



Force Multipliers for the Joint Battlespace Session Expeditionary Maneuver Warfare Conference

**Presented by
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Expeditionary Maneuver Warfare & Combating Terrorism
S&T Department
26 October 2005**



Naval Research: A Statutory Mission

Naval Research Laboratory (Appropriations Act, 1916):

“[Conduct] exploratory and research work...necessary... for the benefit of Government service, including the construction, equipment, and operation of a laboratory....”

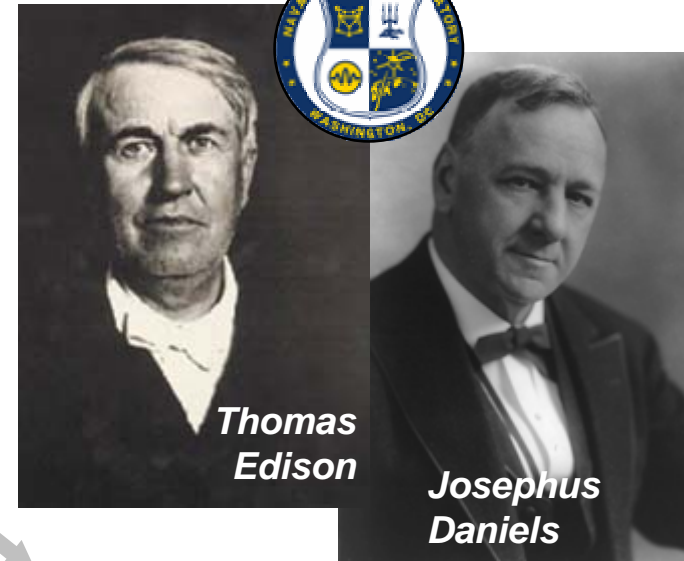
Office of Naval Research (Public Law 588, 1946):

“... plan, foster, and encourage scientific research in recognition of its paramount importance as related to the maintenance of future naval power, and the reservation of national security.... ”



Vannevar Bush

Harry S Truman



Thomas Edison

Josephus Daniels

Transitioning S&T (Defense Authorization Act, 2001):

*“...manage the Navy’s basic, applied, and advanced research to **foster transition** from science and technology to higher levels of research, development, test, and evaluation.”*

ONR is an Echelon 1 Command





USMC Science and Technology



Experimentation



Requirements



Acquisition



ONR S&T Departments

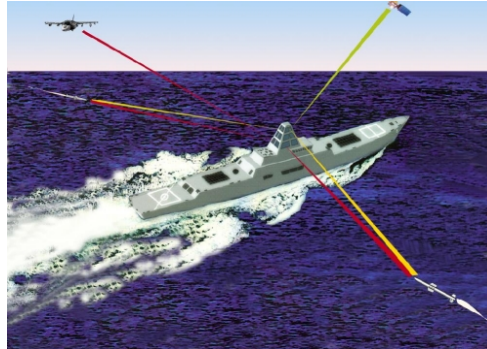
Code 30

**Expeditionary Manuever
Warfare & Combating
Terrorism**



Code 31

C4ISR



Code 32

**Ocean Battlespace
Environment**



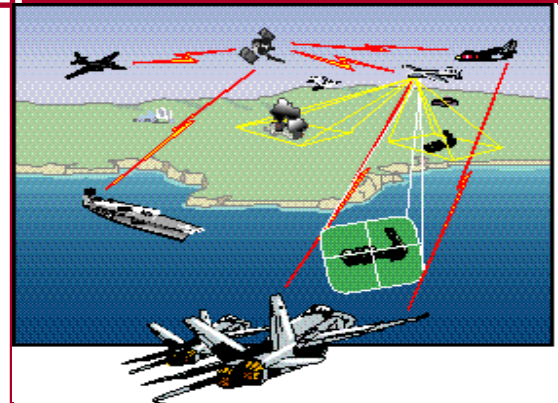
Sea Warfare and Weapons



Warfighter Performance



Air Warfare and Weapons




Code 33

Code 34

Code 35

S & T Departments: Customers and Portfolios

EMW	FORCENet	SEA SHIELD	SEABASE	SEA WARRIOR	SEA STRIKE
MCCDC, MCWL, MARCORSYSCOM MARFOR, NAVFAC NCIS, DTRA, DHS SOCOM SPECWARCOM JNLW Directorate Army Research Lab	SPAWAR NETWARCOM ONI NRO NSA	N096 NAVMETOC CORE NOPP NOAA NASA UNOLS	NAVSEA NAVSURFOR NAVSUBFOR NAVAIRFOR (for ship systems) USCG DOE	Surgeon General Medical Officer of the USMC CNET CNP NIH	NAVAIR NAVAIRFOR Air Force Research Lab
DASN LMW	DASN IWS/LMW/ AIR/C4I	DASN SHIPS/ IWS/AIR	DASN SHIPS/LMW	DASN SHIPS/C4I/ LMW	DASN SHIPS/ IWS/AIR
30 – Exp. Warfare & Combating Terrorism	31 – C4ISR	32 – Ocean Battlespace Environment	33 – Sea Warfare and Weapons	34 – Warfighter Performance	35 – Air Warfare and Weapons
Exp. Man. Warfare USMC STOs in multiple warfighting areas – C4; ISR; Logistics; Human Performance, Training & Survivability; Maneuver; MCM Warfare (w/32); Ground-based Firepower; Non-lethal Weapons; Naval Specwar;	Electronics Computer & Info Sciences Radar/EO/IR Maritime sensors EM propagation & interaction Signal & image processing C3 Networking Surveillance EW	Oceanography Coastal Geosciences Marine geology & geophysics Modeling & Sim Marine metrology Atmospheric effects Space MCM (w/30) UUV's (w/33)	Chemistry Power & energy conversion Naval materials Non-linear dynamics Ship Structures Ship HM&E ASW & UUV's (w/32) Ocean eng. & marine systems	Cognitive science Neural science Behavioral science Social org./science Manpower, personnel & training Human factors Medical science Bimolecular science Biosystems Biomaterials CBWD	Physics Aerospace materials Energetics Surface & Air launched weapons Kinetic & Directed energy weapons Robotics UAV's Air Vehicles
Combating Terrorism 					



