



Charting a Course for Underwater UXO Detection Lessons Learned at Vieques

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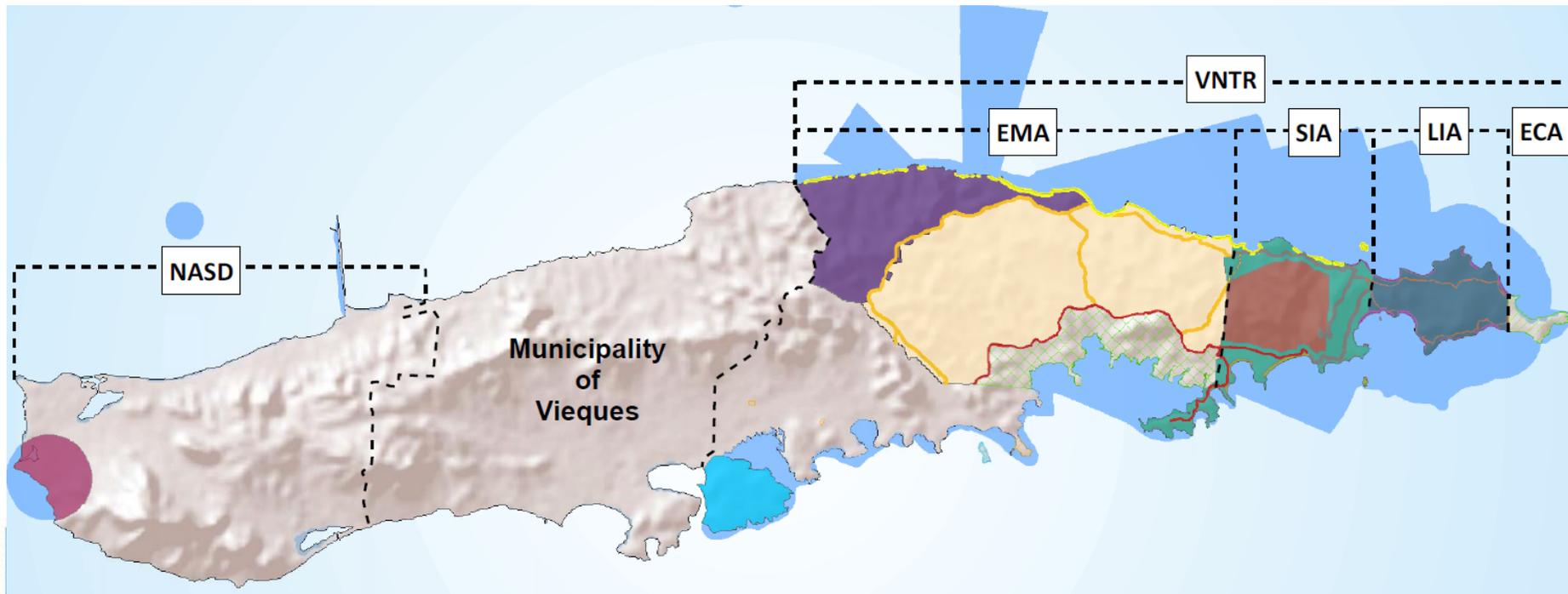
Vieques and Munitions Response Support Branch

NAVFAC Atlantic

SERDP • ESTCP
SYMPOSIUM
2018 | Enhancing DoD's Mission Effectiveness

Vieques Background

- 1945 to 1999: Multi-purpose live-fire training, ammunition support
- 2001 to 2003: Transferred ~18,000 acres to DOI for FWS management
- 2005: Vieques placed on National Priorities List (NPL) or “Superfund”
 - Munitions cleanup supports future land and water use



Strategic Approach

To Environmental Restoration Program at Vieques

- Top priorities – safety, risk reduction, efficiency, cost effective solutions
- CERCLA process followed
- Munitions Clearance
 - Land first (exposure higher)
 - Reduce explosive hazard and environmental risk
- Ecological resources
 - Protect endangered species, sensitive habitat
 - Consultation with natural resources agencies
- Innovative Approaches
 - Land: Metal Mapper / TEMTADS
 - Underwater: new technologies
 - Land and water: remote controlled equipment



Munitions Response Sites

Progress on Land

- **Surface clearance**
 - 4,000 acres cleared of munitions
 - 102,000 MEC items removed
- **Subsurface clearance (roads & beaches only)**
 - 12 miles of roads, 11 miles of beaches
 - 7.7 million pieces of MPPEH picked up and processed
- **Scrap metal**
 - 18.7 million lbs processed
 - 16.4 million lbs recycled



Munitions Response Sites

Beach Clearance

- Approximately 11 miles of beaches cleared of munitions
 - Remote control excavator is effective near the water line, and may work in the surf zone
- Beach Dynamics Study to optimize beach clearance
 - Sand depth goes up and down by more than 6 feet on certain beaches
- FWS plans to open most beaches outside of the LIA (people want access)



