

Unmanned Systems (UxS): Revolutionizing NOAA Missions

RDML Nancy Hann

NOAA Office of Marine and Aviation Operations

Deputy Director for Operations and the NOAA Corps

July 17, 2018





Purpose

To provide the SAB examples of how unmanned aerial and marine systems are being developed and applied to meet NOAA airborne and at-sea requirements

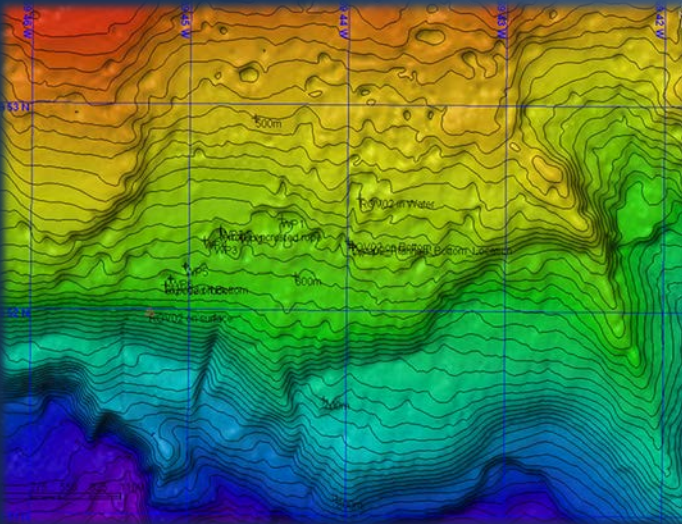


UxS Serving NOAA Missions



Fisheries:

- Acoustics
- Environmental sensors
- High-definition cameras



Hydrographic Survey:

- Multibeam sonars
- Backscatter
- Water column data



UxS Serving NOAA Missions



Weather and Climate:

- Environmental sensors
- Instrument deployment
- Lidar
- Doppler radar



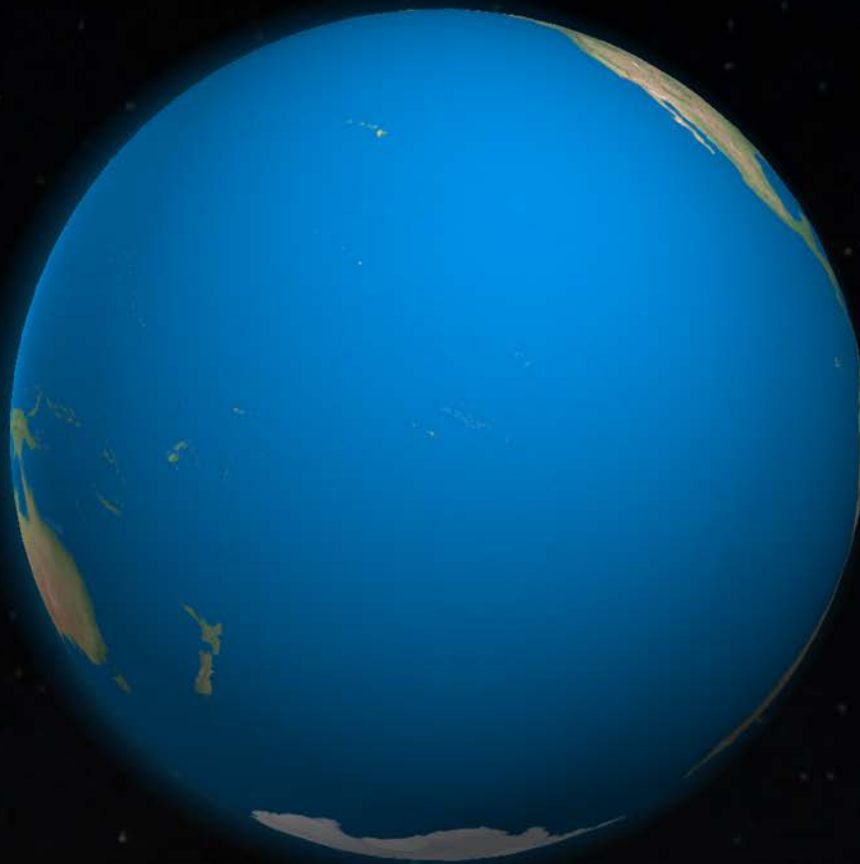
Ecosystem Assessment:

