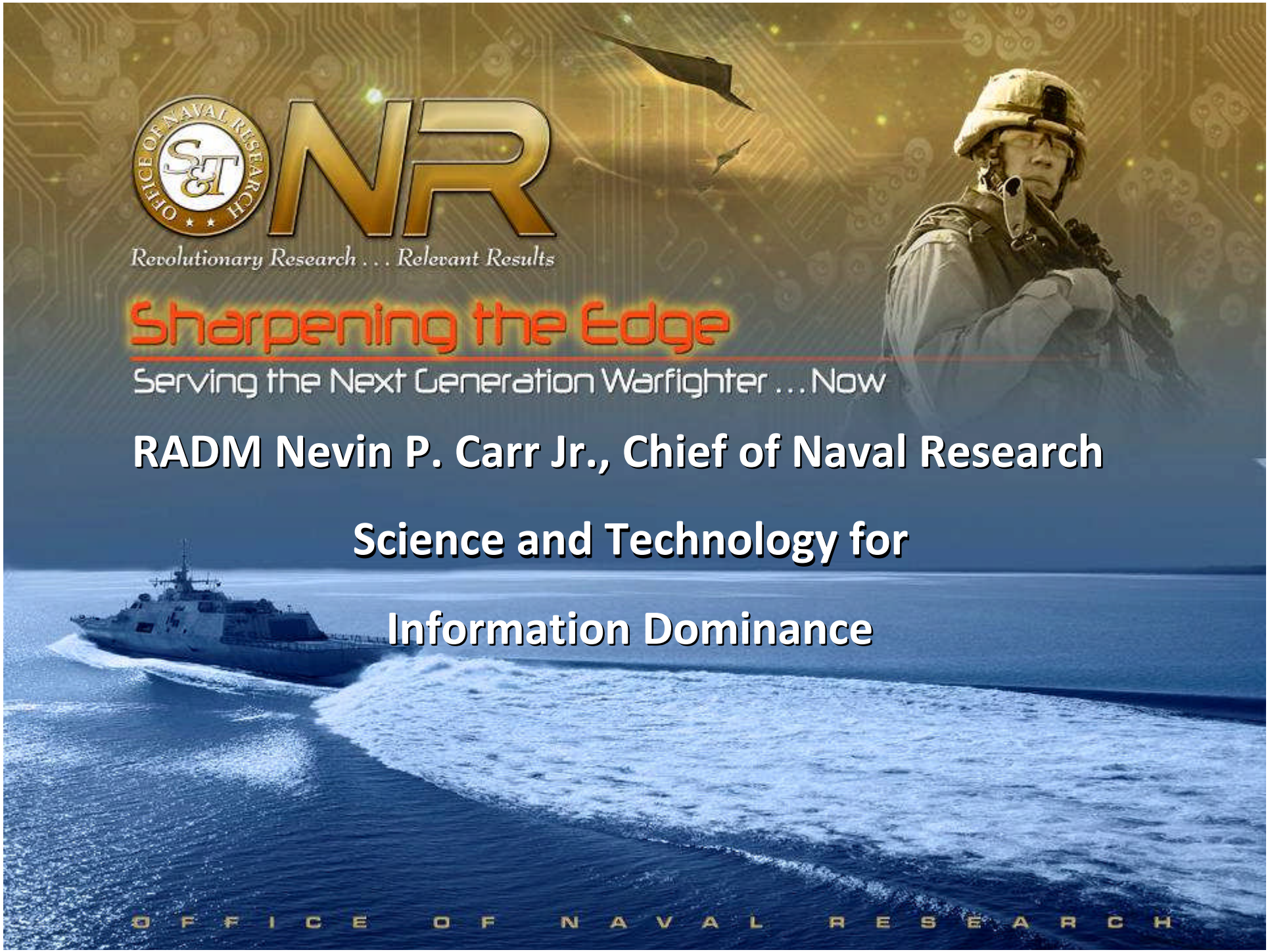
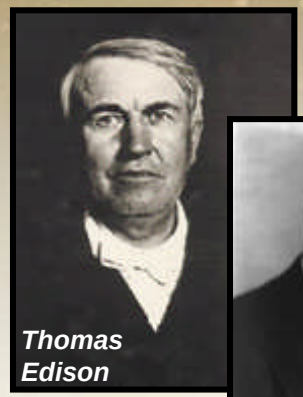
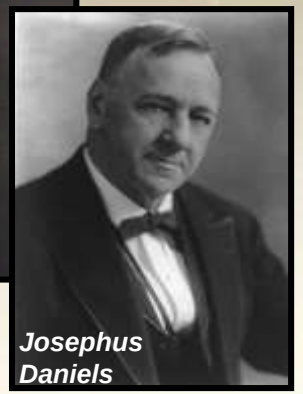

