Naval Information Warfare Center
ATLANTIC

Naval Information Warfare Center Atlantic

Standards in the Age of Artificial Intelligence

2024 Defense Standardization Program (DSP) Conference

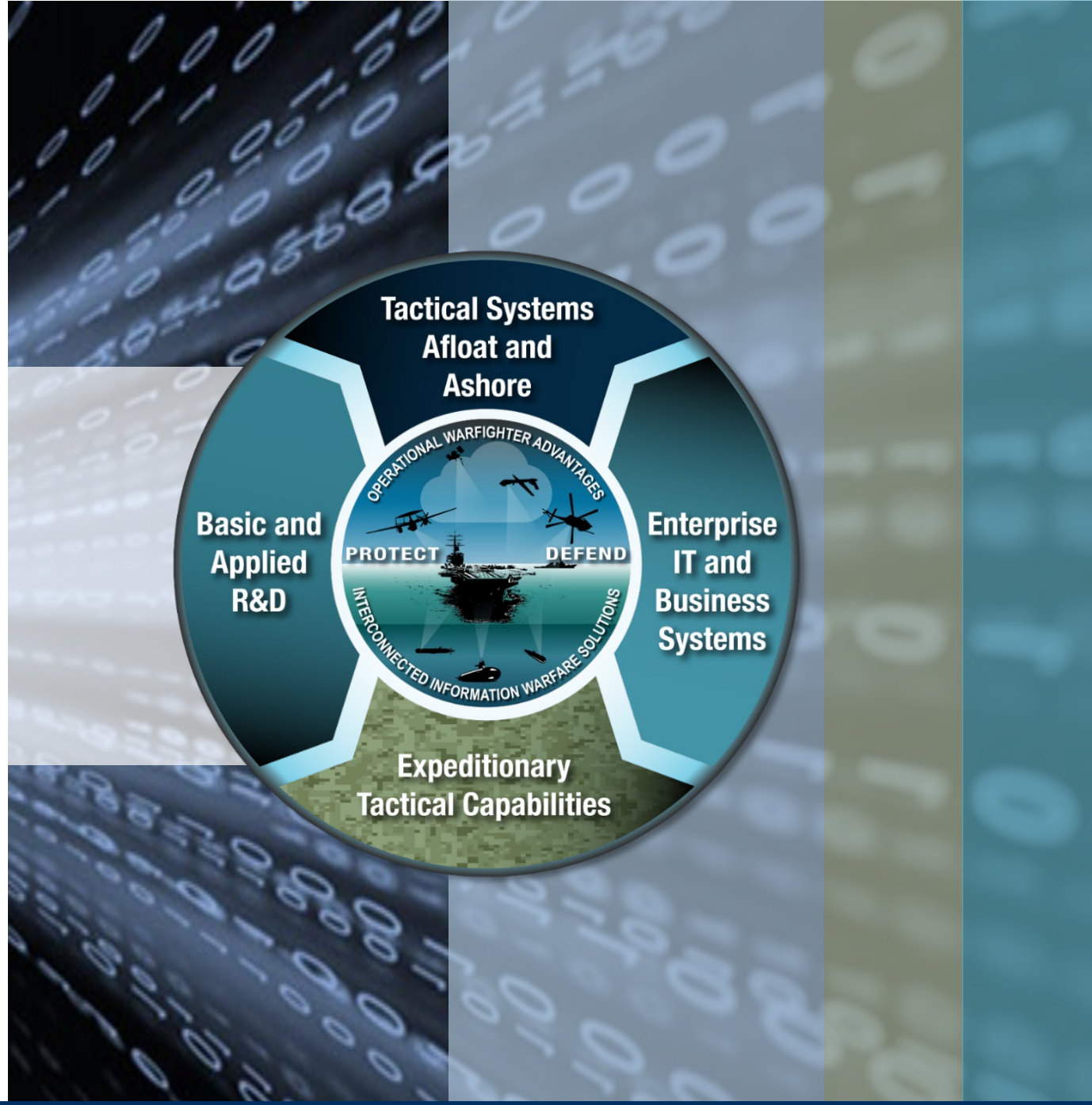
07 August 2024

Presented by:

Mr. Robert Keisler, SSTM

Director, Data Science & Artificial Intelligence

NIWC Atlantic 5.6 Engineering Competency



Naval Information Warfare Center ATLANTIC

AI is integral to future competition

The rapid speed at which AI capabilities are advancing compels the United States to lead in this moment … Promoting responsible innovation, competition, and collaboration will allow the United States to lead in AI and unlock the technology's potential.

President Joe Biden
Executive Order 14110
October 30, 2023

Research, development, science, and technology enable us to innovate at the speed of relevancy — ensuring our competitive edge over our adversaries… We are indeed in an innovation race — and it is one we must win.

