

# Marine Data and the Businesses in the United States

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World Ocean Forum - Blue Economy Session  
September 26, 2024





# Agenda

- NOAA's Mission and Capabilities
- Marine Economy Satellite Account
- Ocean Observations Enterprise
- Ocean Data and AI Applications

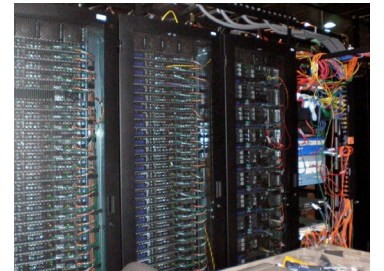
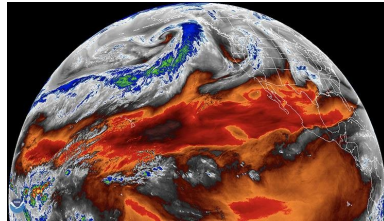
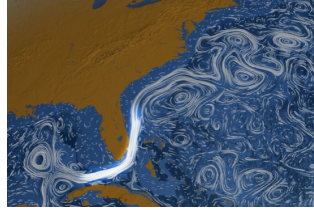




# NOAA Overview



# NOAA's Mission





# Marine Economy Satellite Account



# The Ten Sectors of the Marine Economy



**Fisheries and  
Other Bio-Products**



**Research and  
Education**



**Professional and  
Business Services**



**Dredging, Restoration,  
and Other Construction**



**National Defense  
and Public  
Administration**



**Offshore Oil and Gas**



**Transportation**



**Shipbuilding**



**Tourism and Recreation**



**Power Generation**



# AMERICA'S MARINE ECONOMY

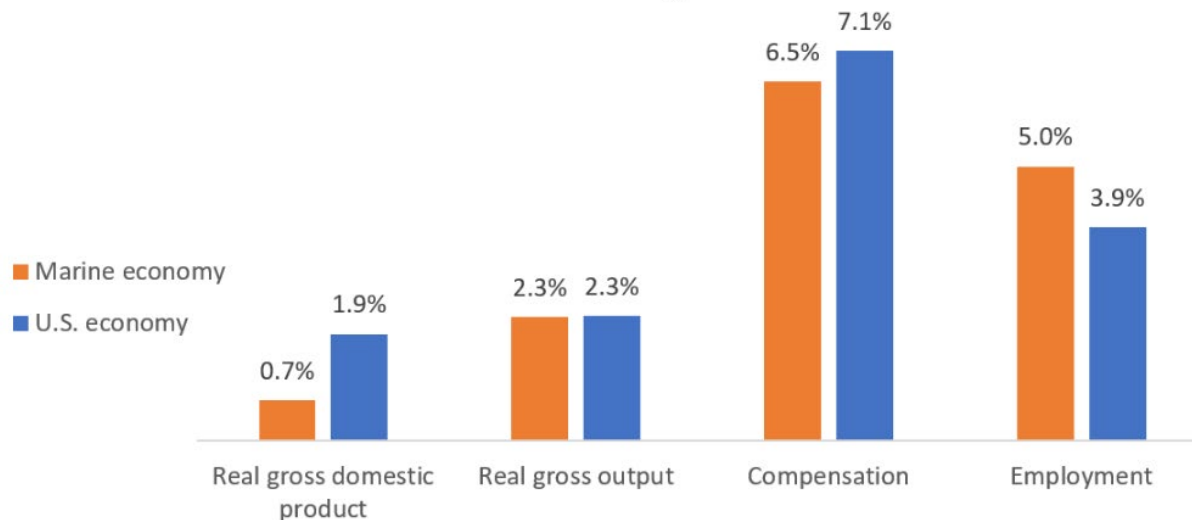
Based on Most Recent 2022 Data from Marine Economy Satellite Account

