised autonomous unmanned surface vehicle.

**Team:**
- Naval Surface Warfare Center Dahlgren
- Naval Surface Warfare Center Panama City
- Marine Corps Warfighting Laboratory

**Operational Relevance:**
- Provide the Marine Corps Landing Force Commander with the capability to autonomously breach and clear shallow water mines and obstacles in littoral environments that would impede or severely hamper amphibious operations and landings.
- An autonomous capability keeps Marines out of harms way during A2/AD littoral maneuver, thereby preserving the force for other critical operations.
- This is a cost effective repurposing of an existing autonomous SURC coupled with a M58 Line Charge.

**Capability Concept(s) Addressed:**
- Clear Assault Lanes. Autonomously breach and clear shallow water mines enabling ship to shore maneuver.
- Clear Assault Lanes. Autonomously breach and clear obstacles in the littoral environment facilitating ship to shore maneuver.
- Protect the Force during difficult and dangerous breaching ops.

**Technology/Engineering Innovation:**
- Integrate an existing mine clearing line charge onto autonomous unmanned surface vehicle (USV) for concept demonstration
- Use autonomous USV technologies to clear amphibious assault lanes in extremely hazardous environments
- Emerging autonomous USV capabilities enable new methods for deploying existing technologies

**Related Efforts:**
- MCWL Logistics Connector Initiative
- Panama City Autonomous AAV initiatives
- NSWC Dahlgren Autonomous Fires efforts (SAF-T, RAPTOR, WASP)

**Objectives and Technical Parameters**

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<th>Metric</th>
<th>Technical Parameter</th>
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<tr>
<td>3.2.4</td>
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**Last Updated:** 10/26/2016
ARES (Aerial Reconfigurable Embedded System)

**Description:** Demonstrate a modular unmanned VTOL vehicle that provides the warfighter with an organic capability for unmanned expeditionary logistics, ISR and casualty evacuation.

**Goal:** Provide cargo delivery and retrograde capability. Development of a modular cargo pod capability to support end to end IED/mine detection. Seabased unmanned cargo operations.

**Technical Approach:** This is a FY16 JCTD proposal that MCWL will invest in. The technical approach is still being worked.

**Performers:** NAVAIR, MCWL, LOCKHEED MARTIN

**S&T Thrust Areas:** Autonomy, C4ISR, Expeditionary Logistics

**EF-21 Linkages:**
Logistics: Integrate logistics demand reduction technologies into training. Explore the use of autonomous systems to deliver tailored medical supplies, and to serve as a casualty evacuation platform.

**Stakeholders:** MEFs, PMA 266, PMA 263, COCOMS, MCWL, JIEDDO, DARPA

**CONCEPT OF EMPLOYMENT:**
ARES (Aerial Reconfigurable Embedded System) a modular unmanned VTOL vehicle that provides the warfighter with an organic capability for unmanned expeditionary logistics, ISR and casualty evacuation.

Modular payload (ISR, EW or Strike or Comms Relay) launched from the Seabase, over the horizon, in support of the CLT.
TERN (Tactically Exploited Reconnaissance Node)

**CONCEPT OF EMPLOYMENT:**

TERN (Tactically Exploited Reconnaissance Node) : an unmanned VTOL vehicle that provides the amphibious Marine Air Ground Task Force (MAGTF) with an organic capability for unmanned persistent Ship borne ISR, Electronic Warfare, Digital Interoperability and Kinetic strike capability.

Persistent ISR, EW, Strike or Comms Relay (Digitally Interoperable) launched from the Seabase, over the horizon, in support of the CLT.

**S&T Thrust Areas:** Autonomy, C4ISR, EW/ Cyber

**EF-21 Linkages:**
TERN will enable long range raids in an A2AD environment by providing Electronic Warfare (EW) support to the assault package. It will also enable persistent long range ISR, strike capability, and escort support to VM-22s as they traverse to inland objective areas.

**Stakeholders:** DCA, PMA-266, PMA-263, ONR, MCWL, MCCDC, DARPA, NAVAIR

**Description:** Demonstrate an unmanned VTOL vehicle that provides the amphibious Marine Air Ground Task Force (MAGTF) with an organic capability for unmanned persistent Ship borne ISR, Electronic Warfare, Digital Interoperability and Kinetic strike capability.

**Goal(s)/Objectives(s):** Design and Build a demonstration vehicle. Integrate Tern development into MQ-X UAS roadmap for deployment in 2024.

**Technical Approach:** Invest in DARPA effort, once ship operations are demonstrated in FY 18 integrate air vehicle in future experiments.

**Performers:** DARPA (Aerovironment, Northrop Grumman)
ASW/ASUW Hunter Killer / Pouncer Team

CONCEPT OF EMPLOYMENT:
• Expeditionary Shore version of SH-60 Detachment from CG or DDG. Like when ship based, operates as the striking, search and localization arm of the other local ASW and associated Expeditionary sensor units.
• Weapons mix can vary based on operational Phase and anticipated Red units in range.
• Parts and maintenance “pack up kit “as on deployment, like when on ship remainder of repair is fly in teams.
• Responds to ASW cueing location within platform search capability. Responds to ASUW cueing.
• Can designate for other shooters.
• Can do ASUW area search, local logistics movement.

SH-60 Expeditionary Shore Detachment

SH-60 Shore Detachment
• Active or Reserve
• Comes with majority of ship detachment personnel
• Subsists from common base.
• SH-60 Self Deploys
• Remainder is air transportable.

EAB Site Footprint
• (1+?) SH-60
• (1) Fuel truck and purifier set. Allows for fuel foraging.
• (1) Weapons Truck: CONNEX with ASW Torpedoes, gun pod, ASUW missile (Penguin?)
• (2) Pack up Kit trucks
• (3) Aircrew Complete to allow for 24/7 standby operations.
• (20-25) personnel total.
• (2) passenger vehicles.
MK VI Patrol Boat (PB)

CONCEPT OF EMPLOYMENT:

Provide capability to persistently patrol shallow littoral areas beyond sheltered harbors and bays for the purpose of force protection of friendly and coalition forces and critical infrastructure; mission includes High Value Unit (HVU) shipping escort and Vessel Boarding, Search, and Seizure (VBSS operations), Theater Security Cooperation (TSC), and Security Force Assistance.

MK VI:
- Lethal Weapons:
  - (2-3) M249, M240, MK 19, M2HB, or GAU-17/ (1) Remote Operated Stabilized weapon
  - (Max Range Arch 2kyds)
- Non Lethal Weapons
  - LRAD
  - Laser Dazzler

FOOTPRINT:
- C4ISR/Nav: Tactical VHF, HF, UHF; SATCOM; Intercom; Blue Force Tracker; CID; EO/IR; Unmanned Vehicle C2; Integrated Marine Radar; DGPS; Link 16;
- Road Transport: Transport: Cradle; Trailer
- Maritime Transport: Transport & L/R by crane, well deck or deck cargo from L-Class, MSC & commercial/coalition ship
MQ-9E Reaper UAS

CONCEPT OF EMPLOYMENT

The MQ-9E is an unmanned system that provides the MAGTF with an organic, self-deployable, expeditionary, multi-mission warfighting capability with the following characteristics:

- On-station time of >10 hours at 2000 nm range.
- State-of-the-art communications systems that provide comms gateways and enhance MAGTF/Joint digital interoperability.
- 9 wing stations capable of carrying 3000 lbs of PGMs, EW payloads, and swarms of recoverable sUAS.

The MQ-9E can provide:

- Close Air Support to dispersed/distributed ground forces
- Strategic/tactical level persistent ISR to commanders at all echelons
- Multifunctional Electronic Warfare capabilities that enable it to operate at stand-off ranges in denied airspaces.

While self-deployable from CONUS, the MQ-9E is also capable of operating from 3000’ expeditionary runways and has an expeditionary maintenance footprint of 4-6 personnel.

S&T Thrust Areas: Autonomy, C4ISR, EW/ Cyber, small UAS deliverables/expendables, multi-domain radar.

EF-21 Linkages:

- “Provide responsive, all-weather fire support options to forces maneuvering from the sea and in support of dispersed formations... Including:”
  - “The range and capacity to provide fires supporting multiple entry points from the sea.”
  - “Increased capability of sensors to provide a target location of useable accuracy.”
  - “Increased capacity to employ unmanned aerial system (UAS) supporting timely target acquisition.”
  - “Increased capability from UAS to acquire targets, control fires, and deliver munitions.” (p. 33)

Stakeholders: DCA, PMA-263, ONR, MCWL, MCCDC, NAVAIR Rapid Response

Description: Leveraging Joint programs, create an Expeditionary and Ruggedized unmanned aerial system that provides the MAGTF with an extremely flexible, robust and affordable capability for long duration unmanned ISR, Electronic Warfare, Digital Interoperability and robust kinetic and non-kinetic strike capability.

Goal(s)/Objectives(s): Determine how MQ-9E can be leveraged to increase Digital Interoperability in urban littoral environments, while enhancing sortie & ISR availability, cyber & EW integration, DACAS opportunities, and reducing O&M costs. Demonstrate MQ-9E in FY-17 and integrate payload and services architecture to inform MQ-X UAS roadmap. Create conditions for operational deployment in 2019.

Technical Approach: Leverage current USD(I) OCONUS Contractor Owned/Contractor Operated Operations to support SPMAGTF CR requirement.

Performers: General Atomics Aeronautical
MV-22 (Weaponized “Hunting Osprey”)

CONCEPT OF EMPLOYMENT (CONENP):
Currently in 2015, the VMM squadron provides the primary function of combat assault support of troops, a secondary function the transportation of supplies & equipment along with ten other potential tasks. In 2030 with the appropriate paradigm shift in the conceptual employment of the VMMs, the MV-22 can be involved into a weaponized platform to improve self-defensive and self-escort capabilities. MV-22 can be further enhanced that could support a variety of USMC combat functions in support Advanced Base Concept (also have MV-22 operating from the advance bases) to include Offensive Air Support (primarily Close Air Support) while also expanding into supporting other Naval Mission Areas such as Anti-Submarine Warfare (ASW), Anti-Surface Warfare (ASuW), and Mine Warfare (MIW). The CONENP Weaponized MV-22 is in development.

