



National Academy of Science Marine Board Fall 2021 Meeting

17 November 2021

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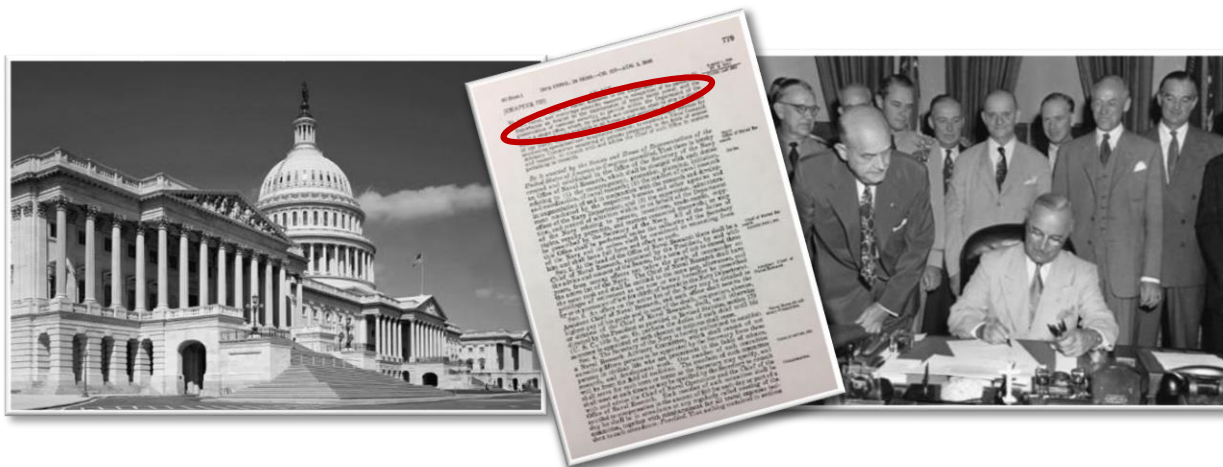
ACCELERATING TO THE NAVY & MARINE CORPS AFTER NEXT

