# NOAA Artificial Intelligence Strategy Updates



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and the NOAA AI Executive Committee**

*Presenter: William Michaels*
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# Artificial Intelligence (AI) Definition

- AI refers to computational systems able to perform tasks that normally require human intelligence, but with increased efficiency, precision, and objectivity.

- A subset of AI called machine learning (ML refers to mathematical models able to perform a specific task without using explicit instructions, instead relying on patterns and inference. Deep learning (DL) is a subset of ML that utilizes artificial neural networks capable of learning from unstructured data or newly added data.

- The use of labeled training data can further improve the AI predictive capability through supervised ML.
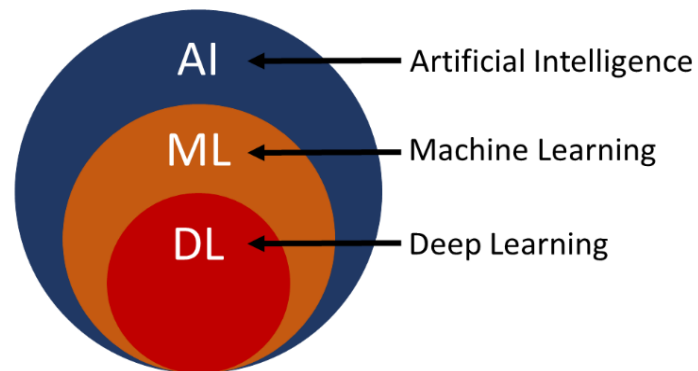


**AI benefits:**
Data quality control
Automated data processing
Data assimilations
Model parameterization
Predictive forecasting

**AI applications:**
Fishery & protected spp. surveys
Weather forecasting
Automated Wx warning
Ocean robotics
Environmental mapping
Hazard detection & prediction
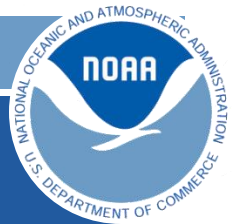
# NOAA AI Strategy

## Strategic Drivers:

White House
- AI Executive Order
- NSTC AI R&D Strategic Plan

Congress
- Weather Act
- CENOTE Act

NOAA
- EPIC & Space Innovation
- Blue Economy

## Vision:

Through the NOAA AI Strategy, expansion of Artificial Intelligence is accelerated across the entire agency to make transformative improvements in NOAA mission performance and cost effectiveness.
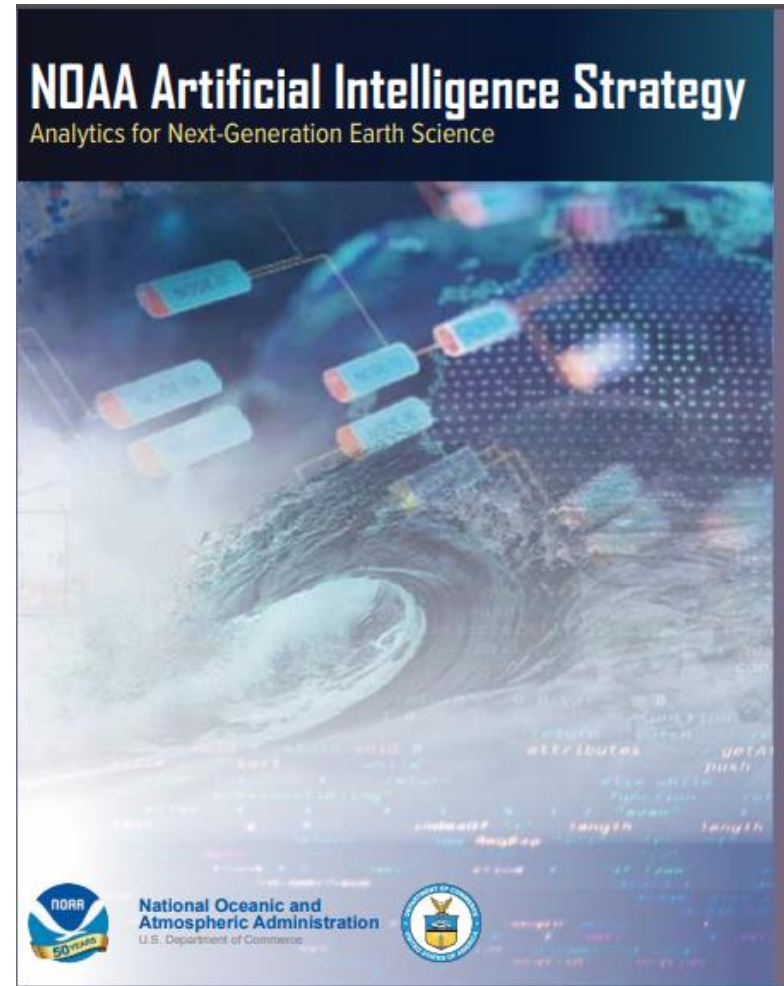
## Purpose:

To dramatically expand the application of AI in NOAA's mission areas in order to achieve transformational improvements in performance, skill, computational efficiency, and cost effectiveness.
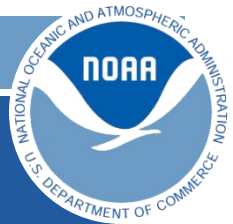
# NOAA AI Strategic Goals

- **Goal 1:** Establish Efficient Organizational Structures and Processes to Advance AI across NOAA.

- **Goal 2:** Advance AI Research and Innovation in Support of NOAA's Mission.

- **Goal 3:** Accelerate the Transition of AI Research to Applications.

- **Goal 4:** Strengthen and Expand AI Partnerships.

- **Goal 5:** Promote AI Proficiency in the Workforce.

Available at: https://www.noaa.gov/media-release/noaa-finalizes-strategies-for-applying-emerging-science-and-technology.



**NOAA Artificial Intelligence Strategy**
Analytics for Next-Generation Earth Science

National Oceanic and Atmospheric Administration
U.S. Department of Commerce

# Goal 1: Organizational Structures

**Objective 1.1.** Explore the establishment of a NOAA Center of AI…

**Objective 1.2.** Develop technical working groups comprised of NOAA line office experts ...

**Objective 1.3.** Prioritize AI-based approaches where applicable in NOAA budget formulation guidance...

**Objective 1.4.** Include discussion of NOAA AI activity in NOAA executive-level engagement and communications with key stakeholders...

**Objective 1.5.** Leverage and adopt the principles… articulated in the NOAA Cloud Strategy and Roadmap, and Big Data Project…
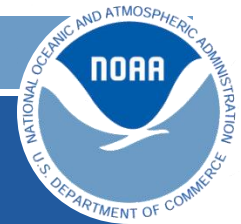
# Goal 2: Research and Development

**Objective 2.1.** Establish a requirement-based process to ensure AI research leverages the best available assets and expertise in support of the NOAA mission...

**Objective 2.2.** Prioritize AI-based approaches and support... to promote collaborative AI research and maintain an awareness of the rapidly evolving AI technology in areas relevant for NOAA mission.

**Objective 2.3.** Establish an annual research and development prize competition series for AI applications in environmental science...

**Objective 2.4.** Evaluate and execute various testbed and proving grounds… to expand AI research, develop best practices and training data, improve algorithms, and evaluate model performance...

**Objective 2.5.** Encourage every prospectus for NOAA Cooperative Institutes (CIs) and Cooperative Science Centers (CSC's)… in AI research and applications.
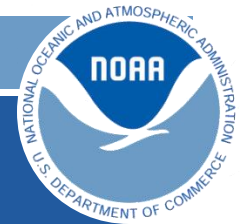
# Goal 3: Research to Applications

**Objective 3.1.** Establish budget efforts to support the transition to operations….

**Objective 3.2**. Transition to operations, commercialization, and academia...

**Objective 3.3.** Develop NOAA technical guidelines… on the best practices and standards for the training data, training practices, and evaluation of model performance....

**Objective 3.4**. Build AI awareness across NOAA line offices...

**Objective 3.5.** Complete an annual report of NOAA AI research transitions, disseminated broadly across the agency and with external partners...

# Goal 4: Expand AI Partnerships

**Objective 4.1.** Prioritize AI-based environmental research in National Oceanographic Partnership Program (NOPP)...

**Objective 4.2.** Expand partnerships in AI-based environmental research with the academic and research community...

**Objective 4.3.** Work with the NSF's National Artificial Intelligence Research Institutes to collaborate with appropriate institutes on AI R&D.

