Disruptive Naval Technologies

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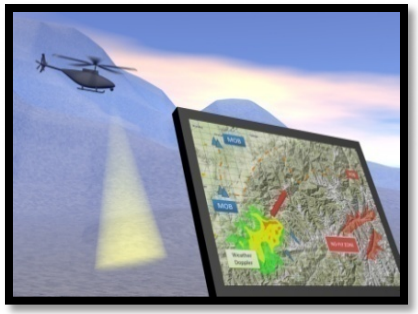
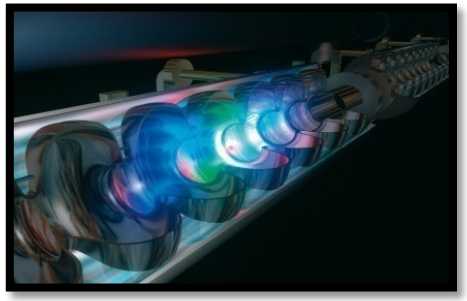
Innovative Naval Prototypes (INP)

Develop disruptive technologies that are high risk or game changing





- **Game changing or disruptive**
  - Dramatically changes the way naval forces fight
  - Radical departure from established requirements and concepts of operation
  - Reduce the acquisition risk
  - Expected to demonstrate/prototype a transitionable warfighting capability in four-eight years
- **Higher risk to produce higher warfighting payoff**
- **Deliver the "Next Big Thing"**

INP Business Process

Ideas Solicited from Innovation Community

Ideas Evaluated by Technical Community

Ideas Receive Advocacy from Warfighter Community

Enterprises
SYSCOMS
PEOs
Fleet/Force
Flag/SES

DoN Leadership Prioritizes & Decides *

** Naval RDT&E Corporate Board*

Key Challenges

- Undersea domain
- Fully integrating manned/unmanned systems
- Improved ship, aircraft and weapon effectiveness
- Enabling affordability and reliability

Current INPs and FY16 New Starts

Current Active INPs:

- Electromagnetic Railgun (EMRG)
- Integrated Topside (INTOP)
- Autonomous Aerial Cargo Unmanned System (AACUS)
- Large Displacement Unmanned Underwater Vehicle (LDUUV)
- Free Electron Laser (FEL)
- Netted Emulation of Multi Element Signatures Against Integrated Sensors (NEMESIS)

FY16 New Start INPs

Naval Research, Development, Test, and Evaluation (RDT&E) Corporate Board decision pending. Membership on the RDT&E Corporate Board is comprised of:

- the Under Secretary of the Navy,
- the Assistant Secretary of the Navy for Research, Development and Acquisition,
- the Vice Chief of Naval Operations,
- the Assistant Commandant of the Marine Corps,
- Director, Innovation, Test, and Evaluation and Technology Requirements,
- Deputy Assistant Secretary of the Navy for RDT&E,
- Deputy Under Secretary of the Navy for Plans, Policy, Oversight and Integration.

Electromagnetic Railgun (EMRG) INP

Why EMRG: A revolutionary long range gun with multi-mission potential including ballistic and cruise missile defense, long range land attack, and anti-surface warfare. It uses electricity instead of gun propellants for 100+ NM range.

Partnerships: NSWC, PEO Ships, IWS, MCCDC, NRL, Sandia National Lab, Lawrence Livermore Labs, JHU/APL, BAE Systems, Boeing, General Atomics, Raytheon, L3, IAP, K2, TDK-Lambda

