Expeditionary Maneuver Warfare Department
ONR Code 30

Dr. John Pazik
Department Head

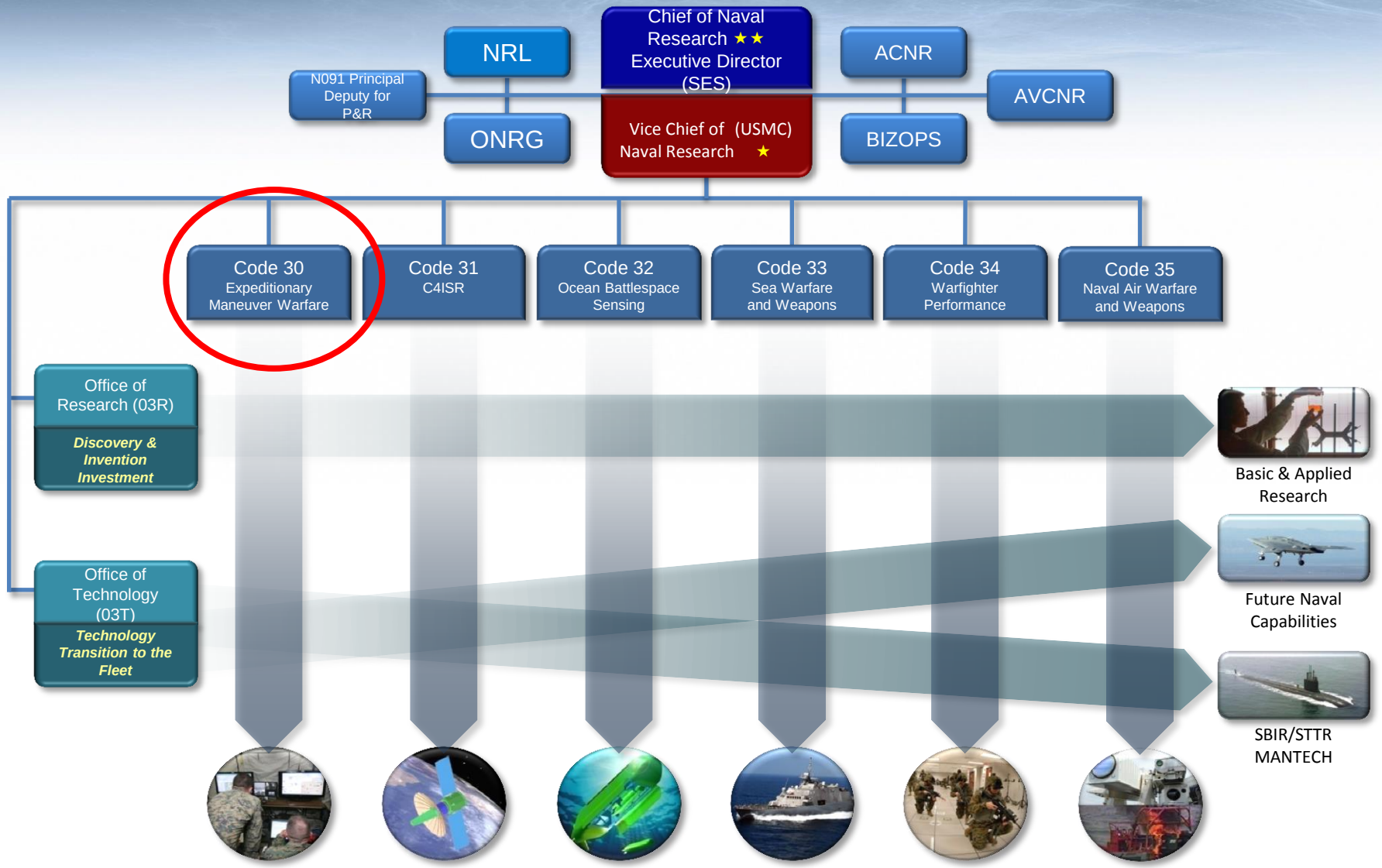
The Office of Naval Research

The S&T Provider for the Navy *and* Marine Corps

- *4,000+ People*
- *1,000+ Partners*
- *23 Locations*
- *$2.1B / year*

U.S. NAVAL RESEARCH LABORATORY

ONR 30: Expeditionary Maneuver Warfare



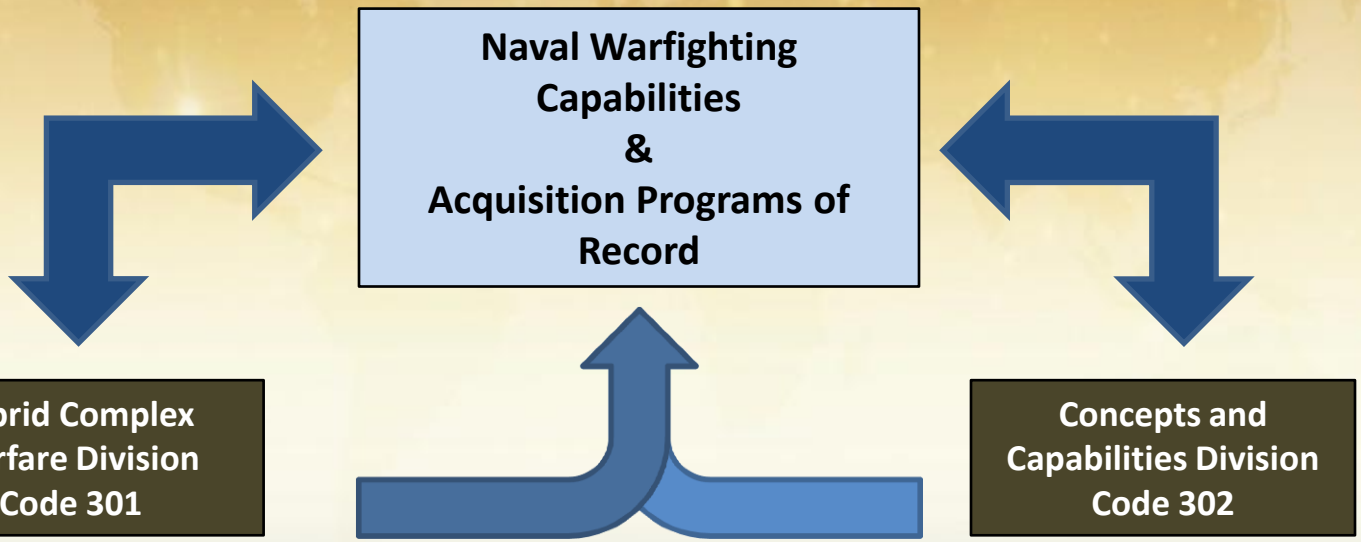
USMC Components of Naval S&T

Office of Naval Research Code 30 – Manages and executes scientific research and technology development for Marine Corps to discover, develop and deliver decisive naval warfighting capabilities, by investing in a balanced portfolio of breakthrough scientific research, innovative technology and world-class people.

MCWL/FD – Identifies plausible future security environments and develops and explores warfighting concepts and CONOPS. It does this in order to identify potential future capability gaps and opportunities in order to inform future force development.

Joint Non-lethal Weapons Directorate – Leverages DoD processes consistent with the Commandant's designation as Executive Agent for the DoD NLW Program. Manages the development and maturation of technologies to produce NLW capabilities which address jointly-prioritized capability gaps for all the services.