The Honorable Carlos Del Toro
SECNAV

Whether you're talking about artificial intelligence, cyber, unmanned platforms, directed energy or hypersonic missiles, we are on the cusp of technological breakthroughs that are going to define future conflict.

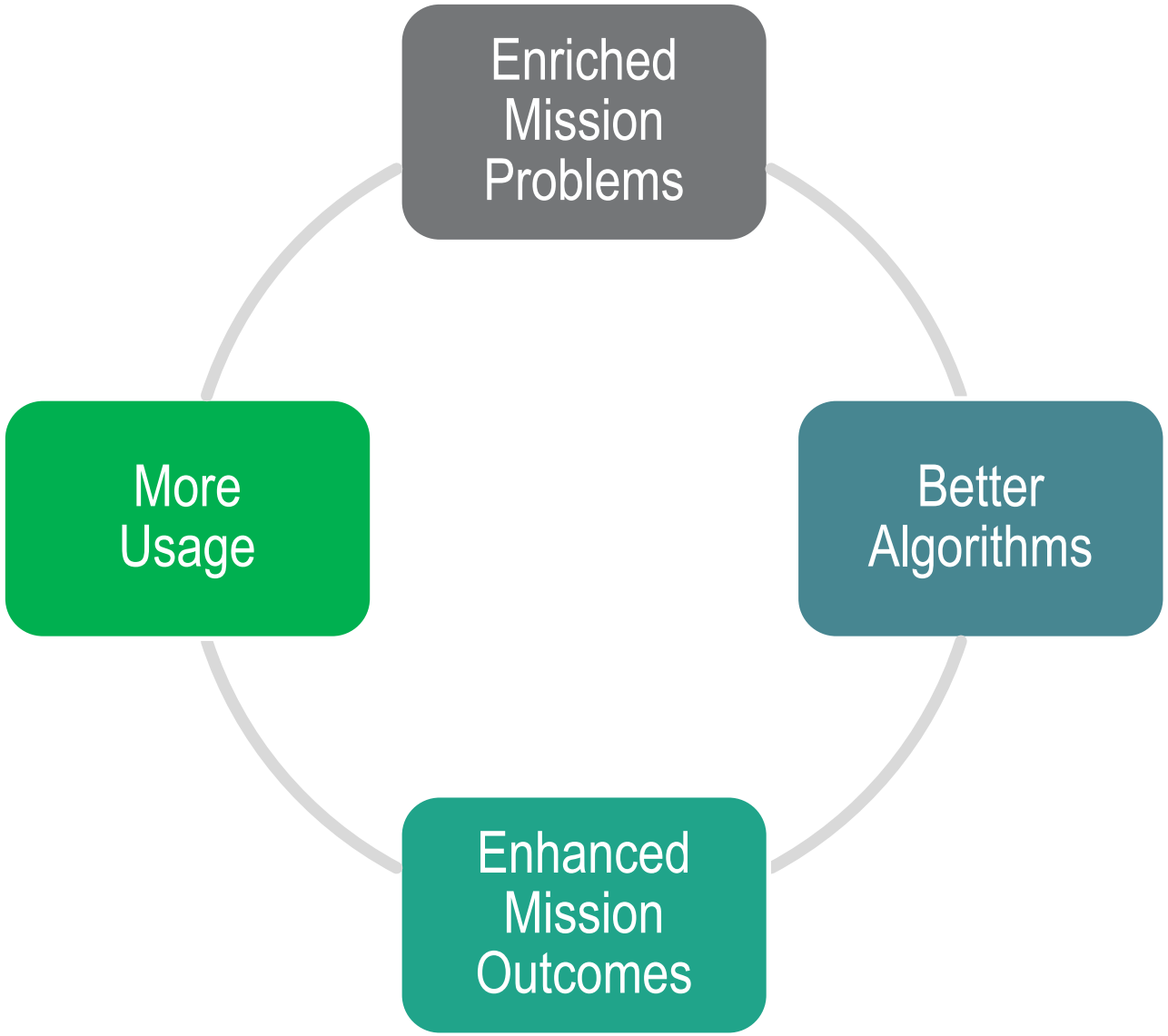
Admiral Lisa Franchetti
Chief of Naval Operations