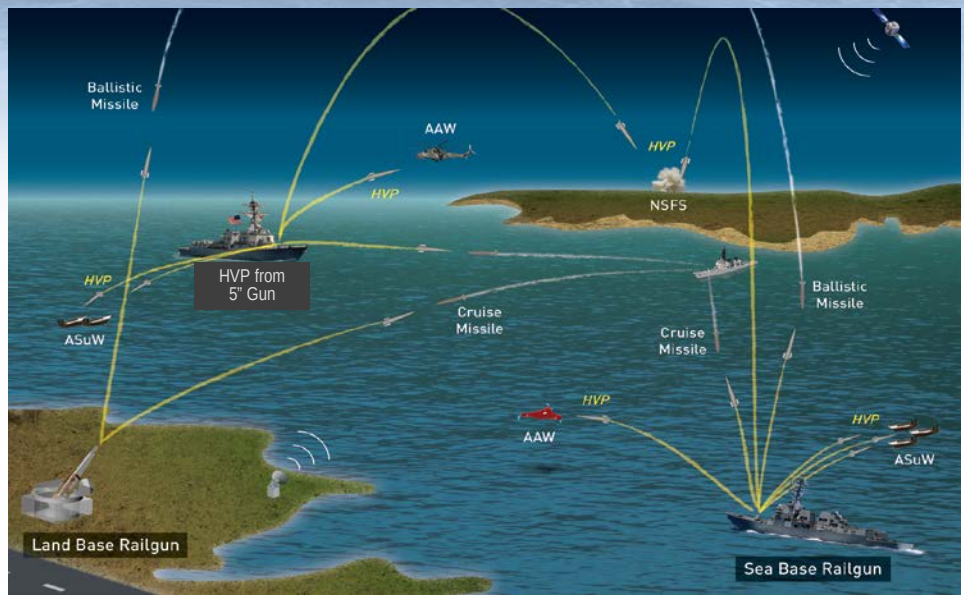
Why is EMRG Hard: EMRG requires development of composite barrels capable of rep-rate fires and with extended barrel life. Compact advanced pulsed power, energy storage system, high speed low drag projectile, and system thermal management all present technology challenges.

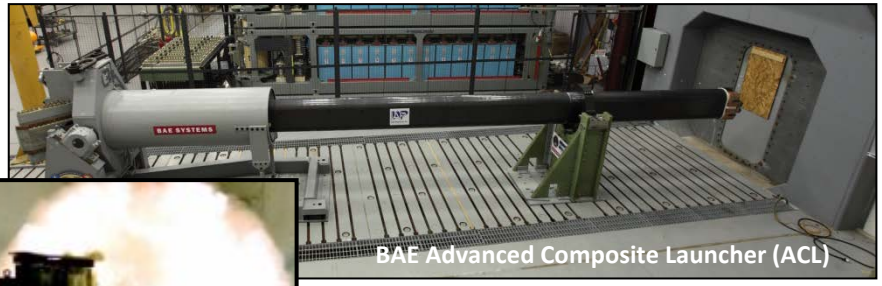
Accomplishments:

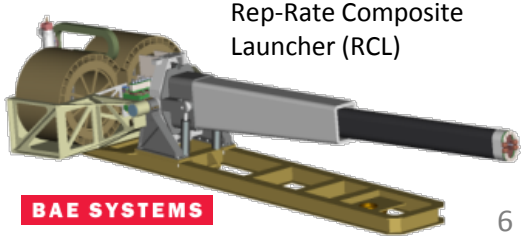
- Demonstrated industry developed advanced composite launchers at relevant energy levels.
  - BAE Systems selected to develop Rep-Rate Composite Launcher.
- World record 32 MJ launch energy (equivalent to ~110NM range).
- Developed extended rail bore life projected over 400 shots from 1 set of rails with path towards 1000.
- Next generation actively cooled pulsed power modules for repetition rate firing designed, fabricated and evaluated.
- Conducted open range projectile sabot discard tests.
- Conducted multi-mission lethality and operational analysis .
- Evaluated EMRG integration into new & existing platforms including DDG 51.

Upcoming Events and Milestones:

- Develop rep-rate technology and thermal management techniques for launcher and pulsed power systems up to 10 rounds/minute.
- Develop rep-rate composite barrel for integration in future gun mount.
- Support OSD's Land Defense and CNO-directed Sea Based demonstrations.







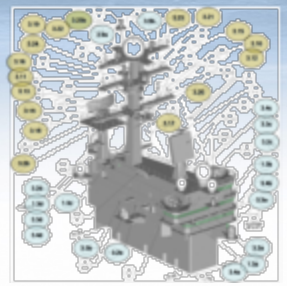
Rep-Rate Composite Launcher (RCL)

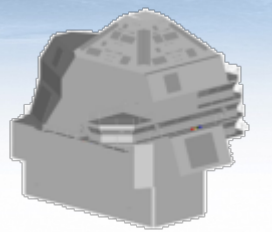
Integrated Topside (InTop) INP

Why InTop: InTop will develop a scalable family of multi-function apertures and electronics that provides a leap ahead capability to utilize the electromagnetic spectrum for electronic warfare, radar, communications and SIGINT on multiple classes of ships and other Navy platforms.