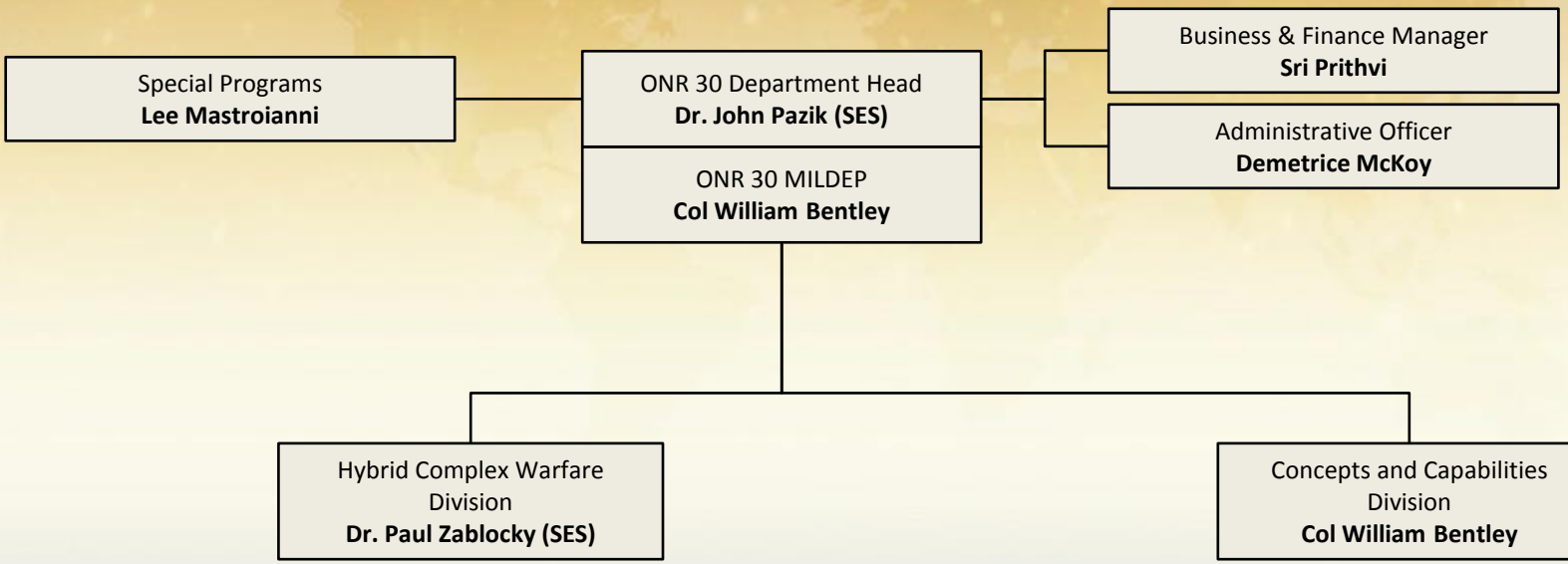
ONR 30 Expeditionary Maneuver Warfare Department



- Mechatronics
- Amphibious Hydromechanics, Counter Detection, and Protection Materials
- Advanced Electronic, Photonic, and Hybrid Sensing
- Decision Support, AI, Machine Learning, and Graph Analysis
- C4, Electronic Warfare, and Electromagnetics
- Applied and Non-linear Physics
- Manufacturing, Maintenance, and Logistics
- Energetics, GNC, Targeting, and Fire Control Technologies
- Human Performance Training and Education
- Robotics and Autonomy
- Cyber Physical Systems
- System of Systems Engineering, Modeling, and Simulation

- Logistics
- Fires
- Force Protection
- Maneuver
- Human Performance
- C4/ISR
- Expeditionary Cyber