ONR
Revolutionary Research . . . Relevant Results
Sharpening the Edge
Serving the Next Generation Warfighter . . . Now
RADM Nevin P. Carr Jr., Chief of Naval Research
Science and Technology for
Information Dominance
OFFICE OF NAVAL RESEARCH

The Office of Naval Research

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…."

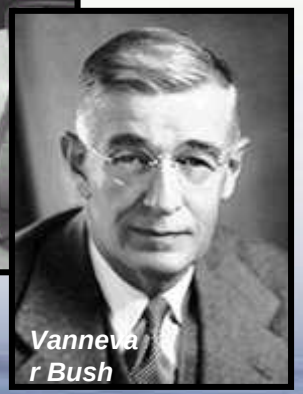

Thomas Edison


Josephus Daniels

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 of naval power, and the preservation of national security…"


Harry S. Truman


Vannevar Bush

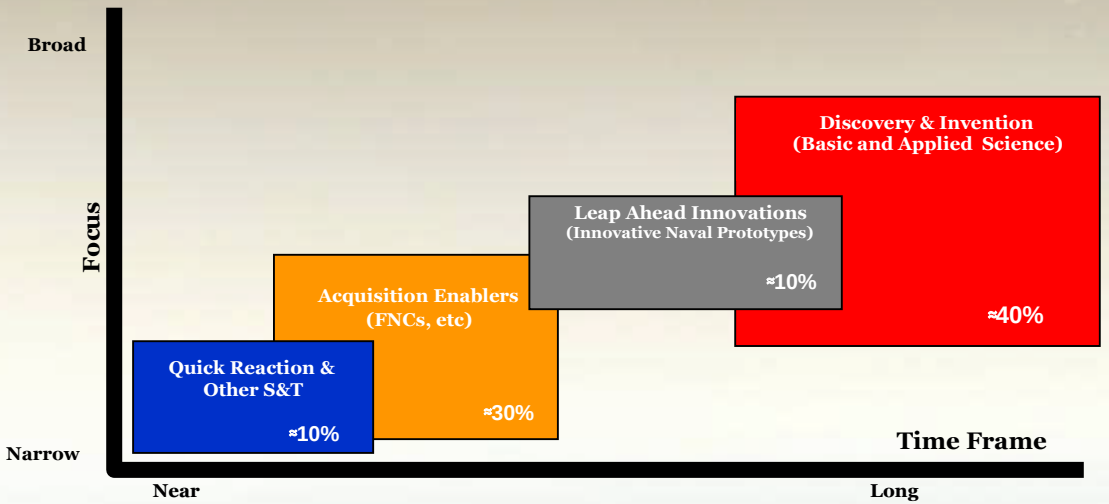
Office of Naval Research - London Office *(1946)*

"…reporting on the latest developments and to assist visiting American scientists to make contact with their colleagues in Europe…"

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."

Naval S&T Strategic Plan



Focus Areas:

- Power and Energy
- Operational Environments
- Maritime Domain Awareness
- Asymmetric & Irregular Warfare
- Information Superiority and Communication
- Power Projection
- Assure Access and Hold at Risk
- Distributed Operations
- Naval Warfighter Performance
- Survivability and Self-Defense
- Platform Mobility
- Fleet/Force Sustainment
- Total Ownership Cost

Tech Solutions

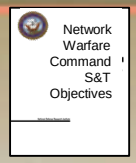
FNCs

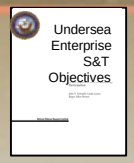
INPs

D&I

Shaping S&T Investment





Extramural (academia, DOE, DHS, CIA, etc)

