

# NOAA RESEARCH PERSPECTIVES: AUTONOMOUS TECHNOLOGIES FOR OCEAN OBSERVATIONS

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*Supporting:* Ocean Exploration and Research Program

Office of Oceanic & Atmospheric Research

National Oceanic and Atmospheric Administration | NOAA

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# Outline

- NOAA Research Mission
- Current methods
- Emerging methods
- Challenges
- Impacts and opportunities

# NOAA MISSION

Understand and predict changes in climate, weather, oceans, and coasts

Share that knowledge and information with others

Conserve and manage coastal and marine ecosystems and resources



**National  
Ocean  
Service**

**National  
Weather  
Service**

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Environmental  
Satellite,  
Data, &  
Information  
Service**

**Office of  
Oceanic &  
Atmospheric  
Research**

**National  
Marine  
Fisheries  
Service**

**Office of  
Program  
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Integration**

# Environmental Intelligence

## MONITORING

## MODELING



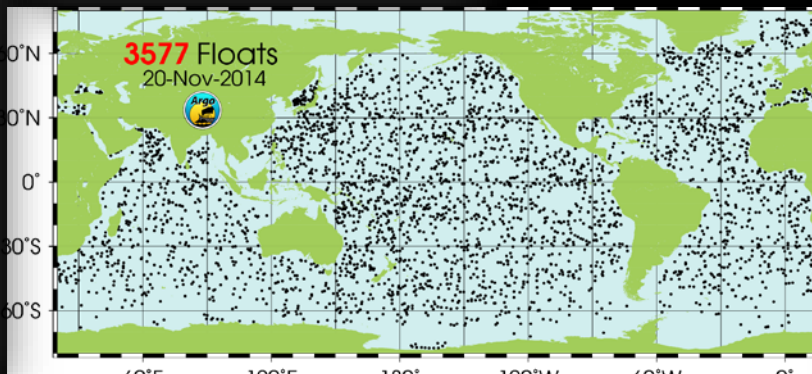
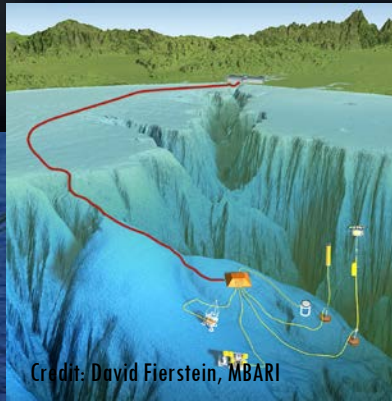
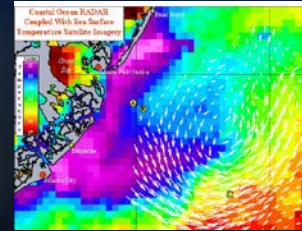
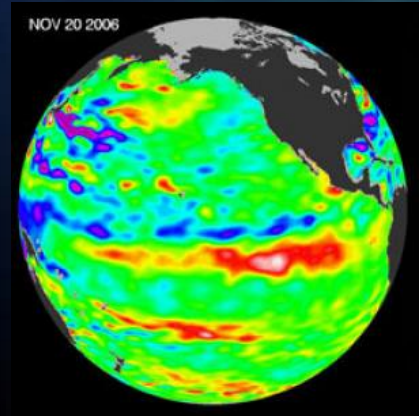
## OBSERVATIONS

