Vieques Underwater Demonstration Project

NOAA Office *of* Response and Restoration
National Ocean Service
2006-2007

University of New Hampshire Joint Hydrographic Center
2006

Science Application International Corporation
2006-07

for
Naval Facilities Engineering Command Atlantic
Vieques Munitions Response Program

February 7, 2008

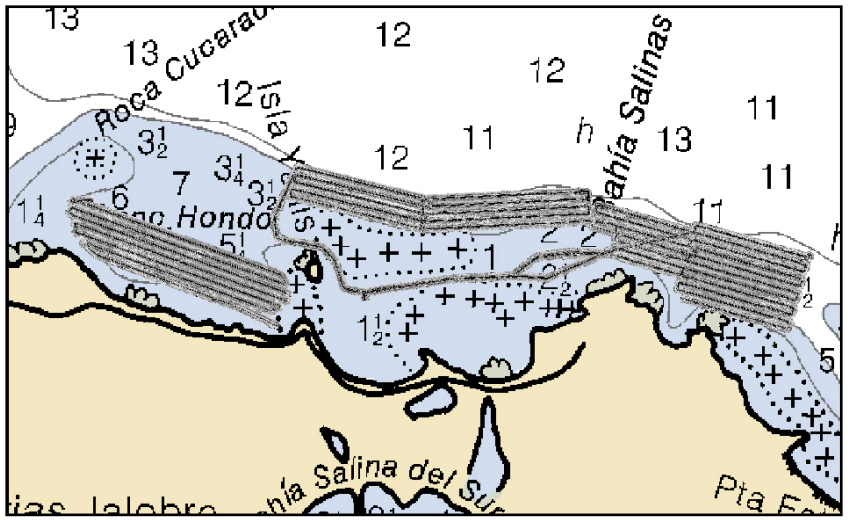
Vieques Underwater Demonstration Project Sites

