

MITRE BlueTech: Accelerating Maritime Innovation

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MITRE | SOLVING PROBLEMS
FOR A SAFER WORLD™

Solving Problems for a Safer World

MITRE Operates Six Federally Funded Research & Development Centers (FFRDCs)

Mission-driven in the public interest

Objective & conflict free insight (not-for-profit)

Unique Vantage Point

Technical Know-How

Pioneering Together

Our Mission is to **solve problems for a safer world**. At MITRE, we work across the whole of government on big problems that challenge our nation's stability. We strive to earn the trust of our sponsors and partners so that we may have **greater impact for public good**.

MITRE





MITRE BY THE NUMBERS

2021 CORPORATE REVENUE

\$2.1 BILLION

GLOBAL TEAM

9,000+

EMPLOYEES

60+

LOCATIONS

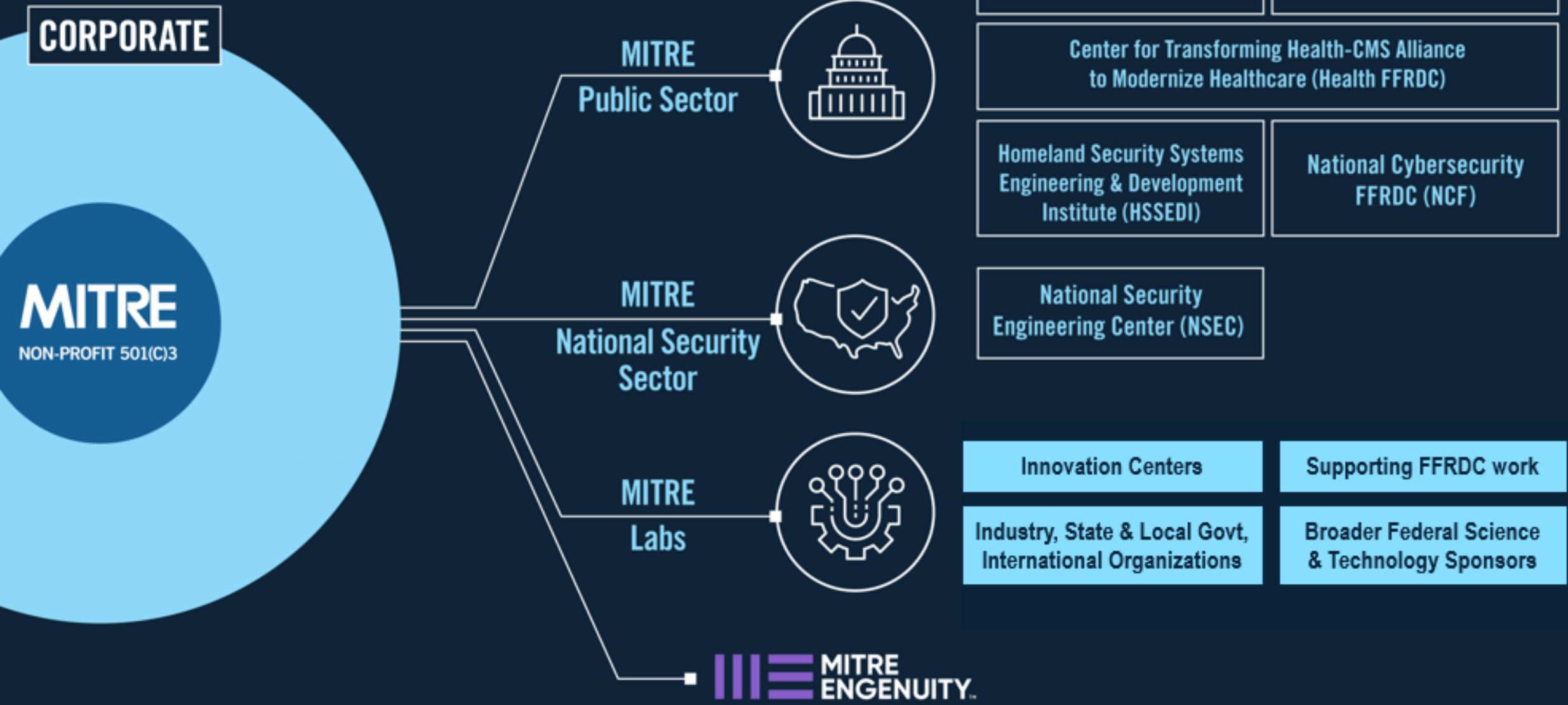
260+

PATENTS

1,300+

TECH LICENSES
SINCE 2014

Our Organization



**MITRE
ENGENUITY**

A Foundation for Public Good

MITRE Labs is a foundry for innovation and disruptive solutions, partnering with industry and academia to extend MITRE's whole-of-government platform to **whole-of-nation impact.**

MITRE Labs' 15 Innovation Centers use deep technical expertise and strategic partnerships to drive **cross-cutting solutions.**

AI & Autonomy | Cyber Infrastructure Protection

Cost, Acquisitions, & Management Solutions

Cyber Operations & Effects | Cyber Solutions

Data & Human-Centered Solutions

Electronic Systems | Emerging Technologies

Enterprise Strategy & Transformation

Health | Infrastructure & Networking

Modeling, Simulation, Experimentation & Analytics

Software Engineering | Systems Engineering

Transportation

A large iceberg floating in the ocean. The tip of the iceberg is visible above the water surface, while the much larger, jagged base is submerged underwater. The background is a deep blue sky with some clouds.

The world's oceans make up ~71% of the earth's surface and play an integral roll in our economic, national, and climate security

Problem

- Ecosystem filled with stovepipes and barriers to entry
- Limited knowledge and understanding of what lies beneath the surface