## ASSESSMENT

## FORECAST & PRODUCTS



# Diverse maritime observing presence



# NOAA Research: Ocean Observing Mission Areas

## Climate and Ocean Measurements

- Air – sea interactions
- Physical oceanography

## Ocean Acidification

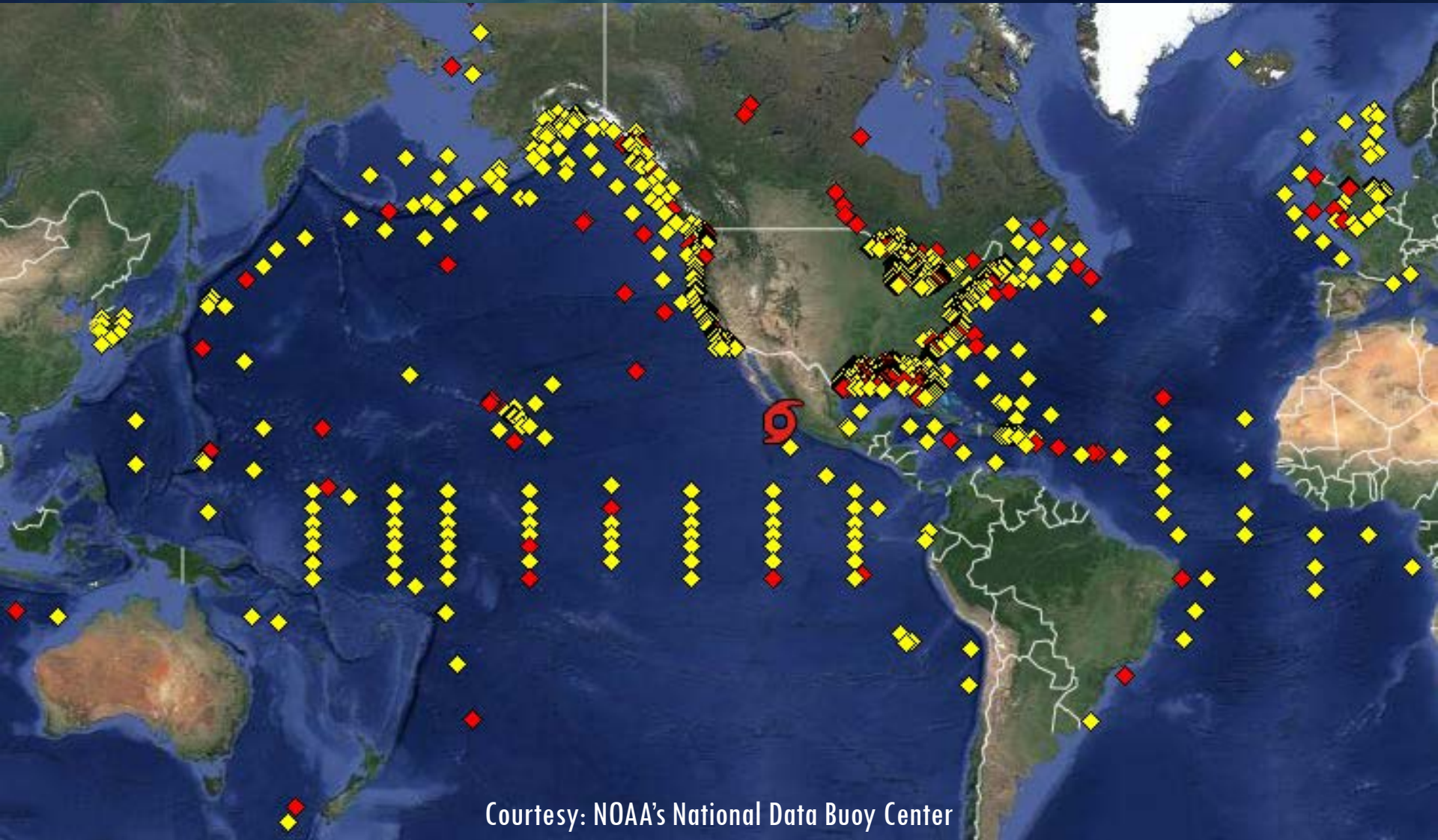
- Water column surveys
- Bio-geochemical assessment