SPECIFICATIONS:
• VMM 165 (12 MV-22s)
• Self-deployable force w/ forward deployed logistics support resident on the RW FARP Barge
• 24/7 all-weather, precision guided fire support
• Range of 2267nm w/ single Air-to-Air Refueling
• Side-Firing 30mm (500 rounds), Altitude 10,000AGL
• Forward-Firing .50 cal chin gun (1000 rounds), ~4mil CEP
• Rockets: APKWS 1 mil @ 90% CEP, 5000m+ range
• Missiles: AGM-176 Griffin, GBU-44 Viper-E, Hellfire
• Torpedoes: Mk54 (600lbs), MK50 (800lbs), etc.
• Deployable Unmanned Aerial Vehicle (UAV) and Unmanned Underwater Vehicle (UUV)

FOOTPRINT:
- Marine Officer (CMO): 29
- Marine Enlisted (CME): 169
- Navy Officer (CNO): 1
- Navy Enlisted (CNE): 3

*current FY TOTE for generic VMM
CONCEPT OF EMPLOYMENT:

Seaplanes are a proven, cost-effective operational capability that can provide lines of communication to remotely dispersed EAB sites that lack port or airfield infrastructure.

Bombardier CL-415MP
- Range: 1310 nm / Speed: 180 kts
- Pax: 9 / Cargo: 6400 lbs
- Missions: Multi/ Fire
- Cost: $35 Million

Japanese US-2
- Range: 2538 nm / Speed: 302 ktas
- Pax: 20 / Ord: 2000 lbs bombs and 2 torpedos or 4 325lbs depth charges +
- Missions: Multi/ SAR
- Cost: $75 Million
Seaplane OV

**Cessna-208 Caravan**
- Range: 908 nm
- Speed: 159 kts
- Pax: 10-14
- Cargo: 3230 lbs
- Ord: Hellfire, Gun pods
- Missions: Log, CAS, etc.
- Cost: $1.9 Million

**Bombardier CL-415MP**
- Range: 1310 nm
- Speed: 180 kts
- Pax: 9
- Cargo: 6400 lbs
- Missions: Multi/Fire
- Cost: $35 Million

**Japanese US-2**
- Range: 2538 nm
- Speed: 302 kts
- Pax: 20
- Ord: 2000 lbs bombs and 2 torpedos or 4 325lbs depth charges + Missions: Multi/SAR
- Cost: $75 Million
US Army Connectors

**Family of Maneuver Support Vessels (MSVs)**

- Seabasing asset
- JLOTS Interoperable w/RRDF
- Self deployable from strategic distances (1,200 nautical miles)
- 24/7 all-weather capability
- Compatible with certain amphibious ship well decks
- Speed: 17 – 22 knots
- Light, Medium, and Heavy variants (MSV-L/M/H)

**EAB Site Footprint**

- MSVs capable of discharging across beach (no infrastructure required)

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**CONCEPT OF EMPLOYMENT:**

Movement, sustainment, and maneuver of tailored (or task-organized) combat configured forces and their equipment

Movement and maneuver of these forces into theater, or intra-theater

Establish or displace EABs
Autonomous Littoral Connector (ALC)

CONCEPT OF EMPLOYMENT:

The Autonomous Littoral Connector (ALC) provides autonomous behaviors for ship-to-shore connectors capable of carrying supplies and equipment from the sea-base to the shore (or shore-to-shore) similar to the mission of Landing Craft, Air Cushion (LCAC) or Landing Craft Utility (LCU) platforms.

ALC will be capable of semi-autonomous navigation, obstacle identification and avoidance as well as delivery in support of EABs.

Autonomous Littoral Connector

- Seabasing asset
- Capable of semi-autonomous navigation, obstacle identification and avoidance
- Common controller for manual embark/debark and Command & Control
- 24/7 all-weather capability
- Compatible with certain amphibious ship well decks
- Mission planning interface which provides health and status of craft in any environment including A2/AD
- Interface with UASs generates multi-platform SA

EAB Site Footprint

- ALC capable of discharging across beach (no infrastructure required)
WASP- Weaponized Automated System Prototype

**Technology/Engineering Innovation**

- Integration of an autonomous weapon system onto an autonomous robot to provide mobile, effective direct fire capability
- Autonomous weapon system provides automated target detection, tracking, and fire control

**TRL:** Current: 3; Projected at end (3QFY17): 5

**Related Efforts:**
- Automated weapon system technology development has been funded as the ONR30 Fires SAFT program
- UGV development and weapon system integration has been funded as a NSWCDD internal investment

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**Objective and Technical Parameters**

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<tr>
<th>CapCon</th>
<th>Metric</th>
<th>Technical Parameter</th>
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<tbody>
<tr>
<td>2.2.3</td>
<td>Effective direct fire</td>
<td>Percentage of rounds on target</td>
</tr>
<tr>
<td>2.2.4</td>
<td>Target tracking</td>
<td>Long duration, accurate tracking</td>
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<tr>
<td>2.3.1</td>
<td>Mobility</td>
<td>Ability to execute vehicle motion</td>
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<td></td>
<td>Survivability</td>
<td>Visual Signature</td>
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**Operational Relevance:**
- Although weaponized unmanned systems are required to provide planned DoD capabilities, no tactically effective ground or surface based systems have been deployed. Current and past attempts to develop these systems have been hampered by the lack of sufficient subsystem autonomy. This effort, leveraging 5 years of ONR investment in weapon system autonomy, will demonstrate an integrated, system level autonomy that enables tactically relevant robotic behaviors.

**Capability Concept(s) Addressed**
- 2.2.3 Provide land based direct fire support for dismount operations
- 2.2.4 Provide automated target tracking and fire control for land based moving targets
- 2.3.1 Provide remotely operated, mobile, low signature platform and weapon payload for direct fire support within threat envelope

**Objective:**
- Demonstrate direct fire capability from a small, remotely operated weaponized Unmanned Ground Vehicle

**Team:** Naval Surface Warfare Center Dahlgren, Office of Naval Research, TARDEC- Tank and Automotive Research Command, Southwest Research Institute
FERRET / CART

**Description:** Explore semi-autonomous robot behavior for RSTA UGV asset. Integrate autonomous capability with the TRC. Explore TTP’s, CONOPS, and understand man-machine interaction by introducing a semi-autonomously positioned robotics capability onto the battlefield.

**Goal:** Position MCWL robotics efforts for follow on robotics requirements efforts in semi-autonomy and collaborative robotics. Generate knowledge products to inform requirements. Autonomous drive to objective/mapping technology in technology denied environment will reduce operator cognitive load and increase mission effectiveness.

**Technical Approach:** Phase II - Experiment with a PackBot 510 with Aware Head, and intelligent loss of communications behaviors. Phase III – Incremental enhancements to enable collaborative teaming.

**Performer(s):** NSWCDD

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**S&T Thrust Areas:** C4ISR, Autonomy/Robotics, Maneuver, Force Protection

**Linkages:**
- CPG Enduring Principles: Marines are focused on combat; every Marine is a rifleman. (p. 1)
- “Experimentation will be concentrated on developing and fielding highly advanced, indirect, or disruptive concepts and capabilities.” (pg. 10)
- EF-21 Command and control - ability to provide adaptive, distributed, cooperative, and collaborative decision-making and planning. (slide 26)

**Stakeholders:** MCWL, MCCDC, JGRT, JCRAS

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**CONCEPT OF EMPLOYMENT:**
**SWARM**

**CONCEPT OF EMPLOYMENT:**
*Swarming occurs when several units conduct a convergent attack on a target from multiple axes.* Attacks can be either long range or short range. Swarming can be preplanned or opportunistic. It usually involves “pulsing” where units converge rapidly on a target, attack and then re-disperse. The intent is to overload an adversary’s cognitive/computational decision making process leading to indecision or hasty decisions and results in an exploitable opportunity. These risk worthy, recoverable, autonomous swarms can operate on the surface, subsurface or in the air and act not only as sensors but can act as shooters.

**FOOTPRINT**
These assets can range from micro to large size. Currently the Navy is working with small ships armed with machine guns IOT assist with straits transits and prevent FAC/FIAC missions from impacting naval operations.

**SPECIFICATIONS**
- **Elusiveness** – The presence of this variable indicates that swarm elements can elude their opponent in some way (perhaps through superior speed or the ability to conceal oneself).
- **Superior situational awareness** – The presence of this variable indicates the swarm has more information (unit locations, activity, intent, etc) about the enemy than he does about the swarm.
- **Standoff capability** - The presence of this variable indicates the swarm has the ability to inflict damage and receive less in return through some advantage in weapons (usually greater range) or through relative self-restraint. The swarm needs to use its enablers and direct its energies to achieving the following two effects or behaviors:
  - **Encirclement** – to attack from three or more major directions.
  - **Simultaneity** – the elements of the swarm have the ability to coordinate their attacks in time and space.

**Autonomous SWARM**
Laser Communications
CONCEPTUAL, This technology exists with NASA

CONCEPT OF EMPLOYMENT:
Laser communication is a capability that could take large quantities of data and transmit/receive with a small burst that is extremely difficult to intercept. Using laser communication over long distances in remote sites would negate the need for a robust satellite WAN assets. There are some challenges in transmitting through clouds and dust storms.

SPECIFICATIONS
- Laser comm from UAVs provide > 1Gbps
- First 2 way comm from New Mexico to a spacecraft orbiting the moon had an error free upload rate of 20Mbps!
- Can be relayed from ground station to UAVs to remote sites.
- Laser speed is significantly faster than typical means of transfer (RF or SATCOM)

FOOTPRINT
- Footprint for a transmission site can vary but to receive a laser shot the equipment can be hand-held.
Description

Common Weapons Control System (CWCS) for Shore/Ship Based ASuW & Digital NSFS Fires

Technology/Engineering Innovation

**Technology/Engineering Innovation**
- Integrate AFATDS, Forward Entry Devices, Comms radios with CWCS for Tomahawk digital fires capability (Naval Surface Fire Support (NSFS))
- Leverage CWCS functionality to develop Shore-Based and LPD based ASuW engagement capability
- Utilize deployed Tomahawk CWCS functionality to support Strike Warfare operations and shape battlefield

**Related Efforts:**
- CWCS initially developed by NSWCDD S&T funding. Capabilities also funded by PMA-280 Tomahawk Weapon System PO.
- NSWCDD/PMA-280 using CWCS as Tomahawk WCS prototype for HCI engineering, demo, & Maritime Tomahawk development
- Utilized by Joint Staff J6 Division to evaluate integrated digital fires with Marines, Army, SPECOPs, and Navy (Bold Quest)
- Utilized by PACFLT, ALCOM for Virtual Ship ASuW & NSFS Engagement Prosecution (Valiant Shield, Northern Edge)

**Warfighting Capability Concept**

**Operational Relevance:**
- Provide Surface Ship Digital Integrated fires to shape battlefield and conduct NSFS, Call-for-Fire missions
- Provide ASuW shore and ship based Weapons Control System
- Cost-effective approach to develop an LPD & Shore Based WCS capability based on tactically deployed TTWCS and CWCS prototype functionality

**Capability Concept(s) Addressed**
- 1.1.1/2. Delivery systems capable of delivering effects
- 2.2. Deliver Fire Support and Effects

**Objective**:
- Provide a digital end-to-end fires capability to support Ship-to-Shore maneuver. Support forces ashore against surface maritime threats using Surface & Land based fires.