- Maritime platforms are still primarily communications and power limited

"Fifty percent of our country that we own, have all legal jurisdiction, have all rights to do whatever we want, lies beneath the sea and we have better maps of Mars than that 50 percent."

– Dr. Robert Ballard, Oceanographer URI

Why Now?

National hard problems, tech advances, federal funding

*Building critical mass;
inflection point in federal
investment in Blue Economy*

- Inflation Reduction Act - \$3.3 Billion NOAA Investment
- FY23 Budget requests significant new funding to “invigorate new sectors of our economy through enhanced climate, satellite, and ocean data.”
- Office of Science and Technology Policy (OSTP) listed “Undersea Technology” as “critical and emerging area” for the first time



MITRE's BlueTech Approach



Build BlueTech Lab

Develop a world class maritime testing facility to enable acoustics, autonomy, and climate research of the future



Connect Ecosystem

Break stovepipes and connect partners across academia, industry, and government



Accelerate Technology

Accelerate mission-critical technology getting into the ocean to solve economic, national security, and climate problems



Grow Workforce

Develop BlueTech workforce of the future through academic partnerships and outreach

Whole-of-nation impact on climate, national security, and economic growth

Build Capabilities

MITRE Labs Undersea Capabilities

30 staff and growing

- Operational focus – deliver novel capabilities to the warfighter as quickly as possible
- Partnerships with industry, academia, UARCs, Warfare Centers, and other FFRDCs
- 10 PhDs

Specialties in

- Rapid prototyping, testing, and evaluation
- Signal processing and sensing
- Underwater acoustic communications
- Acoustic propagation and multi-physics modeling
- Novel transducer design
- Physical acoustics and oceanography
- Unmanned Undersea Vehicles



MITRE

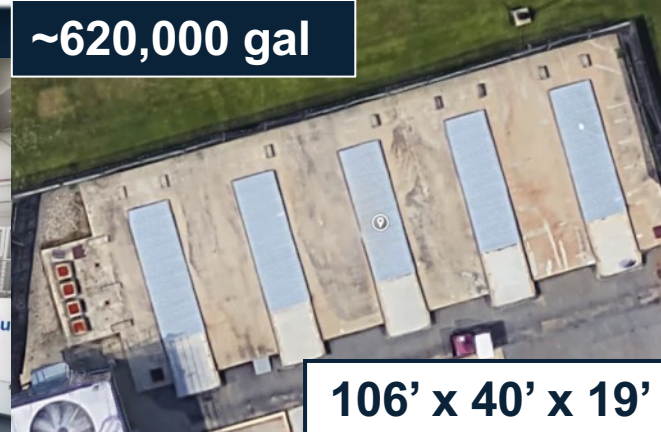
BlueTech Lab

- Amongst largest in region
- Open collaboration center
- Direct network connections to other locations throughout country
- Available for booking starting Jan 2024