Naval Research Enterprise

Warfighting Enterprises & Centers of Excellence

Broad

Focus

Narrow

Fleet/Force

N8/N2/N6

USFF

PDASN

MCCDC

TOG

CNR

N4*

N1/N093*

N8F*

VCNO

S&T Corp Bd

ACMC

RDA

Discovery & Invention (Basic and Applied Science)

≈40%

Leap Ahead Innovations (Innovative Naval Prototypes)

≈10%

Acquisition Enablers (FNCs, etc)

≈30%

Quick Reaction & Other S&T

≈10%

Near

Mid

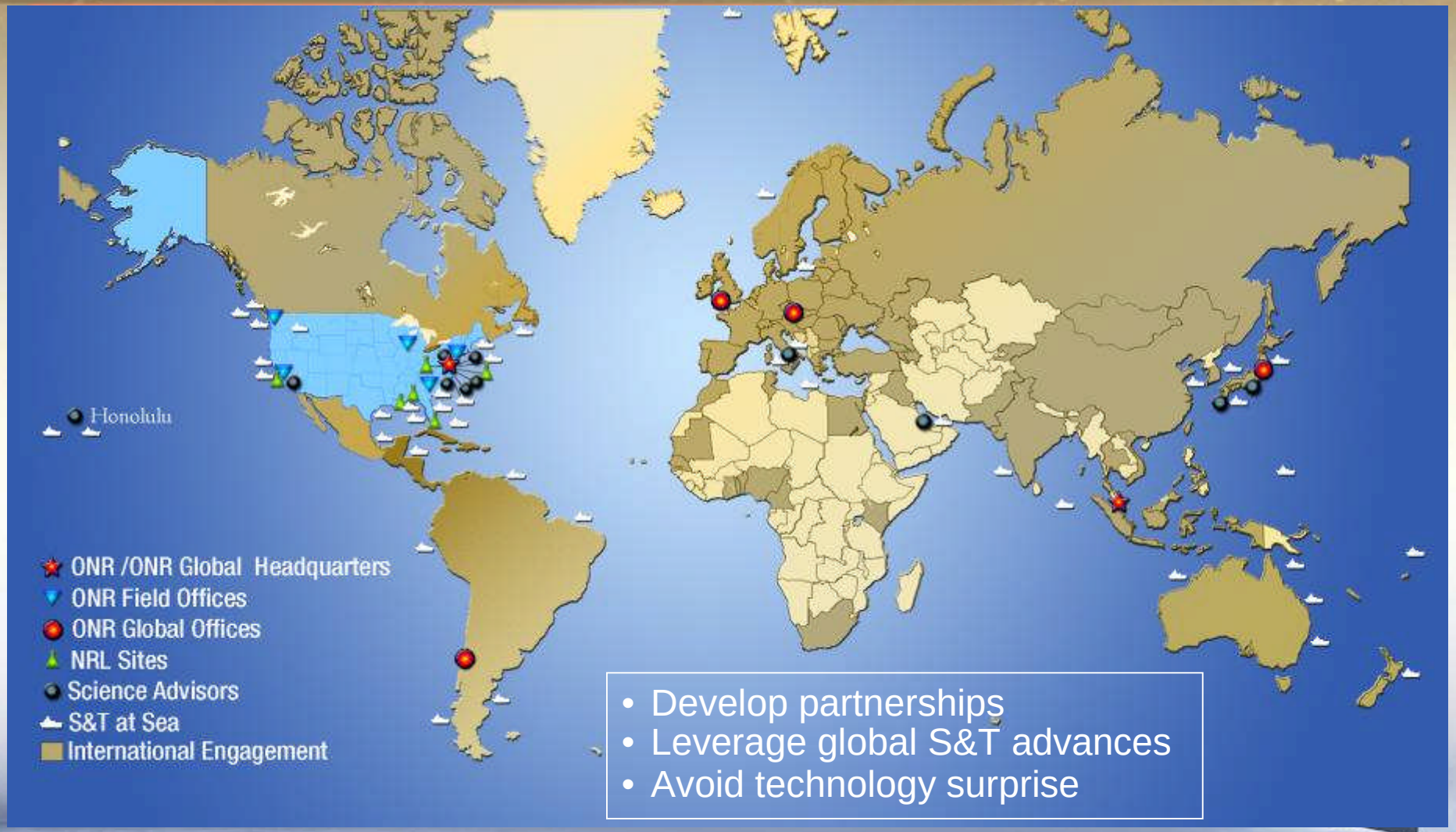
Long

Time Frame

- Fleet
- FMF

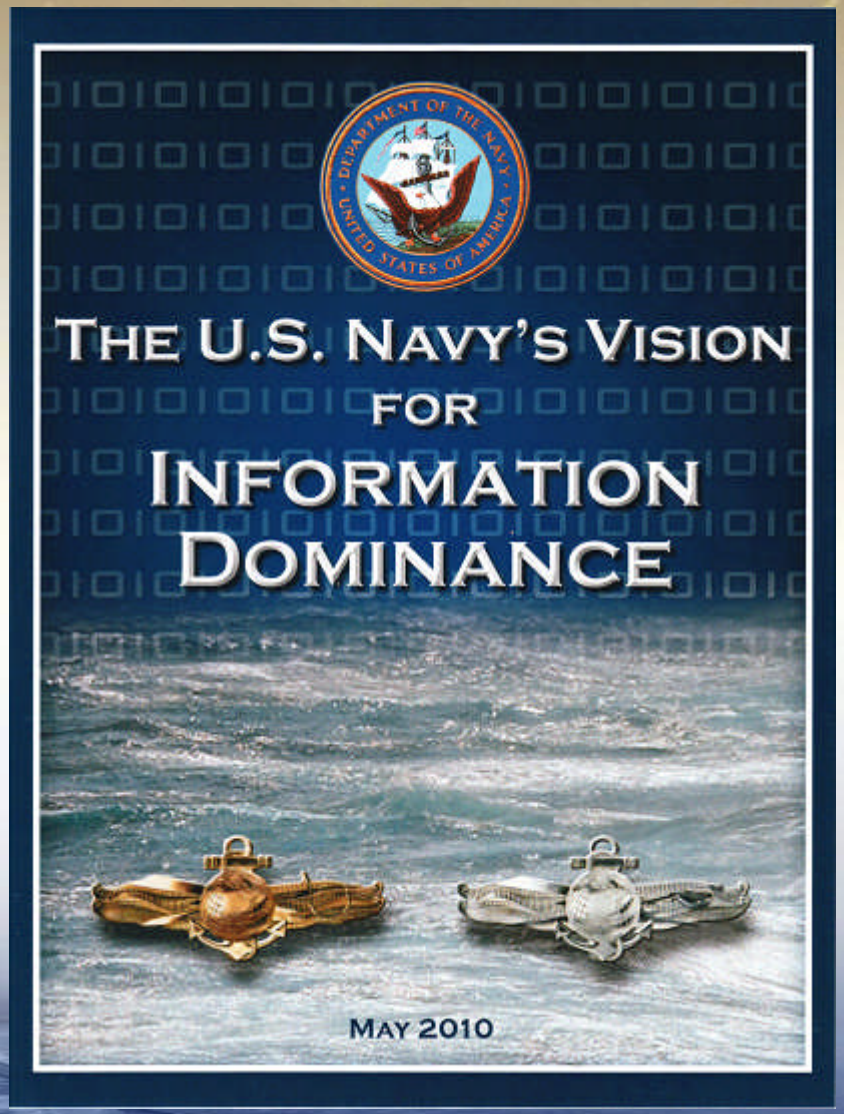
POR's

ONR Global



- Develop partnerships
- Leverage global S&T advances
- Avoid technology surprise

Vision



Navy Information Dominance

Foreword

The CNO has directed that the Navy position itself to remain pre-eminent in the fields of Intelligence, Cyber Warfare, Command and Control, Electronic Warfare and Battle & Knowledge Management. There is no other Service or nation that is as good, collectively, across these mission areas as the U.S. Navy. To obtain information age dominance, we will exploit new opportunities in distributed command and control, networking, and use of vast stores of collected data -- information and intelligence that too often lies at rest, undiscovered, unavailable, and untapped. In short, information will be elevated to a "main battery" of the U.S. Navy's arsenal. This paper provides a vision, principles, and initial direction to help guide us towards achieving our aspirations.