Naval Information Warfare Center ATLANTIC

AI a diverse field and a range of technologies

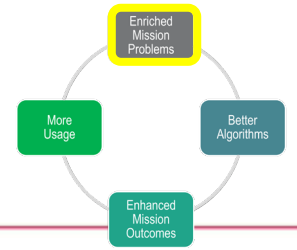
- **GOFAI (Good Old-Fashioned Artificial Intelligence)**
  - Symbolic
  - Expert Systems
  - Rules-based Systems
  - Knowledge Bases
  - Logic-based Systems
- **Generative**
  - Generative Adversarial Networks (GANs)
  - Variational Autoencoders (VAEs)
  - Transformer-based Models (GPT, etc.)
- **Optimization**
  - Gradient Descent
  - Simulated Annealing
- **Machine Learning**
  - Supervised Learning
    - Linear Regression
    - Logistic Regression
    - Support Vector Machines (SVM)
    - Decision Trees
    - Random Forests
    - Gradient Boosting Machines (GBM)
    - K-Nearest Neighbors (KNN)
    - Recommender Systems
  - Unsupervised Learning
    - K-Means Clustering
    - Hierarchical Clustering
    - Principal Component Analysis (PCA)
    - Gaussian Mixture Models (GMM)
    - Autoencoders
    - t-Distributed Stochastic Neighbor Embedding
  - Neural Networks and Deep Learning
    - Convolutional Neural Networks (CNNs)
    - Recurrent Neural Networks (RNNs)
  - Reinforcement Learning
    - Q-Learning
    - Policy Gradient Methods
    - Actor-Critic Methods
- **Computer Vision (CV)**
  - Optical Character Recognition (OCR)
  - Facial Recognition
  - Gesture Recognition
  - Object Detection
  - Image Segmentation
- **Natural Language Processing (NLP)**
  - Language Models (Small and Large)
  - Sentiment Analysis
  - Named Entity Recognition (NER)
- **Evolutionary Computation**
  - Genetic Algorithms
  - Swarm Intelligence
- **Probabilistic Models and Bayesian Networks**
  - Bayesian Belief Networks (BBN)
  - Markov Chain Monte Carlo (MCMC)
  - Expectation-Maximization (EM) Algorithm
  - Hidden Markov Models (HMM)
  - Gaussian Mixture Models (GMM)
- **Robotic Process Automation (RPA)**
  - Hyper-automation/Intelligent Automation
- **Autonomy and Robotics**
  - Autonomous Behavior
  - Intelligent Agents
- **Unmanned/Uncrewed/ Drones Manufacturing**
- **Data Science**
  - Predictive Modeling
  - Statistical Analysis
  - Data Visualization
  - Data Engineering

**** AI adjacent***


Enriched Mission Problems
Better Algorithms
Enhanced Mission Outcomes
More Usage

Naval Information Warfare Center ATLANTIC

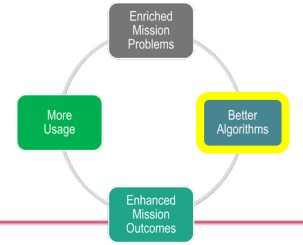
Enriched Mission Problems



- AI integration requires a comprehensive analysis of missions to pinpoint where it can address pressing challenges or reveal new opportunities.
  - This may be at the task level or rethinking entire mission processes.
  - AI outcomes should be tied back to Measures of Effectiveness/Performance.
- A proper AI use case standard defines methods like how to: select and define problems, link to missions, identify datasets, document algorithms, set success metrics, manage acceptable risks, and establish clear accountability for outcomes.
  - AI use cases should be captured in an AI inventory.
  - AI use cases should be reviewed to ensure responsible innovation is occurring.

Naval Information Warfare Center ATLANTIC

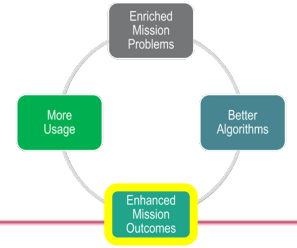
Better Algorithms



- AI requires the *AI Factory* to ensure engineering and development processes are standardized and repeatable.
  - The factory enables the entire lifecycle of AI from algorithm experimentation to development to testing and evaluation to deployment.
  - The factory focuses on fundamental standards for delivering AI capabilities not tools, as tools will change over time.
- AI will require more and/or revitalized data standards.
  - Data must meet VAULTIS to be usable for AI systems.
  - The data inputs to and exhaust from AI may require us to develop new standards, ontologies, and graphs.

Naval Information Warfare Center ATLANTIC

Enhanced Mission Outcomes

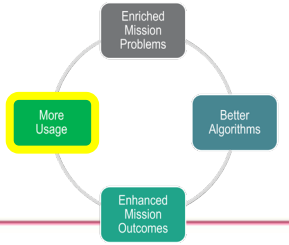


- Testing, Evaluation, and Continuous Monitoring of AI is unique.
  - AI is not software. We must manage it's risks differently.
  - AI safety nets require intentional human-machine teaming and trust considerations.