**Objectives and Technical Parameters**

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<td>2.2</td>
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**Team**:
- Marine Corps Warfighting Lab, Naval Surface Warfare Center (Mission Engineering Directorate, CTO, Rapid Technology Office, H Department); Lockheed Martin, Raytheon Missile Systems.

Last Updated: Oct 24, 2016
Visible Light Communications (VLC)

**CONCEPT OF EMPLOYMENT:**

LED lamps have recently become the technology of choice for lighting in many environments, from indoor office spaces to outdoor vehicular use. These LED lamps can be modulated at relatively high speeds, opening up the possibility to use them to provide simultaneously illumination and data transmission, so-called visible light communications (VLC). One of the most compelling applications for VLC is in large unobstructed indoor spaces where many users desire concurrent high-speed connectivity, such as conference centers and classrooms; Wi-Fi fails here because of its limited spectrum re-use.

**SPECIFICATIONS**

- Advanced Modulation and Coding for Optical Communication Systems
- Cross-Layer Design and Optimization of Optical Networks
- Ultraviolet Communications
- FSO and Hybrid RF/FSO Networks and Communications
- Fiber-optic Channel Characterization
- Signal Processing for Optical Communication systems
- Other promising applications include indoor geo-location, vehicle-to-anything (V2X) communications, indoor positioning, and transmission inside airplane cabins. In our research we consider modulation, signal processing, user tracking, and resource allocation for this new optical communications modality

**FOOTPRINT**

- This equipment is intended to replace existing lighting in certain environments in order to facilitate a communications network through the visible spectrum
Lightning Bolt Handheld

Description

Global LPI/LPD BFT with LPD infil capability.

Technology/Engineering Innovation

Technology/Engineering Innovation

- Utilizes ONI waveform to provide global exfil of PLI
- Utilizes Iridium network to provide global infil

TRL: Current: 7; Projected at end (3QFY17): 8

Related Efforts:

- DoD developed waveform to provide global LPI/LPD BFT capabilities
- Iridium service providing infil capability
- First generation devices currently deployed

Last Updated: 31 Oct 2016

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Warfighting Capability Concept

Operational Relevance:

- Global LPI/LPD Blue Force Tracker (BFT)
- Handheld unit with user interface to provide limited exfil (GPS, Brevity codes) and infil (Free text/Brevity codes)
- Infil provides limited two-way comms allowing reach back capability to the user

Capability Concept(s) Addressed

- 4.1 COP situational awareness
- 4.3 Secure BLOS two-way BFT

Objectives and Technical Parameters

Objective: NSWC BFT will provide SA utilizing BLOS LPI/LPD two-way Position, Location, Information. PLI will feed back into the COP for commander and unit leaders SA.

<table>
<thead>
<tr>
<th>CapCon</th>
<th>Metric</th>
<th>Technical Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Situational Awareness</td>
<td>Global PLI</td>
</tr>
<tr>
<td>4.3</td>
<td>Secure, BLOS</td>
<td>Global LPI/LPD</td>
</tr>
</tbody>
</table>

Team: Naval Surface Warfare Center Dahlgren Division (NSWCDD)
**Stalker**

**CONCEPT OF EMPLOYMENT:**

A long endurance (8 hrs.) Group 1 UAS with digital architecture and communications relay capability, providing an aerial repeater.

Stalkers can be employed IVO the CLT providing network connectivity (voice and or data) to the Seabase and or space.

**Description:** A long endurance (8 hrs.) Group 1 surrogate UAS with digital architecture and communications capability, providing a multi-payload platform for MCWL experimentation.

**Goal(s)/Objective(s):** Provide a Group 1 UAS platform that supports various projects, to include: Counter Unmanned Systems, Sensor Fusion, GPS Denied Environment, Etc.

**Technical Approach:** Support and maintain the STALKER XE 240 UAS platform in support of aerial payload applications; Experiment with the payload in different environments to assess the capability.

**Performer(s):** NAVAIR China Lake, Lockheed Martin, Progeny Systems
AN/TPS-80 G/ATOR

**CONCEPT OF EMPLOYMENT:**

G/ATOR Block 1 will be deployed as a sensor for the Tactical Air Operations Center, Early Warning/Control or as an Early Warning site. With the Composite Tracking Network (CTN) provides data to Cooperative Engagement Capability (CEC), with CAC2s provides data through link 16.

G/ATOR Block 2 will be deployed with the Target Acquisition Platoon (TAP) within the Artillery Regiment and is integrated through Advanced Field Artillery Tactical Data System to the Fire Direction Center.

**SPECIFICATIONS:**

- Block 1 Detection of Air Breathing Targets, Cruise Missiles and UAS: 360 degrees
- Type 0: Classified
- Type 1: Classified
- Type 2: Classified
- Block 2 Detection of Rockets, Artillery and Mortars
- 1800 mils, 6400 mils
- 60Km

**FOOTPRINT:**

<table>
<thead>
<tr>
<th>System</th>
<th>Length</th>
<th>Width</th>
<th>Height</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>REG</td>
<td>20ft</td>
<td>8ft</td>
<td>8ft (stowed)</td>
<td>8950 lbs.</td>
</tr>
<tr>
<td>PEG/MTVR</td>
<td>25ft</td>
<td>8ft</td>
<td>12ft</td>
<td>48000 lbs.</td>
</tr>
<tr>
<td>CEG/HMMWV</td>
<td>16ft</td>
<td>8ft</td>
<td>6ft</td>
<td>12100 lbs.</td>
</tr>
</tbody>
</table>

**UNCLASSIFIED**
**Bi/Multi-Static Sonar Installation**

**CONCEPT OF EMPLOYMENT:**
- Command activated transmitter & receivers that record time of arrival difference between transmitter ping and target reflection. Time difference describes an arc, arc intersections are the target location.
- Low frequency gives great range but lessor accuracy.
- Localization to prosecution criteria would require a broad area search asset, i.e. P-8 Maritime Patrol Aircraft, surface vessel, or another Submarine.
- Once emplaced and active ensonified area becomes no-go zone for RED subs until neutralized.
- Can be used to create and maintain bastions for US units to move into and operate from and cue MPA.

**Low frequency Bi-Static Sonar Large Area search team**
- Would be USN reserve unit.
- C-130/C-17 deployable
- Analysis gear matches current ship/AC equipment to facilitate manning, and training
- Essentially passive (only local COMMs) in employment except Acoustically when Sonar is active.
- Receivers can parasitically geo-locate other transmitters (i.e. Red ASW units) and potentially use their sonar return to locate targets.

**EAB Site Footprint**
- (UASV Transmitter and receiver emplacement/replacement vessel (can be multi-purpose UASV shared w/other units)
- Analysis and control station. Truck mobile ISO-90 sized.
- Transmitter Unit(s) (Sea Buoy sized cylinder 19.5’x 5’dia. at sea offshore). CONEX carries unit and equipage to install*
- (2+) Receivers. Small relay ashore. Fibre optic cable to receiver in water column. Single tow trailer for cable /relay.*
- 4 Sailor analysis cell
- *These are potentially disposable
**Multi-Static High(er) Frequency Sonar Installation**

- **CONCEPT OF EMPLOYMENT:**
  - Array is emplaced in Choke points, Straits. Command activated transmitter & passive receivers
  - Higher frequency gives less range, better location accuracy.
  - Locating data quality supports Shore ASW Weapons employment (ASROC like if within range) or quick reaction by ASW Hunter Killer Team.
  - Once emplaced and active area becomes no-go zone for REDsobs until neutralized. Use includes Delousing passing Blue units, monitoring red transits in early phase of operations.
  - In passive mode can detect and localize surface raiders and cue shore ASUW weapons (HIMARS).

---

**ASW Localization and Choke Point Surveillance Team**
- Would be USN reserve unit.
- C-130/C-17 deployable
- Analysis gear matches current ship/AC equipment to facilitate manning, and training
- Can operate passively (with only local COMMs) to cue active operations. Acoustically detectable when Sonar is active.
- As passive receivers can geo-locate active transmitters.

**EAB Site Footprint**
- (UASV Transmitter and receiver emplacement/replacement vessel (can be multi-purpose UASV shared w/other units)
- Analysis and control station. Truck mobile ISO-90 sized.
- Transmitter Unit(s) (Sea Buoy sized cylinder 19.5’x3’dia.) CONEX carries multiple active units and equipage to install*. 
- Multiple Receivers. Small relay ashore. Fibre optic cable to receiver in water column. Single towed trailer load for cable and relay.*
- 4 Sailor analysis cell
- *These are potentially disposable
**UTACC (Unmanned Tactical Autonomous Control and Collaboration) / Squad X**

**CONCEPT OF EMPLOYMENT:**
UTACC (Unmanned Tactical Autonomous Control and Collaboration) provides mission level semi-autonomous control of multiple unmanned systems supporting a single mission or task. The Commander will determine the loadout according to mission. Squad X is interface (C2, User Interface, data display) between the unmanned systems, UTACC, and the squad.

UTACC is an interface and system that allows a single Marine to task a section of autonomous vehicles with varying capabilities with a single mission. UTACC will command and control multiple unmanned vehicles throughout the duration of the mission or task, enabling fire and forget C2 of multiple unmanned systems.

**UTACC SPECIFICATIONS:**
- Squad?
- Intelligence Preparation of the Battlespace
- Conduct RSTA missions in support of the squad
- Enables one Marine to command and control many UGV/UAV assets

**Squad X SPECIFICATIONS:**
- Squad X interface on each squad member
- Threat sensing, precise munitions at squad level

**FOOTPRINT:**
- (2) Autonomous Prepositioning Vehicles (1 Ground, 1 Air)
- (3) Semi-Autonomous FERRET UGV ISR end points
- (3) Semi-Autonomous UAV RSTA end points
- (1) Semi-Autonomous RV(M) / CART end point
- (1) Marines
**CONCEPT OF EMPLOYMENT:**
GhostSwimmer AUV is a bio-inspired covert and highly maneuverable underwater vehicle. This unmanned autonomous system (UAS) with sensors have many uses. A sensor/AUV group can act as US ‘localized’ A2AD. Working in groups, they provide intelligence/capability (greater than sum of the parts) for initial scoping of EAB-areas, threat detection, IPB, and have a positive impact on resilience. They can affect adversary’s target evaluation decision process via amorphous operation/movement of UAS and other EAB components that’s defined analytically with random paths that counters probabilistic enemy countermeasures. UAS assist FP by locating, tracking, identifying, (eventually countering) adversary’s assets, defining our: parameters of adaption, response maneuvers, or active defenses, a priori. UAS can also counter the use of overwhelming numbers of adversary UAS by acting as scouts and counter-UAS weapons.