## Value Added (GDP)



# Comparison with US Economy

Chart 1. Growth in Marine Economy Compared to U.S. Economy, 2022



# Marine Economy Sectors Output 2022

## Diverse Sectors

### Marine Sector Sales in 2022 (Inflation Adjusted)

	Tourism and Recreation	\$220 Billion
	Defense and Public Administration	\$194 Billion
	Offshore Minerals	\$66 Billion
	Transportation	\$56 Billion
	Marine Living Resources	\$31 Billion
	Ship and Boat Building	\$20 Billion
	Coastal Utilities	\$15 Billion
	Research and Education	\$12 Billion
	Professional and Technical Services	\$8 Billion
	Construction	\$7 Billion



# Comparison with Selected Industries



\$459 BILLION

ARTS, ENTERTAINMENT  
AND RECREATION



\$701 BILLION

UTILITIES



\$734 BILLION

DATA PROCESSING AND  
INTERNET PUBLISHING



\$777 BILLION

MARINE ECONOMY

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**\$777 BILLION**  
in sales.



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**\$476 BILLION**  
in GDP.

<https://www.bea.gov/data/special-topics/marine-economy>.

For more information, contact [MarineEconomy@noaa.gov](mailto:MarineEconomy@noaa.gov).

# Marine Natural Capital Accounting

## Pilots:



**Living Resources**



**Offshore Minerals**



**Tourism and Recreation**





# Ocean Observations Enterprise



# National Oceanic and Atmospheric Administration



Aircraft



Satellites



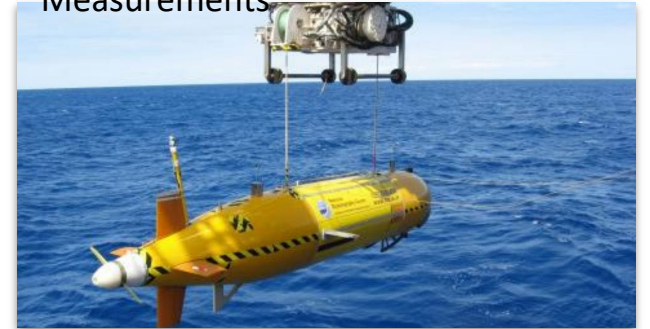
Ground and In Situ  
Measurements



Ships



Physical and Social Scientists



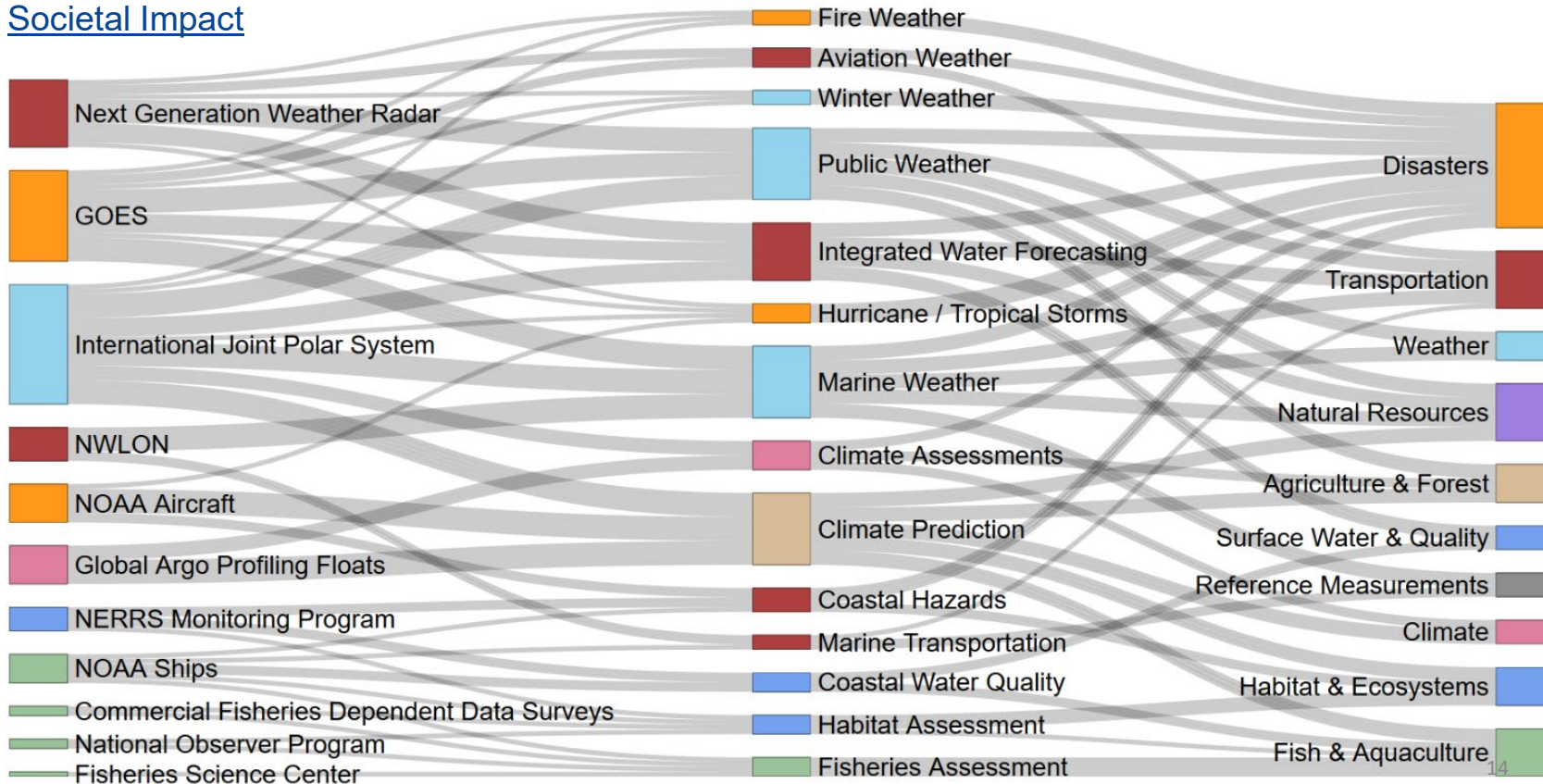
Uncrewed Systems (UxS)