DON FY-06 S&T Portfolio

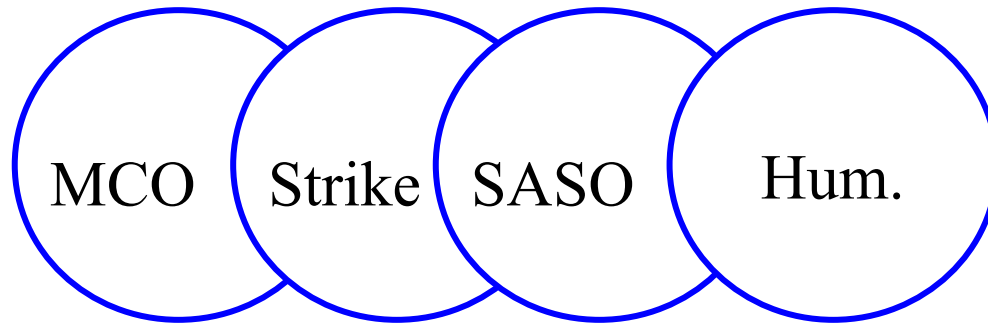
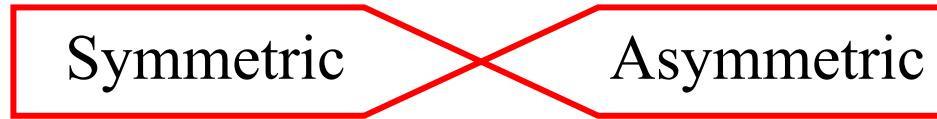
<p>Discovery & Invention (\$720M – 41%)</p> <ul style="list-style-type: none">• Naval Scientific disciplines• NRL/Warfare Centers• National Naval Responsibilities• Technical workforce sustainment• High impacts/surprises	<p>Acquisition Enables (\$551M – 32%)</p> <ul style="list-style-type: none">• FNC's (TOG Oversight)• Warfighter Protect• Capable Manpower (N1/N00T)• LO/CLO (PMR-51)
<p>Directed/Pass-through (\$295M – 17%)</p> <ul style="list-style-type: none">• JFCOM's Joint Experimentation• POM-04 PDM (except EM Rail Gun)• PBD's and earmarks	<p>Leap-ahead Innovations (\$182M – 10%)</p> <ul style="list-style-type: none">• Innovative Naval Prototypes• Swampworks• Tech Solutions• SEA TRIAL• Fleet/Force Response Programs



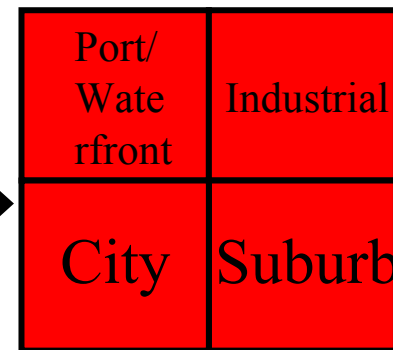
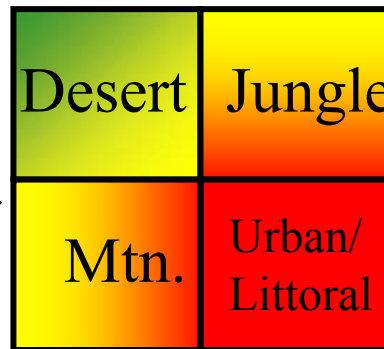
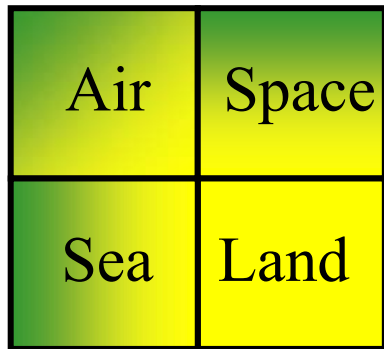
Most Contested

—

Least Invested



Maritime Domain



Urban Littoral Area



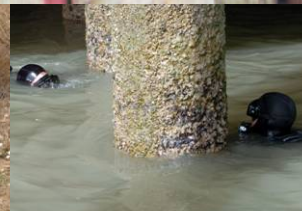
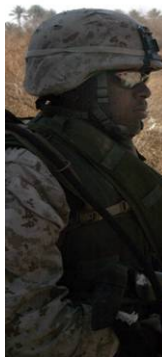
ONR 30 Mission

- *To lead the Department of the Navy's Science and Technology efforts that develop future combat capabilities for Naval Expeditionary Maneuver Warfare and the Department's role in Combating Terrorism, through:*

...the exploitation and subsequent application of Science and Technology in order to enhance the ability of the Navy-Marine Corps team to achieve assured access and conduct decisive operations as the naval portion of a joint campaign.