## Ocean Exploration

- Bottom and benthic ecosystem Assessment
- Maritime archeology

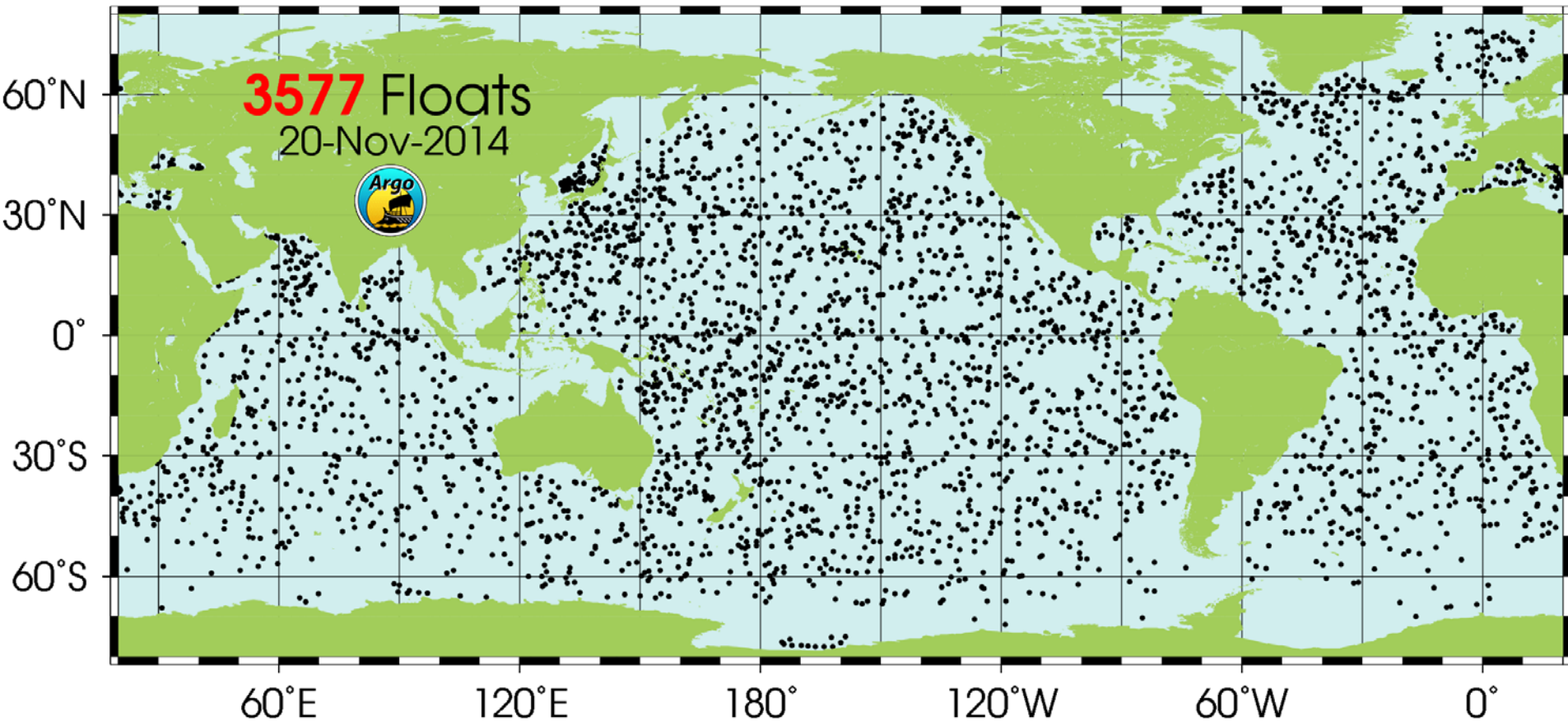


# Buoys



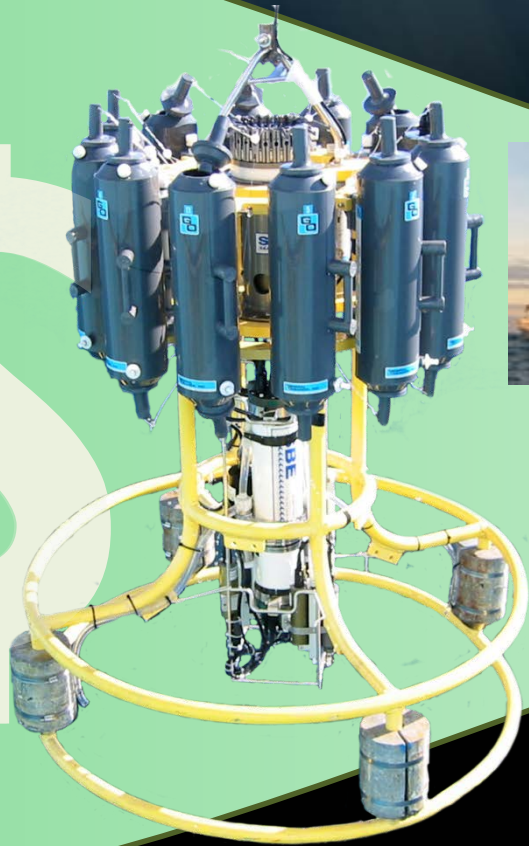
Courtesy: NOAA's National Data Buoy Center