**Objective 4.4**. Increase the number of formal cooperative agreements on AI-based environmental research and applications with interagency and international partners...

**Objective 4.5.** Formalize new public-private partnerships through established mechanisms...

**Objective 4.6**. Provide innovative and substantive contributions to the policy and advisory committees such as the National Science and Technology Council (NSTC) Select Committee on AI... scientific exchange during... conferences, workshops...
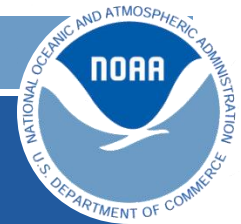
# Goal 5: Promote AI Proficiency in Workforce

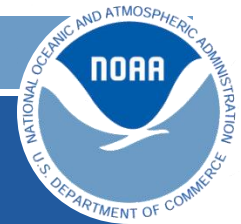**Objective 5.1.** Provide increased online and on-scene AI training...

**Objective 5.2.** Assignments in the NOAA Rotational Assignment Program (NRAP)… cross-pollination of AI expertise would raise the overall AI proficiency of the workforce.

**Objective 5.3**. Support AI-related graduate degree, professional development, and technical training...

**Objective 5.4.** Support and lead collaborative events such as conferences, workshops...

**Objective 5.5.** Actively encourage graduate programs, internships and cooperative student training...
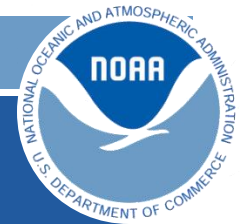
**Objective 5.6.** Update individual development plans (IDP), position descriptions, performance plans, and career paths as a practical approach to build and retain NOAA's workforce proficiency in AI.
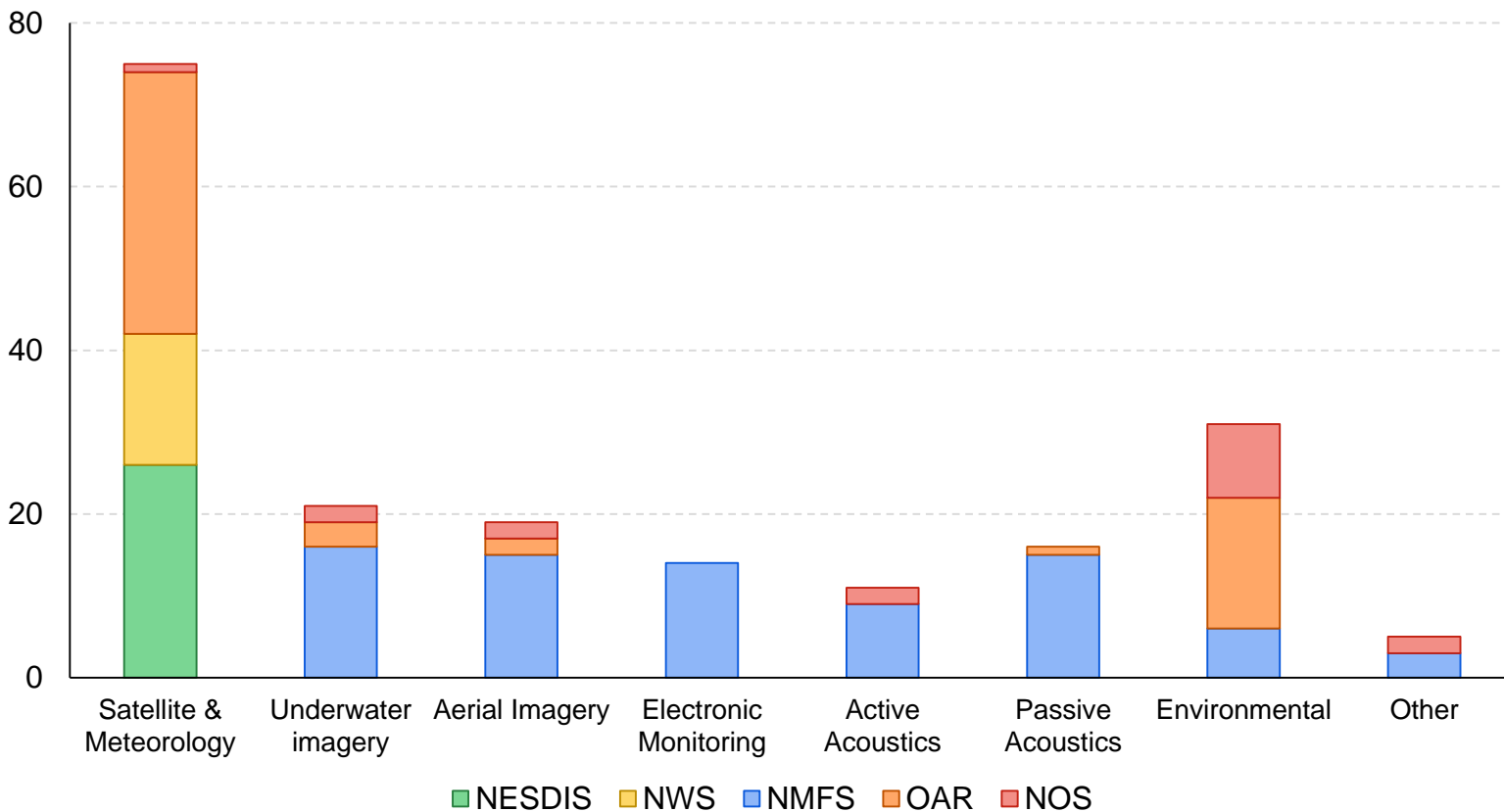
# NOAA AI Data Call - Applications