Bahia Icacos

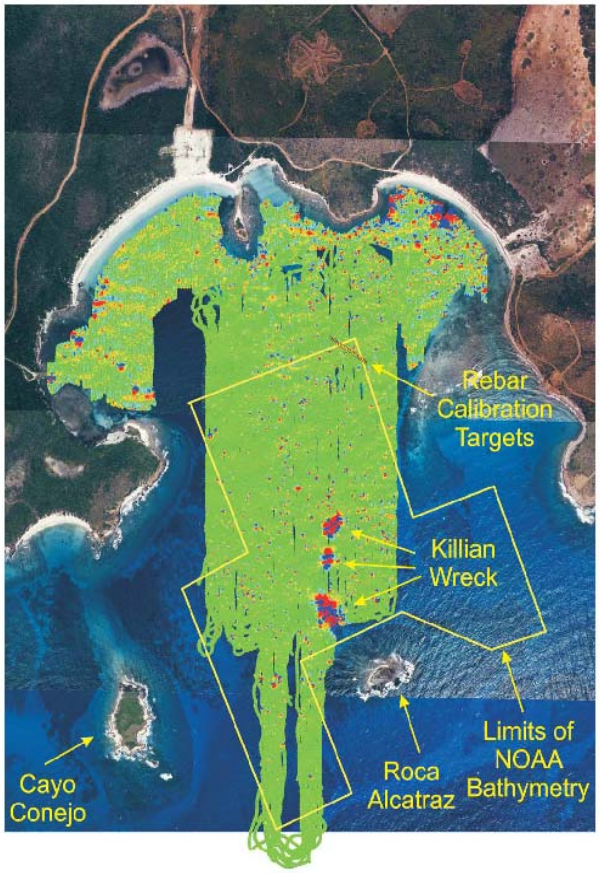
Bahia Salinas del Sur

Live Impact Area

Vieques Underwater Demonstration Project Sites



NOAA AUV Survey Site in Bahia Icacos and Bahia Salinas del Sur



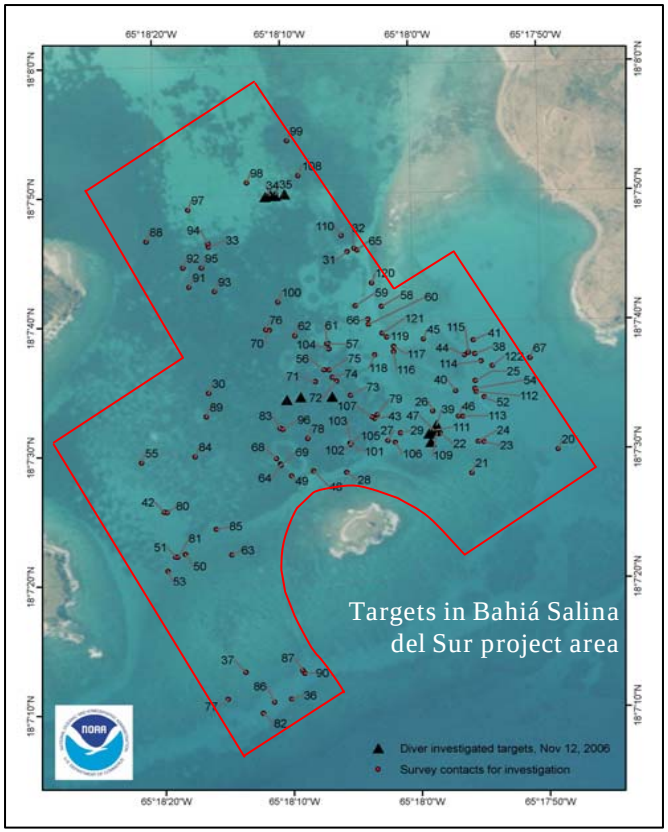
NOAA and SAIC Boat sonar survey site in Bahia Salinas del Sur

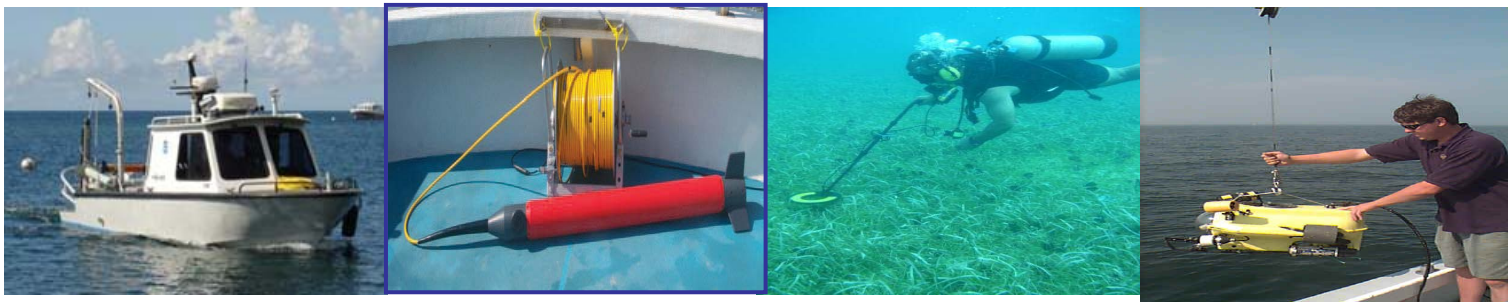
NOAA Survey

- **Funded by Congressional Funding. No NAVY funding involved**
- **Study conducted by NOAA Office of Response and Restoration in 2006-2007**
- **Conducted in conjunction with University of New Hampshire**
- **R&D objective to determine capability of detection technology for application to underwater UXO mapping**
- **Use of NOAA National Ocean Service ocean mapping technology to demonstrate feasibility to detect UXO.**
- **Use of small boat with towed sonar and magnetometer in Bahia Salinas del Sur in November 2006**
- **Use of Autonomous Underwater Vehicle (AUV) in Bahia Icacos (Nov 2006) and Bahia Salinas del Sur (June 2007) with side scan sonar**