ONR 30
Expeditionary Maneuver Warfare Department



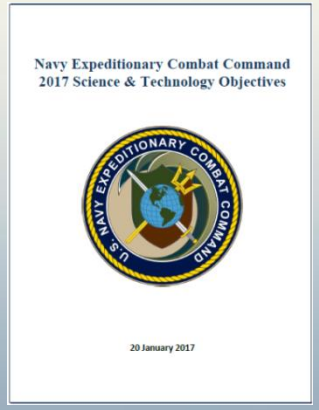
Expeditionary Cyber	– Dr. Waleed Barnawi
Mechatronics	– Jeff Bradel
Amphibious Hydromechanics, Counter Detection, and Protection Materials	– Troy Hendricks
Advanced Electronic, Photonic, and Hybrid Sensing	– Dr. Joong Kim
Decision Support, AI, Machine Learning, and Graph Analysis	– Martin Kruger
C4, Electronic Warfare, and Electromagnetics	– Dr. Dan Purdy
Robotics and Autonomy	– Dr. Michael Qin
Applied and Non-linear Physics	– Dr. Mike Shlesinger
Manufacturing, Maintenance and Logistics	– Billy Short
Energetics, GNC, Targeting, and Fire Control Technologies	– Dan Simons
Human Performance Training and Education	– Dr. Peter Squire

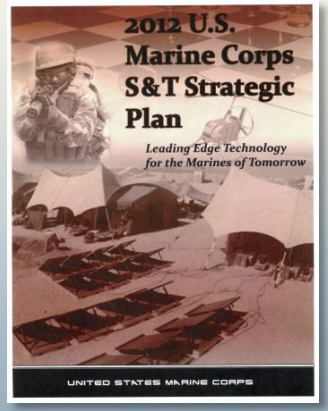
Logistics	– LtCol Robert Lingler
Fires	
Force Protection	
Maneuver	– Maj Travis Carlson
Human Performance	
C4/ISR	– Maj Thomas Haakensen
Expeditionary Cyber	

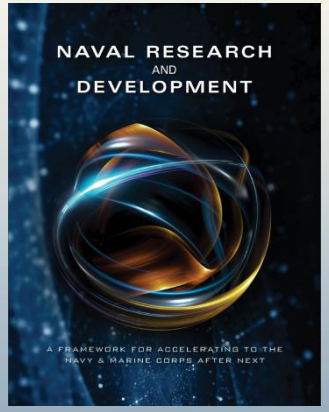
What ONR Code 30 Does and Why

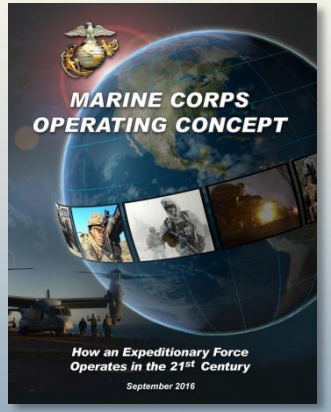
Plan, execute, and manage an integrated (6.1-6.3) portfolio of scientific research and technology development in Expeditionary Maneuver Warfare in order to provide advanced warfighting capabilities for the future Marine Corps, NSW and NECC.

- ✓ Advance state-of-the-art technology and scientific knowledge
- ✓ Expand warfighting capabilities through development and transfer of mission relevant S&T and scientific knowledge
- ✓ Inform both new operational concepts and requirements development