- **Investment Thrust Areas:**

- C4
- ISR
- Maneuver
- Fires
- Logistics
- Human Performance/Training and Survivability
- Mine Countermeasures (MCM)
- Combating Terrorism





USMC Basic Research Focus Program

- Basic Research component to:

- Strengthen Naval benefit from Nation's research infrastructure (NSF, NRC, NRF, Universities, etc.)
- Enable USMC to go beyond “technology harvesting” by encouraging its own scientific discovery and invention
- Anticipate the future (USMC & USN After-Next) needs of Expeditionary/Combating Terrorism operations in specific focus areas:

- Communications
- Information Efficiency
- Lightweight Power Sources
- Materials for Forensic Sensing
- Human Sensory Enhancement
- Landmine Detection
- Energetic Materials

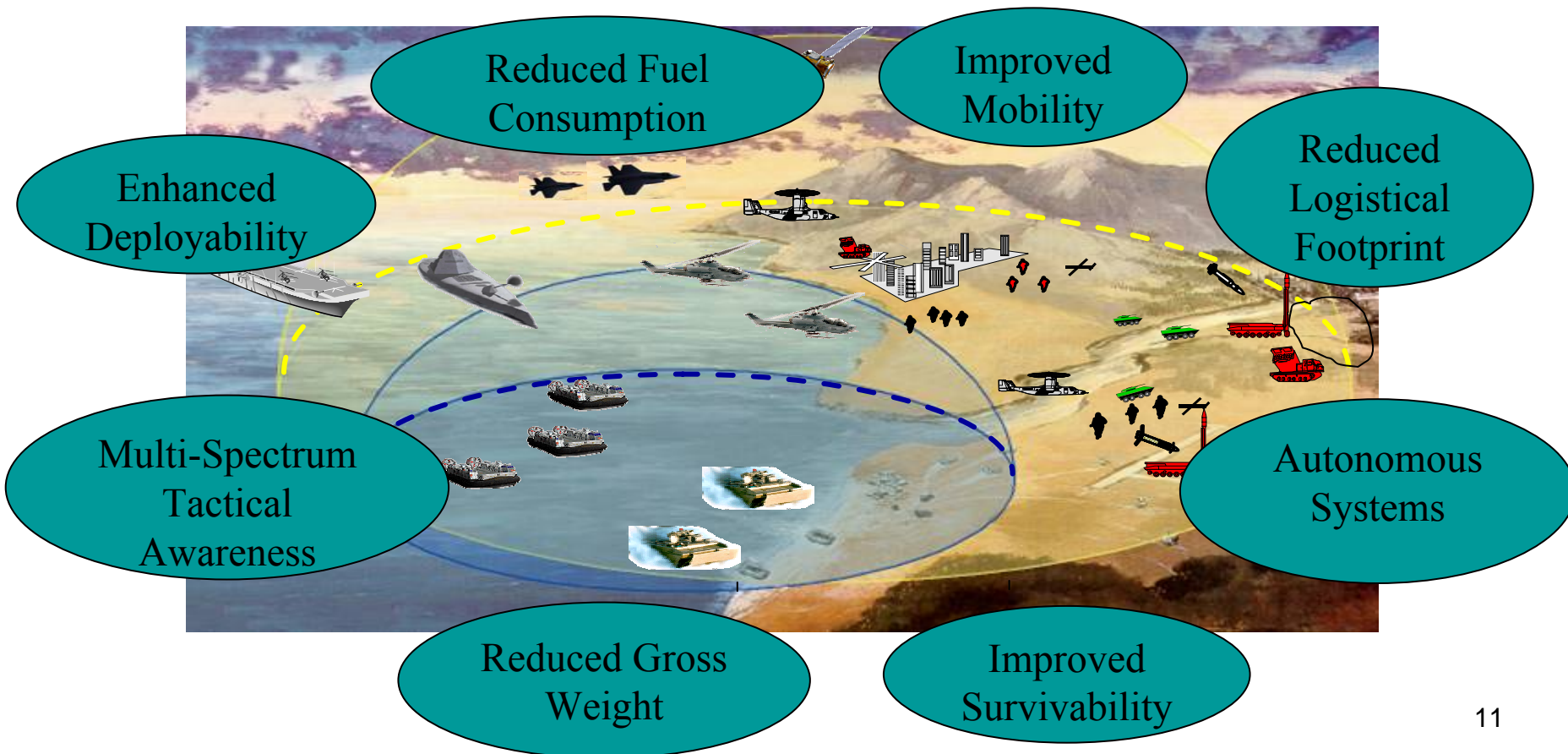


Examples of Texture Based Segment



Maneuver Warfare Desired Operational Capabilities

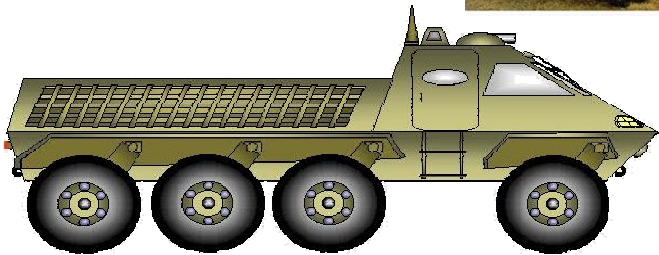
“Maneuver Warfare is the shift from quantitative characteristics of warfare - mass and volume - to qualitative factors of speed, stealth, precision, and sustainability”... *Expeditionary Maneuver Warfare, 10 Nov 2001*



THRUST AREA

MANEUVER

Develop, demonstrate, and transition technologies that will increase the warfighting capabilities and effectiveness of the Marine Corps Air Ground Task Force (MAGTF). This Thrust aims at capturing emerging and “leap ahead” technologies in the areas of mobility, materials, propulsion, survivability, durability, signature reduction, modularity, and unmanned systems..