- Sonar systems
- Environmental sensors
- High-definition cameras
- Sampling



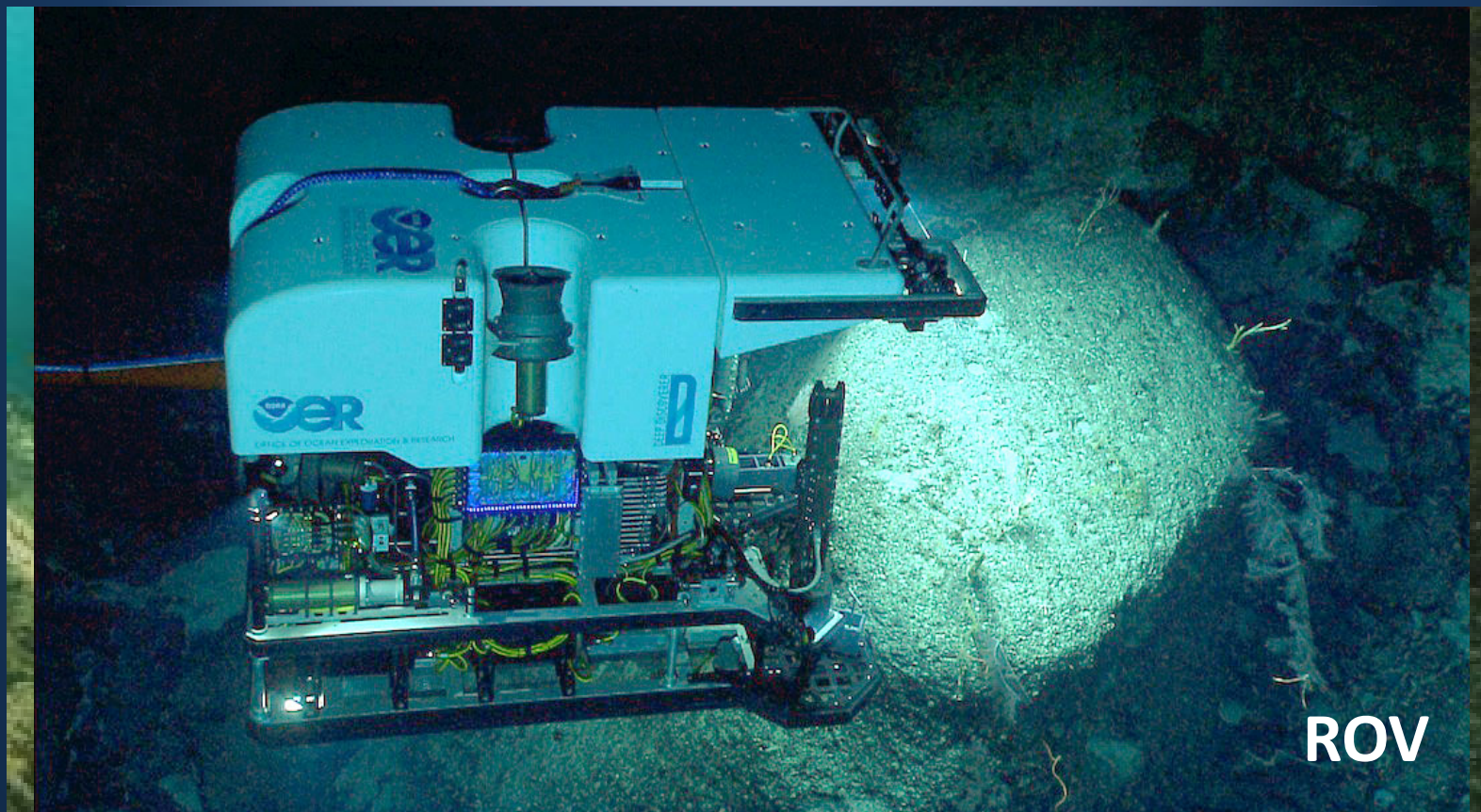
Why UxS?

- **Augmentation**
- **Long Duration**
- **Remote Locations**
- **Hostile Environments**
- **Enforcement**