# Argo Floats





# AUTONOMOUS PLATFORMS = FORCE MULTIPLIER



**CTD\***

\*requires



**ARGO**

\$

# Buoyancy Gliders

Widespread use within NOAA and with NOAA partners

- Between 2008 and 2013, IOOS partners flew 33,409 glider days



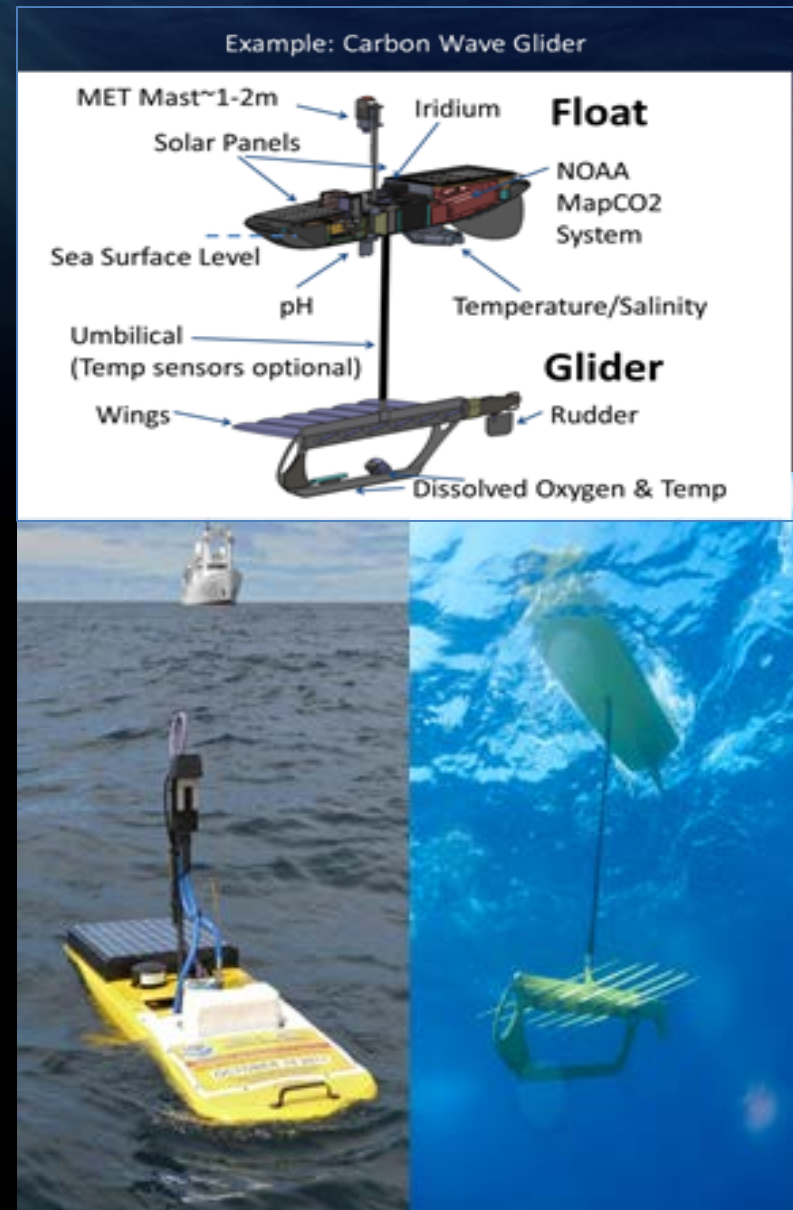
SOURCE: [www.ioos.noaa.gov/glider](http://www.ioos.noaa.gov/glider)





# Ocean Acidification

- Current methodology reliant on buoy and ship based observations
- Emerging requirement for large spatial and temporal coverage
- Systems must be robust and provide reliable data availability



# Benthic Ecosystem Assessment

Large AUV application for bottom characterization and living marine resource assessment