NOAA has made significant progress in the application of artificial intelligence (AI) and specifically machine learning (ML) analytics. Key drivers in NOAA's application of AI-ML include need to improve data assimilation and forecast modeling, and need to accelerate the data processing of big data collected from emerging technologies
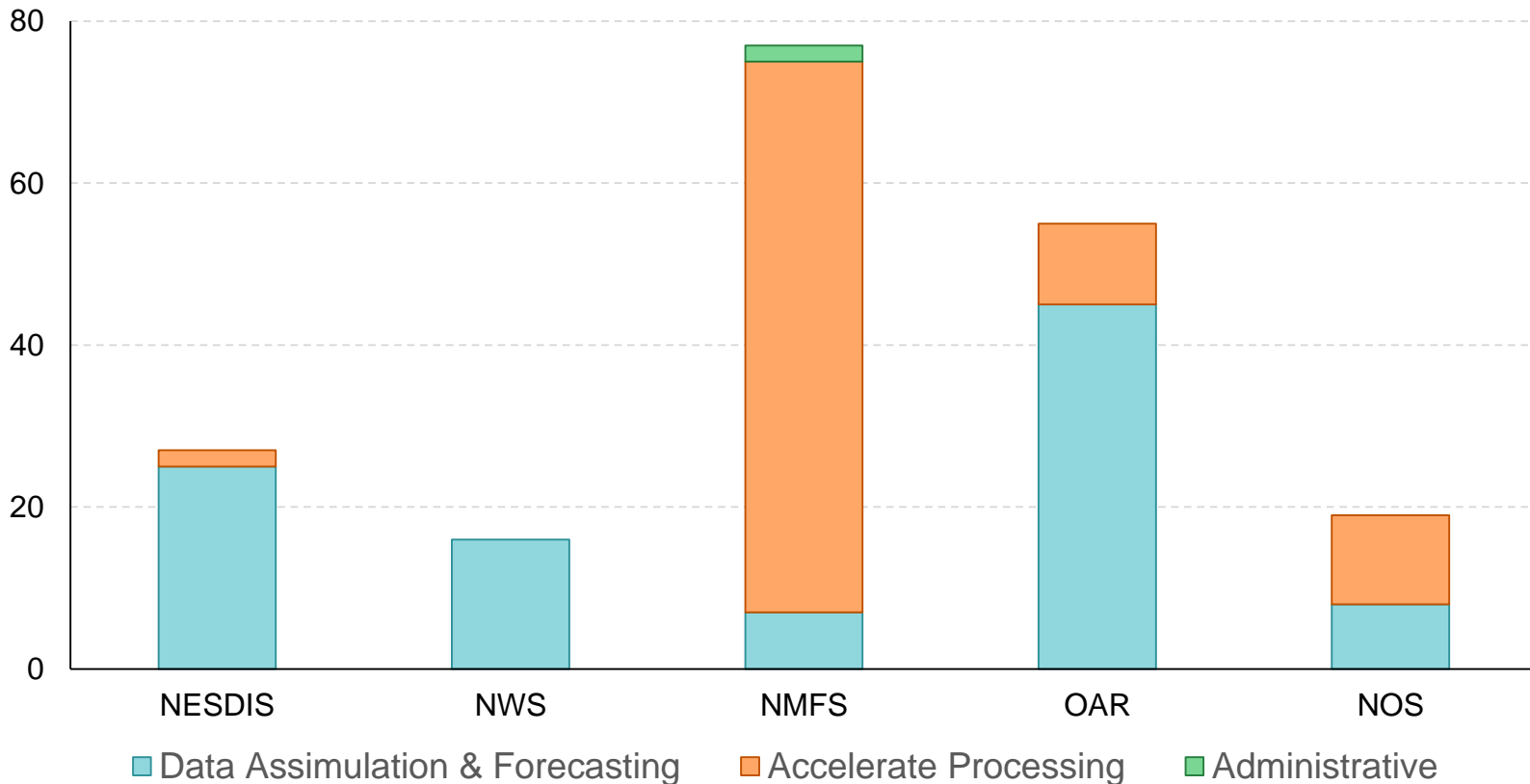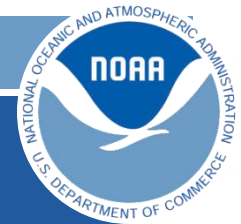
# NOAA AI Data Call – Data Types