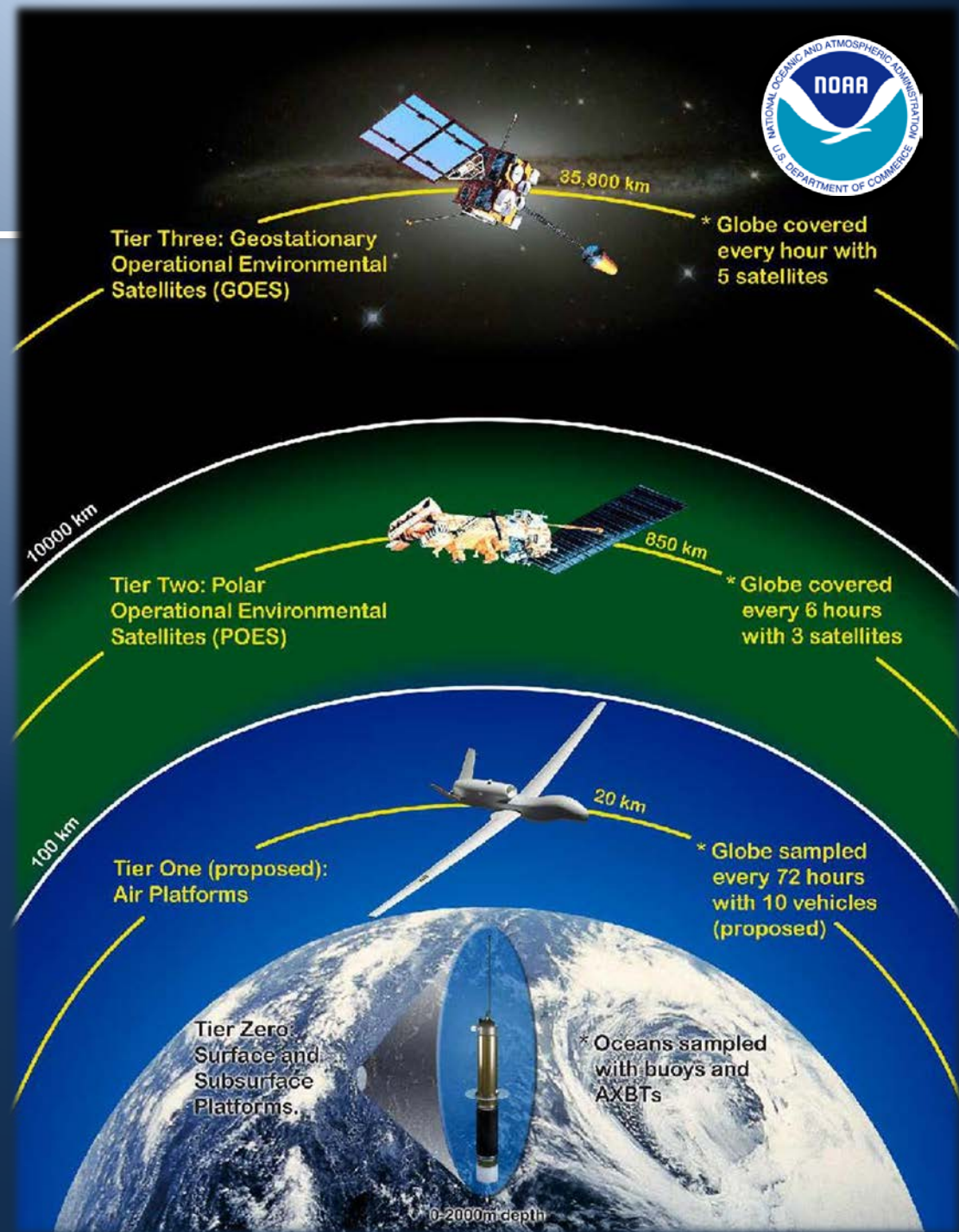
UxS Types Currently Used by NOAA



ROV



UAS: Unmanned Aerial Systems





High Altitude UAS