FOCUS AREA

PROJECT

SURVIVABILITY

SURVIVABILITY SYSTEMS MATERIALS (D&I)

EXPLOSIVE RESISTANT COATING ACTD (D&I)

ELECTROMAGNETIC NON-EXPLOSIVE ARMOR (D&I)

COMBAT VEHICLE SURVIVABILITY STUDY (D&I)

ADVANCED ELECTROMAGNETIC ARMOR (D&I)

SHOCK MITIGATED SEAT (D&I)

ULTRA ARMORED PATROL VEHICLE (D&I)

ACTIVE RPG DEFENSE (FNC)

UNMANNED SYSTEMS

GUNSLINGER HOSTILE FIRE DETECTION (FNC)

ADVANCED MOBILITY

COGNITIVE ASSESSMENT & TASK MANAGEMENT (D&I)

EXPEDITIONARY DECISION SUPPORT SYSTEM (FNC)

MODELING & SIMULATION BASED DESIGN (D&I)

BATTLEFIELD POWER GENERATION (FNC)

ELECTRONICALLY CONTROLLED ACTIVE SUSPENSION (D&I)

ADVANCED LEAD-ACID BATTERY (Plus-Up)

FUTURE TACTICAL TRUCK SYSTEM ACTD (D&I)

EXTREME TERRAIN MEDEVAC VEHICLE (Plus-Up)

EFV OBSTACLE DETECTION SYSTEM (FNC)



Requirements of the next Combat Tactical Vehicle (CTV)

Survivability -

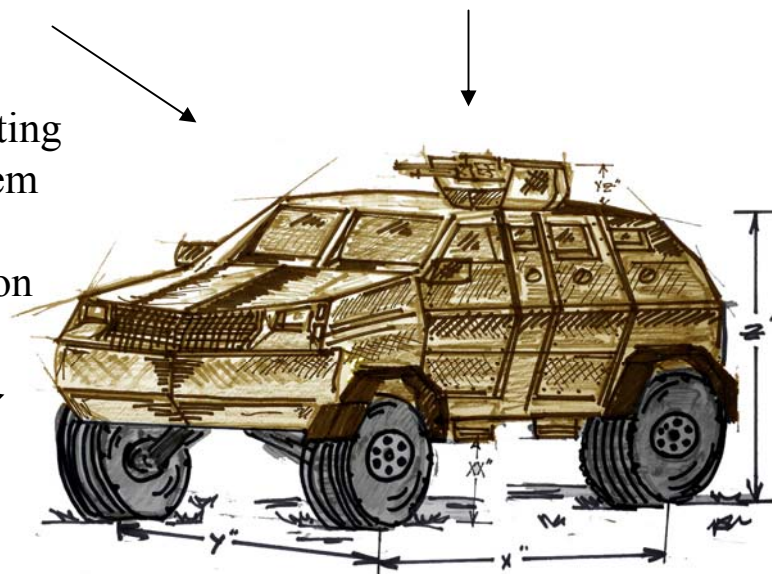
- V shape Underbody Armor
- Advanced Composite Armor Design
- Roll protection
- Shock Absorption Seating
- Fire Suppression System
- A and B Armor Kit
- Overpressure Mitigation

6 passenger

- 3 Vehicles per Reinforced Squad for Distributed Operations

Transportability

- CH-53 External
- 12,000 Curb Weight



Improved Automotive Performance

- Improved Suspension, Drive Train, Braking
- Stabilization Control

Energy Efficient

- Increase Range
- On Board Exportable Vehicle Power
- Hybrid Consideration

Space Claim to Allow for Follow on

Technologies; Net Centric, Communications, Navigation, Position Locating Systems, etc...