The concepts in this paper boldly point to the new niche Navy will fill at the intersection of maritime, information, and cyberspace domains. We do not seek to replace kinetic combat with information warfare or diminish the need for traditional instruments of military power. Rather, we aim to develop a penetrating understanding of our adversaries and an unmatched knowledge of the operating environment to amplify traditional naval combat capabilities and expand options for our operational commanders. As we develop a globally-distributed, highly networked force, our Fleet will become much greater than the sum of its individual parts. Fundamentally, our information capabilities are being designed to deliver game-changing decision superiority and command and control overmatch.

Time is short and the task paramount. Potential adversaries are working to offset our strengths and level the playing field. We can no longer afford inefficiencies incurred with stove-piped networks, systems and processes. Unless we leap ahead to develop a rigorous and comprehensive approach to control the electromagnetic spectrum and cyberspace, we will risk losing our competitive advantage. To achieve our aspirations, we must dramatically alter the status quo. The CNO expects us to develop and maintain a fleet battle management capability that synchronizes all elements of information, dominates the electromagnetic spectrum, and permits the Navy and our nation to wield information as a weapon.

I ask for your help in translating this vision into reality.

David J. Dorsett
Vice Admiral, U.S. Navy
Deputy Chief of Naval Operations
for Information Dominance

1

"… a main battery of 21st century American seapower"

Guiding Principles

C2 Dominance

- Every platform will sense and report
- Any sensor, data link, terminal or processor system that currently supports only one model platform or weapon will be migrated to the globally interconnected net-centric architecture or divested
- Globally-integrated, service oriented backbone architecture
- Scalable enterprise wide services
- All data and information will be rendered universally discoverable, transparent and accessible
- Data will be standardized across Navy and maritime domain
- Joint, Defense, interagency, Intelligence Community partner architectures and data resources will be aggressively leveraged
- Navy information professionals will receive world-class training, qualification, experience and tools

UxV and Autonomy

- Collectors and sensors will be dynamically tasked and managed
- Every shooter and weapon will be capable of compiling, assessing, exploiting, and using composite target data from any collector, sensor or data repository
- Remotely piloted, autonomous, and unattended platforms, sensing, and communication nodes will be emphasized

Secure Communications and Networks

- Data processing, correlation, exploitation, fusion, and analysis will be network-hosted
- Every sensor and processor will be adaptively connected
- Vulnerabilities and risks uniquely associated with net-centric operations

Control of the EM Spectrum

- Every platform will sense and report

Information Dominance
ONR S&T Focus Area

"Enable the war-fighter to take immediate, appropriate action at any time against any desired enemy, target, or network by assuring that *automatic, continuous analyses of intelligence, persistent surveillance, and open information sources* have, at all times, optimized the possible courses of action based on commander's intent."

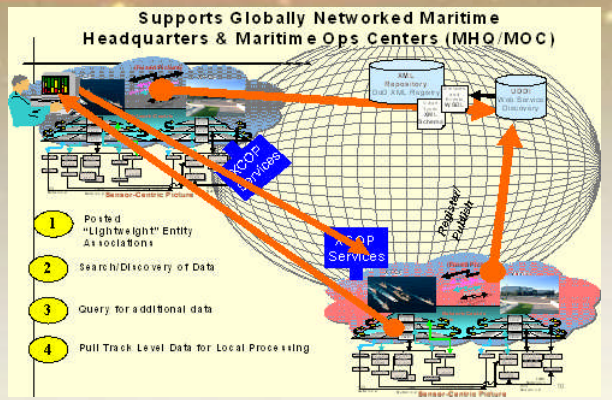
Priorities and Opportunities

- **C2 Dominance**
- **UxV and Autonomy**
- **Secure Communications and Networks**
- **Control of the EM Spectrum**

C2 Dominance

Service Oriented Architecture

- Provides a flexible environment to facilitate the development of common picture
- Agility and adaption
- Extensible and unrestricted