# NOAA's Observing System Portfolio



## Observing System Societal Impact

## NOAA Mission



## WHAT DOES THE ENTERPRISE DO?

Improve lives and livelihoods with ocean, coastal, and Great Lakes information by:

**GATHERING** thousands of observing data sets every day from public and private programs; and

**INTEGRATING AND TRANSLATING** those data sets into models, products, tools, information, predictions, and projections.



## LOCATIONS

Serving the nation's coastal communities, including the Great Lakes, the Caribbean and the Pacific Islands and territories



NANOOS

CeNCOOS

SCCOOS

GLOS

GCOOS

NERACOOS

MARACOOS

SECOORA

CARICOOS

ATLANTIC OCEAN



IOOS<sup>™</sup>  
Integrated Ocean  
Observing System

## OUTCOMES

IOOS' data and information are used to:

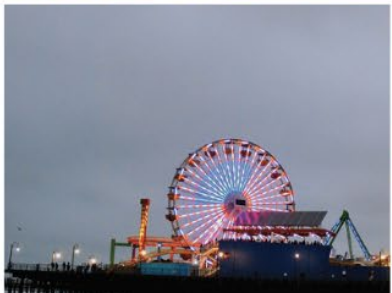
- Predict weather and climate variability
- Improve the safety and efficiency of maritime commerce
- Increase resilience and reduce risk for coastal communities
- Protect and restore healthy coastal ecosystems





# OCEAN-BASED CLIMATE RESILIENCE ACCELERATORS

Funding accelerator programs to support small businesses and entrepreneurs commercialize ocean, coastal, and Great Lakes-based climate solutions



# The Opportunity: Ocean-Based Climate Resilience Accelerators



## THEME AREAS



**Ocean Renewable Energy**



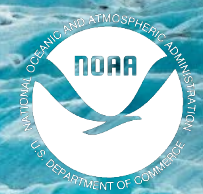
**Coastal and ocean-based  
carbon sequestration  
monitoring and accounting**