NASA Global Hawk UAS

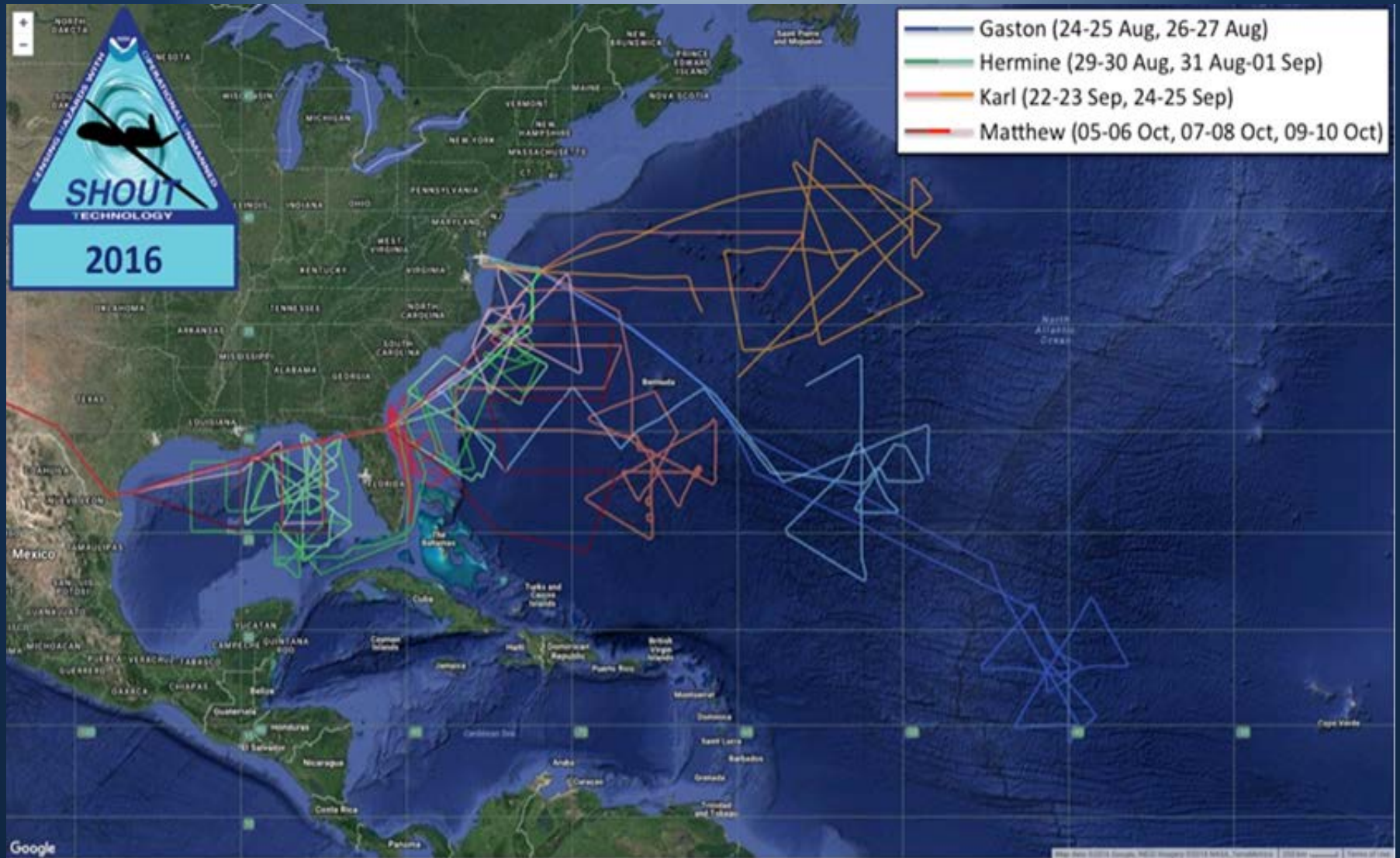


~ 55,000-63,000 ft.

~26 hr.

~11,000 nm

~1,500+ lbs.