NOAA has applied AI-ML to a variety of environmental data demonstrating its interdisciplinary research and operational capabilities in support of its cross-functional mission requirements.



Legend: ■ NESDIS ■ NWS ■ NMFS ■ OAR ■ NOS

# NOAA AI Data Call – TRLs

NOAA has made progress in transitioning the applications of AI-ML into operational efficiencies, as shown by the Technology Readiness Levels (TRLs). About 37% of the NOAA AI projects are in transition, while 25% reached the operational phase.
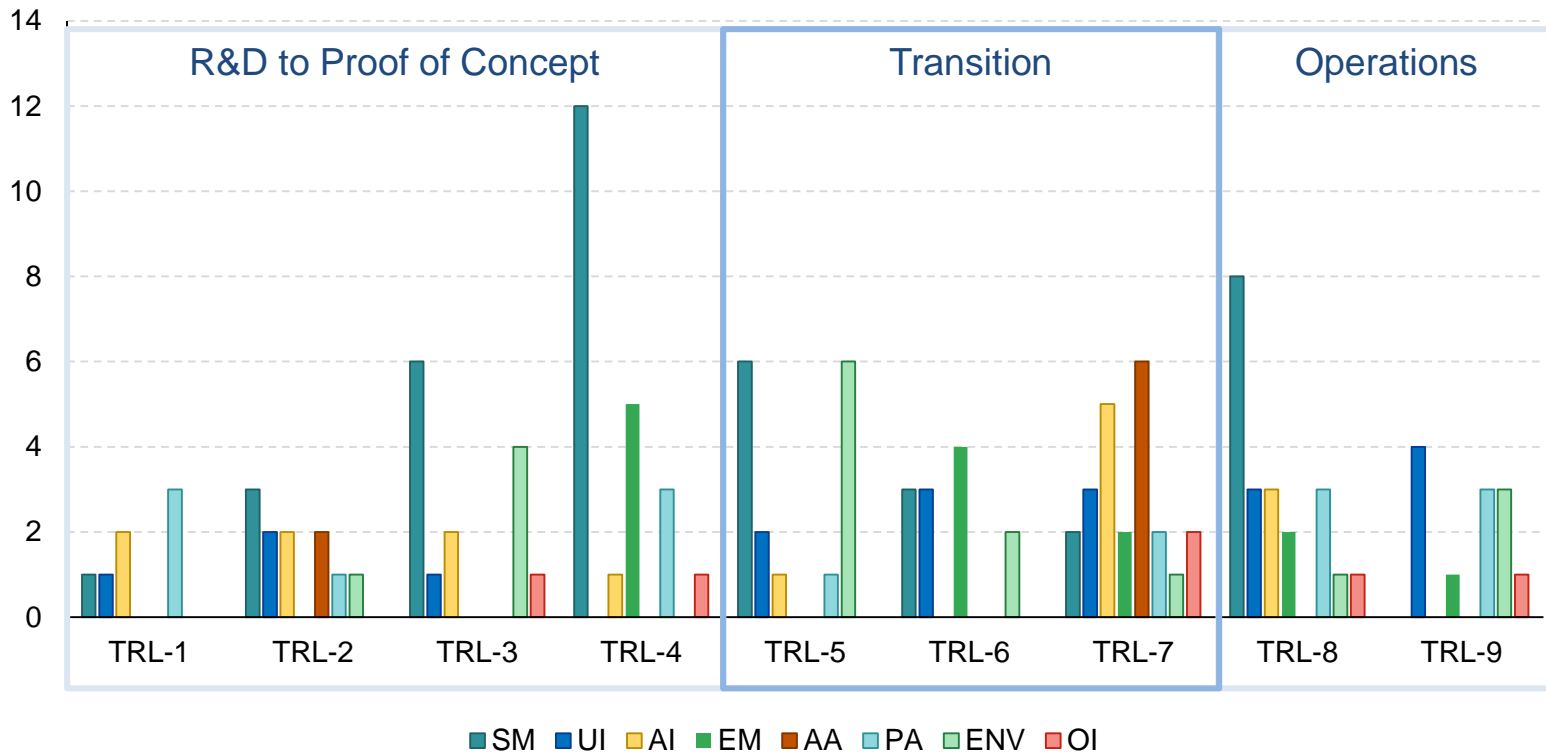