Partnerships: NSWC, PEOs IWS, C4I, Subs, Ships, Carriers, NRL, SSC, Northrop Grumman, Raytheon, Lockheed Martin

Why is InTop Hard: InTop requires adoption of shared RF resources across sensor, weapon & communication domains and the ability to perform dynamic resource and spectrum allocation in real time.





Accomplishments:

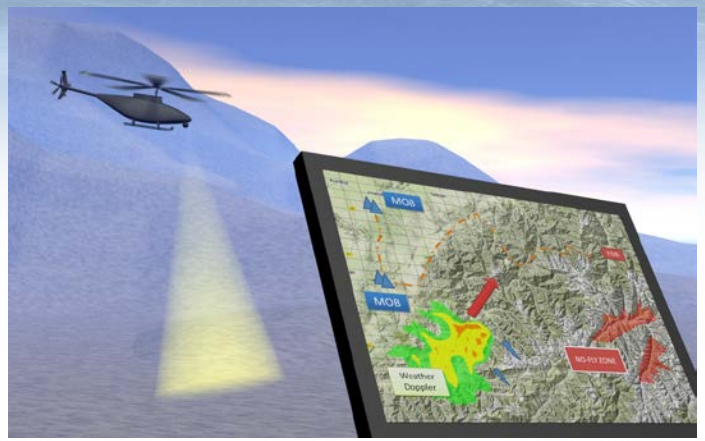
- Completed over the air testing for Submarine Wideband SatCom Antenna (SubSatCom) transmitter.
- Completed integration of all antennas and electronics for Electronic Warfare/Information Operations/Line of Sight Communications (EW/IO/Comms) Advanced Development Model (ADM).
- Completed final build of the Low Level Resource Allocation Manager and Infrastructure Development (LLRAM&ID).
- Completed design and began construction of testbed at Naval Research Laboratory's (NRL) Chesapeake Bay Detachment (CBD).
- Awarded Flexible Distributed Array Radar contract.

Upcoming Major Milestones:

- SubSatCom delivers to NUWC in May 2014 for testing on submarine mast.
- EW/IO/COMMs ADM delivers to CBD in July 2014 for test and demonstration.
- FlexDAR completes design in April 2015.

Autonomous Aerial Cargo Utility System (AACUS) INP

- **Why AACUS**: To enhance the USMC capability to provide time-sensitive logistics support to greatly disbursed locations by developing platform-agnostic intelligent autonomous capabilities, autonomous approaches & landings for unprepared landing sites, supervised by field operators with no special training, & integration across a variety of manned or unmanned rotary wing aircraft.
- IED avoidance and increased speed over trucks.
- Potential to reduce the Cost per Flight Hour per Pound of Cargo.



Why is AACUS Hard:

- Unprepared landing site selection and execution in GPS-denied conditions.
- Dynamic contingency re-planning until the point of landing.
- A supervisory control system that any USMC personnel can operate.
- Integration across multiple manned or unmanned rotary wing aircraft.
- Prevalent Industry proprietary software architecture.

Deliverables:

Platform Agnostic Sensor Suite and Software Package

Solution Attributes:

- Low impact (size, weight, power, cost) modular sensors developed on open Service Oriented Architecture.
- A supervisory control system that any field personnel can operate.
- Agile development with multiple flight demos.

Upcoming Major Milestones:

Phase I flight demos occurred in FEB/MAR 2014

S&T Partners/Performers:

AACUS Advisory Group (USMC, USAF, US Army, NAVAIR, NASA, Academia); Lockheed Martin, Aurora Flight Sciences; FFRDC & Government Performers (JPL, AMRDEC, AFDD).

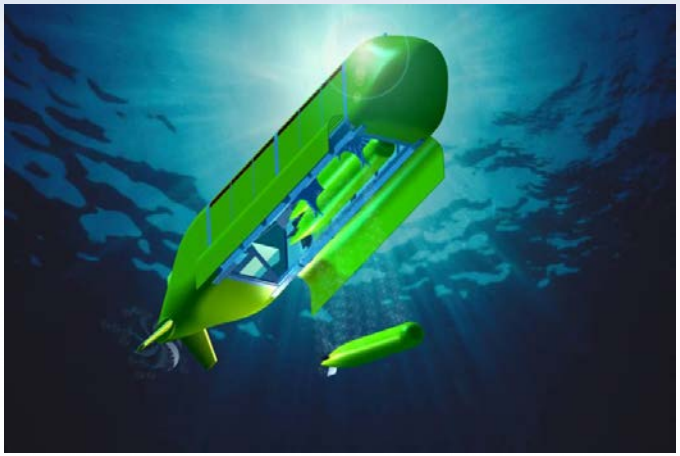
Potential Transition Partners:

USMC, USN, USA (ATUAS), DARPA (VXP, ARES)

Large Displacement Unmanned Underwater Vehicle (LDUUV) INP

Why LDUUV: Develop fully autonomous long endurance UUVs capable of 60+ days of operation in the littorals, extend and multiply the current Navy platform's capability.