**SPECIFICATIONS (Boston Engineering’s GhostSwimmer AUV):**
- Maneuverability: Turn radius 3 ft; all speeds/flow
- Speed: 0-4 kn now (future max: 10+ kn)
- Range: ~25 nmi (speed dependent)
- Payload size: Up to 23 lb (dry weight)
- Nav accuracy: Current: ≤2% of distance travelled
- Size: 5.5 ft long x 110 lbs
- Depth rating: 1 – 300’ operational depths
- Noise: 5X quieter than prop; “looks like” ocean noise

**FOOTPRINT:**
- Control: One laptop or smart device OCU
- Shipping Crate: 8’x3’x2.5’ 150lb
- C2: Pre-programmed by user
- Maintenance: One user could control 1-5 AUVs <0.5hr washdown post-sortie
- Temp range: Operates in 40F – 110F water
- Other: Standard tools and COTS seals

Distribution Statement: E (DoD Only)
Ground-Based Air Defense Directed Energy

**GBAD (HMMWV mounted)**

**CONCEPT OF EMPLOYMENT:**

The Ground-Based Air Defense Directed Energy On-the-Move program, commonly referred to as GBAD, is designed for use on light tactical vehicles and aims to provide an affordable alternative to traditional firepower to keep enemy unmanned aerial vehicles (UAVs) from tracking and targeting Marines on the ground.

**SPECIFICATIONS:**

- 30kW Raytheon PWG Laser
- L3 Beam Director
- Lithium Batteries
- ACT Phase Change Material Thermal Management System
- Leidos BMDL Radio Network
- Small Form Factor Image Trackers

**FOOTPRINT:**

**HMMWV or JLTV Mounted System:**

- High Energy Laser (HEL)
- Beam Control (Refractive BD)
- Thermal Management (Cooling)
- Power (Storage and Conditioning)
- ISR Sensor
- HPASS
- Beam Control (Optical Bench/SW)
Point Air-Defense Battery

CONCEPT OF EMPLOYMENT:
LAAD Battery Consists of a HQ and (2) Firing Platoons
LAAD Battery provides close-in, low altitude, surface-to-air weapons fires, and when task-organized, provide command and control, and forces for ground security in defense of the Marine air ground task force (MAGTF) Commander’s designated vital areas.

SPECIFICATIONS:
- 1 Low Altitude Air Defense (LAAD) Battery
- Deployable from East or West Coast
- 24/7 all weather, surface to air fires
- 6km range with up to 10,000 ft of altitude protection
- Protect against Group 3 & 4 UAS, Fixed and Rotary Wing Aircraft

FOOTPRINT:
- (6) LAAD C2 HMMWV
- (30) LAAD Fire Unit Vehicle (FUV)
- (3) 4-door HMMWV
- (3) HMMWV trailer
- (90) Marines
Expeditionary-Mine Counter Measures (EX-MCM) Company

CONCEPT OF EMPLOYMENT:

EOD MCM PLTs are specifically prepared to locate, identify, neutralize, recover, exploit, and dispose of underwater ordnance in support of underwater mine countermeasures (UMCM), and are equipped with special low influence signature gear to operate in close proximity to influence initiated maritime ordnance. EOD MCM PLTs are normally employed as an integrated part of the combined MCM team.

Capable of world-wide MCM operations to defeat mines in harbors/ports, SLOCs, and designated areas of operations to permit the flow of military and commercial maritime traffic. Improve efficiency and effectiveness to decrease timelines to reopen SLOCs, ports/harbors, and amphibious landing areas.

Ex-MCM:

EOD Unmanned Systems
- Mk18 Mod 1 “Swordfish”
  - Man-portable (100 lbs), 8 hrs endurance, 3 vehicles per system
  - Relocate, localize and classify objects on the seafloor, and limited area search (harbors) from 10-300 FSW.
- Mk18 Mod 2 “Kingfish”
  - RHIB/crane launched (800 lbs), 20 hrs endurance, 3 vehicles per system
  - MCM search/reconnaissance, and hydrographic mapping from 10-300 FSW
- SEAFOX ROV
  - Man portable (92 lbs)
  - Relocation and ID (via video) of contacts on the seafloor and in the water column for the purpose of mine neutralization.
- SEABOTIX ROV
  - Man portable (90 lbs), approx 1-2 hrs battery endurance
  - Fiber optic wire-guided ROV that can be used to reacquire, identify and neutralize underwater mines.

FOOTPRINT:

- 28 pax, 2x11m RHIB, 3x 8.5m RHIB, 3xS80 CRRC, 6xMk Mod 2, 6x Mk18 Mod 1, 3xSEAFOX, 3xSEABOTIX.
- Transport: Air transportable mission package based from shore or afloat (AFSB, LCS, MK 6, T-ATF, JHSV, MLP, T-ARS, NAVO white hull, MCMV, L-Class Allied vessels.
- Launch and recovery of the 11M RHIB EOD MCM craft while underway can be affected using two different methods. For naval vessels equipped with a stern gate, the 11M RHIB EOD MCM craft can be launched using the 11M RHIB Stern Gate Launch and Recovery (SGLR) trailer. Another option for naval vessels equipped with a Boat and Aircraft (B&A) crane is a 36 foot tall lifting sling.
**USV**

CONCEPT OF EMPLOYMENT:

Unmanned Surface Vessels (USVs) are employed to provide both Force Protection of assets in the area as well as counter-swarming capabilities to disrupt enemy swarming attacks. The CARACaS (Control Architecture for Robotic Agent Control and Sensing) control system is a bolt-on kit that turns any vehicle into a robot, capable of executing defined missions with no human interaction.

**USV:**

- Lethal Weapons:
  - 50 cal machine gun
  - Rocket launcher
- Non Lethal Weapons
  - Loud Hailer
  - Laser Dazzler
  - Flash-Bang Grenade launcher
- (all capacities are dependent on the size of the vessel)

**FOOTPRINT:**

- (1) 11m Rigid Hull Inflatable Boat (RHIB)
- (1) CARACaS Robotic Control System
- (1) Command and Control Station
Counter UxS

CONCEPT OF EMPLOYMENT:

Counter UxS (Counter Unmanned Systems) includes multiple networked and fused sensors and weapon systems capable of providing detection, identification, tracking, and defeat of enemy unmanned systems.

Counter UxS capabilities will be attached to the CLT in order to detect, track, identify and defeat enemy unmanned surveillance and strike systems. Radar could be attached to a CLT by mounting it to a vehicle or dismounted at EAB. Loitering Miniature Aerial Munition (LMAM) and EW/Cyber system will be used for prosecution of adversary UxS. Stalker will be employed for detection of unmanned ground and surface vehicles.

SPECIFICATIONS:

- Radar can detect and track group 1 UAS at 5km, group 2 at 10km, and group 3 at 15km.
- Stalker can detect unmanned ground and surface vehicles out to 5km.
- LMAM max. range 5km
- Tablets with Killswitch or MAFIA should be distributed among CLT.
- EW/Cyber TBD, effective against attack from multiple UxS.

FOOTPRINT:

- (1) 360 degree LCMR radar with air surveillance capability and EO/IR sensor.
- Multiple tablets with Killswitch or MAFIA application to conduct fires coordination.
- (2) Stalker aircraft with full kit.
- (6) LMAMs and launch tubes with (2) ground control stations.
- (2) Generators to run radar and EO/IR sensor.
- EW/Cyber system
Compact Laser Weapon System (CLWS)

CLWS SPECIFICATIONS:
- Integrated onto a variety of air, sea, land, vehicle-based platforms
- Range: varies per laser size (~ 2-7kM)
- Aim point accuracy for first round hit
- Minimizes collateral damage
- Range of Lethal and Non-lethal application based on laze time and target
- Low cost per shot
- Reduced logistics footprint
- Reduction in Supply Chain and Life Cycle Mgmt Costs

FOOTPRINT:
- Tripod configuration (sold to SOF) = 590 lbs (without actual tripod) / 27.3 ft³
- Battery Power Supply: 155 lbs/14x22x32/Rechargeable, rugged nickel metal hydride battery pack for electrical power to all components. AC power supply also delivered. Two battery boxes delivered with the system.
- Compact Chiller: 160 lbs/17x28x28
- Gimbaled HEL Beam Director: 70 lbs/16x25x18
- Toughbook Display with Game Style Controller: 5 lbs/18x2x18
- Ruggedized Fiber Laser: 200 lbs/24x19x37/Compact repackaging of high reliability 2kW industrial fiber laser

CLWS can support the following missions: C-UAS, Direct Fire, C-ISR, Obstacle Breaching, Force Protection, C-IED/UXO, Counter-Sniper, Mobile Ambush. Vehicle Checkpoint, LZ Denial, Port/Harbor/Airfield Defense, C-FAC/FIAC, Major Event Protection

We are integrating this system on a STRYKER for the MFIX 2016 exercise
Advanced Capability Extended Range Mortar (ACERM)

**Description**

Increased 81mm mortar range by 3.5x (>20km)

**Technology/Engineering Innovation**

- New high-lift mortar cartridge design (no rocket motor)
- Low-Cost ($1k AUPC) SAL Seeker
- Direct Connect Weapon Programming Computer
- Advanced trajectory shaping

**Operational Relevance:**

- 81mm Extended Range (>20km) Mortar Cartridge
- GPS (10m CEP50) & SAL (1m CEP50) precision guidance against static and moving targets
- Low Cost (<$15k AUPC) design

**Capability Concept(s) Addressed**

- 2.2.1-4 Deliver Fire Support and Effects: Harass, degrade, mission abort, or destroy static/moving tactical targets – land/sea

**Objectives and Technical Parameters**

**Objective:** Demonstrate extended range, precision fire support from medium mortar system in support of Ship to Shore Maneuver.

<table>
<thead>
<tr>
<th>CapCon</th>
<th>Metric</th>
<th>Technical Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.2.1-4</td>
<td>Maximum Range</td>
<td>20km</td>
</tr>
<tr>
<td>2.2.1-4</td>
<td>Static Target</td>
<td>&lt;10m miss</td>
</tr>
<tr>
<td>2.2.1-4</td>
<td>Moving Target</td>
<td>&lt;5m miss on 60knot target</td>
</tr>
</tbody>
</table>

**Team:** NSWCDD, NSWCIHDEODTD, ARL, United Technologies

Last Updated: 25 OCT 2016
RAPTOR- Remote Weapon Station Auto Prioritization, Targeting, and Operator Cueing

Objective: Demonstrate a remotely operated, direct fire weapon system that uses automation to reduce manning, reduce operator workload, and reduce time-to-engage for targets in the amphibious environment.