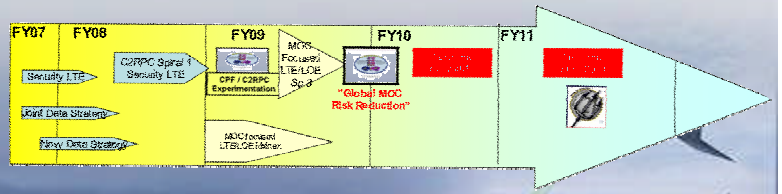


ONR Reference Implementation

- Government owned SOA infrastructure
- Leveraged AF investments information services at virtually no implementation cost
- Adopted by AFRL

C2RPC (C2 Rapid Prototype Continuum

- Prototype Implemented in PACFLT MOC
- Risk reduction prototyping and rapid introduction to fleet
- Inform Requirements and Acquisition
- Currently developing a real-time capability for tactical edge



Priorities and Opportunities

- C2 Dominance
- UxV and Autonomy
- Secure Communications and Networks
- Control of the EM Spectrum

Strategy

- Today Navy and DoD have used a number of uninhabited, remotely operated UXVs which is an intermediate step towards autonomy
- For relatively simple, slowly changing environments (such as today's undersea battlespace) rule-based can be effective and represent the next step
- Rule-based systems are brittle and do not work well as the environment becomes complex, uncertain, and / or dynamic
- Improving performance requires the system to comprehend the battlespace in context of the commander's intent and develop executable courses of action

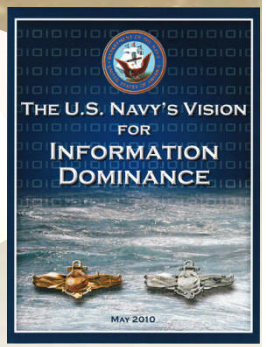
Ultimately the shortfall that drives the need for automated information analysis integration and autonomy is lack of sufficient numbers of people

UxV and Autonomy

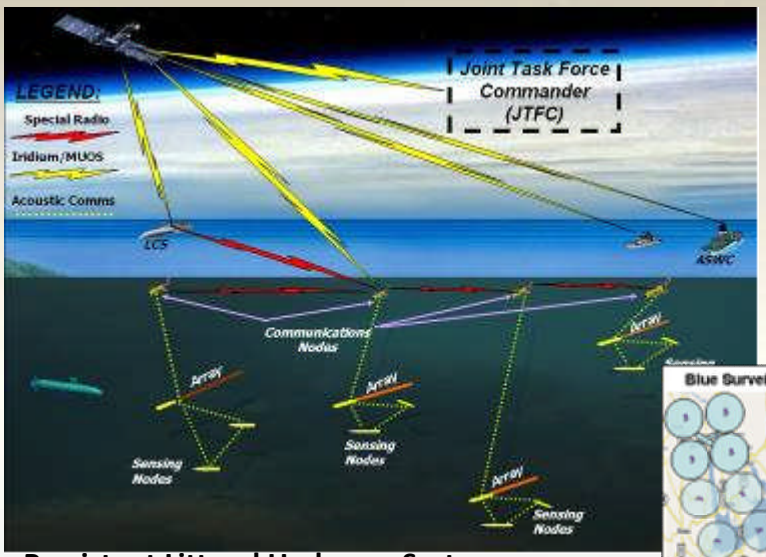
Now:
- **Uninhabited UxVs are an intermediate step towards autonomy**

We are here

The Future

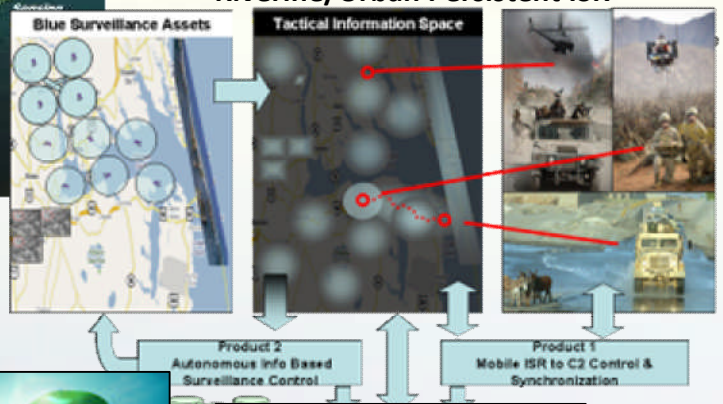


Mid-Term:
- **Current UxV systems are rule-based and can support relatively simple missions, but do not operate well in complex, uncertain dynamic environments**