NOAA Survey Tools

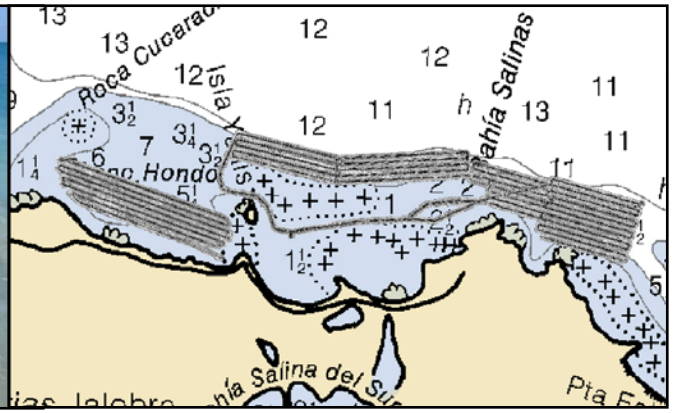
- A 27-foot NOAA Navigational Response Team (NRT) vessel
- Equipped with towed sonar and magnetometer
- Use of a remotely-operated vehicle (ROV) for real-time video target confirmation
- Demonstrated effectiveness of side scan and multi-beam sonar, magnetometer, video, and SCUBA divers in locating ordnance and related debris
- No UXO contact allowed
- Survey conducted in Bahia Salinas del Sur





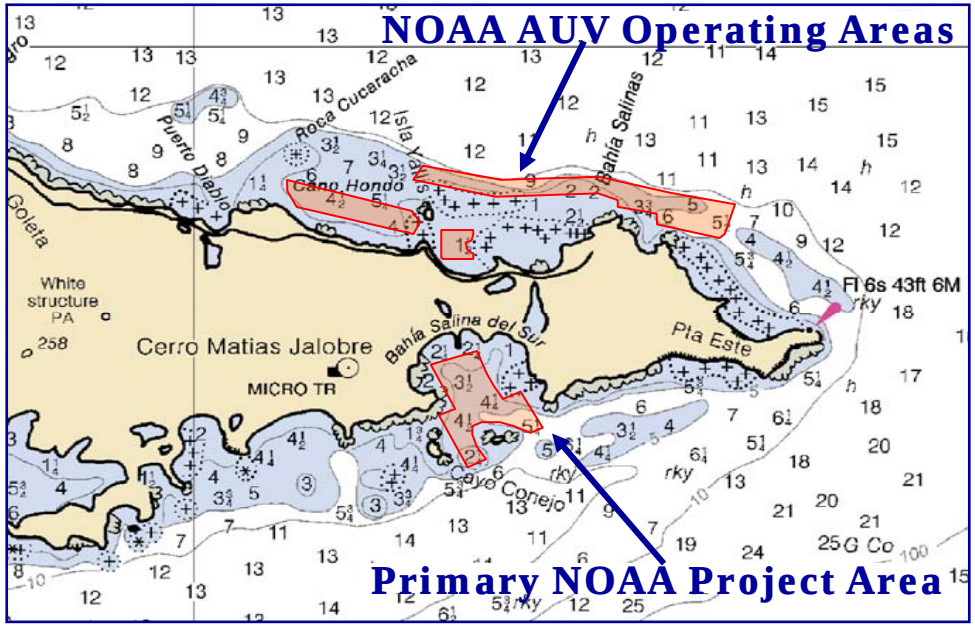
NOAA Survey Tools

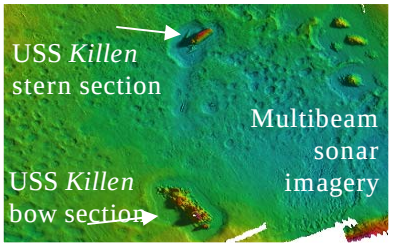
- Autonomous Underwater Vehicle (AUV) Hydroid REMUS 100 AUV.
- Equipped with Side Scan Sonar and GPS
- Operates 10 hours + endurance at 5 knots
- Launch from shore, operate remotely
- Survey in Bahia Icacos and Bahia Salinas del Sur