Team: Naval Surface Warfare Center Dahlgren, Office of Naval Research, TARDEC - Tank and Automotive Research Command, Southwest Research Institute

Description

Modular, automated, self-contained weapon system for integration on existing amphibious vehicles as a remotely operated weapon station

Technology/Engineering Innovation

Technology/Engineering Innovation

- By integrating shot detection systems, a Remote Weapon Station, vision based sensors, and advanced processing, the system has the capability to automatically detect, track, and engage threats within range of its sensors.

TRL: Current: 3; Projected at end (3QFY17): 6

Related Efforts:

- Automated weapon system technology development has been funded as the ONR30 Fires SAFT program
- System integration and prototype development has been funded by an OSD ECTD

Warfighting Capability Concept

Operational Relevance:

- This system would provide a modular, self-contained weapon system for integration on existing amphibious vehicles.
- The system is automated to enable remote operation and will automatically detect, track, calculate fire control, and aim the gun based on visual tracking.

Capability Concept(s) Addressed

- 2.1.1 Automated target detection and localization in sea and land environments
- 2.2 Deliver small arms direct fire support during amphibious and land operations against static and moving targets
- 2.3.3 Can be integrated on existing amphibious vehicles (AAV) as a self-contained, remotely operated weapon station

Objectives and Technical Parameters

| CapCon | Metric | Technical Parameter |
|--------|
| 2.1.1  | probability of detect | Available targets vs. detected targets |
| 2.2.2  | Time-to-engage | seconds |
| 2.2.4  | Time-to-engage | seconds |
| 2.3.3  |               |           |
Laser Weapon Module (LWM)

LWM SPECIFICATIONS:
• Integrated onto a variety of air, sea, land, vehicle-based platforms
• Range: varies per laser size (~20kM)
• Aim point accuracy for first round hit
• Minimizes collateral damage
• Range of Lethal and Non-lethal application based on laze time and target
• Low cost per shot
• Reduced logistics footprint
• Reduction in Supply Chain and Life Cycle Management Costs

- Boeing initiating IR&D to build Laser Weapon Module (LWM)
  - Drop-in" laser weapon system that is platform agnostic
  - 30 cm Beam director for tracking and stabilization
  - 10kW COTS IPG laser
  - LWM Design to support 50-100kW laser
  - Power & thermal storage for interface to platforms
- Initial integration targeting General Dynamic’s Stryker Combat Vehicle
  - LWM Pre-Production Ready Unit (PPRU) for integration & testing in 2017
- LWM has a larger laser so the range is greater and the mission set expands above what the CLWS can do. IE – C-RAM, C-CM in addition to C-UAS, Direct Fire, C-ISR, Obstacle Breaching, Force Protection, CIED/UXO, Counter-Sniper, Mobile Ambush. Vehicle Checkpoint, LZ Denial, Port/Harbor/Airfield Defense, C-FAC/FIAC, Major Event Protection

FOOTPRINT:
- 10kW LWM Current Estimates as of SRR:
  - Total Estimated Volume: 176 ft³
  - Total Estimated Mass: <7,162 lb
  - Total Estimated Power: <65 kW
CONCEPT OF EMPLOYMENT:

(X) EAB HIMARS Fire Hubs available from Battery Q, 5/11 Camp Pendleton, each deploying as Platoon (REIN).

Force Artillery Headquarters (FAHQ) provides a task organized liaison capability which facilitates command and control (C2) of GS surface to surface missile fires, to include joint and combined, in support of the JFMCC.

M142 High Mobility Artillery Rocket System

- 1st Platoon (REIN), Battery Q, 5/11
- C-130/C-17 deployable from Miramar, CA
- 24/7 all-weather, precision guided fire support
- ATACMS range 300+ km, ~500lbs blast fragmentation warhead, >5m CEP, maximum ordinate >500,000 feet
- GMLRS 84+ km, ~200lbs blast fragmentation warhead, >5m CEP, maximum ordinate >80,000 feet
- Capacity: (X) ATACMs per battery
- GLSDB range 150+ km, ~200lbs unitary penetration warhead, ~1m CEP (excl. TLE), maximum ordinate ~40,000 feet
- Capacity: 6 x GLSDB per HIMARS

EAB Site Footprint

- (1) M142 High Mobility Artillery Rocket System
- (1) Fire Control Center Truck
- (1) Munitions trailer
- (4) Marines
Small Lethal Additively Manufactured Multi-Rotor (SLAMMR)

**Objective**: Demonstrate ability to fly munition to a known target, loiter, and conduct a simulated engagement.

**Team**: Naval Surface Warfare Center Dahlgren Division

**Description**: Multi-Rotor platform loitering munition for precision engagement of tactical targets and clearing of assault lanes.

**Technology/Engineering Innovation**

**Technology/Engineering Innovation**

- Loitering munition that utilizes a multi-rotor platform to provide high maneuverability and hover capability
- Additively manufactured warhead to provide enhanced lethality
- Modular payload design to enable rapid reconfiguration for a variety of mission sets

**TRL**: Current: 3; Projected at end (3QFY17): 4

**Related Efforts**

- Concept developed by NSWCDD for the FY16 Navy 3D-Print-A-Thon sponsored by DASN-RDTE
- Further development currently funded through 219 funds

**Warfighting Capability Concept**

**Operational Relevance**:

- Low cost precision kinetic effects
- Scalable effects/Modular payloads
- Increased standoff range

**Capability Concept(s) Addressed**

- 2.2.1. Amphibious Fire Support and Effects. Harass, degrade, mission abort, or destroy static tactical targets-sea
- 2.2.3. Amphibious Fire Support and Effects. Harass, degrade, mission abort, or destroy static tactical targets-land
- 3.1.4. Clear Assault Lanes. Defeat objects with localized kinetic, and/or non-kinetic effects

**Objectives and Technical Parameters**

<table>
<thead>
<tr>
<th>CapCon</th>
<th>Metric</th>
<th>Technical Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.2.1</td>
<td>Flight Time</td>
<td>10 minutes</td>
</tr>
<tr>
<td>2.2.1</td>
<td>Accuracy</td>
<td>&lt;2 meters</td>
</tr>
<tr>
<td>2.2.3</td>
<td>Lethality</td>
<td>TBD. The lethal effects can be tailored based on the customizable payload</td>
</tr>
<tr>
<td>3.1.4</td>
<td>Reacquire previously mapped items</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Related Efforts**:

- Concept developed by NSWCDD for the FY16 Navy 3D-Print-A-Thon sponsored by DASN-RDTE
- Further development currently funded through 219 funds
**Multi-Missile HIMARS**

**CONCEPT OF EMPLOYMENT:**

Using the HIMARS architecture modifying the Norwegian Naval Strike Missile (or like missile) in the antiship mode and a AIM-120 like missile in the same launcher


(http://www.kongsberg.com/en/kds/products/missilesystems/navalstrikemissile/)

**SPECIFICATIONS:**

- Provide multi-mission capability from the same launcher footprint as a standard HIMARS detachment. Must have data link or UAV support. (Link 16 min, CEC preferred)

**FOOTPRINT:**

- Same as HIMARS ATACAM with exception of link receive capability.
**Description**

VASS is designed to be a multi-functional tool, capable of integration with a weapon system, as a stand-alone system, and also has training applications.

**Technology/Engineering Innovation**

- **VASS provides an interface between existing UAVs and a gun weapon system**
- **Provides user the ability to use one system (VASS) for target tracking and digital shot corrections from live UAV video**

**Technology/Engineering Innovation**

- **TRL:** Current: 6; Projected at end (3QFY17): 7

**Related Efforts:**

- Originally developed using ONR funds (IAR project), follow on work funded by NSWC Dahlgren funds (NISE)
- NSWC Dahlgren, as part of the USS DAHLGREN experiments in support of FAC/FIAC mission threads, continues to fund VASS improvements

**Warfighting Capability Concept**

**Operational Relevance:**

- VASS can act as a Forward Observer to gun weapon systems during Naval Surface Fire Support (NSFS) missions
- Intuitive interface provides point and click targeting/tracking and gunfire correction orders
- VASS quantifies the weapon miss distance to provide Battlefield Damage Assessment in real-time

**Capability Concept(s) Addressed**

- 1.1 Delivery systems capable of maneuvering troops, and material and delivering effects to conduct early raids and other shaping activities from distance.
- 2.1 Multi-Domain Intelligence, Surveillance, and Reconnaissance (ISR-T)
- 2.2 Deliver Fire Support and Effects
- 3.1.3 Precision marking of obstacles

**Objectives and Technical Parameters**

**Objective:** Clear, concise (1-2 line) description of the goal of the exercise (spell out all acronyms on slide once).

<table>
<thead>
<tr>
<th>CapCon</th>
<th>Metric</th>
<th>Technical Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Detection/tracking of land target</td>
<td>Geolocation to within 50-ft, demonstrate adequate tracking</td>
</tr>
<tr>
<td>2.1</td>
<td>Target identification and classification</td>
<td>Demonstrate identification and classification of potential targets from live UAV video</td>
</tr>
<tr>
<td>2.2</td>
<td>Targeting and destruction of target</td>
<td>Demonstrate rapid convergence of gunfire onto static land target</td>
</tr>
<tr>
<td>3.1.3</td>
<td>Geolocation accuracy</td>
<td>Geolocation to within 50-ft</td>
</tr>
</tbody>
</table>

**Team:** NSWC Dahlgren UAV and VASS groups.

**CONCEPT OF EMPLOYMENT:**

This application could be used to close straits and could also be used on barges however this employment has not yet been tested.

**SPECIFICATIONS:**
- Parasitics present safety consideration
  - Sabots, Obturator (5”), Armature (RG), etc...
  - Large mass: ± 2nm (3.7km) down range
  - Sabot: ± 0.25nm, ± 12° down range
- Max Range
  - Navy 5”: ± 35nm
  - RG: ± 100nm
- Max Range Flight Time
  - Navy 5”: ~3min
  - RG: ~4.5-5min

**FOOTPRINT:**
- M109A7 Paladin (39 Cal)
  - Surface to Surface Range: ~45 km
  - Firing Rate: 1-4 rpm (hand loaded)
  - Muzzle Velocity: ~1 km/s
  - Lethality
  - Fires: Similar to Navy 5” / 54
  - Air: slow, non-stressing, non-maneuvering threats
  - ERCA (Extended Range Cannon Artillery – 52 Cal)
  - Surface to Surface Range: ~60-65 km
  - Firing Rate: 10 rpm (autoloaded)
  - Muzzle Velocity: ~1.3 km/s
  - Lethality
**Box O’Rockets**

**CONCEPTUAL, This is just a vision**

**CONCEPT OF EMPLOYMENT:**

In this application we envision the ability to be able to launch myriad weapons such as ASCMs, TLAMs, ATACMs etc. These weapon systems can be launched from a barge, the back of a fan tail or other means, and targeting systems aboard ships or aircraft can guide these on to a long range target.