Mid Altitude UAS

Boeing ScanEagle UAS

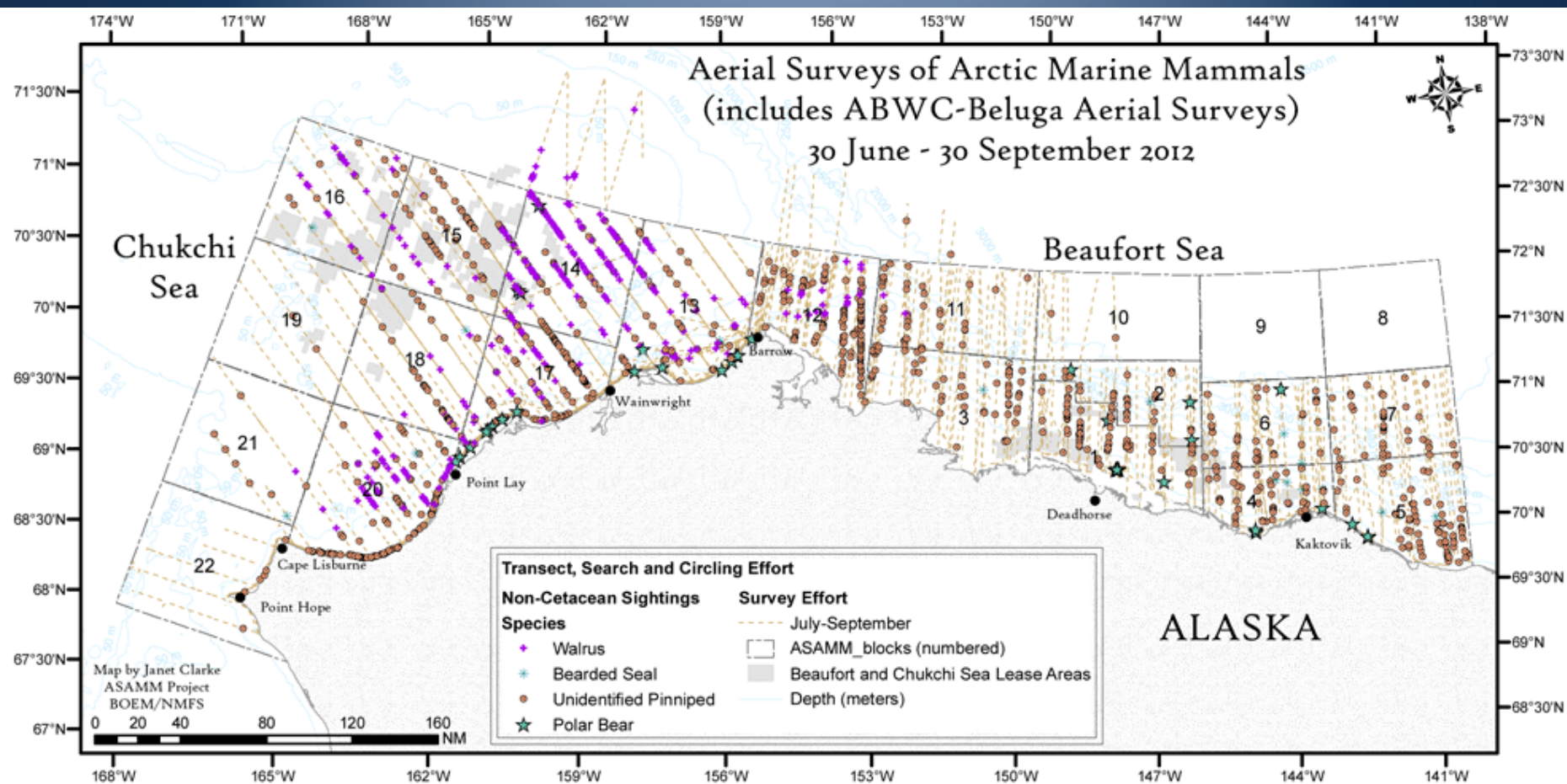


- Assess marine mammal population distribution and abundance (routinely used to estimate abundance of whales and seals)
- Investigate relationships between animals and their environment
- Monitor the effects of human activities on animals



Mid Altitude UAS

Marine Mammal Observation Area





Low Altitude UAS





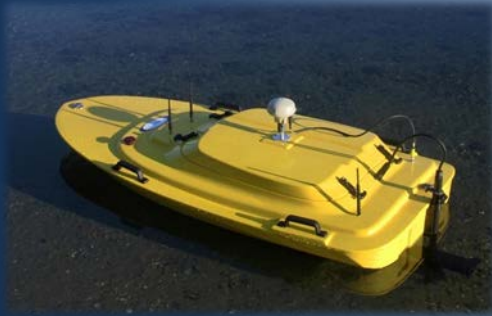
NOAA UAS Inventory

NOAA's UAS Inventory	
2016	2017
13 Models	22 Models
42 UAS	58 UAS

UAS Model		April 2016	July 2017
NWS	DJI Phantom ¹	7	7
	3DR Iris	1	1
	Skywalker X8	3	1
	DJI-s1000	1	2
	Skywisp		3
OAR	Easystar		2
	Raytheon Coyote	8	7
	Sensitel Manta ¹	1	1
	Penguin BE		1
	Altavian Nova ²		1
NMFS	DJI Phantom ¹	1	2
	DJI Inspire ¹	1	1
	APH-17	1	1
	APO-18	2	2
	APH-22	12	15
	APO-42		1
	DJI Matrice 201 RTK ²		2
	FireFly6 Pro ²		1
NOS	md4-1000	1	1
	Sensefly eBee RTK		1
	Sensefly eBee Plus		1
	DJI Phantom 2 ¹		1
OMAO	WMD-59 Quad	1	1
	AV Puma AE	2	2
Total UAS		42	58



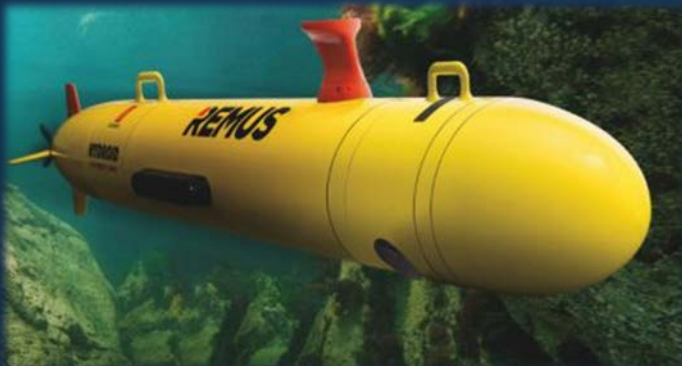
UMS: Unmanned Marine Systems



Surface Vehicles (USV)



Buoyancy Gliders



Underwater Vehicles (UUV)