THRUST AREA

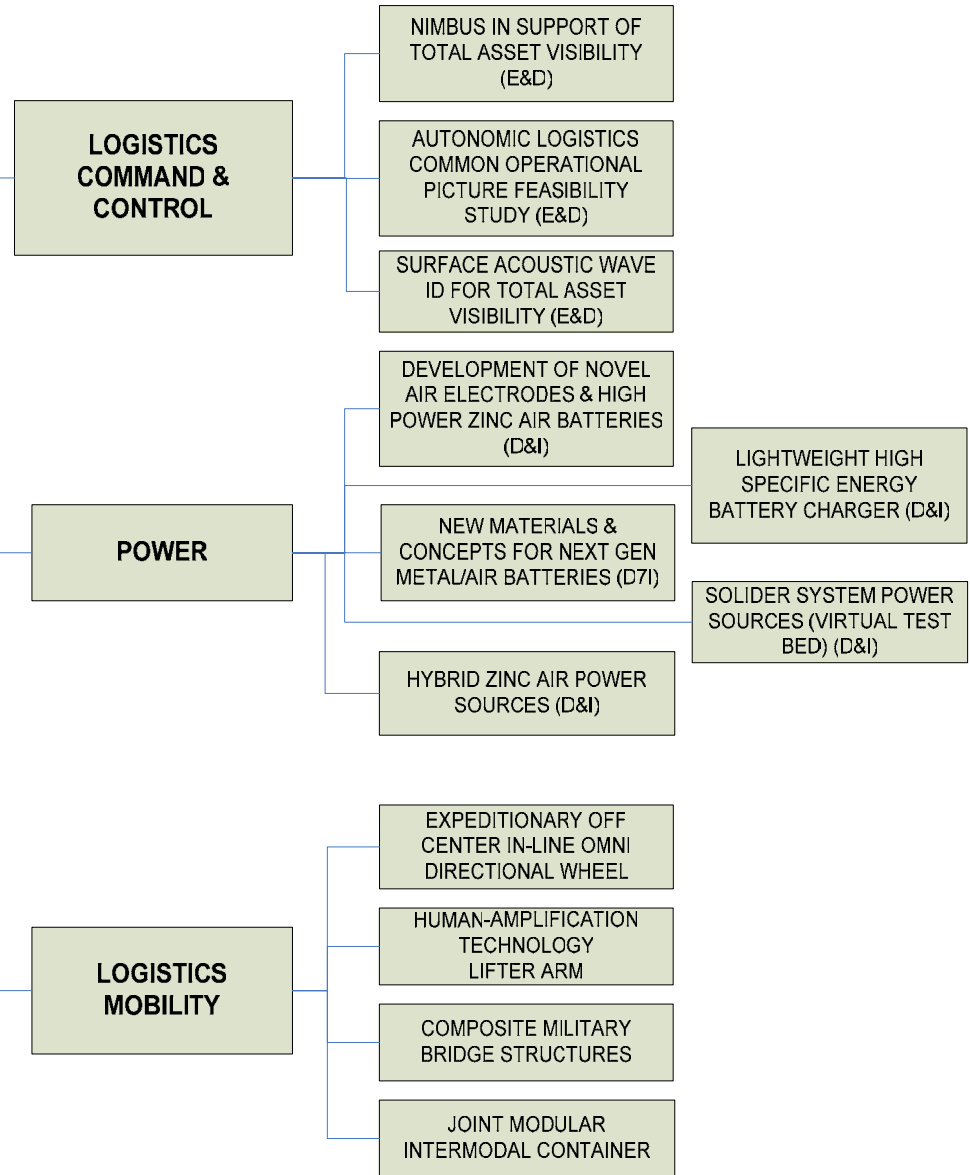
LOGISTICS

Develop and mature technologies for application to the current and future Marine Corps expeditionary systems. Focus is on supporting the Tenets of Seabased Logistics with emerging technologies focusing of improved distribution, reduced combat load in the areas of fuel, water and energy and improved maintenance capabilities.



FOCUS AREA

PROJECT



Synthetic Fuel Requirements

Hydrogen

Near term

- Water
- Natural gas
- Coal
- Biomass

Longer term

- Gas hydrates
- Water splitting

Carbon

Near term

- Natural gas
- Coal
- Biomass

Long term

- Coal
- Shale
- Gas hydrates
- Recycled carbon (CO₂)

Mossgas, Mossel Bay, SA



Symtroleum

Energy

Near term

- Natural gas
- Coal
- Nuclear

Long term

- Coal
- Shale
- Nuclear
- Gas hydrates



Logistic Fuels Production

Different Requirements - Different Options

Moss gas, Mossel Bay, SA



945,000 gal/day

Symtreolera

Land Based production facility

- Current technology can be used
- Flexibility in output
- Few restrictions on plant size
- Wide flexibility for carbon source
- Can build large scale (100,000 bbl/day+)

Transportable production system

- Barge or platform installation
- Constraints demand technology change
 - Weight, height, etc may differ
- Intermediate scale of production
- Restrictions on carbon source



Mobile production system

- Installed on vessel
- Highly constrained application
 - Size, weight, orientation, movement, etc
- Limited carbon sources
 - CO₂ from atmosphere or water
 - CO₂ from engine exhaust