- Acoustics (Sensing and Communications)
- Optical (Sensing and Communications)
- Autonomy (USV and UUVs)
- Rapid Prototyping



~620,000 gal



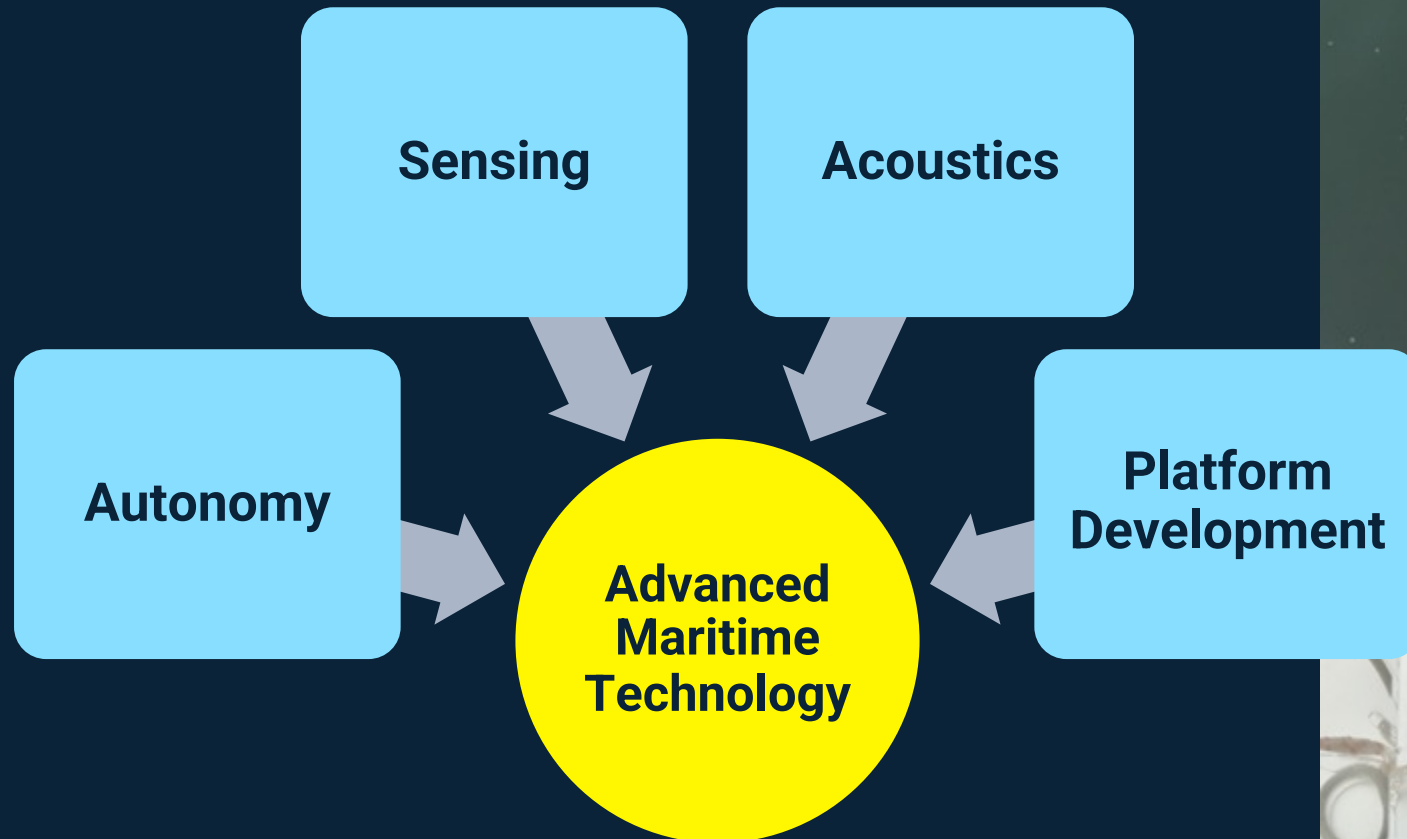
106' x 40' x 19'