**Hazard mitigation and coastal  
resilience**



**Ecosystem services  
management**



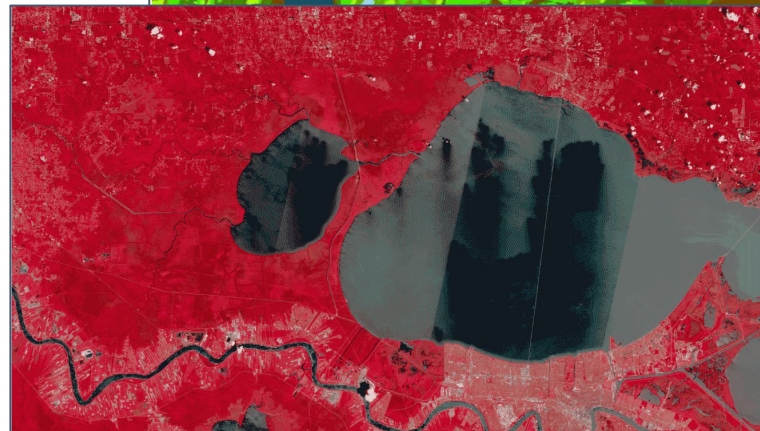
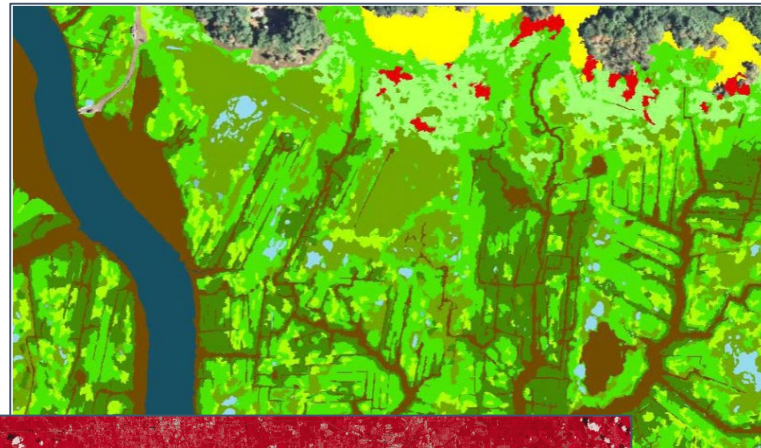
# Ocean Data AI Applications