A Guiding Vision

ALIGN

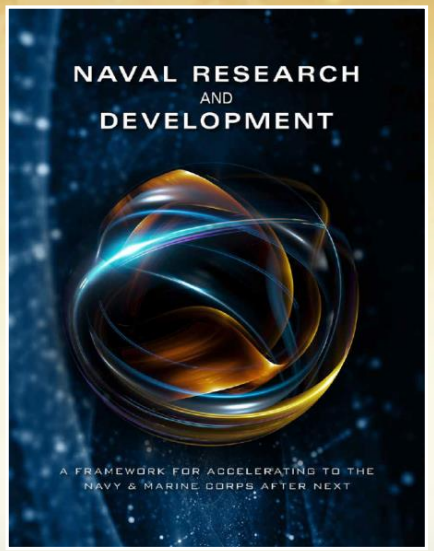
To Shared R&D Priorities

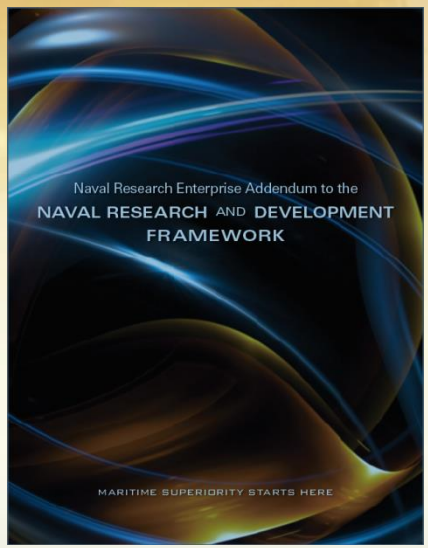
ALLOCATE

Resources to Speed Results

ACCELERATE

Technology-Enabled Capabilities





Framework Priorities

- Augmented Warfighter
- Integrated & Distributed Forces
- Operational Endurance
- Sensing & Sense-Making
- Scalable Lethality

Integrated Research Portfolios

- Amphibious Expeditionary Maneuver
- Information, Cyber, and Spectrum Superiority
- Mission Capable, Persistent, & Survivable Sea Platforms
- Aviation, Force Projection, & Integrated Defense
- Undersea Battlespace & Maritime Domain Access
- Warfighter Supremacy

We must be "First to Field Decisive Capabilities"

Contested Urban Environment

Area Description

Complex terrains:

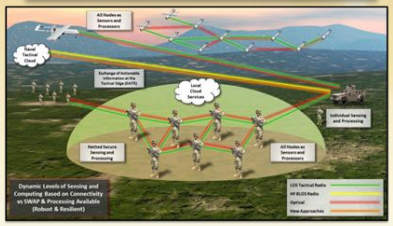
- Crowded and cluttered physical, human, communication, and informational environment
- Physical compartmentalization and additional dimensions
- Proliferation of observation and fires technologies
- Threat obscuration

Technical Approach

- Urban fires and weapons
- Urban mobility
- Urban communication
- Threat sensing, detection, and prevention
- Urban survivability

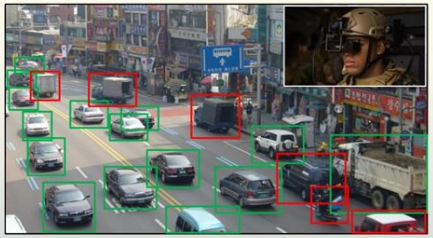
ONR 30 – Emphasis Areas

Expeditionary Communications and Cyber



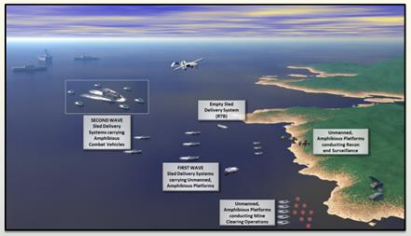
Contested Urban Environment

Cooperative Autonomy



Cognitive Advantage and Artificial Intelligence

Flexible and Scalable Effects



Amphibious Maneuver Enablers

Marine Corps Operating Concept

Design For Maintaining Naval Superiority

Next Warfighter Revolution

Information Warfare	Complex Terrain	Peer & Near-Peer Threat	Manned Unmanned Teaming	21st Century Amphibious Maneuver	Next Gen Combined Arms	Warfighter Sensing and Decision Adv.	Technology Proliferation