USV – Hydrographic Survey



ASV Global C-Worker



Teledyne Zboat



USV: Unmanned Surface Vehicles

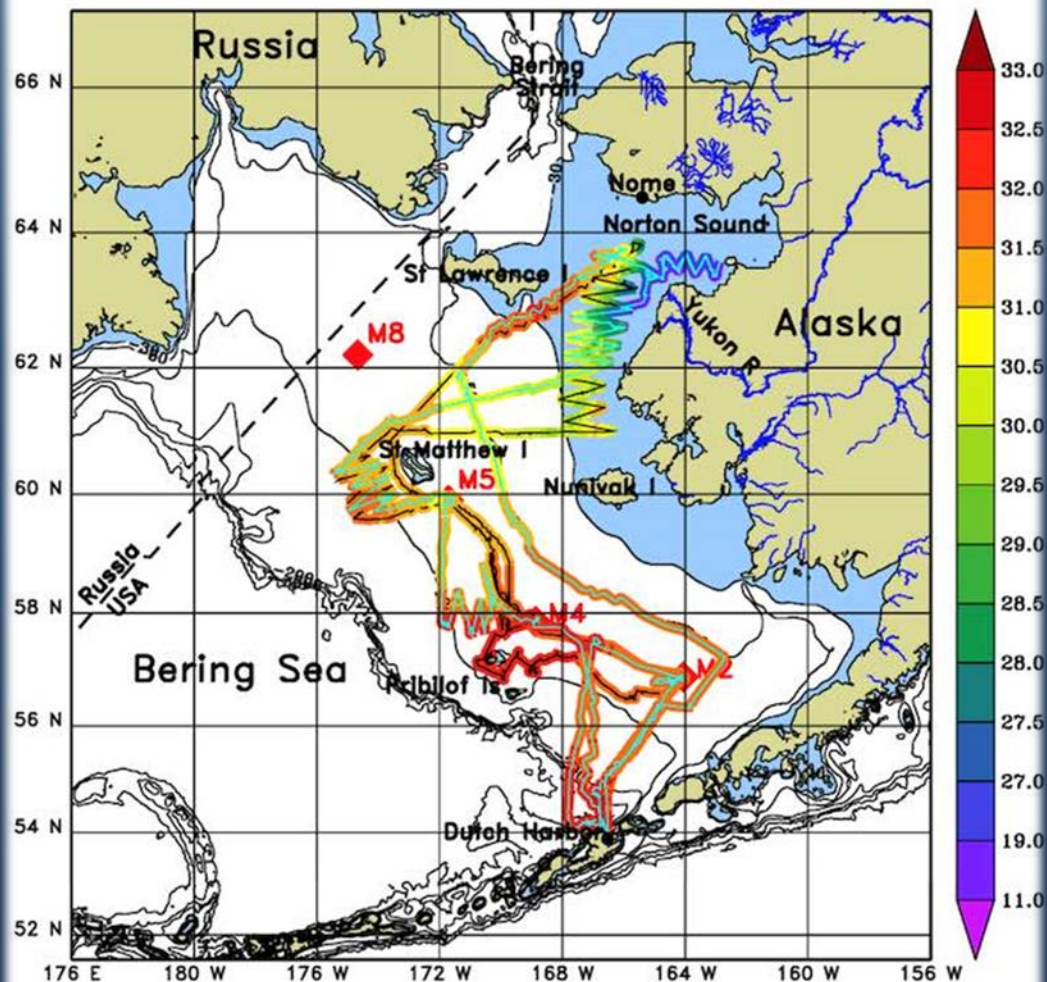
Research Applications





USV: Unmanned Surface Vehicles

Saildrone sd-126 (black) & sd-128 (cyan) Salinity
23-APR-2015 22:00:00 to 28-JUL-2015 18:00:00 UTC



Depths contoured at 30, 50, 100, 200, 500, 1000, 2000 m
NOAA/PMEL/EcoFOCI Mooring sites M2, M4, M5 & M8 shown

§ (PSS78)



USV: Buoyancy Glider

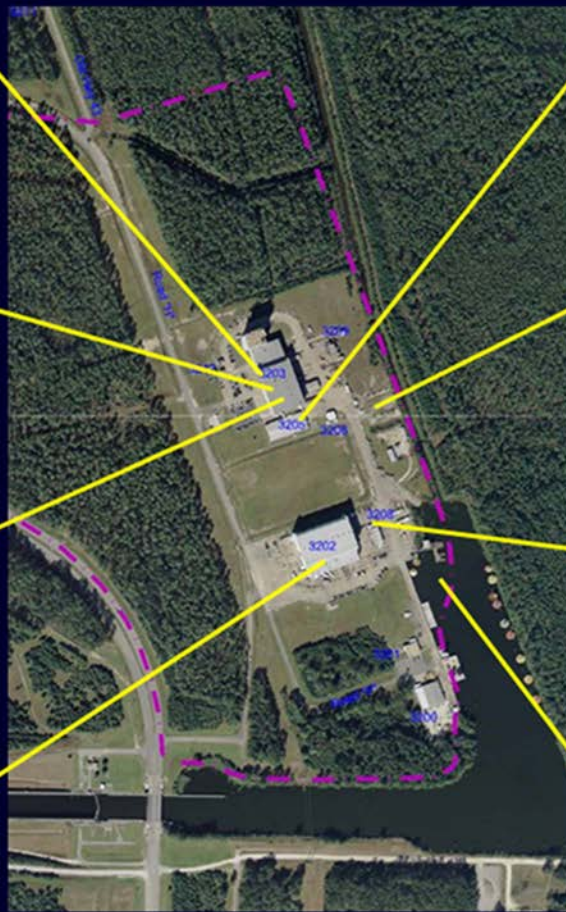
An ocean glider is autonomous: it travels through the ocean without human help.