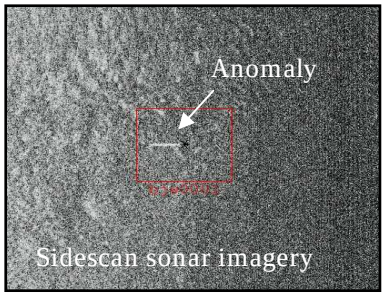


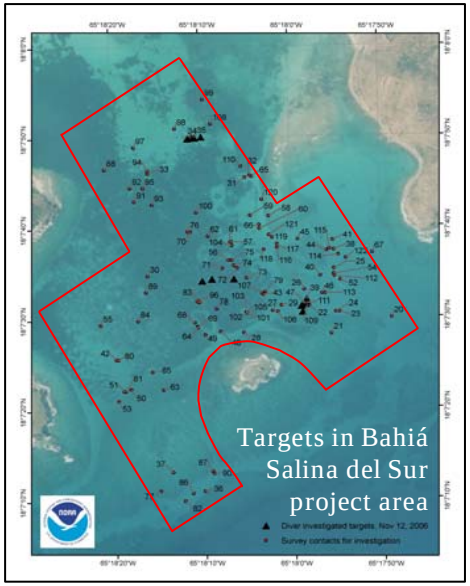
NOAA's Underwater Demonstration Project

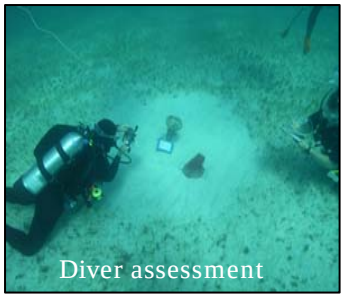
November 2006







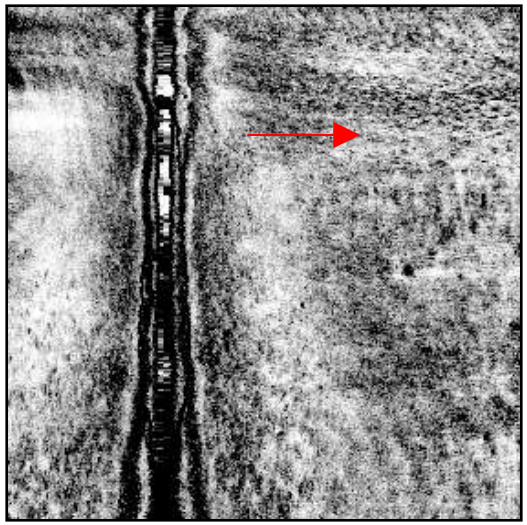


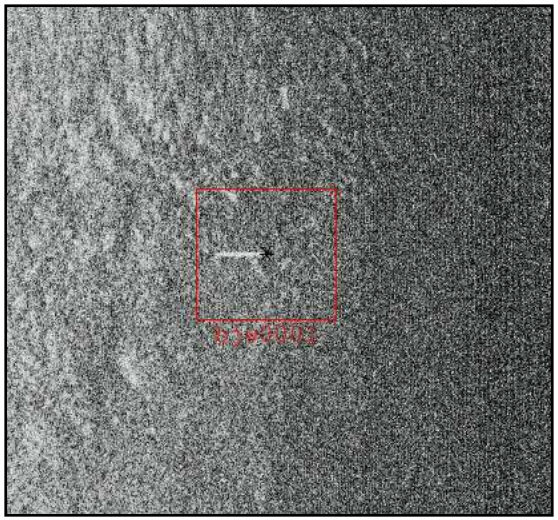


- **Collected 200% sonar coverage for project area**
- **ROV targets selected from a mosaic of sidescan, multibeam and magnetic imagery**
- **ROV video confirmed that suspected targets were UXO and related debris**
- **Divers gathered target position, took still pictures and noted habitat adjacent to target**

Anticipated NOAA Survey Products

- Bathymetry and sonar maps
- Some sites groundtruthed by SCUBA and 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