# AI for Coastal and Ocean Resilience

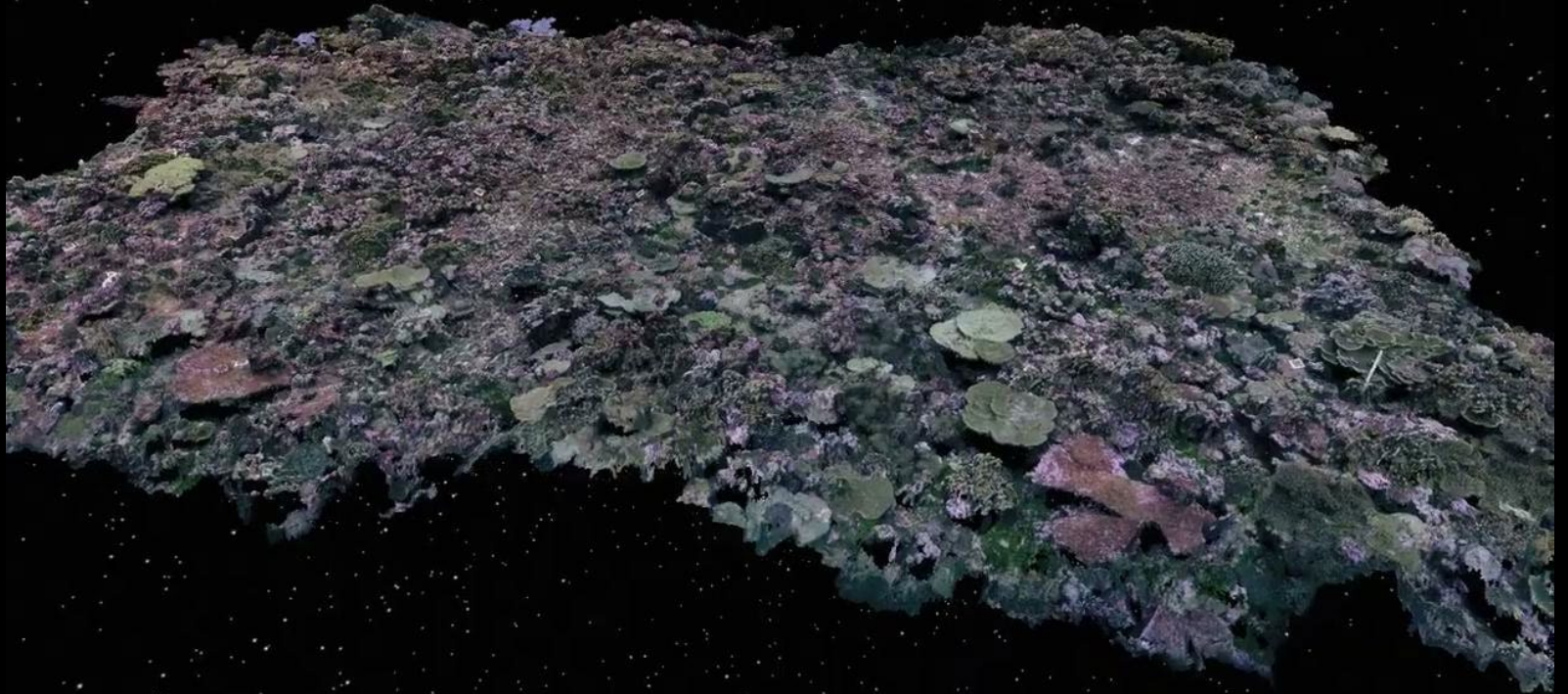


## Advancing Coastal Mapping and Management

- Focus: Developing next-generation land cover data for U.S. coastal areas, including Great Lakes
- Outputs: High-spatial-detail land cover and habitat datasets
- Applications:
  - Guide coastal management decisions
  - Map flood extents using unlabeled satellite imagery



# Digital Twins of Coral Reefs



# AI for Harmful Algal Blooms (HAB)



<https://oceanservice.noaa.gov/facts/hab-solutions.html>  
Imagery of the Western Lake Erie harmful algal bloom from September 26, 2017

*(National Ocean Service 2023, Grasso et al. 2019)*

## Monitoring Paralytic Shellfish Toxins

- Blooms lead to frequent summer closures of shellfish beds
- Aquaculture production, coastal development, and climate change could exacerbate disruptions caused HABs
- Desire for more precise HAB forecasts.

# AI for Coastal and Ocean Safety



## Rip Current Detection

- Objective: Automatic identification of rip currents using ML
- Method: Faster Region-based Convolutional Neural Networks (R-CNN)
- Application: Object detection in computer vision
- Process: Custom temporal aggregation for detecting rip currents in still images/videos
- Sources: Coastal imagery & beach webcams
- Result: Higher accuracy than human detection

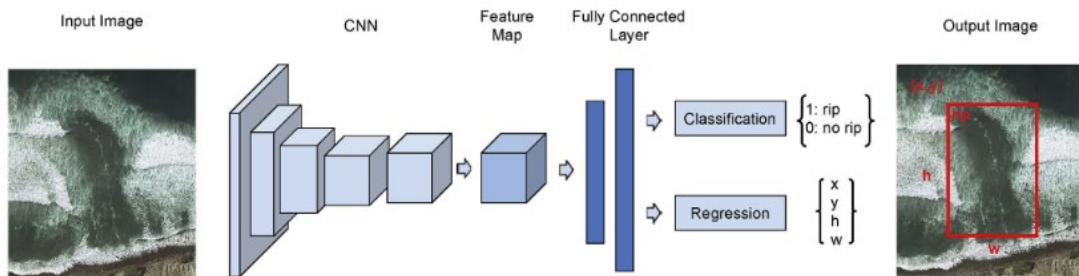
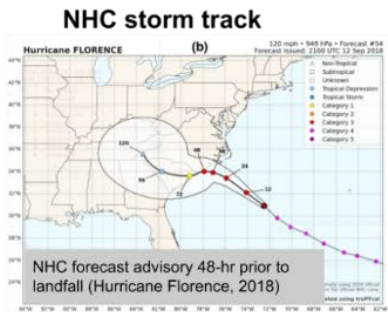