**SPECIFICATIONS:**

- Weapon specifications would apply for all the variants.
- The ranges and payloads would vary and meet the needs of the target.

**FOOTPRINT:**

- This concept is one that is variable and we could tailor it to whatever is necessary.
- The footprint is variable for this application.
**JHSV (Heavy)**

**CONCEPT OF EMPLOYMENT:**
Modified JHSV. Add the original helo hanger, surgical capabilities, C2 and upgrade to combatant. This will allow surgical facilities, helo maintenance and vehicles and armament to directly support CLTs, their support ships or contracted civilian lift. This may allow for CLTs to come in by air and meet up with vehicles without any traditional amphib or infrastructure support. It may also allow for the CLT to receive sustained maned helo support. Connecter info in next concept.

**SPECIFICATIONS:**
- CH-53 capable hanger with prepoed spares for ACE.
- C2 for coordination of multiple CLTs.
- Remove ferry seats to increase space for C2, medical and crew/troops.
- Full active duty Navy manning
- Improved crane and ramp to support unmanned container delivery, AAV direct water entry and CLT submersible support. Add multi-missile HIMARS boxes for fire support shore & self defense

**FOOTPRINT:**
- Size would be same as JHSV. Crew would be larger and USN to provide capabilities required.
**STOVL FARP Barge**

**CONCEPTUAL, This is just a vision**

**CONCEPT OF EMPLOYMENT:**

Being able to use the F-35B to FARP on barges will make the targeting of these critical assets significantly more challenging. It is likely that these STOVL FARPS can be on the move continuously with the ability to have TACAN and other navigational aids to aid in the location for inbound aircraft.

**SPECIFICATIONS:**

- TACAN
- Infrared Lighting
- Special decking on kits to support MV-22 operations
- Force Protection requirement
  - USN riverine force (enabler)
  - USMC troops ashore/LAAD
- Multi-barge connectors (increase surface area LZ)
- Low visibility/bad weather approach capability (ITG)
- Sea state/weather minimums (stability)
- Firefighting stations (ARFF)
- Air Traffic Control Mobile Team (MMT)
- Navy tug/barge operators with USMC FARP personnel

**FOOTPRINT:**

- Not yet specified due to the short takeoff limits. Additional barges may need to be tied together to facilitate the F-35B.
STOVL FARP Barge
(Notional Concept)
RW FARP Barge

**CONCEPTUAL**, This is just a vision

**CONCEPT OF EMPLOYMENT:**
- Floating FARP capable of operating in shallow draft estuaries
- No Host Nation basing rights requirement (easier permissions)
- Minimal manpower footprint
- Inherent mobility increases enemy targeting problem
- Multi-purpose Retail/Wholesale
  - Minimal up front costs (S&R, R&D)
  - “Kit” out commercial barges procured/leased in theater
    - Navy CEB use pre-fabricated kits to convert commercial barges for FARP use
    - Kits become part of MPF and/or forward staged in PACOM, SOUTHCOM, etc

**SPECIFICATIONS:**
- TACAN
- Infrared Lighting
- Special decking on kits to support MV-22 operations
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- Firefighting stations (ARFF)
- Air Traffic Control Mobile Team (MMT)
- Navy tug/barge operators with USMC FARP personnel

**FOOTPRINT:**
- **River Barge (FARP site)**
  - *PROPOSED*
  - Dimensions: 200L’ x 35’W
  - Draft: 9 ½’ Draft (fully loaded)
    - 1 ½’ (Empty)
- **Blue Water Barge (Surface Connector)**
  - *PROPOSED*
  - Dimensions: 369’L x 62W’
  - Draft: 23’ Draft (fully loaded)
    - XX’ (Empty)
RW FARP Barge
(Notional Concept)
Conception of Employment:

The Ground Unmanned Support Surrogate (GUSS) is a semi-autonomous, off-road capable, Internally Transportable Vehicle-Light Strike Vehicle (ITV-LSV) which fulfills multiple roles and is significantly smaller than other wheeled assets designed for vertical insertion.

System provides dismounted units semi-autonomous logistic resupply and casualty evacuations capabilities. Enable an organic semi-autonomous ground vehicle to “lighten the load” for EAB operations.

EAB Site Footprint

- 1 GUSS – slightly larger than the old M151 jeep and smaller than a standard HMMWV

Ground Unmanned Support Surrogate – Autonomous Internally Transportable Vehicle (GUSS - AITV)

- C-130/C-17/ CH-53/MV-22 deployable
- Electro-optics, lasers, and navigation sensors - provide navigation and obstacle sensing for autonomous missions
- Controlled by GPS guided pre-determined waypoints, or a “follow me” mode in which it shadows a warfighter, or direct tele-operation or can be man-driven.
- Cruising range: 482km
- Capacity: 1,700lbs of cargo, or (2) passengers and (1) litter patient.
Ships Taken Up From Trade (STUFT)

CONCEPT OF EMPLOYMENT:

Ships Taken Up From Trade (STUFT) is an arrangement for supplementing the fleet in time of war under which merchant ships are employed to support military operations.

The uses for such ships can range from troop/cargo/equipment transportation to service as mine clearance and hospital ships; much is dependent on the number of merchant ships that can be made available from the National Defense Reserve Fleet or from allied or friendly nations.

STUFT

- Supplemental cargo and personnel lift
- Salvage and towing vessels for barges/dracons
- Medical
- Fuel (tankers)
- Potential “lilypads” for aviation
- Aid in resupply and/or displacement of EABs

EAB Site Footprint

- No permanent footprint
**LARC-XV (Modified)**

**CONCEPT OF EMPLOYMENT:**

Capable of moving 15 tons ashore. It had a 90 mile water (@ 7kts) range and 260 mile land (@28 mph) range in 1960. At tech update may provide three times the speed at constant range and payload. This would provide the ability to move up to LAV-25s ashore from any roll on roll off ramp, well deck, barge, etc. It could also move a CLT from one island to another of provide logistics from non-traditional platforms ashore. It would be a “risk worthy” flexible connector.

[www.globalsecurity.org/military/systems/ship/larc.htm](http://www.globalsecurity.org/military/systems/ship/larc.htm)

**SPECIFICATIONS:**

- Lift 15 tons, cargo area support a LAV-25/HIMARS minimum
- Water speed of 21kts loaded, land speed 50 mph. Water range 90 miles, land range 260 miles
- Ballistic protection to 12.5mm
- Sea State 3 capable
- Armed with VLS Griffin C-ER and Stinger like missile containers

**FOOTPRINT:**

- Size would be approx same as 1960 LARC-XV
- 45 ft long x 15 feet wide x 16 feet tall.
- 75,000 lbs.
- 360 gal of JP-5.
Floating KMAX

**CONCEPT OF EMPLOYMENT:**

The longer the helo is in the air or has its rotors turning the easier it is to detect and the more gas it burns. If a kmax help could land on the sea and start its own rotors it could provide quick logistics and medevac with increased loiter (engine off while on floats). As it would only have doper shift off its rotors while turning it would limit the time it could be tracked. As it drifted on the current it would slowly retrograde from its last position when its rotor were turning. It may be possible to have a corpsman provide medevac stabilization in-flight even if it is a UAV.

**SPECIFICATIONS:**

- Provide 4000lbs of cargo or three litters and a corpsman up in a 200 km radius with autonomy. Land vertically on unimproved areas on land or the water. Have the ability to auto start and transfer casualties and cargo at sea.

**FOOTPRINT:**

- Slightly larger than a current K-max helo. Cargo may be required to be carried in water tight modules or internally. Requires the ability to move three litters with medical support equipment and room for corpsmen to provide aid.
Picatinny Pallet

CONCEPT OF EMPLOYMENT:
Responsive sustainment of equipment and supplies in multiple locations in all environmental and tactical conditions for dismounted platoons in order to achieve assured resupply capability. Delivery means must not unduly burden the unit with manning, maintenance, or recovery requirements.

ROUTINE SPECIFICATIONS:
- LOGPAC – All Classes of supply, water, mail, etc.
- Weight: 10 to 500 lbs, 500 to 1,000 lbs, 1,000 to 2,000 lbs
- Accuracy: (T) 25m (O) 5m
- Pre-planned
- Signature reduction – noise, electronic, visual
- Anti tampering – payload, delivery mechanism, cyber

EMERGENCY SPECIFICATIONS:
- Normally Class III, Class V, and Class VIII. (CBRN equipment and Class I can be exceptions) Also consider Class VII (any item in an Infantry Company MTOE),
- Accuracy: (T) 30 min (O) 10 min
- Up to 25 Km from company/ battalion trains.
- Up to 500 lbs
- Accuracy: (T) 5m (O) 1m
Motorized Floating Containers

CONCEPT OF EMPLOYMENT:
Motorized containers. A kit that provides bouncy and mobility to a standard shipping container allowing it motor to location without a connector. This would allow anything that could be containerized to be moved from ship to shore or back without a container. This would allow resupply from barge, LCS, or with the addition of a small wheeled pallet down any roll on roll off ramp with the assist of a winch. Deception packages could also be deployed this way.

https://www.youtube.com/watch?v=wRcaKX6C5Mo
https://www.youtube.com/watch?v=KBTDkV3aEL0

SPECIFICATIONS:
- Apply to propel and float a 20 or 40 ft equivalent container at 7kts for at least 40 nm.
- Possess guidance that permitted reliable delivery at a location.

FOOTPRINT:
- Motor section is likely 5 feet longer than a 20 ft equivalent unit.
- Likely 7 ft longer than a 40ft equivalent unit.
- Nose cone is likely inflatable and required compressed air. Defeated footprint negligible.
Water Purification System Barge

**CONCEPT OF EMPLOYMENT:**

(X) LOG Barge: Logistic barge capable of providing multiple Classes of Supply (Class I, II, III, IV, VIII, IX) to provide sustainment to other barges from a stationary position by use of Rigged Inflatable Boats (RIBs) to provide sustainment to other barges. Or the barge can be moved alongside of the other barges to provide sustainment. The LOG barge could weeks worth of sustainment.