BlueTech Lab Ribbon Cutting – Nov 20th 2023



An open collaboration space to accelerate BlueTech for Global Scale Problems



Qualisys Underwater Camera System

QUALISYS

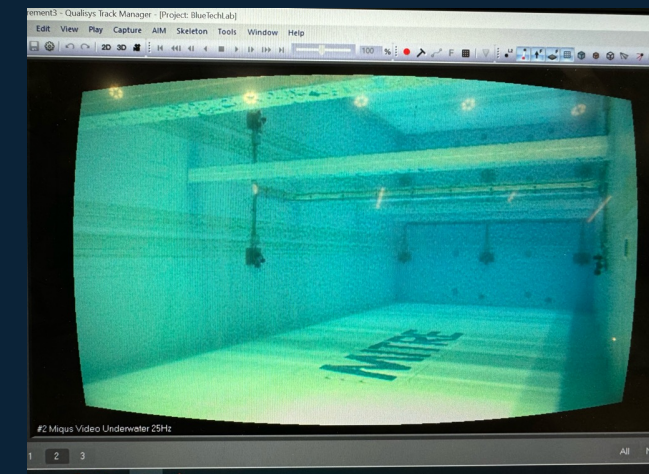
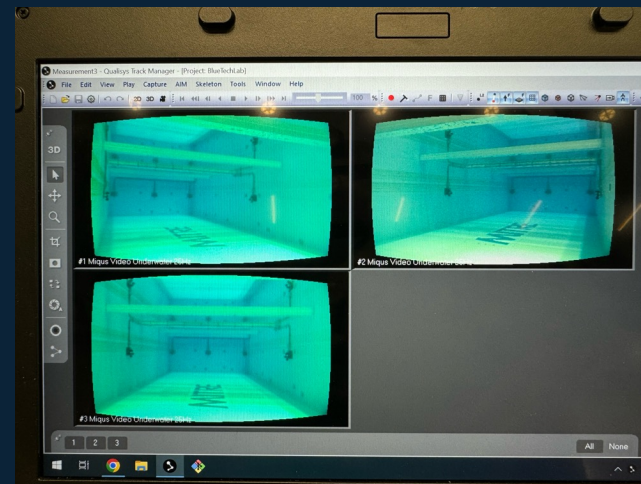
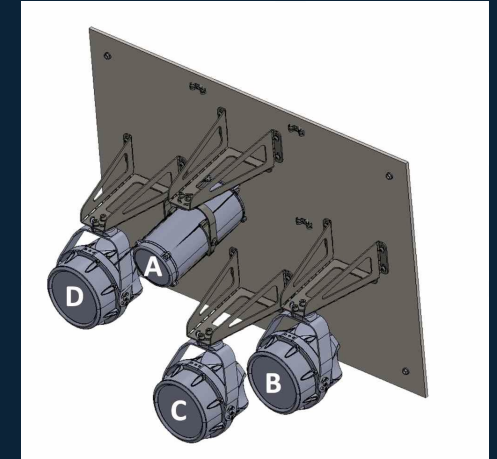
- 6-DOF Optical In-Water Tracking System:
 - 20 Arqus A12U – 12MP – 300fps
 - 8 Miquis Video U – Full HD 1080p
 - Sub-centimeter resolution in 3-dimensional space
 - precise tracking of μ and small UUVs
- One of the largest installations in the US



Arqus A12U



Miquis Video U



DAQ system

- **Acoustical Measurement Capabilities:**
 - Low frequency limit of 4 kHz, based on best measurement practices
 - Integrated data acquisition and mechanical rotator system
 - 16 channel Rx, 1 channel Tx, 2 MHz sampling rate with Python command line control
 - Future plans to expand to 128 Rx Channels and 2+ TX channels
 - Precision acoustic calibration and beam pattern measurements between 5-600kHz with 0.1° resolution
 - Catalog of underwater transducers for transmit and receive