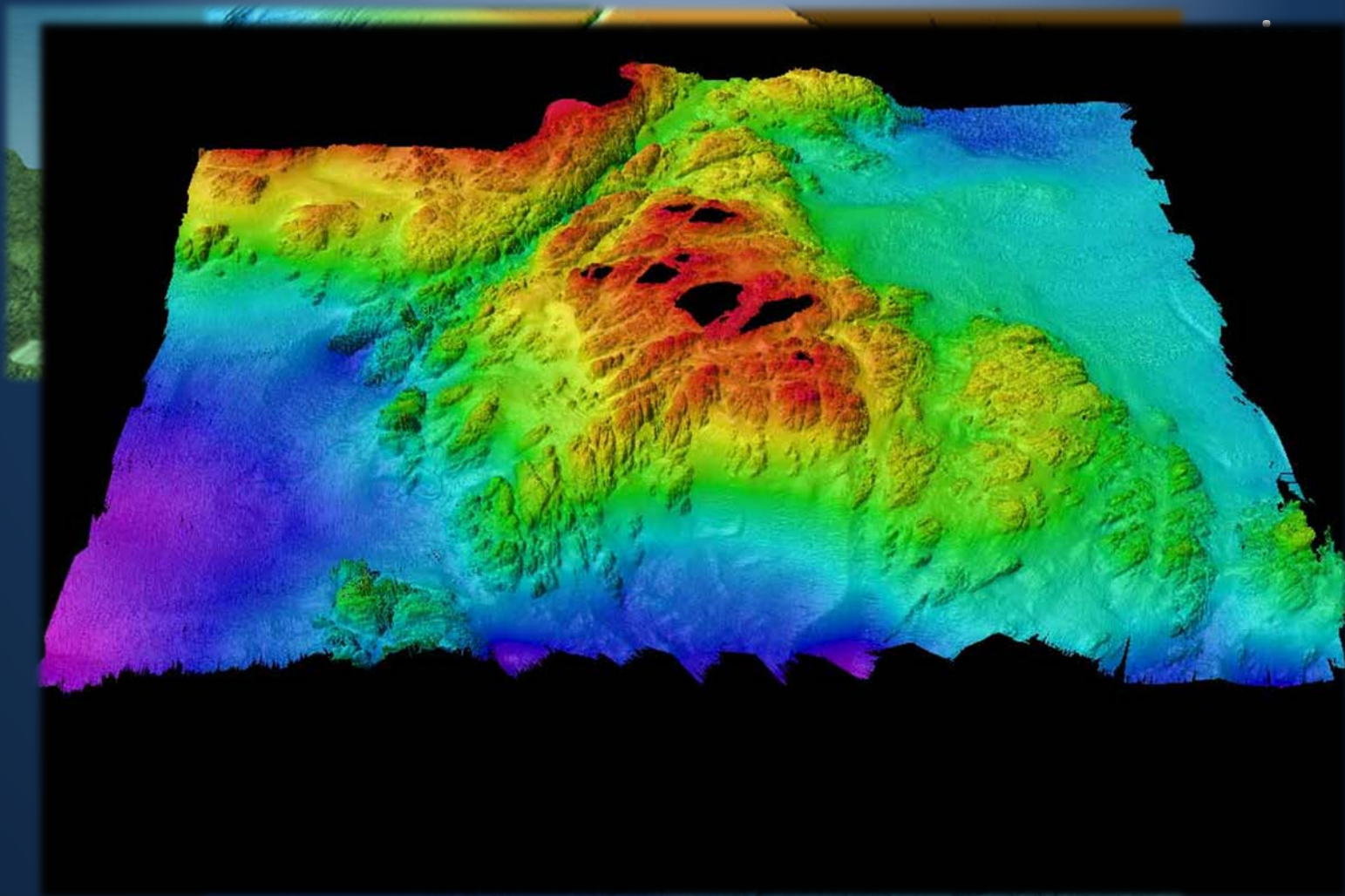
USV: Buoyancy Glider

National Data Buoy Center Facilities at SSC, MS





UUV: Unmanned Underwater Vehicle





	UMS Name	UMS Type	Number of Platforms Used as of FY16
NMFS	SeaBed	UUV	1
	Emily	USV	3
	Iver2	UUV	1
	Slocum Glider	Glider	4
	Saildrone	USV	1
NOS	Kongsberg-Hydroid Remus 100	UUV	1
	Kongsberg-Hydroid Remus 600	UUV	1
	ASV Global C-Worker 5	USV	1
	ASV Global C-Worker 4	USV	1
	Bluefin 12	UUV	1
	Slocum Glider	Glider	5
	Teledyne Z-boat	USV	2
	Gliders (variety)	Glider	39
OAR	Seaglider	Glider	4
	Wave Glider	Glider	2
	Slocum Glider	Glider	1
	Iver2	UUV	2
	Slocum Glider	Glider	2
	Oculus Underwater Glider	Glider	2
	Spray Underwater Glider	Glider	3
	Wave Glider	Glider	1
	Saildrone	USV	5
	Sentry	UUV	1
	Spray Gliders	Glider	12
	Spray Gliders	Glider	2
	Emily	USV	10
	Liquid Robotics	Glider	1
	Athena-Nike vessel	USV	1
Total			110



