

NOAA UAS Program

National Marine Sanctuaries UAS Applications

NOAA's Office of National Marine Sanctuaries serves as the trustee for a network of underwater parks encompassing more than 600,000 square miles of marine and Great Lakes waters.



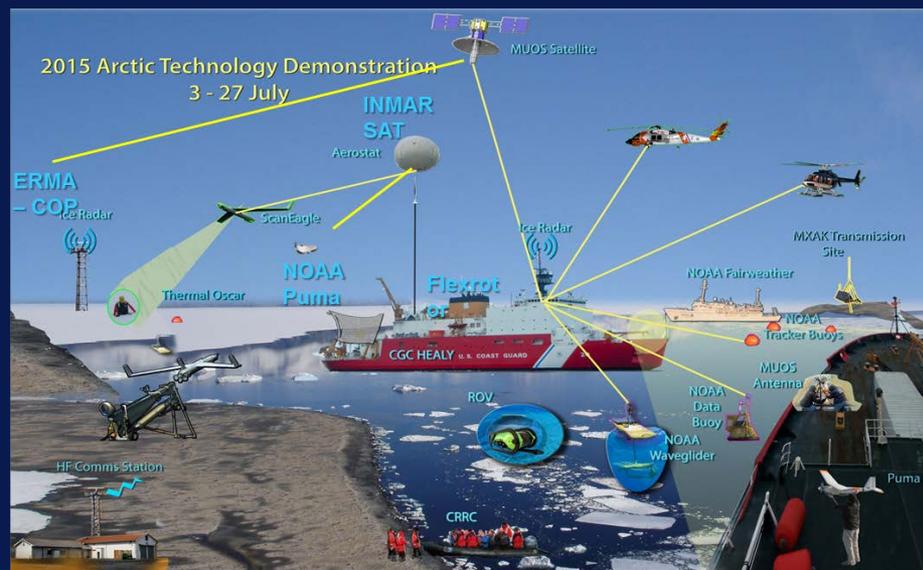
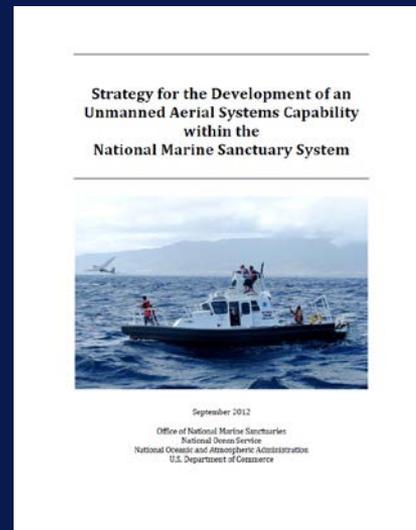
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NOAA – Office on National Marine Sanctuaries

Operational Goals & Science Objectives

Implement ONMS UAS Strategy & Support NOAA's Missions with Inter-Agency Partners

- ❖ Science – Habitat & Living Marine Resources
- ❖ Marine Monitoring
- ❖ Emergency Response
- ❖ Enforcement
- ❖ Multi-Agency Arctic/Antarctic Operations
- ❖ Multi-Platform Assessment

- ✓ Aerosonde (2005 – 2007)
- ✓ Silver Fox and Manta (2005 – 2012)
- ✓ ScanEagle (2007, 2009 and 2016)
- ✓ Multi-copters (2010 - present)
- ✓ Puma (2008 - present)



Approach: Operational Testing & Assessments

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Requirement	Definition	Puma
Targeting Data	Streaming video	
Science Data	Geo referenced HD (25 MP) still, Lidar and hyperspectral images	i45
Launch and Recovery	Launch/recovery from both a ship and shore	
Altitude	30m to 150m as required for sensor resolution	
Geographic Locations for Near-shore	Pearl and Hermes atoll, French Frigate Shoals, Laysan, and Lisianski in NWHI; windward shores of main HI islands plus southern tip of the Island of Hawaii. Kayak Island, outer shore in Kenai Fjords area and Priblof Islands in Alaska and the Olympic (outer) Coast of Washington State. Arctic.	Ship
Geographic Locations for at-sea	Subtropical Convergence Zone (STCZ) 30-35N, 150-180W, Arctic	Ship
Coverage	Near-shore area of 1165 km ² (340 nm ²); At-sea area of 10,000 km ² (2915 nm ²).	Ship
Resolution	1 meter or better (1.4 - 5 cm)	i45
Temporal Sampling	Near-shore and at-sea once or twice (10) per year plus as needed during cleanups.	Ship
Seasonal Window	Late winter and early spring in subtropical convergence zone; early spring through summer in Arctic, Alaska and Washington State.	
Data Access Time	Streaming video in realtime; still and IR images for post flight analysis.	