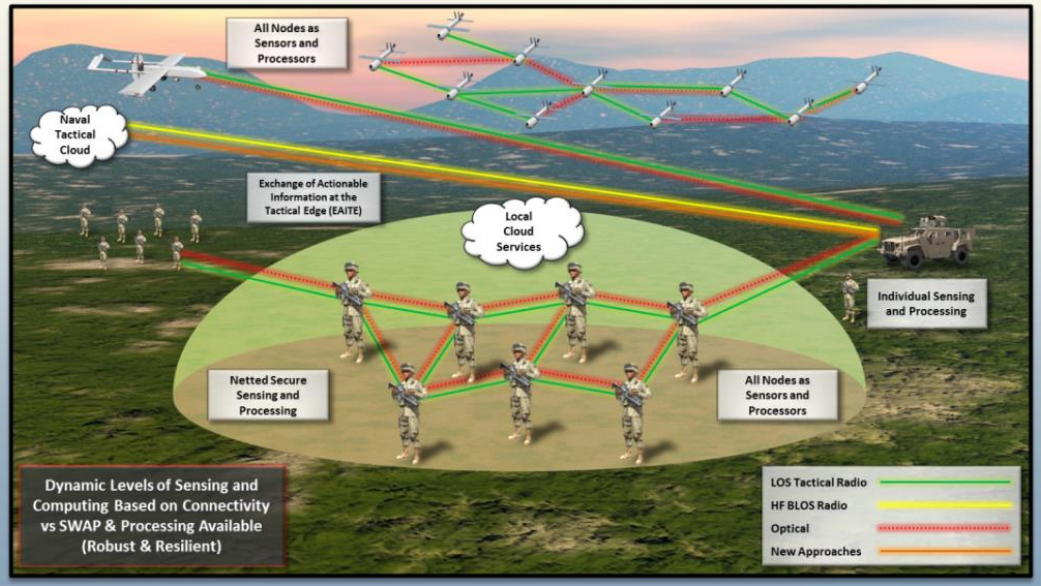
Expeditionary Communications and Cyber

Area Description

- Resilient, robust, and secure communications
- Cyber and information warfare capability
- Electromagnetic signature control and influence
- Rapidly changing network conditions amidst battle of signatures and physical movement
- Exploits close physical proximity while mitigating connectivity shortfalls

Technical Approach

- Networked and local computational availability
- Non-GPS precision, navigation, timing
- Antennas and propagation
- Communications and information theory
- Communications signal processing



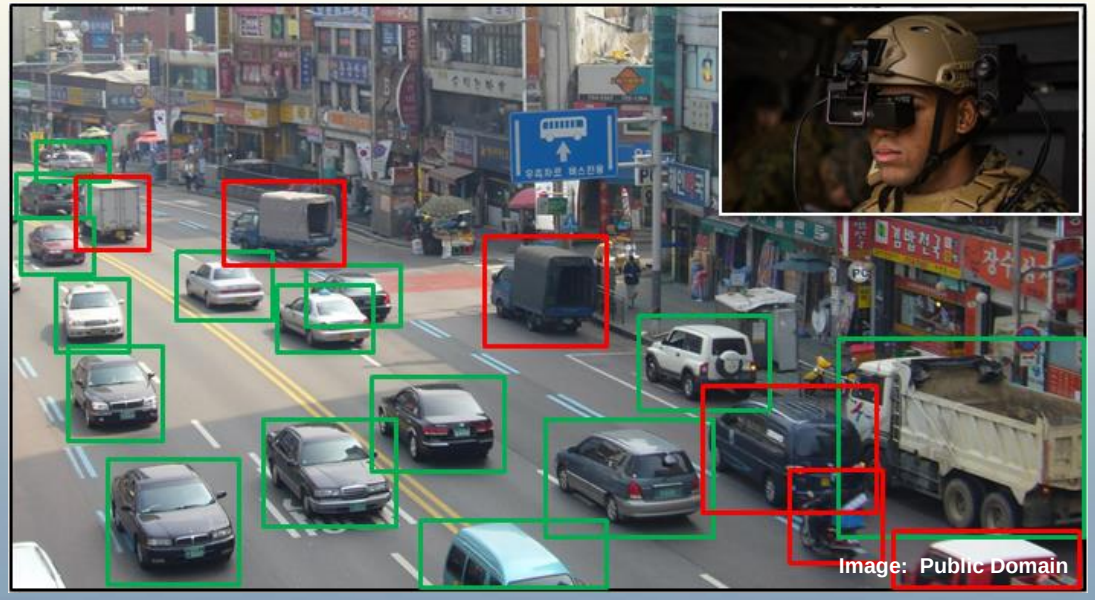
Cognitive Advantage and Artificial Intelligence

