

NOAA's Underwater UXO Demonstration Projects Vieques Island, Puerto Rico

Vieques Restoration Advisory Board Meeting
May 7, 2008

Jason Rolfe
NOAA's Office of Response & Restoration

NOAA's Underwater UXO Demonstration Projects

November 2006 & June 2007

- Joint projects with NOAA, University of New Hampshire and Navy; conducted November 2006 & June 2007
- Demonstrated effectiveness of side scan and multi-beam sonar, magnetometer, autonomous vehicles, video imaging, and SCUBA divers in locating ordnance and related debris
- Bahiá Salina del Sur project conducted aboard a 30' NOAA Navigation Response boat
- Bahiá Icacos projects conducted using Autonomous Underwater Vehicle (AUV)
- Remotely Operated Vehicle (ROV) and divers used to confirm suspected targets



Remotely Operated Vehicle



Autonomous Underwater Vehicle



NOAA's Navigation Response Boat

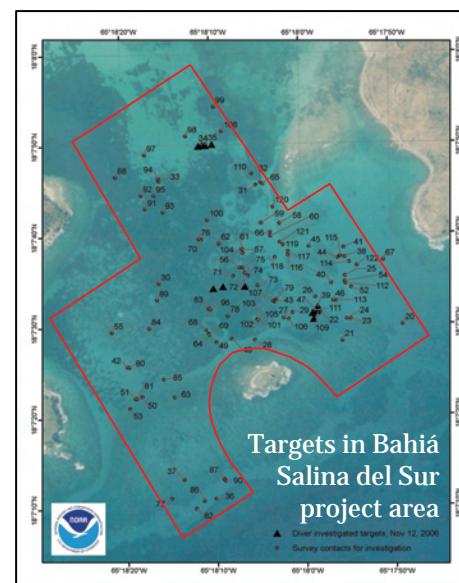
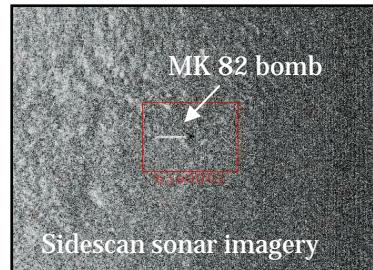
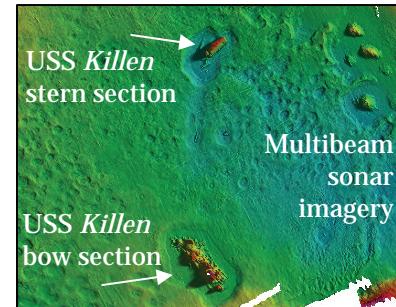
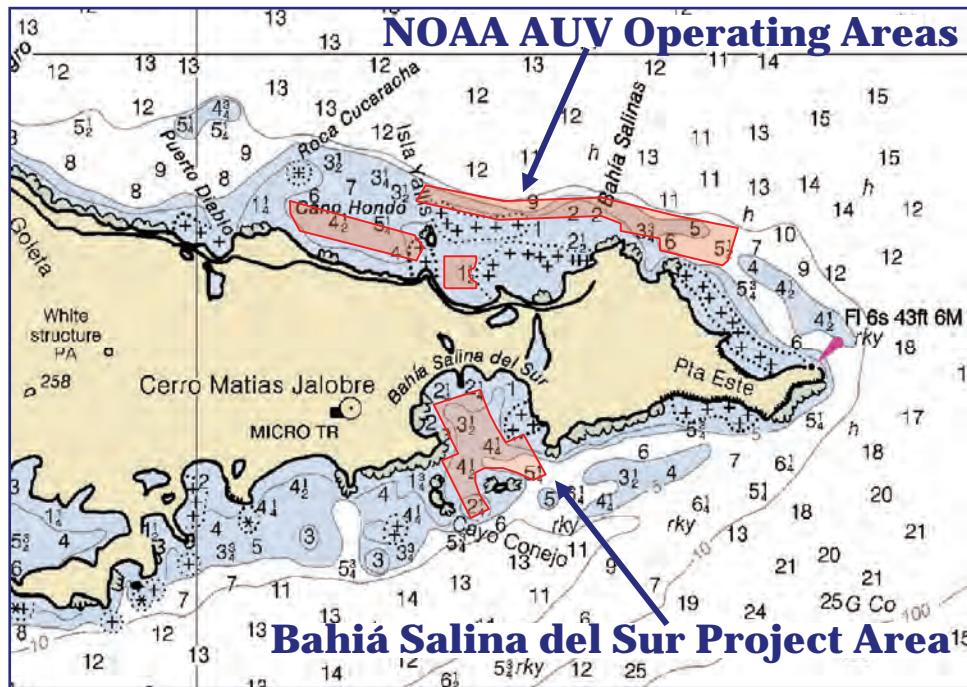


Ordnance in Bahiá Salina del Sur



Bahiá Salina del Sur Project Area

November 2006



Autonomous Underwater Vehicle Projects

November 2006 & June 2007

Objectives:

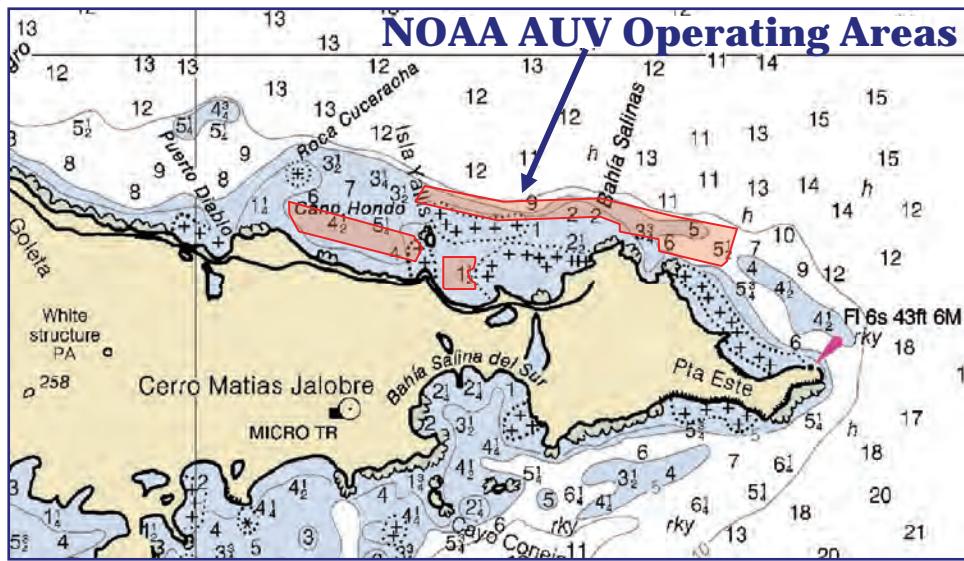
- Demonstrate feasibility of using an Autonomous Underwater Vehicle (AUV) to detect UXO;
- Compare AUV based sonar to ship based sonar in small object detection; and
- Provide near-real time data products to a wide audience base.



NOAA AUV

NOAA AUV

- Hydroid REMUS 100
- Programmed on shore to follow a predetermined course and launched from beach or boat
- Data collection through 300 kHz side scan sonar onboard AUV
- GPS aided Inertial Navigation System
- No operators required while vehicle is collecting data

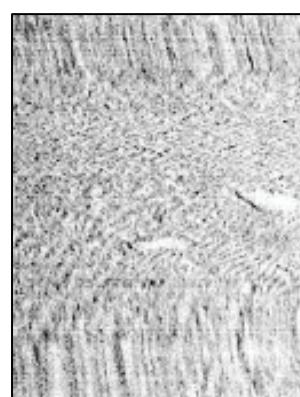


NOAA AUV Operators

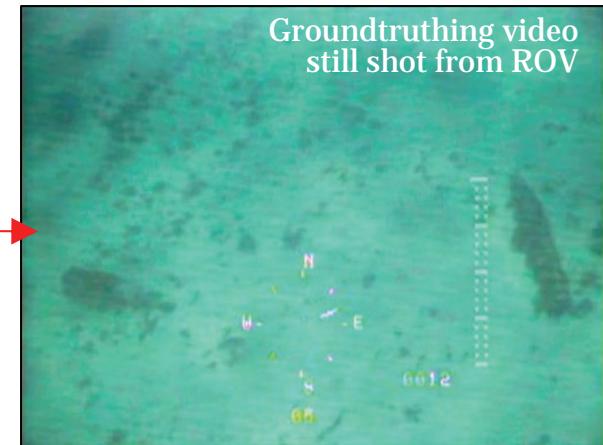


Autonomous Underwater Vehicle Projects

November 2006 & June 2007



AUV sonar imagery
and suspected UXO



NOAA Remotely Operated Vehicle (ROV)

- Teledyne Benthos Stingray ROV
- ROV controlled by NOAA operator from contract boat
- Live video feed to view and groundtruth items detected by AUV sonar



Results and Deliverables

Results:

- Munitions and munitions debris appear in bathymetry as depth anomalies. These targets were often surrounded by a grazing halo. Grazing halos are a good proxy for detecting UXO using bathymetry data
- Sidescan sonar provides high resolution image enabling detection of more targets. The distinguishing feature for most munitions identified is a sharp edge with a well defined shadow
- Due to omni-directional nature of magnetometer and strong background signal, only very large targets such as USS *Killen* debris could easily be identified
- ROV and divers provided human eyes and experience to distinguish UXO from coral outcroppings

Deliverables:

- Bathymetry and sonar maps
- Diver/ROV groundtruthing still and video images
- Geographic Information System (GIS) documentation of all underwater anomalies
- Recommendations for future surveys using vessel, sonar and video technologies
- Data analysis compilation



Project Challenges and Recommendations

Project Challenges

- Diver and ROV ground truth data difficult to correlate directly with sonar due to differences in underwater positioning technology
- One direction magnetometer data prevented small object detection due to height off bottom and strong magnetic signature of local geology
- Some munitions are located in very shallow areas difficult to access using surface vessels
- Some munitions present in the area are of a dimension smaller than the resolution of the sonar systems used
- ROV operations limited by weather, sea state, currents, and other vessels
- Many of the munitions in the area were encrusted by corals, making it hard to distinguish them from naturally occurring features

Recommendations:

- Use appropriate underwater positioning system on divers or ROVs
- Perform a gradiometer survey of the area to correlate with sonar records
- Test Unmanned Surface Vehicle for sonar and video imagery in shallow water; consider airborne LIDAR
- Video camera integrated into AUV eliminates need for ROV and provides precisely positioned video
- Eliminate ROV from operations to reduce team and equipment and use AUV with video and sonar
- AUV efficiency allows more time for divers to distinguish coral from UXO





For more information, please contact:

*Jason Rolfe, Vieques Program Coordinator
National Oceanic and Atmospheric Administration
Office of Response and Restoration
301-713-4248 x111
jason.rolfe@noaa.gov*

Or Visit NOAA's Office of Response and Restoration at:

<http://response.restoration.noaa.gov>