Infrastructure

- Unclassified of classified experimentation up to Collateral SECRET
- Two-Ton Overhead gantry crane
- Surface-level mobile platform with rotary stage for precise position
- Dry lab with shared test equipment and visitor storage

Experimental Capabilities

- **Flexible platforms for transmit and receive**
 - Transmit 100 Hz – 200 kHz
 - Receive DC – 170 kHz
 - Ettus USRP X310 Software Defined Radio
 - Portable power amplifiers and impedance matched hydrophones
 - Portable preamplifiers and data recorders
 - Suite of ACOMMS modems
- **Supporting equipment and accessories**
 - Castaway CTDs, GPS units, weights, floats, mounts, etc.
- **4 Custom MITRE buoys (experimental)**
 - 8-20 kHz Tx, 4 Rx hydrophones, WiFi shore connectivity with SSH remote connection
- **4 Sandshark micro-UUVs**
 - Rated to 200m depth, 2-4 knots, WiFi connectivity



**Test and evaluation for
sensing and ACOMMS
with custom-built and
COTS assets**

BlueTech Lab Robotic Capabilities



Blue Robotics BlueROV2

Tethered Power/Control
Imaging Sonar
Optical Camera
Onboard Illumination

Accelerating innovation
through basic platform
capabilities and
availability.

Autonomy
Acoustics
Communications
AI / Machine Learning
Undersea Imaging
Machine Vision
Live Virtual Constructive
Distance Learning
MOSA



Seafloor Systems EchoBoat-160

Autonomous Operation
Dynamic Positioning
Remote Control
Undersea Surrogate

Connect the Ecosystem

BlueNERVE:

The connective tissue
accelerating collaboration
across the regional
maritime ecosystem



NERVE makes MITRE's labs accessible from anywhere, by any U.S. Partner

Shared nation-spanning network for wide range of technical activity

- Private tenancies to protect each lab & project's assets
- Open-on-request sharing between projects & labs
- Remote-access logon accounts for U.S. Persons
- Direct site-to-site connectivity with U.S. Partners
- Integration with commercial cloud hosts

Virtual Machine hosting platforms

- Secure baselines & project-specified configurations
- Support for NIST SP 800-171 compliance

Shared infrastructure

- Enterprise customer support
- Authentication, patching, anti-virus, etc.
- Access to Internet & MITRE Partners services