ONR 75th Anniversary



Public Law 588

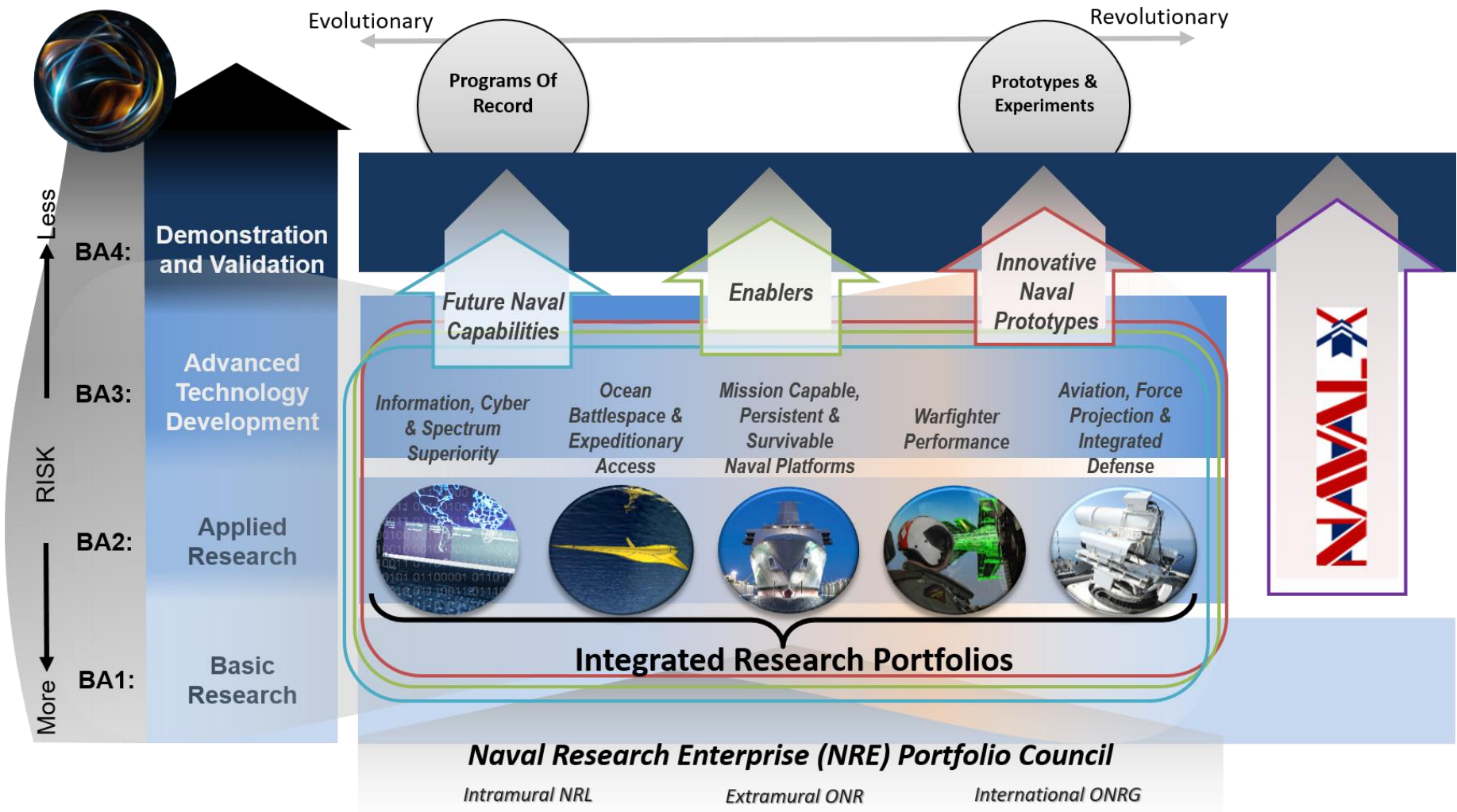
- *Congress recognizes the value of scientific research.*



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

- *Win the current war* (direct transition of S&T, FNCs, and workforce)
- *Win the future war* (scientific research, INPs, and future workforce)
- *Full-spectrum warfare* (set the pace-lead, extract a cost, change the calculus)