Area Description

- Meld machine intelligence and human decision making Ground warrior advanced decision support
- Enhance warfighter sensing, cognitive speed, and decision superiority
- True, rapid, all-source data fusion
- Knowledge products delivered to the warfighter with real world context

Technical Approach

- Data science and analytics
- Image classification
- On-board processing
- Augmented Reality
- Visual attention models



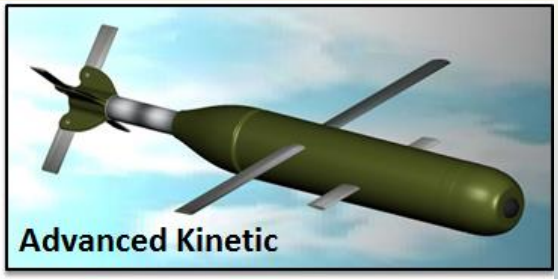
Flexible and Scalable Effects

Area Description

- Combined arms warfare against peer states in complex denied and degraded environments
- Increase precision, range, lethality, and magazine capacity against advanced threats
- Retaining mobility and tempo
- Leverage information warfare to enhance combined arms and weapons targeting, guidance, and effects

Technical Approach

- Long range precision
- Directed energy
- Guidance and controls
- Weapons energetics
- Low signature weapons
- Electronic warfare



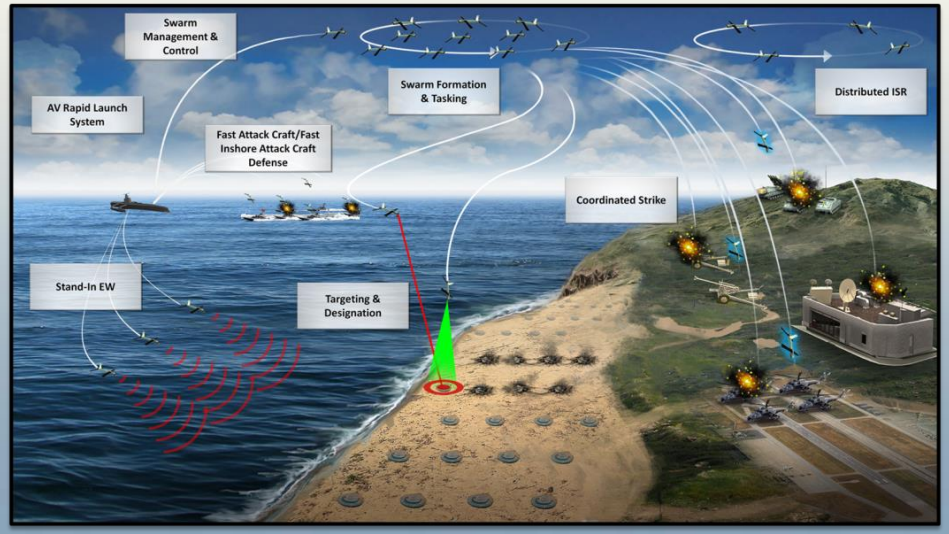
Cooperative Autonomy

Area Description

- Extend reach, increase mass and quantity, and augment the capability of expeditionary forces
- Allow penetration of environments too dangerous for manned systems
- Retain capability despite combat losses with automatic and flexible unmanned adjustment
- Disperse capabilities associated with traditional capital assets

Technical Approach

- Low cost ground, air, and amphibious autonomous systems
- Distributed, collaborative, coordinated and cognitive autonomy
- Autonomous sensing, obstacle detection and path planning
- Unmanned C4 and control theory
- Manned-unmanned teaming