- Longer endurance
- Larger payload



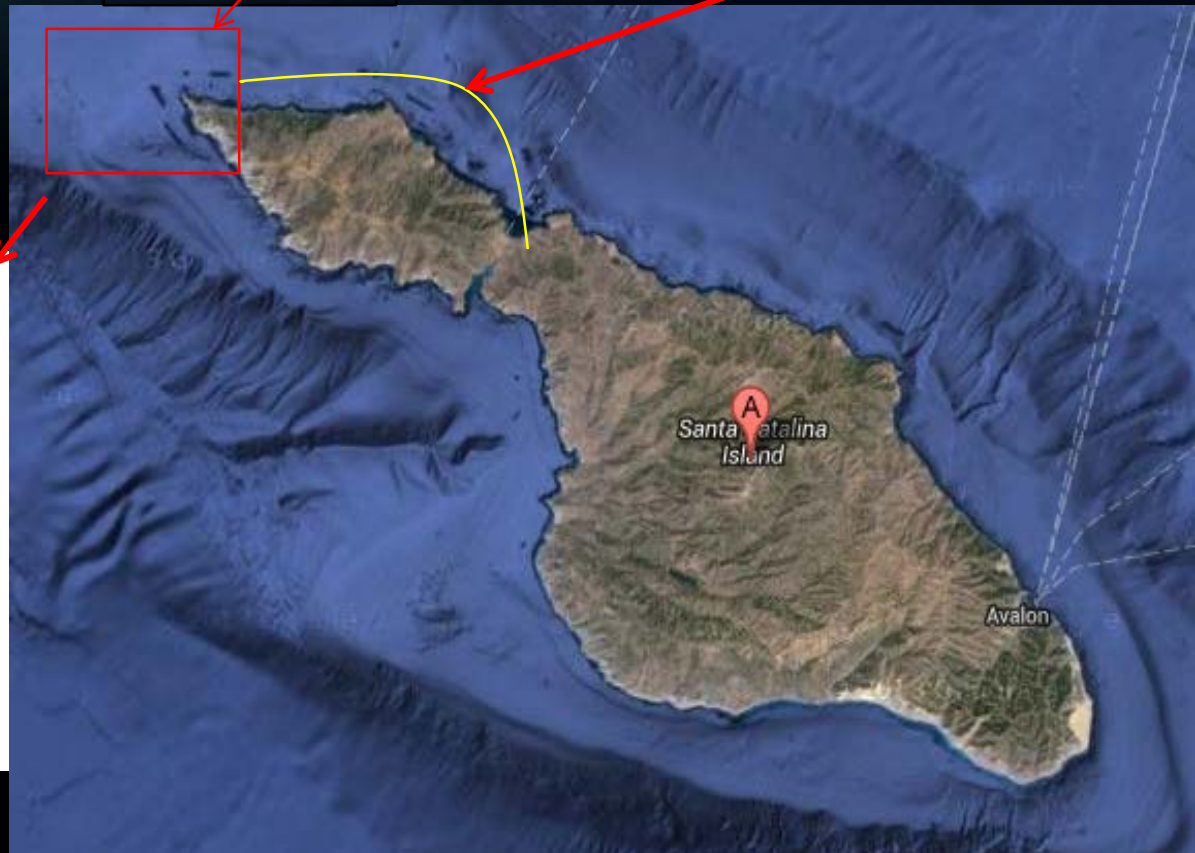
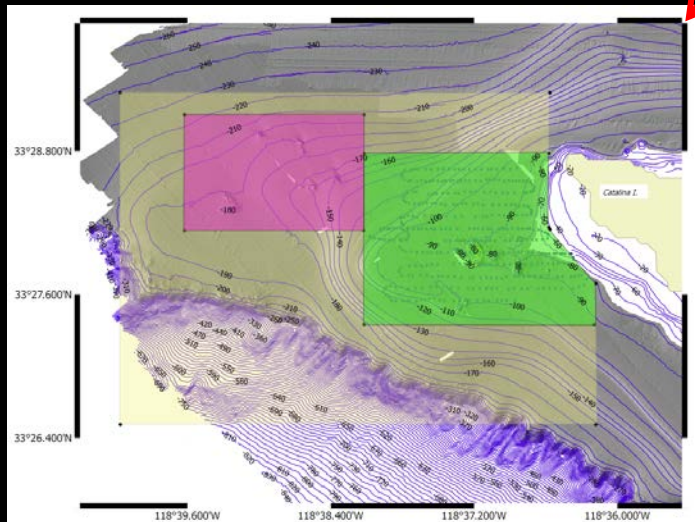