The Portfolio – ONR Departments



NAVAL PLATFORMS

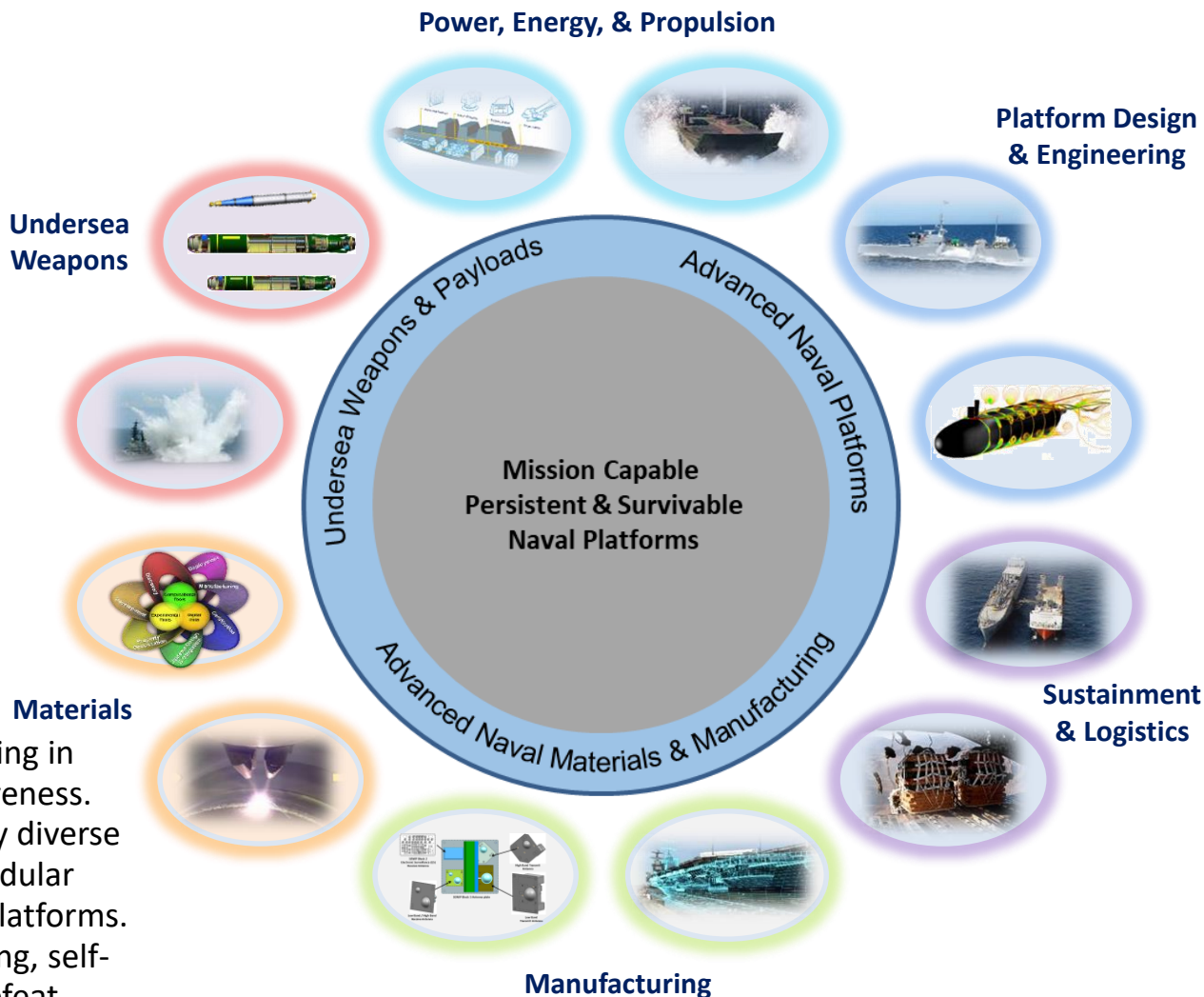
Mission Capable, Persistent, and Survivable

AT A GLANCE

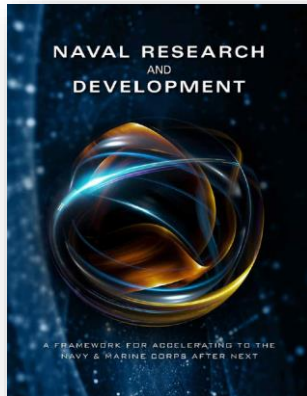
Research on concepts, systems and component technologies that improve the performance and survivability of Navy and Marine Corps platforms in an increasingly distributed yet interconnected force.

WHY IS THIS IMPORTANT

- Threats to the fleet/force are increasing in number, range, precision and effectiveness.
- Sustainable operations in increasingly diverse environments require affordable, modular survivable and rapidly upgradeable platforms.
- Maritime superiority requires enduring, self-sustaining platforms able to deter/defeat aggression through overwhelming capability.



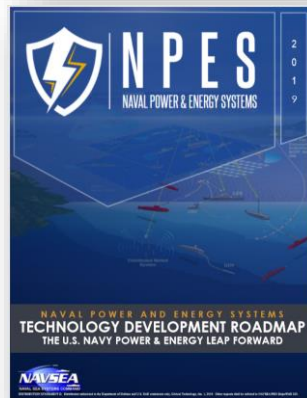
Strategic P&E Guidance



From Naval R&D Framework

- Operational Endurance Priority:

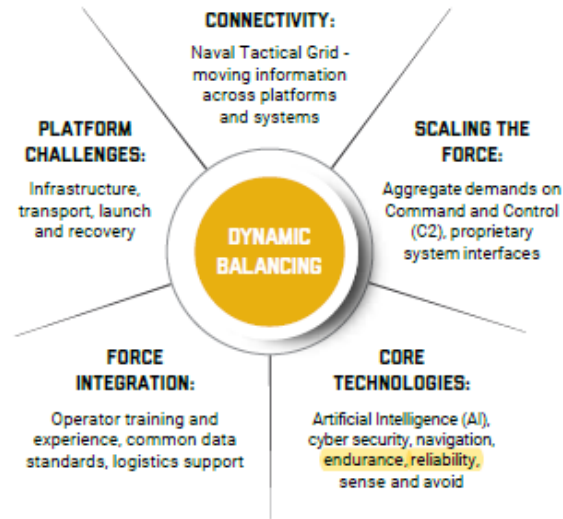
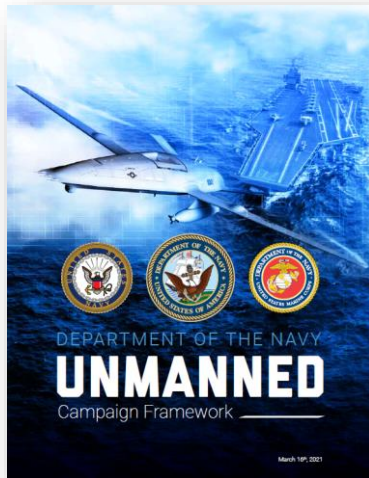
- Enable maneuverability, efficiency and resiliency for sustained operations by warfighters, systems and platforms (regardless of the threat or operating environment)
- Improve platform-level energy storage/efficiency for propulsion and weapons systems



The 2019 Naval Power & Energy Systems Technology Development Roadmap (NPES TDR)

- Reinforces power and energy as the foundation of the kill chain.
- Promotes energy harvesting and improved efficiency in components, power systems, and energy conversion systems

Strategic P&E Guidance

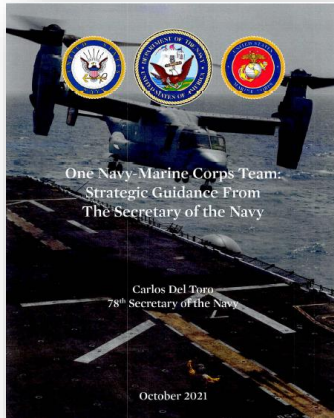


*“New and converging technologies will have profound impacts on the security environment. Artificial intelligence, autonomy, additive manufacturing, quantum computing, and new communications and **energy technologies** could each, individually, generate enormous disruptive change.”*

Strategic Guidance

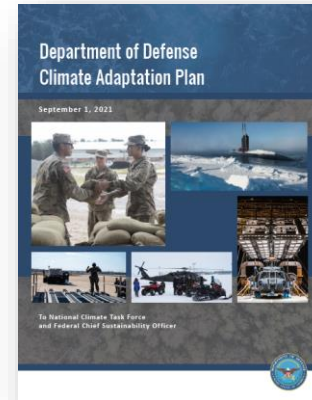


***“We will
prioritize defense
investments in
climate resiliency
and clean
energy.”***



Enduring Priorities:

- ***Expand Forward Presence***
- ***Enhance Warfighting Readiness***
- ***Innovate and Modernize***
- ***Combat Climate Change***



***“Ensure the DOD can
operate under changing
climate conditions,
preserving operational
capability and
enhancing the natural
and man-made systems
essential to the
Department’s success”***

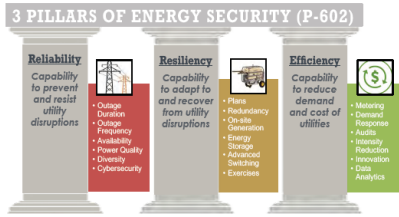


Executive Order 14008:

**Tackling the
Climate Crisis at
Home and Abroad**

DoN Operational Energy Goals

1. Extend operational reach of current and future weapons systems through more effective use of energy
2. Reduce energy consumption and energy logistics requirements to forward deployed strike groups
3. Increased energy resilience of forward bases, supply depots, and cooperative security locations – Get more energy to the warfighter
4. Increase the effective use, conversion, storage, distribution, and control of energy to enable integration of future weapons and sensors onto platforms
5. Foster and guide an energy culture in our sailors and marines through policy, training and education



Direct Air Capture & Blue Carbon Removal Technology Program

Objective:

- Develop and combine Blue Carbon (BC) and Direct Air Capture (DAC) technologies with fuel synthesis (FS) technologies to provide fuel producing options for forward base deployment.