Safe harbor for prototype / legacy systems

- Vulnerability analysis tools permitted for use

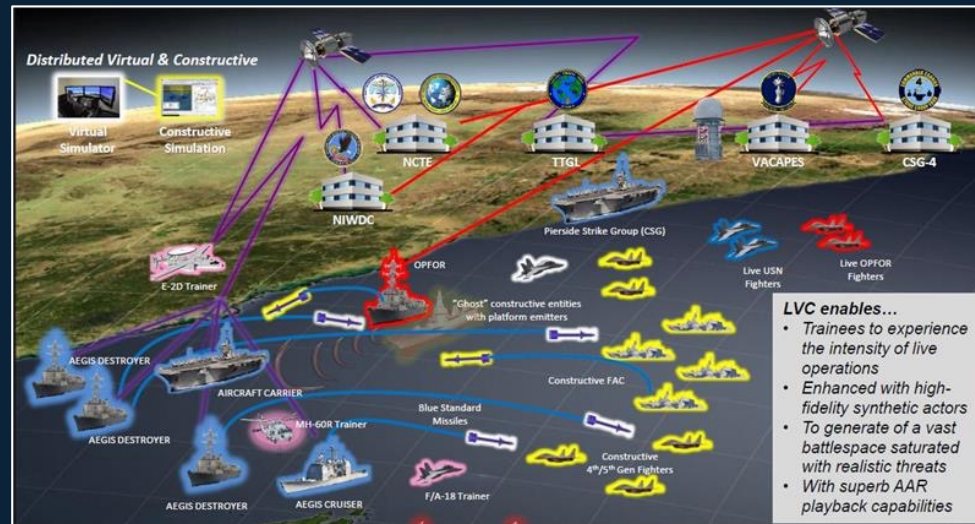
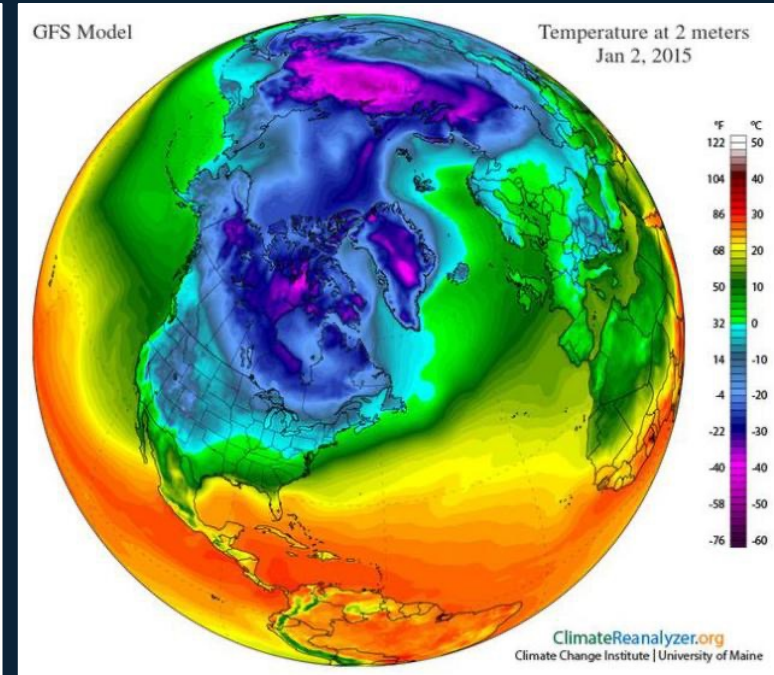
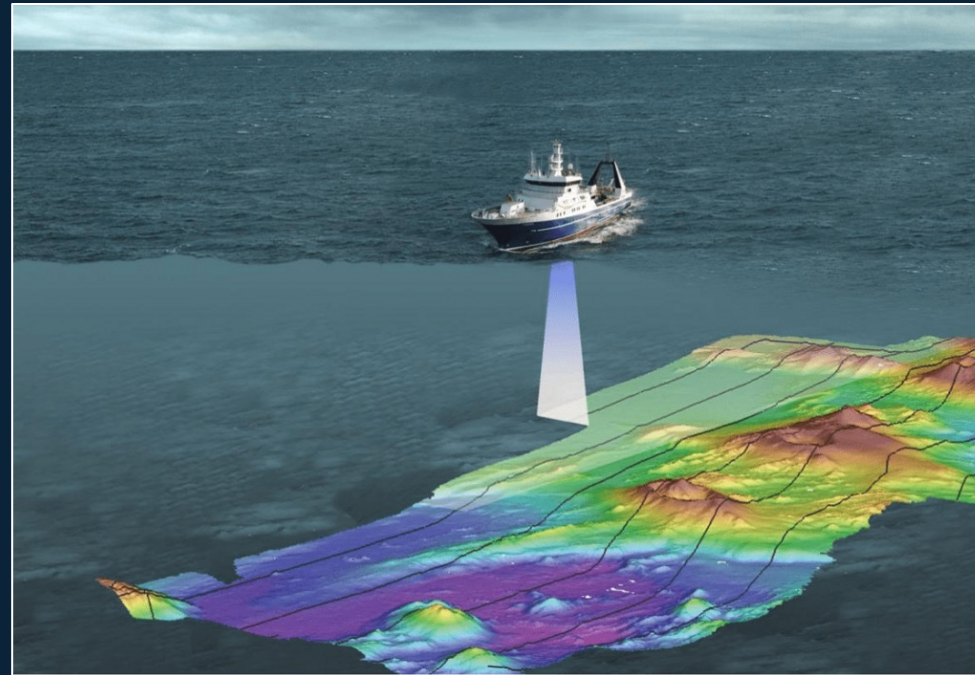


Example Use Cases

Use 1:
Distributed
platform real-time
collaboration

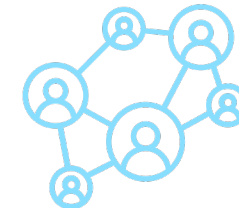
Use 2:
Advanced
Modeling
capabilities

Use 3:
Data Accessibility





Accelerating collaboration and open data access across the Blue Economy innovation ecosystem