- Responsible AI standards are critical to mission outcomes.
  - AI assumes a prominent role in decision-making and problem-solving, and it is crucial that its deployment is responsible, equitable, reliable, traceable, and governable.
  - We must ensure that AI systems adhere to laws, policies, and ethical values and avoids unintended consequences.

Naval Information Warfare Center ATLANTIC

More Usage

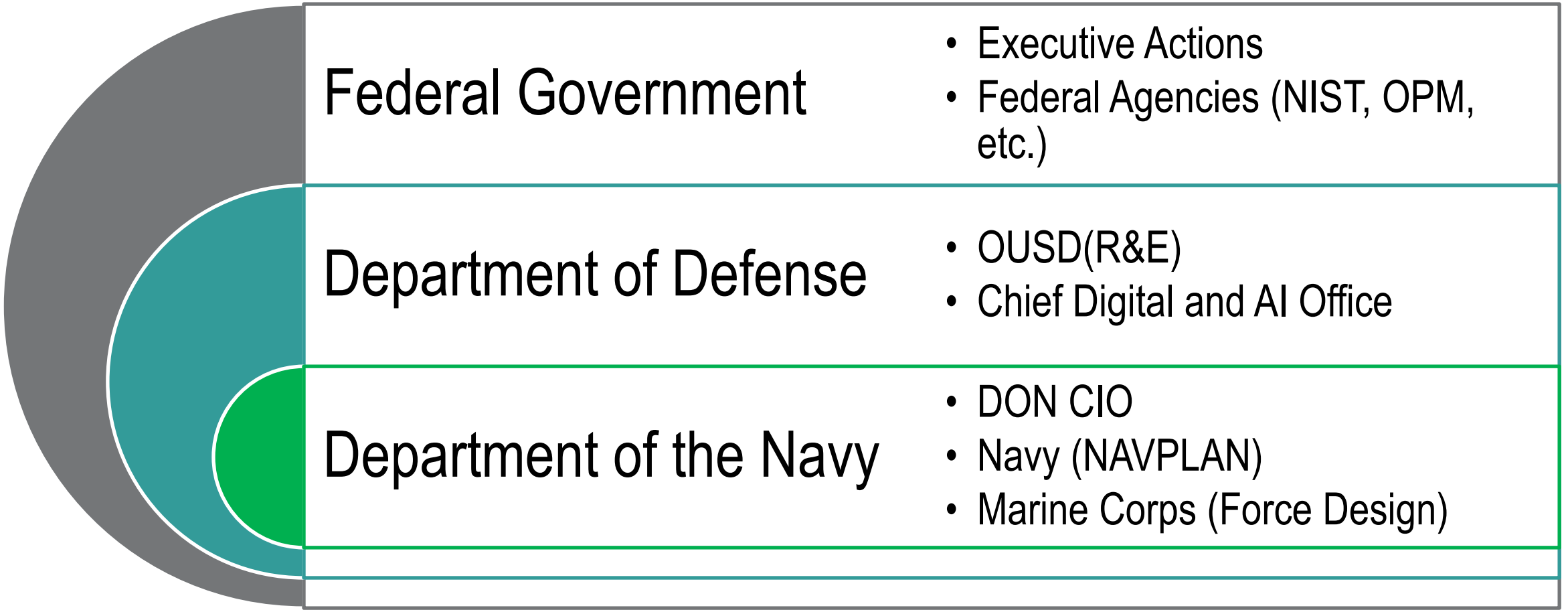


- Building appropriate teams is critical.
  - Data Scientists (and spinoff roles) are the caretakers of AI. There should be standards and controls on the job title and work roles.
  - *Strike Teams* are one way to effectively go from a mission problem to an AI solution. Constructing these teams, parachuting them into problems, and scaling to more teams is going to be necessary.

- AI systems at scale require literacy standards (just like cyber security!).
  - We do no think much about the way AI influences our lives already, but we should.
  - We will need standards around human-machine teams and how AI presents itself to users in the future. Not just for trust, but also human decision-making and judgement.

Naval Information Warfare Center ATLANTIC

Major Governance, Policy, and Standard Drivers



Naval Information Warfare Center
ATLANTIC

Questions

?

Mission:

Conduct research, development, prototyping, engineering, test and evaluation, installation, and sustainment of integrated information warfare capabilities and services across all warfighting domains with an emphasis on Expeditionary Tactical Capabilities & Enterprise IT and Business Systems in order to drive innovation and warfighter information advantage.

Vision:

WIN THE INFORMATION WAR.

Follow us on Social Media
Search "NAVWAR"

Listen to NIWC Atlantic's award winning Technically Speaking podcast on your favorite podcast apps!

NIWC Atlantic is part of the Naval Research & Development Establishment (NR&DE)

https://www.niwcatlantic.navy.mil

CHIPS Magazine (navy.mil)