# Catalina Rock Fish Assessment

- **Demo Sensor:**
  - EK60 Echosounder
  - Stereo Camera package
  - CTD
- **AUV deployed from shore**

Rockfish  
assessment  
area

Echo Ranger Transit - ~6 mi



# Samples of Collected Assessment Data

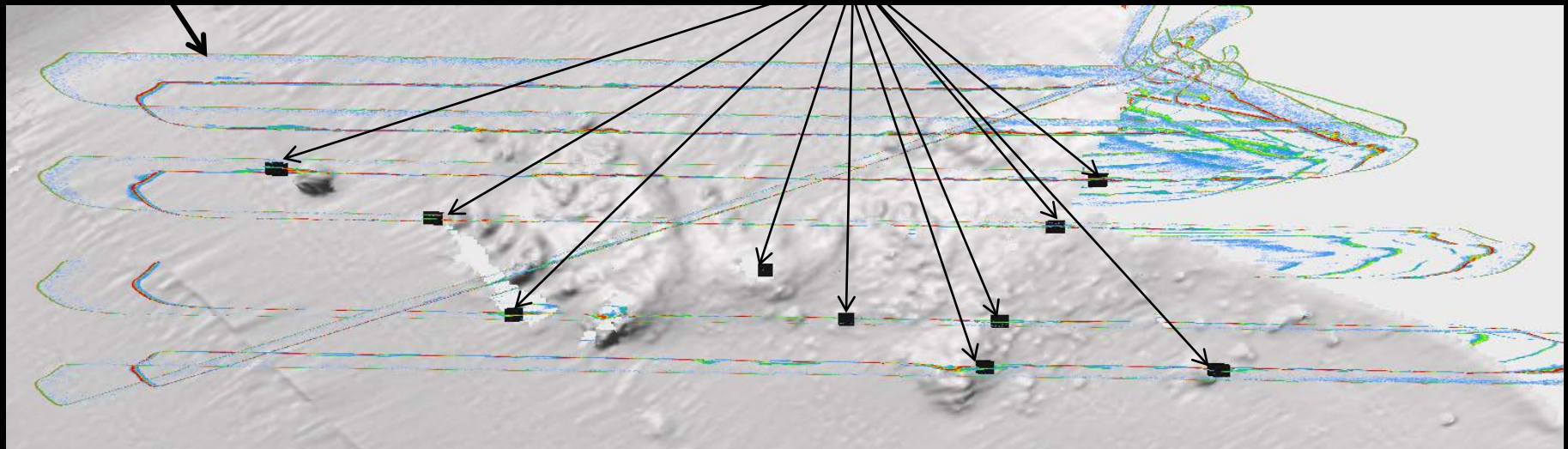
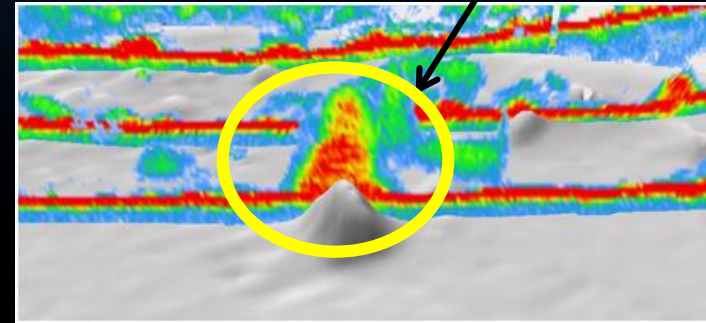
## Assessments completed

- Echo sounder survey - constant depth of 120 ft
- Echo sounder and camera survey - 60 ft altitude