UUV: Unmanned Underwater Vehicle

Unique Applications – Hybrid ROV/UUV





ROV: Remotely Operated Vehicle

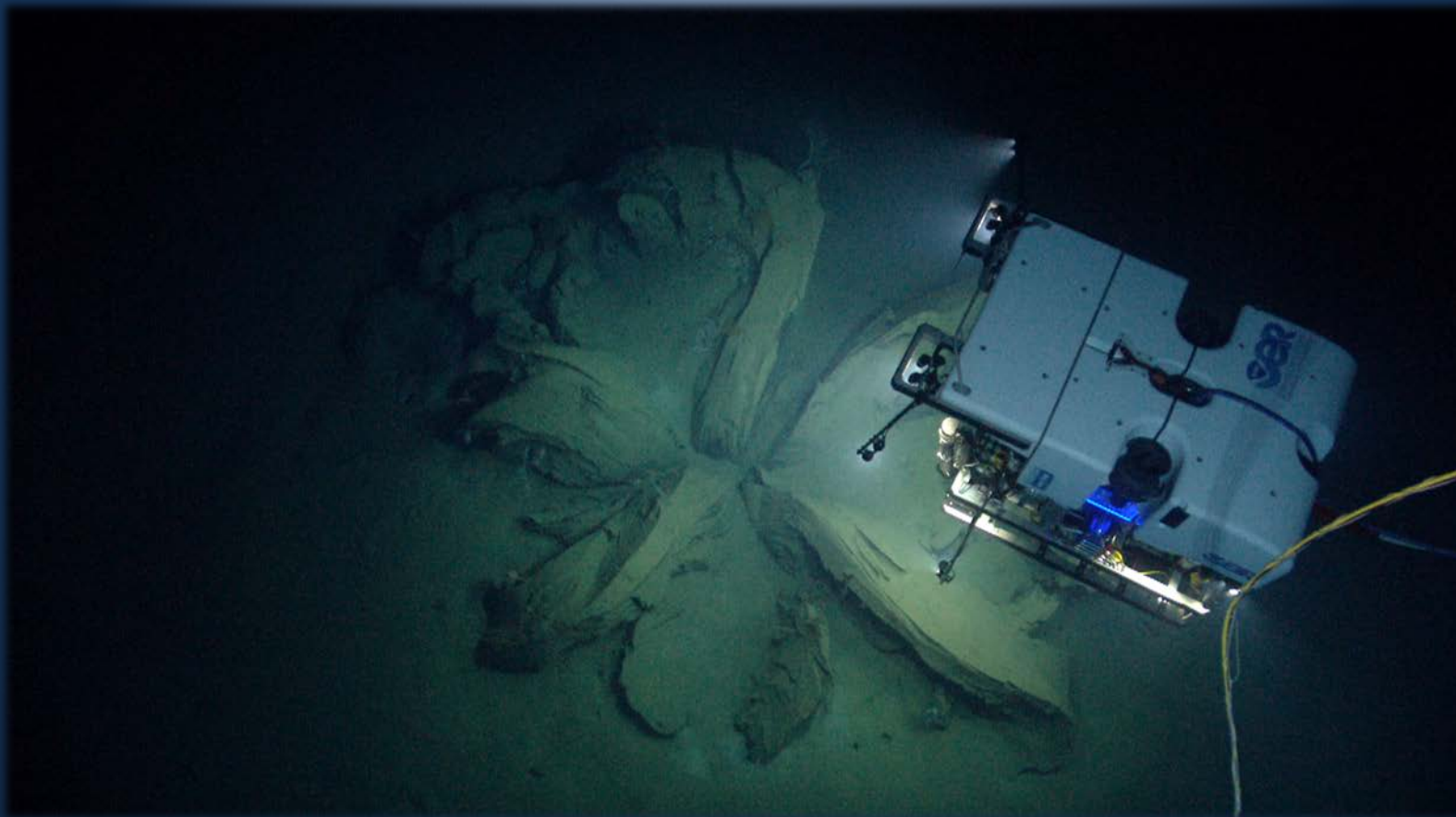
Comprehensive Characterization

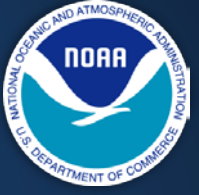




ROV: Remotely Operated Vehicle

Adapt to Observations





Key Considerations

Unmanned Systems

- provide new capabilities or mission profiles
- require the development of new enabling technologies
- require skilled personnel to operate and maintain
- require unique infrastructure
- require supervision
- are part of a broad network of platforms



NOAA Management Framework

UxS Executive Oversight Board

- Implement NOAA UxS Roadmap
- Priority setting
- Enhance collaboration & resource sharing
- R2O
- Governance & policy development
- Initial focus on UAS
- Initiating action on UMS

The Board reports to the NOAA Fleet Council



NOAA UxS Partners

- Other Federal Agencies
- State and Regional Government Institutions
- Academia
- Industry
- Non-Profit Organizations

The UxS Landscape is Evolving. . .



. . .Rapidly