- Ability to extend the reach of the Navy into the denied areas
- Focus Areas: Endurance, Autonomy, Advanced Energy
- 5x –10x Current UUV Energy Density
- Open Architecture
- Open Ocean/Over the Horizon Operations



Why is LDUUV Hard:

- LDUUV operates in complex ocean environments near harbors, shore, and high surface traffic locations that change significantly over relatively short periods of time.
- Need to dramatically increase power and endurance from current capability.
- Need to mature autonomous systems to compete complex missions and remain navigationally safe without human intervention.

Solution Attributes:

- Development of advanced air independent UUV energy systems to provide months of operations
- Focus on technologies that enable full autonomy in a cluttered maritime environment
- Conduct pier to pier fully autonomous operations to demonstrate increased mission flexibility
- Defined interfaces and standards to payload and autonomy capability development
- Leverage technologies from Navy Enterprises

Approach:

- Two BAAs, one addressing Autonomy and Endurance (individually), the other addressing Advanced Energy
- Potential for synergy with other UUV energy initiatives
- Leverage legacy and developmental autonomy technologies

Accomplishments:

- LDUUV Prototype Completed
- Testing underway including ongoing Bottoming Testing
- Both BAAs for open competition are closed
- Preparing plans for next generation vehicle

Free Electronic Laser (FEL) INP

Why FEL: FEL brings speed-of-light capability to tracking, target discrimination, countermeasures and scalable direct fire in any maritime environment. It will provide Naval Platforms with a highly effective and affordable self defense capability against current and future surface, sub-surface and air threats, future ASCMs and TBMs, swarms of small boats and asymmetric threats. This multimission capability which is a key element for future Naval layered defense provides all electric, speed of light, scalable effects with deep non-explosive magazines.

Partnerships: Argonne National Laboratory, Los Alamos National Laboratory, Naval Post Graduate School, Naval Research Laboratory, Thomas Jefferson National Laboratory, United States Naval Academy, Advanced Energy Systems, Inc., Colorado State University, Niowave, Inc., Multiple other National Laboratories to U.S. industrial base.

Transition Partners: NAVSEA, PMS 405, PEO IWS, PEO Carriers, PEO Ships

Why is FEL Hard: This program is the first ever development of a high average current, compact and shipboard suitable IR FEL system.

Accomplishments:

Atmospheric Windows: NRL research and test campaign with NASA resulted in discovery of three optimal atmospheric windows for laser propagation (1.06, 1.6 and 2.2 microns) in a cluttered and turbulent maritime environment.

Advancement in FEL SOA: Experiments at DOE laboratories advance the SOA in component FEL technology.

Detailed Design of 100kW FEL complete: Successfully completed Critical Design of 100KW FEL demonstration prototype that is scalable to MW class FEL.