NOAA Survey Challenges

- Operated with limited bathymetric information
- Time on-site (in water) determined by Land Cleanup Ordnance Disposal Contractors because of safety regulations
- Irregular shoreline most apparent, up to 120m off.
- No charted soundings in survey area
- Extreme shoal area throughout most of the bay prevented access for side scan sonar work
- Due to remote location operating conditions unforeseen equipment issues were encountered
- UXO and metal debris needs to be segregated by SCUBA, photo or video groundtruthing
- Limited on-water support for AUV
- AUV operations limited to water depths of 4 meters or deeper
- In very shallow conditions (<5 meters) AUV scanning and imagery can be adversely affected by sea state
- Re-acquiring targets from an ROV from a vessel of opportunity poses positioning challenges
- ROV operations limited by weather, sea state, currents, and other vessels in area

NOAA Recommendations

- Smaller boat platforms would allow for better access and more time on site.
- Test Unmanned Surface Vehicle (USV) for increased positioning and imagery in extremely shallow water.
- Video camera integrated into AUV eliminates need for ROV and provides precisely positioned video over many more targets
- Eliminating ROV from operations reduces the operations team and equipment
- AUV survey can expand diver capabilities for object investigation and identification with co-registered sonar and video imagery
- More R&D surveys needed to determine sonar equipment capability and positive identification for underwater UXO detection

Questions/Comments for NOAA

- **NOAA Contact**

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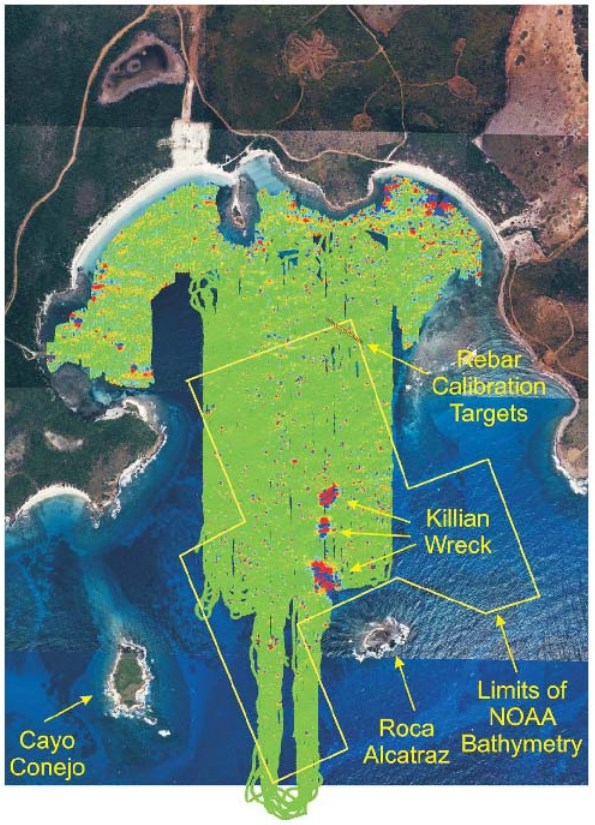
- **NOAA Vieques Website**

- **http://mapping.orr.noaa.gov/website/portal/vieques/projectsunderwater.html**

SAIC Survey

- **Survey conducted by Science Applications International Corporation (SAIC) in 2006 -2007**
- **Towed sonar survey conducted in Bahias Salinas del Sur**
- **Survey site same as the previous NOAA survey site**
- **Sonar equipment design and variation tested**



SAIC Survey

- **Survey conducted by Science Applications International Corporation (SAIC) in 2006 -2007**
- **Towed sonar survey conducted in Bahia Salinas del Sur**
- **Survey site same as the previous NOAA survey site**
- **Sonar and magnetometer equipment design variation tested**
- **No SCUBA support,; video camera damaged; no groundtruthing**
- **No UXO contact allowed**

SAIC Survey Results

- **Survey problems encountered similar to NOAA survey observations**
  - **Irregular shallow shoreline**
  - **Coral reefs and small coves restricted boat maneuverability**
  - **Remote location conditions restricted operations**
- **Data analysis under evaluation**