Approach or Tasks

- Establishing collaborative efforts with DOE, industry, and government labs to leverage expertise to advance program objectives
- Development of lighter, smaller, more deployable technologies for blue carbon removal
- Scalable thermochemical and biological approaches to liquid fuel and lubricants from CO₂
- Development of more efficient and scalable direct air capture systems

Integrated Low Carbon Fuel Technologies

Future BC



Future FS



Future DAC



Future Technology

- Scalable
- Integratable
- Deployable
- Strategic fuel autonomy

Quarterly Activity & Results

- Interagency agreement established between ONR and DOE to support DAC activities that apply to DoD energy security
- Developing liquid fuel synthesis skid development and integration
- Industrial support for carbon capture system development

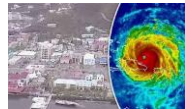
Naval Energy Resilience

Problem/Gap & Capability

- Enhance naval energy resilience to improve energy security, operational capability, strategic flexibility and resource availability.
- Support the warfighter abroad by reinforcing the Navy's foundation at home.
- Overcome current energy resiliency challenges that will have a profound impact on energy infrastructure, helping to increase robustness, sustainability, and resiliency for the military and the U.S. power industry.
- As the Navy develops and fields in- creasing numbers of high-power sensors and weapon systems, the importance of the energy resilience of these systems continues to increase.