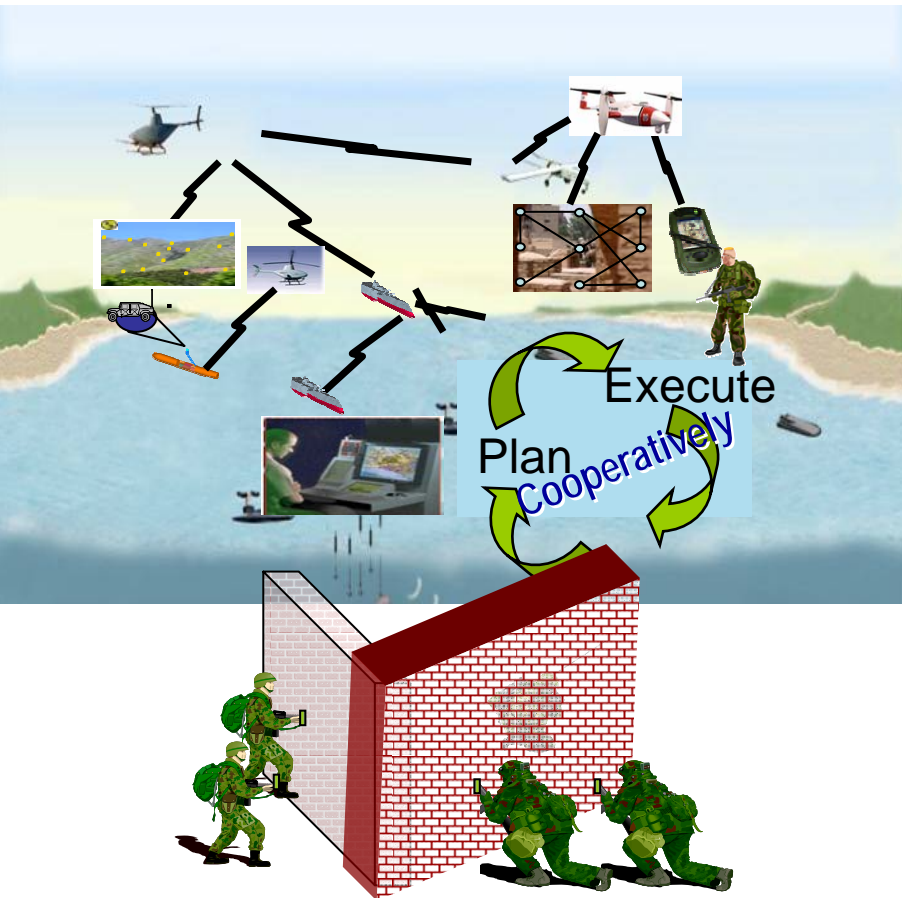


Increasing Complexity

THRUST AREA

INTELLIGENCE, SURVEILLANCE, & RECONNAISSANCE

Develop and leverage advanced technologies for applications in future intelligence, surveillance, and reconnaissance. Enhance situational awareness, and tactical decision making.



FOCUS AREA

PROJECT

SENSOR FIELDS

DESIGN TOOLS ENABLING MISSION SPECIFIC SENSOR FIELDS (FNC)

SMART ALGORITHMS FOR TACTICAL SENSORS (FNC)

AUTOMATED TACTICAL PLATFORM & SENSOR PLANNING & MANAGEMENT (FNC)

TACTICAL NET & DCGS INTEGRATION (FNC)

DETECT/ GEOLOCATE/ TRACK/IDENTIFY

TAG, TRACK AND LOCATE (D&I)

PLANAR ARRAY ANTENNA (FNC)

RF EMITTER ID AND GEOLOCATION (FNC)

TACTICAL LITTORAL SENSING (FNC)

CLASSIFY (KNOWLEDGE)

SIGNAL VISUALIZATION (FNC)

AUTOMATED PATTERN RECOGNITION (FNC)

DISTRIBUTED TACTICAL DATABASE (FNC)

TRANSPARENT URBAN STRUCTURES (D&I)

REMOTE SENSOR FUSION CARD (FNC)

DETECT AND ID FACILITIES (FNC)

SENSING THROUGH WALLS (FNC)

HUMAN TO SENSOR FIELD INTERFACE (SMART DATA PULL) (FNC)

TACTICAL DISTRIBUTED DATA ANALYSIS & AUTOMATED I&W (FNC)

DECISION AIDS (FNC)

MODELING ADVERSARIAL DECISIONS IN COMPLEX OPERATIONAL WARFARE (D&I)