Echo Ranger  
survey track

Rockfish  
aggregations

Rockfish  
aggregation



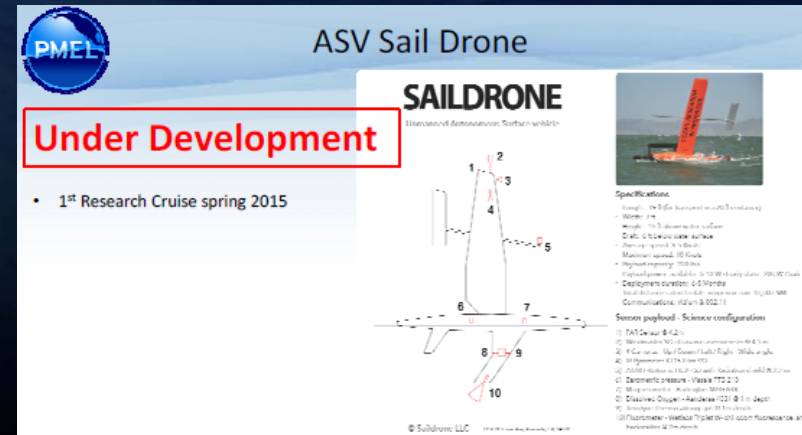


# Arctic Observations: New tools needed

## NOAA's Arctic Action

### Strategic goals:

- Forecast sea ice
- Improve weather and water forecasts and warnings
- Understand and detect Arctic climate and ecosystem changes
- Improve stewardship and management of Arctic ocean and coastal resources



**PMEL** ASV Sail Drone

**Under Development**

- 1<sup>st</sup> Research Cruise spring 2015

**SAILDRONE**  
Autonomous Atmospheric Surface Vehicle

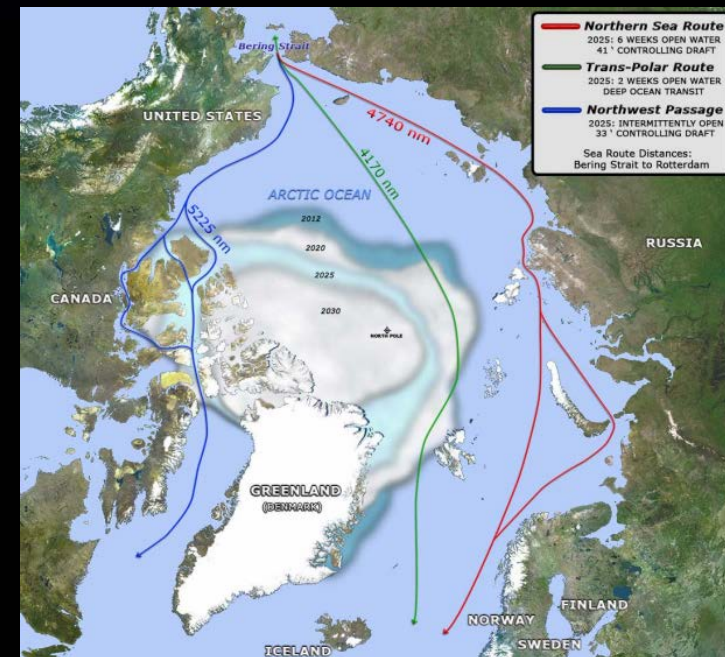
**Specifications**

- Weight: 100 lbs (45 kg)
- Wingspan: 10 ft (3 m)
- Cruise speed: 10 knots
- Maximum speed: 15 knots
- Deployment duration: 0-5 months
- Deployment location: 0-100°W, 0-100°N
- Communications: Iridium S-Band

**Science payload - Science configurations**

- 1) TMT Ocean B (2)
- 2) SeaWiFS (1)
- 3) SeaView (1)
- 4) SeaView (1)
- 5) SeaView (1)
- 6) SeaView (1)
- 7) SeaView (1)
- 8) SeaView (1)
- 9) SeaView (1)
- 10) SeaView (1)

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# Autonomous Technology Challenges

- Platform endurance (energy)
- Sensor accuracy, longevity and robustness
- Business case and concept of operations
- Implementing test beds for calibration between old and new methodologies
- Safety – regulatory compliance, COLREGS



# Opportunities

- Continued sensor and platform development
- Need for skilled operators and technicians
- Increased understanding of the ocean – through greater spatial and temporal measurements
- New ship designs
- Ocean basin infrastructure

# Vision: Integrated Observing





Questions?

Thank you.