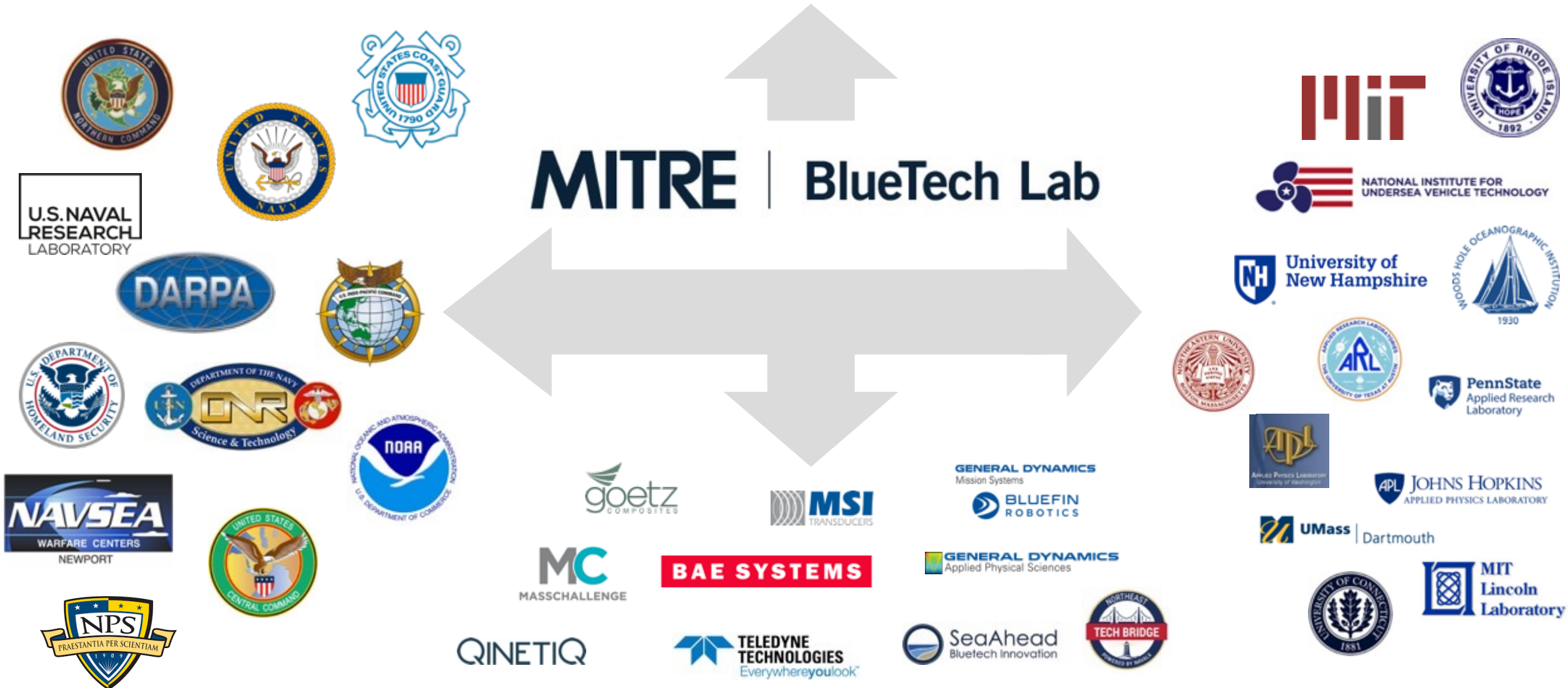


- Connect maritime infrastructure (tanks, labs, etc.) together utilizing MITRE NERVE
- Accelerate getting new technology into the oceans
- Optimize utilization of infrastructure and expertise
- Increase understanding of the maritime environment
- Grow maritime workforce of the future



CLIMATE CHANGE - ECONOMIC SECURITY - NATIONAL SECURITY

ENVIRONMENTAL PROTECTION - MARITIME COMMERCE



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