Requirements Study and Analysis of Alternatives informed Platform, Sensor and Application Decisions

Accomplishments: Operational Assessments & Transition

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Requirement	Assessment Location	PUMA	VTOL
Marine Monitoring	Several Assessments including Atlantic, Pacific, Gulf, Arctic	2011-17	
Coastal Monitoring	Several Assessments including Atlantic, Pacific, Gulf, Arctic	2011-17	
OLE	Several Assessments including Atlantic, Pacific, Gulf, Arctic	Policy	
Oil at Sea	Several Assessments including California, Arctic (Real Oil)	2011-16	
Oil on Shore (SCAT)	Several Assessments including California, Arctic (Real Oil)	2011-16	
Marine Debris Sea	Several Assessments including Hawaii, Olympic Coast, Arctic	2011-16	
Marine Debris Shore	Several Assessments including Hawaii, Olympic Coast, Arctic	2011-16	
HI Monk Seals	NWHI	2014-15	
Turtles	NWHI GRNMS	2014-15	
Cetaceans	CINMS/NWHI	2012/14-15	
Menhaden	GRNMS	2013-16	
Sea Birds	Acceptable for cueing	2011-15	
MIZOPEX	Marginal Ice Zone	2013-16	
MDA/AIS	Sat data is available (Tested on other platforms)		
ERMA	Real Oil Spill / End-to-End test in Arctic & Antarctic	2013-15	
ACE	Coordinated through ERMA	2013-15	

Observation Strategy Advancements were made with Inter-Agency & Industry Partners

Puma-AE Milestones

Maritime & Polar Strategy



Envelope &
Weather
Expansion



Sensor Upgrades
& Test



Ship Recovery
System Upgrade
& Test



Equipment
upgraded & Test
(Arctic)

Mission Concept Review (Super Gimbal test in NWHI)

USGC, NOAA, NAVAIR Coordination

AeroVironment Briefing & Shearwater Testing (Net Capture & Antenna)

Puma System Upgrade & Testing

Polar Star Fit-Check and FAM

Rapid Proto-Typing & Deployment
Maritime, Arctic & Antarctic
Readiness Levels 5>8

Polar Star Deplo

Deep Freeze Deployment
(NSF Coordination)

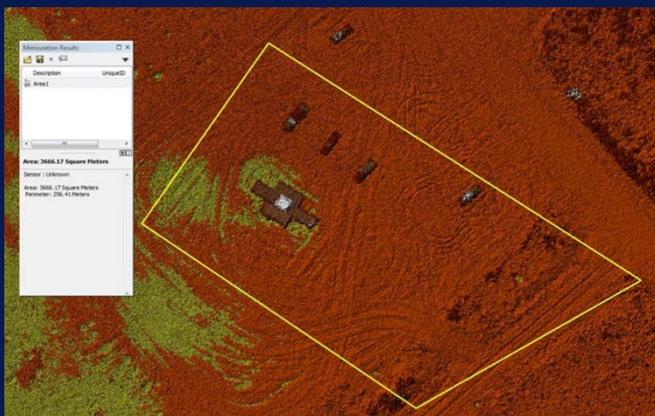
R&D, T&E, Spiral Development, Operational Assessments

12/30/15- 02/24/16

- ✓ Due Regard Operations
- ✓ Beyond Line-of-Sight (5 NM)
- ✓ Puma Envelope Expansion
- ✓ Weather Criteria Expansion
- ✓ Ship Recovery System
 - ✓ Net Capture Recoveries tested by NOAA (3/15)
 - ✓ Net Capture System (Final Clearance 7/15)
- ✓ 24MP Nadir Camera (Tested 1/15)
- ✓ 14MP Camera/Lidar (Tested 1/15)
- ✓ Super HD Gimbal AE (Q3CY15)
- ✓ Transition Planning
- ✓ Training & Operating Manuals
- ✓ Maintenance Plan & Manuals
- ✓ Sparing and Support
- ✓ Data Management Plan
- ✓ Net-Capture & Antenna Upgrades/Testing
- ✓ Polar Star Cruise
 - ✓ Net-Capture
 - ✓ Extended Range
 - ✓ Advanced Payload (Ground, Land & Shipboard)

Transition: Research > Development > Transition (RL Movement)

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Requirements Capture moves the readiness levels towards an operational capability
Enforcement, Marine & Shore Monitoring (Including Arctic), Advanced Payloads – RL 8

Additional Partnerships (who have shared in our successes)

In close cooperation with the NOAA Line Offices, Government, Industry & Academia



*Joint Operations have increased Maritime Services Interoperability
Puma-AE owned and operated by every maritime service – Readiness Level 9*

Science & Technical Challenges and Solutions

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- ❖ Operating sUAS BVLOS – due regard operations.
- ❖ Spontaneity of UxS Operations - platforms / operators need to be at operational sights used to respond to emergencies and events in real time.
- ❖ Remote and/or hazardous operations ideal for UxS data gathering
- ❖ More equipment is coming to market. Batteries and payloads are getting better (longer range/duration flights) and higher resolution imagery.
- ❖ Manned – Unmanned Systems Teaming (MUM-T)
- ❖ VTOL that is designed to operate from boats and water landings.



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Future Direction & Operations

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- ❖ Regular Sanctuary Operations for Marine Monitoring & Emergency Response
- ❖ Inter-Agency Support for Marine Domain Awareness
- ❖ Arctic Shield 2017 & 18
- ❖ Test Bed - Continued unmanned systems advancements for Research, Development & Transition



Deployment of UAS Assets to the Office of National Marine Sanctuaries Enforcement, Marine & Shore Monitoring (Including Arctic), Advanced Payloads – RL 9