Approach

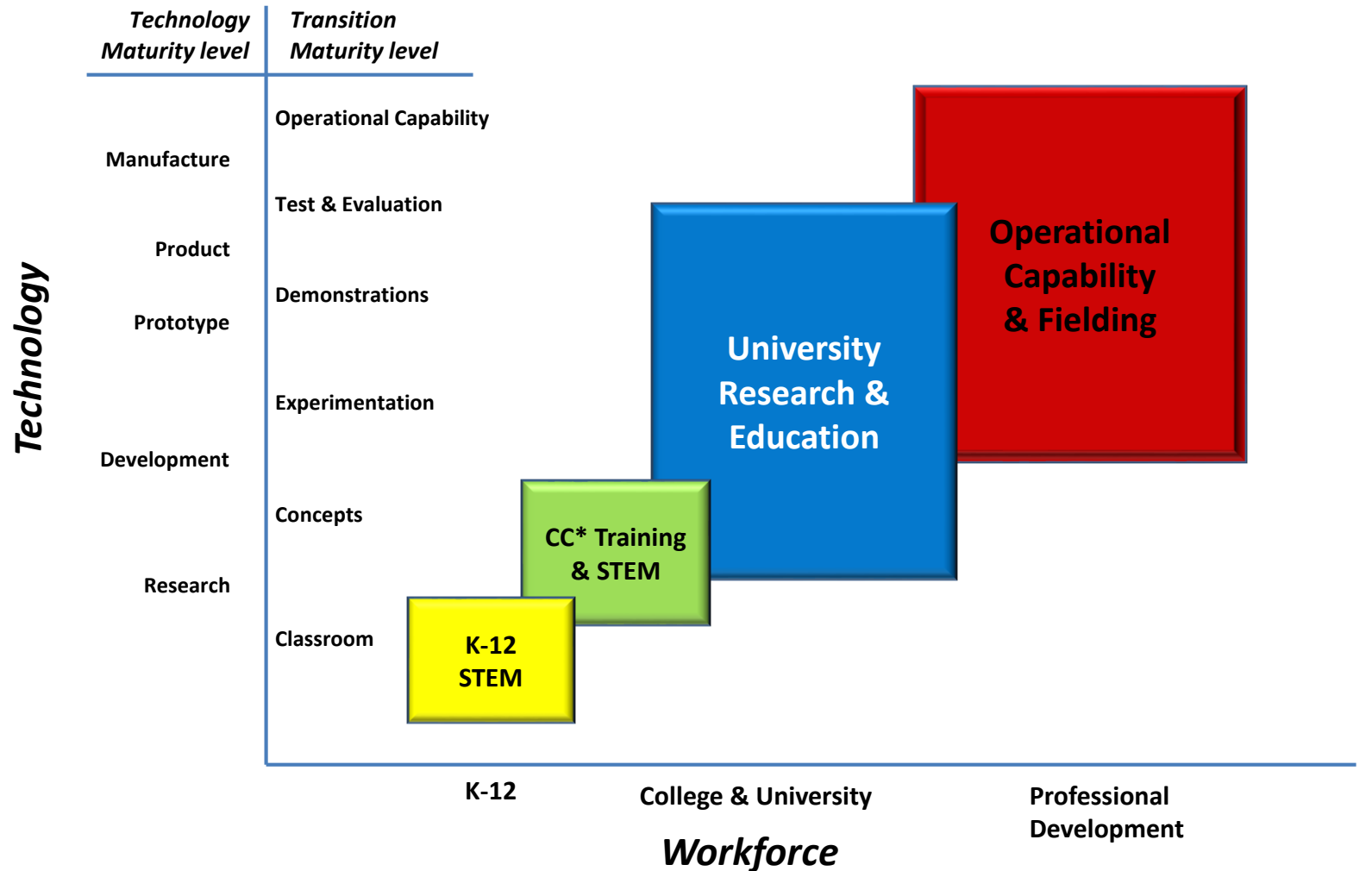
- Leverage experienced energy university researchers working in concert with industry partners and the Department of Defense (DOD)
- Apply Energy Resilience fundamentals for benefit of commercial power grid, naval shore-based power consumers, and naval operational mission needs
- Improve performance, reduce costs, and reduce logistical burdens on operational forces



Thrust areas

- Electrical power intermittency
- Integrating renewable energy sources into the grid
- Energy storage
- Improved micro-grids
- Grid security
- Local generation of zero-carbon fuels
- Inspection and structural health monitoring of critical energy infrastructure.

Building Capacity from Classroom to Operational Capabilities



CC* = Community College

Partnerships



- **NRL and Warfare Centers**

- Workforce Development
- Emerging Technical Areas and Needs



- **Reliance 21 Communities of Interest**

- Ground and Sea Platforms COI
- Energy and Power COI
- Materials and Manufacturing Processes COI



- **TTCP**

- MAT – Materials and Processing Technology Group
- MAR - Maritime Systems Group



- **NATO-AVT**

- Panel
- Technical Committees
- Working Groups



- **Interagency Advanced Power Group (IAPG)**

- **OSD HPCMP CREATE-Ships**

- CREATE-RF
- CREATE-GV

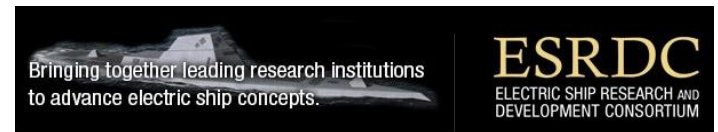


- **Navy Information Exchange Agreements**

- Technical Project Officer

- **Outreach**

- Joint Defense Manufacturing Technology Panel
- PSU-ARL Advisory Board
- NSF
- DOE
- ARPA-E
- Research Journal Support
- PhD Thesis Committee Member
- Mentoring
 - UMBC Center for Women in Technology



Focused on the Future

Delivering capability now, and for the future fight!

- Capacity - Platforms
- Readiness
- Resiliency – all aspects
- Lethality
- Autonomy
- Endurance
- Manufacturability
- Speed

When We Lead / We Win