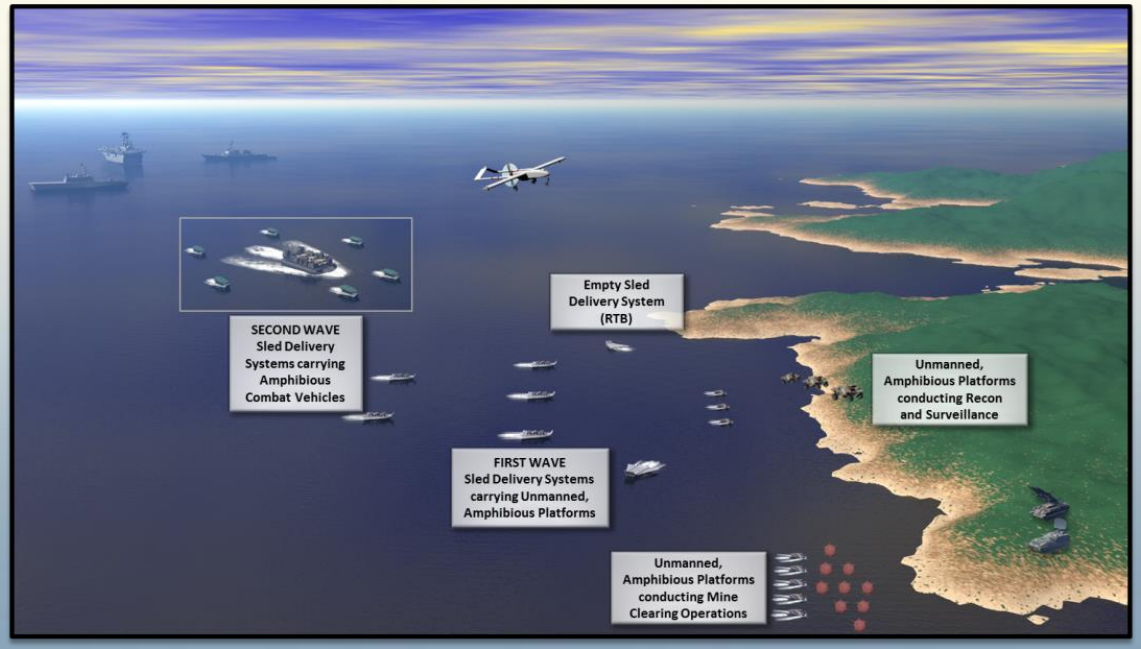
Amphibious Maneuver Enablers

Area Description

- Land forces and material through contested sea-land interfaces
- Address the time, space, force, and information dynamics of amphibious assaults
- Improve individual vehicle capability and expand viable mission scope

Technical Approach

- Novel platform design
- Improved hydrodynamics
- Multi-mission payloads, packages, and sensors
- Passive and active protection
- Signature management



Important…but not a Priority

Area Description

- Human performance
- Sustainment and maintenance
- Power and energy
- Threat detection and defeat

Technical Approach (examples)

- Chemical sensing
- Acoustic detection
- Pre-shot threat detection
- Advanced coatings for vehicles
- Vehicle health and diagnostics
- Warfighter training methodologies
- Injury prediction models
- Hybridization of energy production, storage, and distribution
- Novel photovoltaic technologies

Technology Concept Demonstration & Experimentation

- S&T efforts derived from USMC guidance documents, warfighter perspectives, and opportunity push
- Looking for opportunities to experiment
  - Less mature technologies
  - New concepts with S&T rather than Off-the-shelf
  - Rapid innovation, prototyping, and demonstration
  - Quick tempo teams of warfighters, labs, and industry
- **Planned experimentations for 2017/18**
  - **Expeditionary Communications and Cyber**
  - **Flexible and Scalable Effects**
  - **Cognitive Advantage**

Creating the Future… Delivering Today



ONR Public Website:
https://www.onr.navy.mil/

ONR Public Website, Broad Agency Announcements:
https://www.onr.navy.mil/Contracts-Grants/Funding-Opportunities/Broad-Agency-Announcements.aspx

- 2017 Long-Range Broad Agency Announcement for Navy and Marine Corps Science and Technology is BAA 17-001.