THRUST AREA

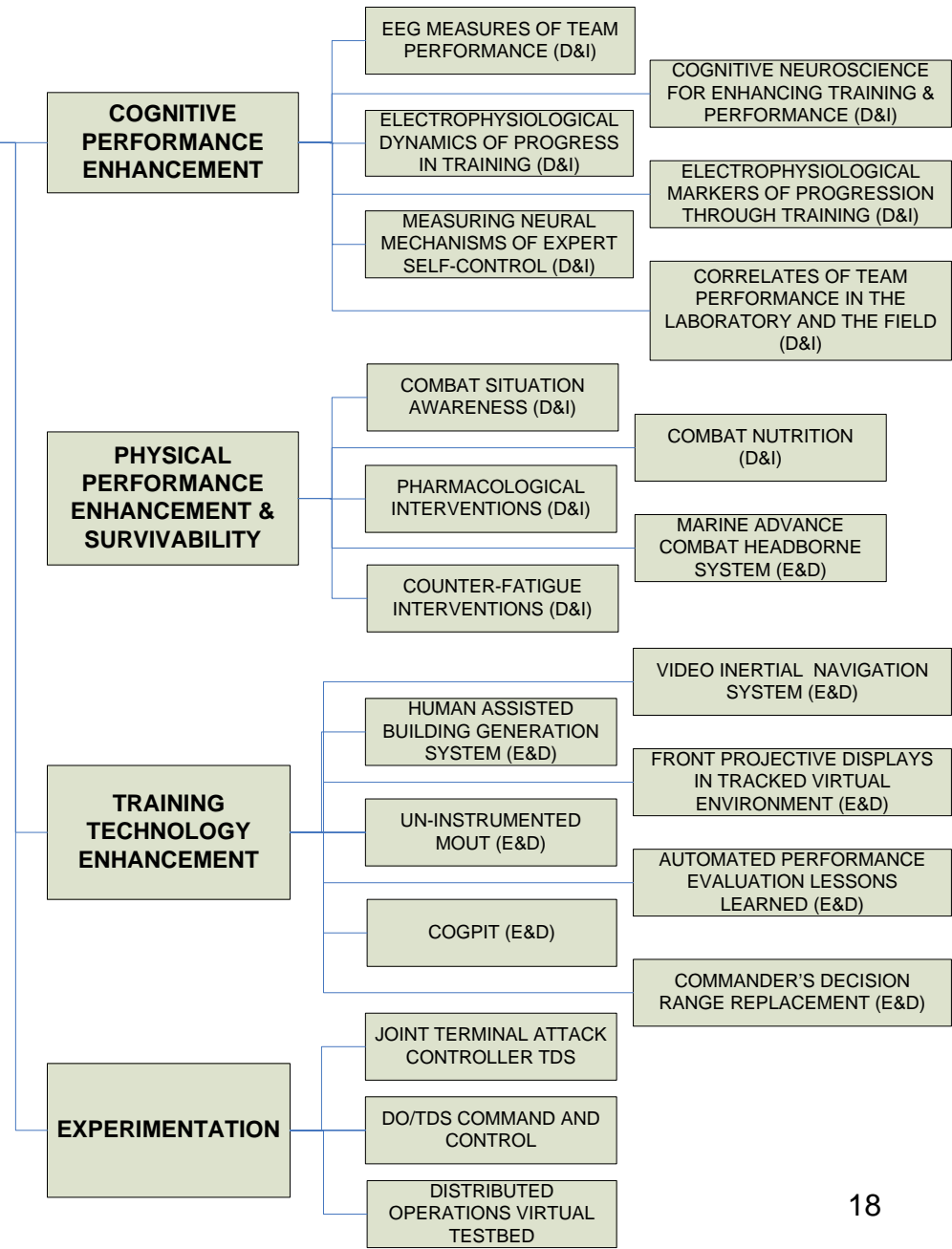
HUMAN PERFORMANCE, TRAINING, & SURVIABILITY

Empower today's warfighter by closing human performance gaps using training and survivability solutions, thereby creating tomorrow's superior warrior. HPT&S is defined broadly to include all aspects of human performance in the domains of Cognitive Performance, Physical Performance & Survivability, and Training Technology Enhancement.



FOCUS AREA

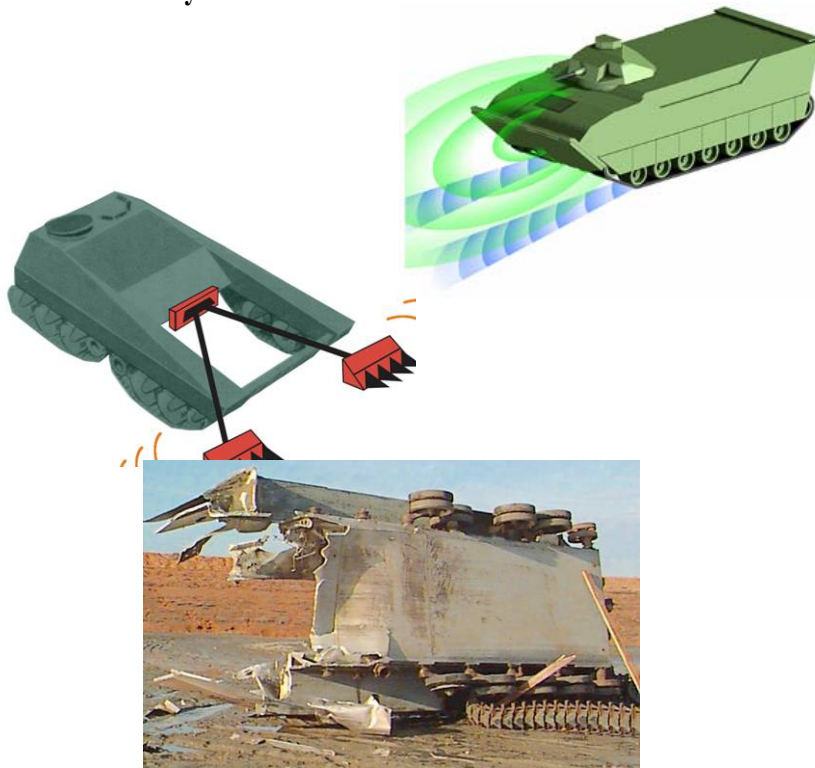
PROJECT



THRUST AREA

MINE COUNTER MEASURE

Develop technologies for critical MAGTF Mine Countermeasures needs to make sea and land MCM an integrated, seamless, and fully integral component of Expeditionary Maneuver Warfare. Focus areas include landmine detection, breaching/ neutralization of all mine types and enhanced survivability



FOCUS AREA

PROJECT

DETECTION / CLASSIFICATION

RF DETECTION OF IEDS (D&I)

JOINT ENGINEER APPLICATION (FNC)

ADVANCED MINE DETECTOR (Plus-Up)

GPR ALGORITHM DEVELOPMENT (D&I)

NEUTRALIZATION

NEUTRALIZATION TECHNOLOGY ROADMAPPING (D&I)

SMART MINE SENSORS COUNTERMEASURE TECHNOLOGY (E&D)

SELF EXTRACTOR / BREACHER (E&D)

THREAT MINE EXPLOITATION (E&D)

SCALEABLE SHAPE CHARGE MUNITIONS (E&D)

LANDMINE COUNTERMEASURES & BREACHING MINE CLEARING LINE CHARGE (FNC)

RADIO FREQ/DIRECTED ENERGY (RF/DE) FOR NEUTRALIZATION OF MINES/IEDS (D&I)

SURVIVABILITY

M&S TOOLS FOR MINE BLAST MODELING (D&I)

MINE SURVIVABLE TESTBED VEHICLE (D&I)

THRUST AREA

FIRES

Develop advanced technologies for application on current and future Marine Corps Expeditionary Firepower systems and elements of the kill chain. Current efforts focus on enhanced lethality and targeting as well as miniaturization and lightweight components.