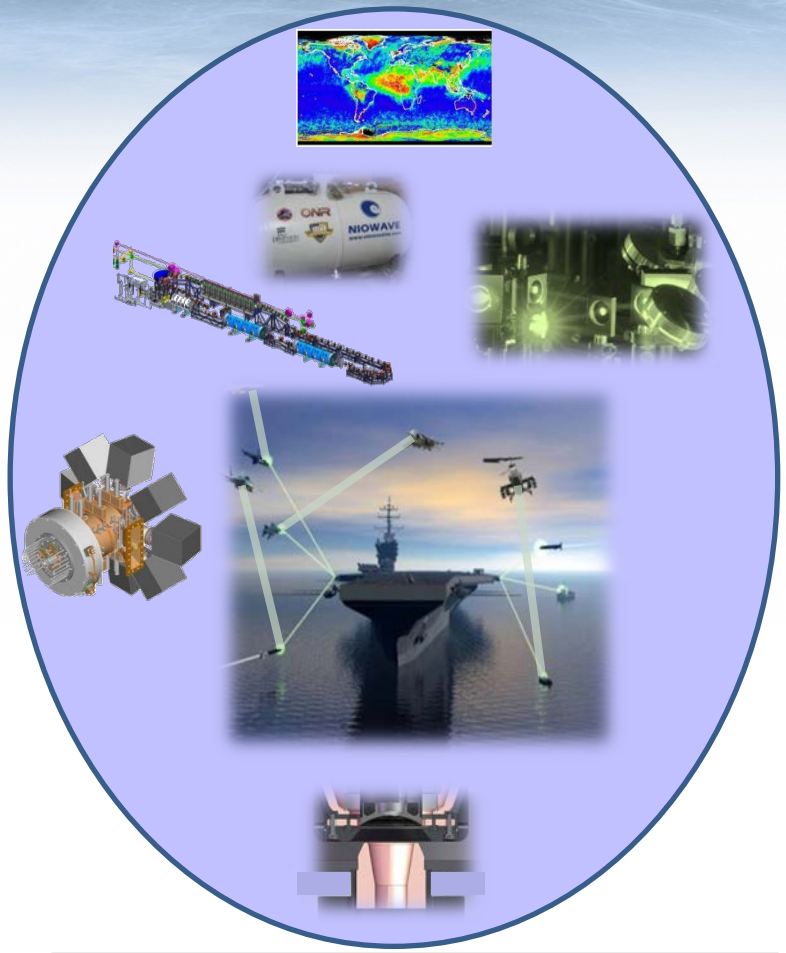
3 X increase in Power output: Repeated and continued demonstration of output power increase of FEL from 10 watts to 20+Kilowatts.

1/3 rd size and weight reduction: 1/3 size reduction in size and weight from current SOA of electron generation and accelerator technologies for MW class FEL.

RF powered: Utilization of RF power for electron generation that produces laser light enables ease of shipboard installation.

Upcoming Major Milestones:

- Completion and technical validation of Megawatt FEL conceptual design
- Successful completion and testing of superconducting spoke cavity



FEL provides precision engagements with speed of light delivery, seconds dwell time, and deep magazine

Netted Emulation of Multi-Element Signature against Integrated Sensors (NEMESIS) INP

Why NEMESIS: Develop a System of Systems (SoS) which provides the ability to synchronize Electronic Warfare (EW) affects across a variety of distributed platforms to create a coherent and consistent EW effect. Additional details classified.

Value to Naval Warfighter:

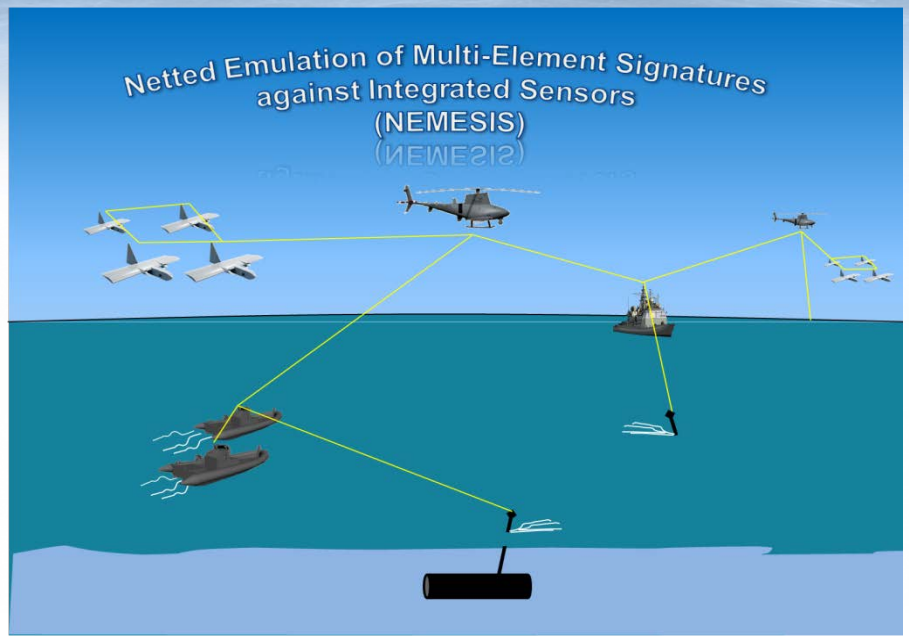
- Enables efficient EW across distributed systems.
- Enables rapid advanced technology/capability insertion for emerging threats.
- Provides battlespace confusion to adversary surveillance and targeting systems.