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**SPECIFICATIONS:**

Ocean Deck Barge: 180’X54’X12’; 3’ Freeboard 2200 S/T
- LWPS can store 3,000 gallons of purified water with a 3,000 gallon tank. Water ready to drink is distributed from these tanks with a 125 GPM pump.
- CRUAS can fly during the night, in the rain, dust and some wind. Can handled up to 4,500 pounds of cargo per mission.
- 11 Meter RIB, (2) 3126B Caterpillar Diesel Motors, Kevlar Composite, (13) Man Crew, 30-40 knots.
- 25K Crane

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**FOOTPRINT:**

- (1) LWPS Water Purification (1)
- (3) Rigged Inflatable Boats
- (1) 3000 Water Tack
- (1) Cargo Resupply Unmanned Aircraft System (CRUAS)
- (3) ISO Supply Containers
- Solar Panels/Diesel Fuel/Generators
- (15) Marines
SEAMOD  (Expeditionary Concrete Fabrication)

CONCEPT:

Re-examine the concept of the concrete fabrication for naval applications similar to WWI concrete ships and WWII Mulberry Harbors off the coast of Normandy. Use hexagonal forms to fabricate concrete modules that can be pre-positioned, submerged, re-inflated, and interconnected to make a variety of floating EAB node platforms.

Comparing Factors:
- construction skill / specialty: less
- fabrication site: expeditionary
- durability / survivability: more
- cost: less
- time to build (“cure”): 4 weeks

THINK:
- QUANTITY: NOT
- COOKIES: NOT
- EXPENDABLE: NOT
- NUMBER: NOT

UNCLASSIFIED
Notional At-Sea Expeditionary Concrete Fabrication Operation

Mr. Brian Burgess, Concepts, Futures CD&I (brian.burgess@usmc.mil)
Notional EAB Fires Node

( Box O’ Rockets embarked on SEAMOD concrete hex forms )
Supply Glider

CONCEPT OF EMPLOYMENT:

Disposable cargo glider for standoff precision aerial resupply. Can be either dropped from a sling or deployed via static line from internal transport.

Supply glider is delivered from MAGTF organic assets for Strategic lift, providing tactically tailored logistics to forward positioned CLTs.

Description: Disposable cargo glider for standoff precision aerial resupply. Glider folds for transport and wings unfold after deployment. Can be either dropped from a sling or deployed via static line from internal transport.

L/D - 13/1

Goal: To demonstrate capability to deliver cargo to multiple resupply points from one rotary wing (manned or unmanned) mission, while minimizing parent aircraft flight time.

Technical Approach: Two competing vendors will design and develop prototype capabilities to prove that a disposable system will be militarily suitable.

Performer(s): Insitech, Logistic Glider Inc., Yates Electrospace Inc.

S&T Thrust Areas: Expeditionary Logistics, Autonomy/Robotics, Maneuver

EF21 Linkages: Littoral maneuver, Expeditionary advanced base ops, Modern force, adjust the balance between accompanying supplies and resupply

Stakeholders: LID, I&L, MAGTF Seabasing and CSS elements
Submersible Support Vessel

LOG-SUB Concept

CONCEPT OF EMPLOYMENT:
Submersible logistic support/medevac boat. The North Koreans have designed several SOF submersibles that can utilize the low observable nature of submersing and the operational flexibility of high water speed (50 kts+). This type vessel could provide logistic support, act as a battalion aid station for multiple CLTs or provide an emergency egress points for a CLT. Matched with the float Kmax like helos it could surface and resupply the helos and receive casualties and then resupply and further transfer casualties when float planes were available.
http://www.globalsecurity.org/military/world/dprk/ssi.htm

SPECIFICATIONS:
- Comms mast for comms with CLTs, float planes and helos
- Have capabilities to support at least one IDC and approx. 5 litters or 20 pax and 8,000lbs of cargo
- 50kts surface speed
- 3kts submerged speed
- 500 nm range @ 20kts, independent ops for at least 14 days.
- At least 12hrs of coms, life support and medical electrical support off batteries

FOOTPRINT:
Submersible Support Vessel
Forward Surgical Capacity

CONCEPT OF EMPLOYMENT:
Forward Surgery Capacity provides an CH53/V22 forward surgical capability. The initiative optimizes the equipment, minimizes logistics demand through technology.

SPECIFICATIONS:
- Use of an autonomous V-22 capable motorized pallet that can roll off aircraft with the supplies, blood, power, and water to support forward surgery for one day without resupply.
- Leverages water purification, solar, blood storage, and advanced power storage to extend the amount of time a surgical team can provide support without resupply.
- Smallest package can support two surgeons and supporting team for one day. Flexible design to build toward and accommodate larger missions.
- Surge to 2 patients per hour, max of 10 per 24 hours, and can hold max number of patients for one day.

FOOTPRINT:
- Payload for one CH-53 or two V-22
- Three shelters of 11X11
Shock Trauma Section

**OV GRAPHIC**
(example graphic for Concepts to consider)

**CONCEPT OF EMPLOYMENT:**
Shock Trauma Section provides a light and maneuverable (via ITV) means to treat trauma on the battlefield with an Emergency Room physician lead team.

The Shock Trauma Section provides the platform and power to operate the latest medical technology in a package that is V-22 compatible and can maneuver with the ground element.

**SPECIFICATIONS:**
- Redundantly powered and constantly monitored blood storage technologies to push blood far forward safely
- Controlled, constant, redundantly powered, and uninterrupted patient warming across the evacuation chain
- Light and maneuverable vehicle that is V-22 capable, can supply the power demands of the medical technology, and can keep up with the ground units
- Can support an ER doctor, ER nurse, ER PA, and an 8404
- Surge to 3 patients per hour, max of 12 per 24 hours, and can hold max number of patients for one day

**FOOTPRINT:**
- One ATV
- Shelter is 11x11
Class VIII Delivery

**CONCEPT OF EMPLOYMENT:**

Class VIII delivery utilizes autonomous UAVs to deliver Class VII supplies from mid-term storage to the point of need.

Distributed Operations will require medical assets to be self-sustaining in austere environments. This capability, organic to medical, will help ensure that light medical platforms can be resupplied in a timely fashion with little impact on air assets supporting combat operations. This approach will leverage AACUS and a medical common operating picture.

**SPECIFICATIONS:**

- Mission Planning and Management System to automate medical logistics
- Compatible with common operating systems to track requests
- Leverage AACUS and mission planning systems for flexibility in payload sizes to leverage available aircraft/ground vehicles and to fit mission requirements
- Autonomy affords for minimal time required for medical team to coordinate and guide delivery to medical unit
- Mission planning system can also use smaller UAVs with 10 pound payloads and 20 mile range that can be organic to medical

**FOOTPRINT:**

- Will require mission planning and management systems to be available at the sea-base, ashore, and on designated aircraft.
- Will require AACUS on a designated aircraft/ground vehicle
**Joint Precision Air Drop System (JPADS)**

**CONCEPT OF EMPLOYMENT:** JPADS is a high altitude capable guided precision airdrop system that provides increased control release from the aircraft, and reduces on ground load dispersion with accuracy. JPADS is controlled by the assistance of a mission planner laptop with precision airdrop applications, meteorology data gathering kit, and GPS re-Broadcast kit.

JPADS provides increased ground accuracy, standoff delivery, increased air carrier survivability, and improved effectiveness/assessment feedback regarding airdrop mission operations.

**JPADS**
- C-130/C-17/ CH-53/MV-22 deployable
- Systems are expected to operate from altitudes of 24,500 up to as high as 35,000 foot mean sea level (MSL),
- Can operate from sea or shore bases
- 24/7 all-weather, precision guided tactical air delivery
- Capacity: JPADS-2K for up to 2,200lbs; JPADS-10K - 10,000 lbs; JPADS-30K for up to 30,000lbs; and JPADS-60K for up to 60,000 lbs
- System disposable with exception of Airborne Guidance Unit (AGU)

**EAB Site Footprint**
- Negligible
Small Unit Water Purification – On the Move (SUWP – OTM)

CONCEPT OF EMPLOYMENT:

SUWP-OTM is built into an Expeditionary Fire Support System (EFSS) trailer reconfigured to provide a high mobility water desalinization, purification and distribution system. When coupled with a prime mover, it is a rugged trailer that extract and stores non-potable water (NPW) via an on-board pump, allowing quick departure from the source, and purify while in route to another objective. The system cleans and clears NPW to NSF Protocol P248 standards at more than 50 gallons per hour. It is a low pressure, low power, high output system so it provides maximum flexibility and reduced power requirements. This reduces exposure of the warfighter and enables greater mobility.

SPECIFICATIONS:

- Water purification (up to 50gal/hr) on the move.
- Bulk source water storage: up to 150gal.
- Distribution: Directly into 5gal Jerry cans (Not Pictured)
- Reduced power requirements: 24v (DC)
- Solar panel integration: Battery recharging of on-board power system and power exportation.
- Organic pumping system: Water extraction at rate of 5gal/min from source up to 100’ away.
- Noise Signature: 70dBA (Less than a busy street)

FOOTPRINT:

- Height: (Travel) Tire Pressure @ 25psi – 61” (153cm)
  (Loading) Tire Pressure @ 10psi – 59” (149cm)
- Width: (Outside Tire Measurement) – 61” (153cm)
- Length: (Towing Ring to Rear Frame) – 72” (183cm)
- Weight: (without source water) – 1561lbs
  (without source water) – 2761lbs
- Solar Panels can be incorporated for trickle charge but are not necessary for use.
- Entire Footprint for full system when laid out is no bigger than 15’x15’
ALC (Autonomous Littoral Connector)

**CONCEPT OF EMPLOYMENT:**

ALC (Autonomous Littoral Connector) provides semi-autonomous amphibious surface logistics support from the Seabase.

ALC will provide the MAGTF the capability to deliver logistics via amphibious connector without the need of putting Marines and Sailors in harms way in contested environments.

**Description:** ALC will be capable of semi-autonomous navigation, obstacle identification and avoidance as well as delivery in support of Company Landing Teams (CLT) and Special Purpose (SP) Marine Air Ground Task Force (MAGTF) operations. Capable

**Goal(s)/Objectives:**
- Development & integration of navigation and perception capabilities in order to enable semi-autonomous and autonomous Ship to Objective Maneuver (STOM).
- Delivery of equipment & supplies from STOM using robotic/sensing technology.
- Sensory perception and obstacle detection
- Mission planning interface which provides health and status of craft in any environment including A2/AD.
- Interface with UAS in order to generate multi-platform situational awareness.

**Performer:** NSWC-DD, Virginia Tech

**S&T Thrust Areas:** Expeditionary Logistics, Autonomy/Robotics

**EF-21 Linkages:**
- Modern Force - Exploits innovative concepts and approaches (p. 8)
- “Increased capacity to employ unmanned aerial system (UAS) from naval platforms and connectors supporting timely target acquisition” (p. 34)

**Stakeholders:** MCWL, MCCDC, MCSC

UNCLASSIFIED
Large Vessel Interface, Lift-on/Lift-off (LVI LO/LO)

CONCEPT OF EMPLOYMENT:

Enables transfer of ISO containers from the cargo ships to the shore through the Sea Base. Eliminates the requirement for a friendly port to unload containers destined for the shore. Provides a logistics capability that does not exist today.