SM (Satellite/Weather), UI (Underwater Imagery), AI (Aerial Imagery), EM (Electronic Monitoring), (AA) Active Acoustics, (PA) Passive Acoustics, ENV (Environmental Observations), OI (Other imagery)

# NOAA AI Strategy Implementation Workshop

**Goal:** Develop the framework for the NOAA AI Strategy Implementation Plan to make transformative improvements in the 'One-NOAA' cross-functional mission priorities, including how the NOAA AI Strategy can support or be supported by the other NOAA Strategies. Invited participants (n=36) provided well balanced perspectives and expertise from each NOAA Strategy and NOAA Line Office.



**NOAA AI Strategy Implementation Workshop Silver Spring, MD during February 27-28, 2020**

- ✓ Overview of NOAA Strategies (AI, UxS, Omics, Cloud, Data, EPIC)

- ✓ Synergistic activities across the NOAA Strategies, and One-NOAA guidance

- ✓ Activities and milestones for the NOAA AI Strategy goals and objectives

- ✓ NOAA Line Office engagement and resource sharing

- ✓ NOAA Center of AI business case and NOAA oversight
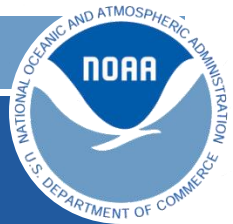
# NOAA AI Strategy Implementation Workshop

*Organizational Structure:* Advance coordination of AI methods, develop repositories and datasets, as well as best practices.

*Research to Applications:* Enhance AI solutions to advance NOAA's research to operational applications in all mission areas.

*Partnerships:* Increase and leverage commercial and academic partnerships for research and applications.

*Training:* Train the current and future NOAA workforce to use AI methods efficiently within the organization.

**The NOAA Strategies will coordinate among the synergistic activities;**
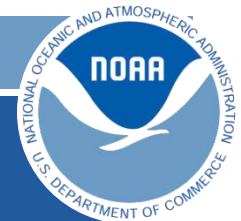
**A I**             **UxS**             **OMICS**
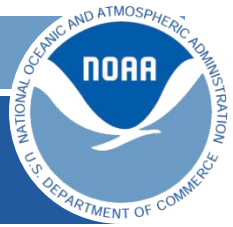
**Cloud + Big Data + EPIC**

# NOAA AI Strategy Next Steps

- Complete the NOAA AI Strategy Implementation Workshop report, including recommendations on coordinating synergistic operation efficiencies across the NOAA Strategies (AI, UxS, Omics, Cloud, Data, EPIC).

- Complete NOAA AI Data Call analysis to the NOAA AI Strategy Implementation Plan supports the cross-functional mission requirements across the NOAA Line Offices.

- Complete the NOAA Center for AI business case, and recommendations on oversight for the NOAA AI Strategy Implementation Plan.

- Complete the NOAA AI Strategy Implementation Plan, including defining activities, milestones, and oversight, in FY2020.

- Complete budget requests for the NOAA AI Strategy Implementation Plan.

# Questions?