Warfighter Need: Addresses Multiple PACOM IPLs and the limitations of traditional EW approaches.

Partnerships:ONR, PMR-51, NRL, PMW-120,SSC-LANT, SSC-PAC, DARPA, NUWC, NSWCCD, NWDC, NAVSEA, SPAWAR, NCWDG, ONI, Fleet.

Solution Attributes:

- Develop modular and reconfigurable EW Payloads based on ONR EW S&T and FNC development and implement in decoy and unmanned air and surface platforms.
- Combine Code 31 EW functionality and decoys with ONR Code 33 and 35 autonomy to formations of unmanned EW systems.
- Network and coordinate CM techniques using Code 31 S&T and FNC technologies.



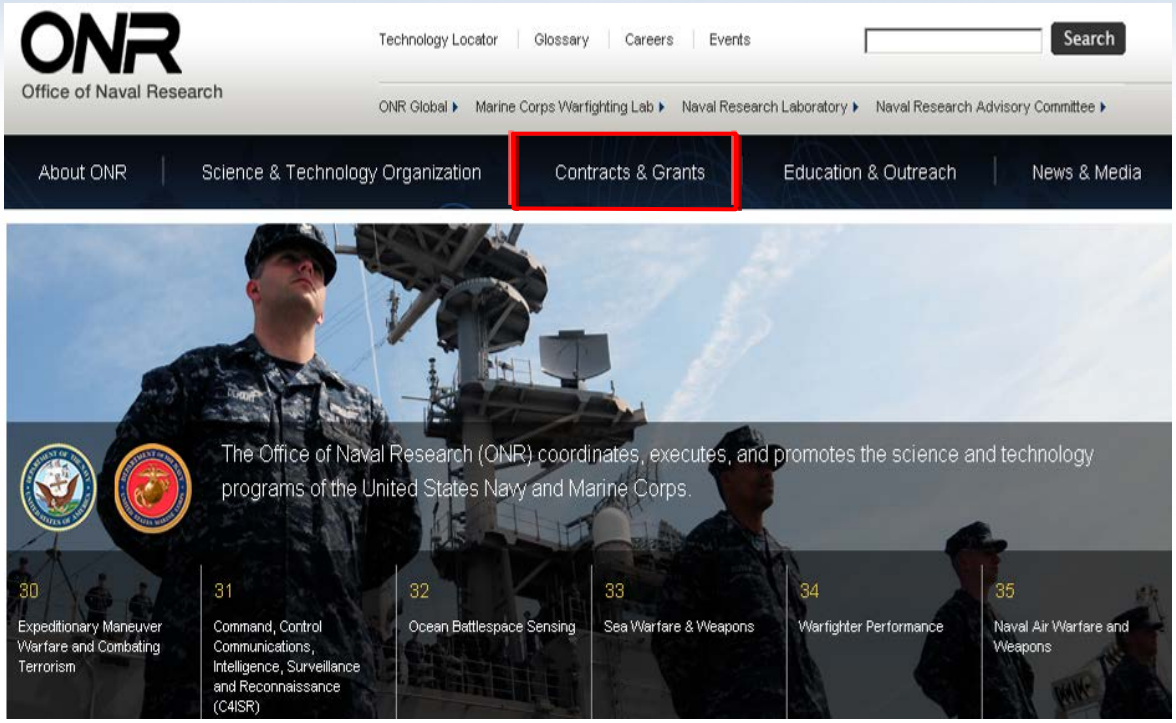
Upcoming Major Milestones:

- Compact payloads (4QFY15)
- Coordinated Techniques (4QFY16)
- System of Systems Demo (4QFY18)

Successful INPs Are…

- High-risk, but technically feasible, and science is mature enough that this is the right time to fund.
- High-Payoff, creating a compelling, understandable Warfighting capability.
- Has a defendable return on investment (Warfighting capability or cost savings compared to INP investment).
- Disruptive, revolutionary or high-impact new capability not being produced through current level of effort.
- Has a defendable path to demonstration evidenced in a proven management team, defined milestones, metrics, deliverables and budget.
- Supported by Stakeholders beginning with ONR and partner organizations but includes a vision for Fleet, OPNAV, Resource Sponsors and Acquisition Community members.

Questions?



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