This same capability can be adapted to reload VLS missile tubes on Navy combatants operating within forward contested austere environments. This could act as part of the support and sustainment EAB.

LVI LO/LO

Mature technologies to reduce technical risk for future advanced at-sea lift-on/lift-off systems by conducting at-sea container transfers with a large-scale technology demonstrator (TRL 6).

Container transfer capacity to be demonstrated:
- 40,000 lbs in SS3
- 20,000 lbs in SS4

Transfer operations to be demonstrated:
- In port container self load / unload to a pier and to a lighter (Harbor scenario)
- At-sea self load / unload from the deck of a container ship (Seabasing scenario)

Uses an advanced crane, to transfer ISO containers to and from various ships through the high end of Sea State 4.
HEIT (Hybrid Energy ITV Trailer)

HEIT

CONCEPT OF EMPLOYMENT:

HEIT (Hybrid Energy ITV Trailer) Tactical Quiet Generator on an ITV trailer. The HEIT also harvests energy from renewable sources (solar, wind, shore power) and stores the energy in a high capacity battery bank.

The HEIT can be deployed with the CLT providing adequate power harvesting and generation to power the COC.

S&T Thrust Areas: Expeditionary Logistics

EF-21 Linkages:

• “...reduction of the logistics footprint ashore...” (p. 41)
• “Employing more efficient electrical generation and distribution systems...” (p. 41)

Stakeholders: MCWL, MCCDC, MCSC, E2O, AMSAA (USA)

Description: HEIT combines ways to generate, scavenge, condition, store, manage and distribute power. HEIT is a standard ITV Ammo Trailer reconfigured to provide 3.5 kW Tactical Quiet Generator (TQG) capabilities with the primary system, the battery bank, providing silent operation and harvests energy from renewable energy sources such as solar, shore power, or conventional energy provided by the on-board generator. With the primary power source being the battery bank, it provides auto-load balancing and an uninterruptable power supply to support the MAGTF.

Goal(s)/Objective(s): Provide power to DO BN/Co through the use of solar, shore, and generator power generation. Identify and match power capabilities to power demands of C4ITV and BN/Co CAPSET. Tie to C4 & supporting requirement through FY15/FY16 and beyond. Focus on EF-21 Experimentation ITV towable solution (using modified ITV Ammunition Trailer) V-22/CH-53/C130 transportable

Fuel sources: Battery, JP-8, Solar, Genset, "leached" shore power
Autonomic Logistics (AL)

**AL Supporting Expeditionary Logistics**

**CONCEPT OF EMPLOYMENT:**

- Autonomic Logistics is the Marine Corps application of:
  - Sense and Respond Logistics (S&RL)
  - Condition Based Maintenance Plus (CBM+)
  - Electronic Maintenance Support System (EMSS)
- Sensors Report Status & Condition of Assets
  - Fuel & Ammo Levels
  - Platform Health
  - Mobile Loads
- Platform status & condition provided for C2 systems

**SPECIFICATIONS:**

Normal Logistics C2 capabilities – embedded sensors and platform logistics modules.

**FOOTPRINT:**

No additional footprint for capability

- Platform sensors, cabling, data bus (CANBUS 2 standard)
- Data-acquisition – STE-ICE controllers on vehicle
- Vehicle power supply
- Vehicle health monitor (EPLS)
- Vehicle display and software
- Off-board Service Application Viewer (software on MCHS)
Expeditionary Manufacturing (3D Printing)

CONCEPT OF EMPLOYMENT:
Expeditionary Manufacturing (EM) capabilities will be developed and fielded as part of the integrated MAGTF repair network – capable of manufacturing both critical ground and aviation flight critical components rapidly and as far forward as possible in the area of operations.

USMC EM capabilities will be part of the larger JTF integrated EM capability – requirements for manufacturing for other Services will be directed by the JTF and accomplished via electronic delivery of all required CAD diagrams, blueprints, and technical drawing packages needed to manufacture requested items.

SPECIFICATIONS:
Provides the capability to:

- Fabricate end-use or repair parts products
- Rapidly fabricate “form-fit-function” prototypes for expedient modifications and/or repairs
- Store and transmit CAD/CAM files and item drawings
- Integrate into a larger repair network of EM capabilities

FOOTPRINT:
Variable – EM locations/instances will require the following:

- Computer
- 3D and/or CAD/CAM software
- Machine equipment (printer) with power supply
- Layering / build material
  - Plastic (powder or liquid)
  - Metal powder
  - Sheet material
USMC Prepositioning Programs

CONCEPT OF EMPLOYMENT:

- Enable the rapid deployment and employment of a fully capable Marine Air-Ground Task Force (MAGTF) anywhere in the world in support of our National Defense Strategy.
- Combines the capacity and endurance of sealift and land prepositioning with the speed of airlift.
- Inherently flexible to respond to the full spectrum of contingencies with effective power projection.

SPECIFICATIONS:

- MPF
  - 2 MSRONS – PACOM AOR
  - Each MPSRON provides a 15K+ MEB
  - 30 days sustainment
  - Global employment

- MCPP-N – EUCOM AOR
  - Supports 5K MAGTF
  - NATO support
  - Global employment

FOOTPRINT:

- MPF:
  - 14 Ships – 7 per MPSRON
  - 70% of MEB supplies/equipment
  - Requires offload location and airfield in vicinity for FIE

- MCPP-N
  - 6 caves and 2 airfield storage facilities – central Norwat
  - Requires FIE and movement to employment area
Submersible Fuel Barges

CONCEPT OF EMPLOYMENT:
- Barge sails under own power with fleet in disguise, maneuvered into place, then submerged until needed
- Cannot reload while submerged, but can off-load while submerged
- Can be sunk to the seafloor or tethered at 18-m depth, submerging takes 90 minutes, several hours to resurface
- Each barge contains 4 support kits (for fuel or munitions), described below
- Offload fuel with hoses to "over the seawall" airfields while submerged; fuel is offloaded from the barge by pushing water into the ballast bladder

SPECIFICATIONS:
- Provides offshore fuel and munitions storage in proximity of bases
- Self-propelled; can also be towed
- Can be sunk to the seafloor or tethered at 18-m depth
- Fuel Storage System: Multiple fuel/water bladders which maintain negative buoyancy
- Munitions Storage System: Waterproof munitions modules locked in place

FOOTPRINT:
- Dimensions: Length 120 m x Beam 40 m x Depth 10 m
- Barge with fuel: Speed (14 KTS); Crew (12); Capacity (50 million lbs, JP-8)
- Barge with munitions: Speed (14 KTS); Crew (12); Capacity (50 million lbs)
- Maximum Depth: 18 meters
Logistics Glider

CONCEPT OF EMPLOYMENT:
Disposable cargo glider for standoff, precision aerial resupply. Glider folds for transport and wings unfold after deployment. Can be either dropped from an external sling or deployed via static line from internal transport.

Autonomous logistics delivery capability from a sea or shore base to multiple widely dispersed EABs operating within the A2AD threat ring from safe distances

Logistics Glider System
- C-130/C-17 deployable
- Can operate from sea or shore bases
- 24/7 all-weather, precision guided tactical air delivery
- Capacity: 300 lbs

EAB Site Footptint
- (1) Recovery trailer (only required if recovery of system is desired)
- (4) Marines
Revolutionary Airlift Innovation (RAIN)

**Description**

Move seabease further out during STOM

**Technology/Engineering Innovation**

- Cost driven, \( \frac{1}{2} - 1 \) ton capacity, single-use “container”.
- Commercial unmanned system technology airdropped from current air connector at or near ceiling.

**TRL:** Current: 4; Projected at end (3QFY17): 6

**Related Efforts:**
- DARPA STTR ST14B-004
- MCWL TACAD

**Warfighting Capability Concept**

**Operational Relevance:**
- Ship-to-objective Maneuver (STOM) cargo resupply by low-cost glider.
- Resupply directly to multiple, distributed, maneuvering small units without logistical infrastructure ashore.

**Capability Concept(s) Addressed**
- 1.1.1. Support of reconnaissance forces.
- 1.1.2. Support of early assault teams.
- 1.1.3. Support of conventional forces.

**Objectives and Technical Parameters**

**Objective:** Demonstrate airdrop extraction, wing unfold, flight control, and parachute landing.

<table>
<thead>
<tr>
<th>CapCon</th>
<th>Metric</th>
<th>Technical Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1.1.</td>
<td>Payload average</td>
<td>671 lbs</td>
</tr>
<tr>
<td>1.1.2.</td>
<td>Offset range</td>
<td>TBD</td>
</tr>
<tr>
<td>1.1.3.</td>
<td>Payload average</td>
<td>1020 lbs</td>
</tr>
</tbody>
</table>

**Team:** DARPA/NSWCDD H33 TEAMS, LGI, UC Davis, NAVAIR, Army Natick Soldier RDEC.
CONCEPT OF EMPLOYMENT:
The towable dracone barges are ideal for liquid logistics distribution in support of an EAB. The dracone can transport product or provide an immediate storage container, on-site. It is perfect for remote areas, where a conventional barge is unavailable or impractical.

For dracones use, conditions tend to involve situations where conventional, steel-hulled barges are not feasible, available or timely (i.e., remote locations and emergency lightering operations). Dracones can be deployed anywhere and can rapidly become an adequate temporary storage capability.

Dracone Fuel System
- C-130/C-17/CH-53 deployable
- Palletized for transport
- Towed by USN/USCG/HN salvage vessels or tugs
- Operable 24/7 all-weather
- Capacity: up to 300,000 gallons
- Discharge range: 200 – 400 meters
- Semi-submersible
- Flexible rubber/polymer fabric

EAB Site Footprint
- Tow vessel and crew (does not need to remain with dracone)
- Can remain off shore in shallow water
CONCEPT OF EMPLOYMENT:
21st century PLUTOs are evident in modern pipe-laying vessels that have taken the concept of using coiled pipe to remarkable lengths. A modern vessel is capable of laying more than 3,800 tons of pipe of up to 16 inches in diameter— at a speed of more than 13 knots.

Towed “conundrums” have receded into history. Coiled pipe reels now ride aboard specialized vessels—constructing a subsea infrastructure that safely connects fuel storage facilities with EABs (either from ship-to-shore or shore-to-shore).

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PLUTO Fuel System

- Towed by USN/USCG/HN salvage vessels or tugs
- Operable 24/7 all-weather
- Capacity: up to 300,000 gallons
- Discharge range: up to 70 miles
- Submersible
- Flexible rubber/polymer fabric

EAB Site Footprint

- Tow vessel and crew (does not need to remain with dracone)
- Fuel discharge point