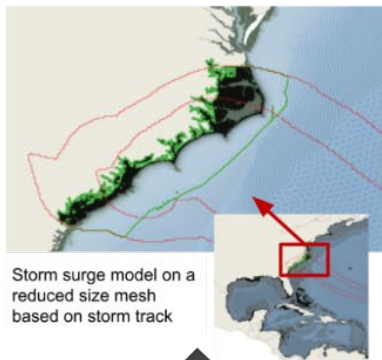
Figure 2. CNN workflow for rip current detection. (Source: CO-OPS)

# Next Generation Probabilistic Coastal Flooding Forecast System

Machine Learning workflow for probabilistic prediction of coastal flooding (Case study: Hurricane Florence, 2018)

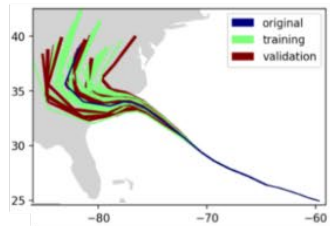
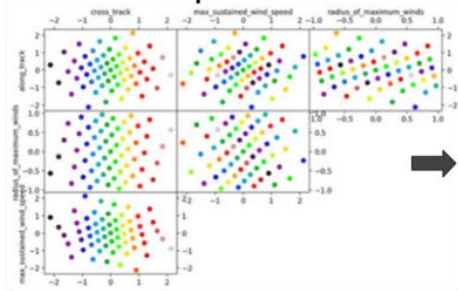


Storm Surge model

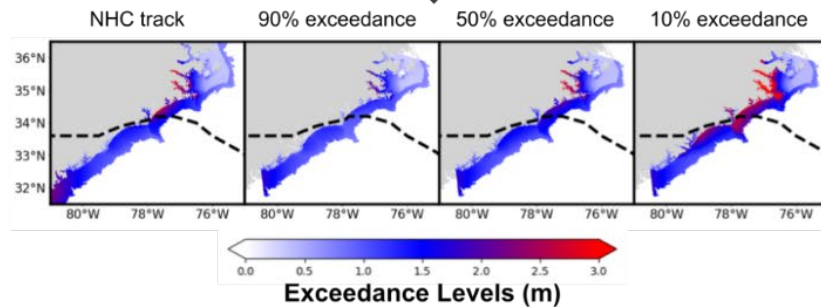
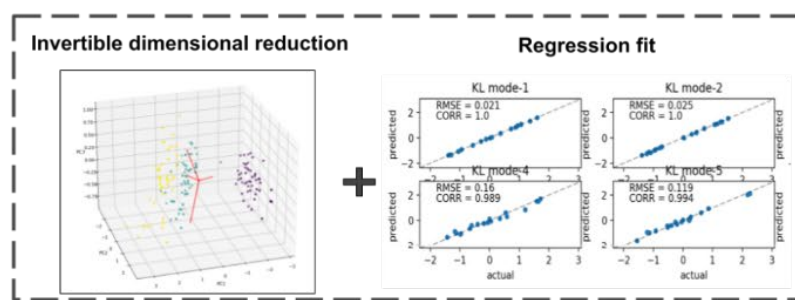


Storm surge model on a reduced size mesh based on storm track

Ensemble of perturbed tracks



ML surrogate model based on limited hydrodynamic models



[1] Pringle et al. (2023), Efficient Probabilistic Prediction and Uncertainty Quantification of Tropical Cyclone–Driven Storm Tides and Inundation. *Artificial Intelligence for the Earth Systems*, 2(2), e220040.

NOAA / OCS / NOS Storm Surge Modeling Team  
Contact: [Saeed.Moghimi@noaa.gov](mailto:Saeed.Moghimi@noaa.gov)

A white NOAA research vessel, identified as S220, is shown from a low angle, moving through the water. The ship features a prominent radar dome and various antennas on its upper decks. The background consists of large, rugged mountains covered in snow and patches of green vegetation. The sky is clear and blue.

**Thank You!**

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