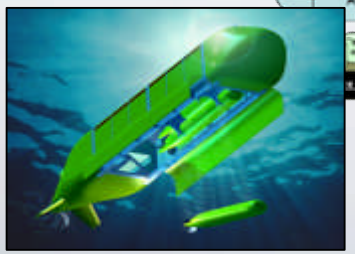


Persistent Littoral Undersea System

Riverine/Urban Persistent ISR



Long-Term:
- **Level of reasoning capable of comprehending the battlespace**
- **Automated, coordinated, distributed, adaptive planning**



Priorities and Opportunities

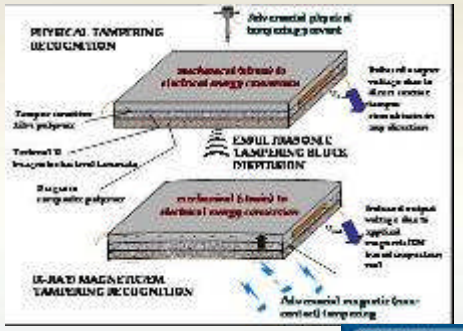
- C2 Dominance
- UxV and Autonomy
- Secure Communications and Networks
- Control of the EM Spectrum

Secure Communications and Networks

Without Trust in Our Networks
There is No NCW

Defined:

- Provide computer network and information assurance technology that identifies, mitigates threats and ensures continuity of essential operations and access to assured data during attacks.



Anti-Tamper

- Tamper Event Monitoring
- Hardware/Software Destruction
- Obfuscation

Removing the Botnet Threat

Priorities and Opportunities

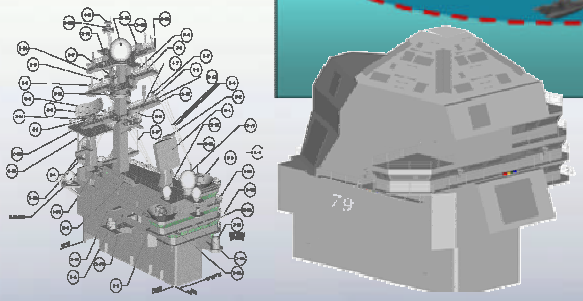
- C2 Dominance
- UxV and Autonomy
- Secure Communications and Networks
- Control of the EM Spectrum

Control of the EM Spectrum

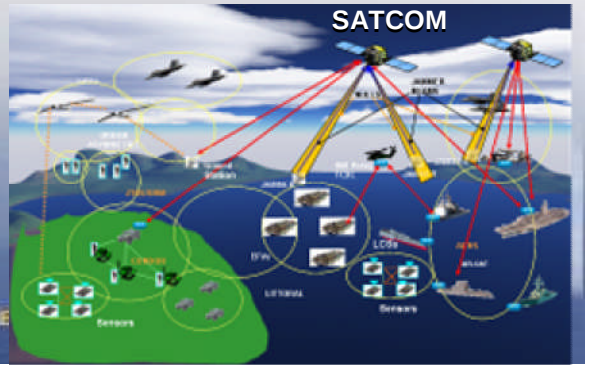
- Extend the frequency range and effectiveness of Nulka and SEWIP transmitter

- Achieve synchronized wide area EM spectrum control across multiple mission areas using multiple assets

- Simultaneously share RF functions, apertures and signal processing
- Continually optimized to meet Commander's highest priority need



Integrated Topside



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S&T Partnership
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Next Generation Technologies for Today's Warfighter
August 24-26
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Arlington, Va.
Register today at: www.onr.navy.mil
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Our Challenge

"I never, ever, want to see a Sailor or a Marine in a fair fight!"

- Adm. Gary Roughead, Chief of Naval Operations