FOCUS AREA

PROJECT

ADVANCED AMMUNITION TECHNOLOGY

MODULAR SCALABLE EFFECTS WEAPONS (FNC)

EFSS PRECISION EXTENDED RANGE MUNITIONS (FNC)

VARIABLE BLAST WARHEAD (E&D)

MEMS FUZE (E&D)

STOICHOMETRIC OPTIMIZATION (D&I)

FIRE FROM ENCLOSED AREA (D&I)

MICRO DETONICS (D&I)

EXTENDED RANGE ELECTRIC PROJECTILE (E&D)

ADVANCED TARGET ACQUISITION (FNC)

CASELESS SMALL CALIBER AMMO (E&D)

ADVANCED AMMO PACKAGING (FNC)

ADVANCED WEAPONS MATERIAL TECHNOLOGY

ADVANCED WEAPONS MATERIAL TECHNOLOGY (FNC)

TARGETING & ENGAGEMENT TECHNOLOGY

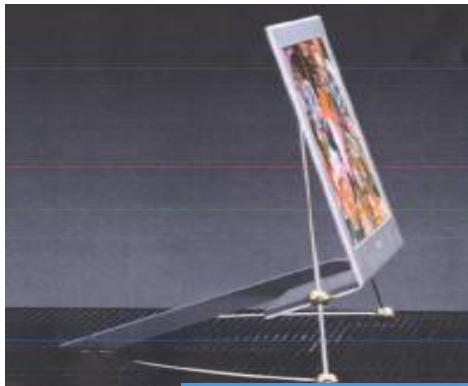
IMPROVED FIRE CONTROL SYSTEM (FNC)

ADVANCED FIRES COORDINATION TECH (FNC)

THRUST AREA

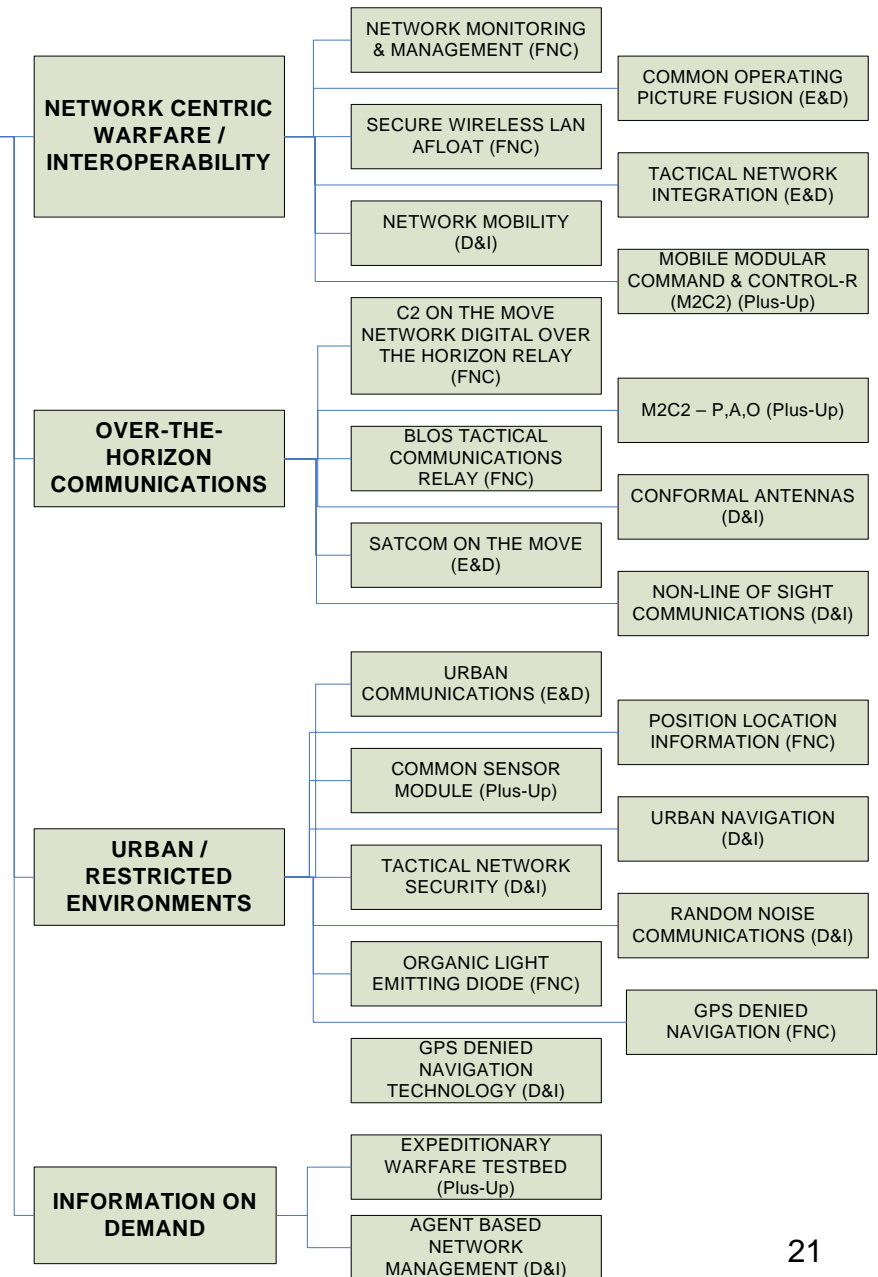
**COMMAND & CONTROL,
COMPUTERS,
COMMUNICATION**

Develop and leverage advanced technologies for applications in future command & control, communications, and computers. Enhance situational awareness, tactical decision making, low probability of intercept/detection comm, and quality of service gains.



FOCUS AREA

PROJECT





Naval Research Enterprise (NRE)

50 weight issues

- What S&T is and what is isn't
- Transition/application of technology for Combat capability
- Naval Futures and S&T Imperatives in the near, mid, and long range:
 - (peer competitors, non-state actors, Asia/Pacific, Economic environment, velocity of tech-change)
- Balanced investment in GWOT, Irregular/Asymmetric Warfare, Expeditionary Warfare
- Balance between major systems/platforms and individual warriors
- Why we do what we do.....



Questions?



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