Munitions Response Sites

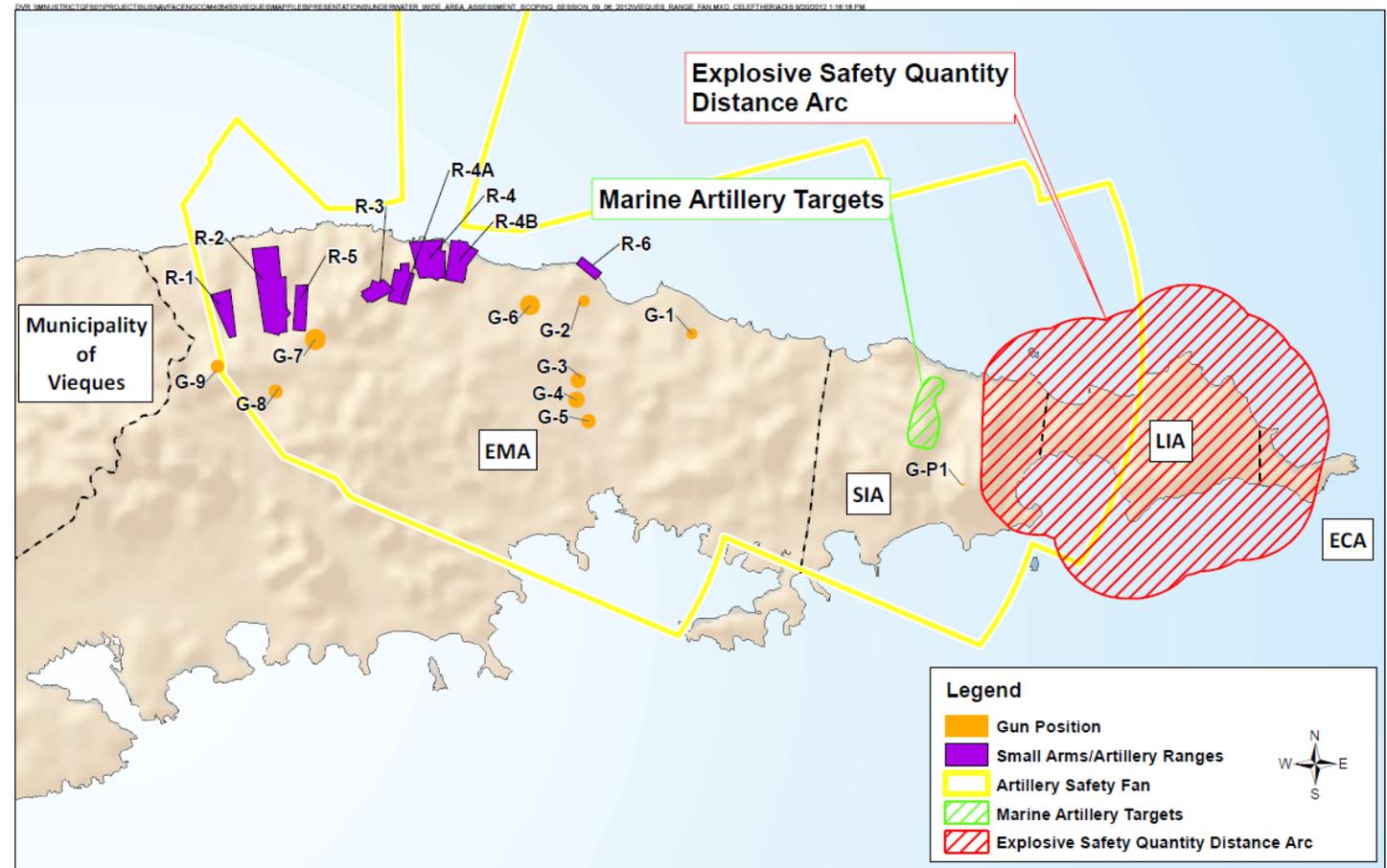
Underwater

- Cleanup is just beginning for underwater sites on Vieques
 - **Wide Area Assessment across 12,000 underwater acres**
 - **Removal actions for high visibility munitions items**
 - Off shore of OB/OD area in western Vieques
 - Around Cayo La Chiva, near a public beach
 - Island-wide Non-Time Critical Removal Action (NTCRA)
- Ecological preservation vs. explosive hazard
 - **Explosive risk of underwater munitions is uncertain**
 - **Uncertainty about appropriate remedial actions**
- Safety for workers, public



Sources of Underwater Munitions

- Open Burn / Open Detonation
- Anchorage and Pier Areas
 - Munitions transfer from ships
- Naval Gunfire
- Marine Artillery
- Air to Ground
 - Long or Short (or both)



Previous Underwater Investigations



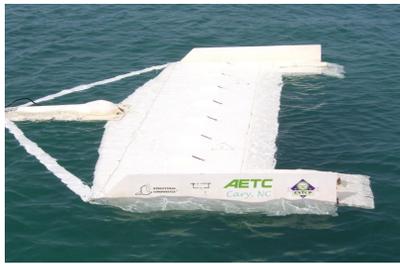
ROV



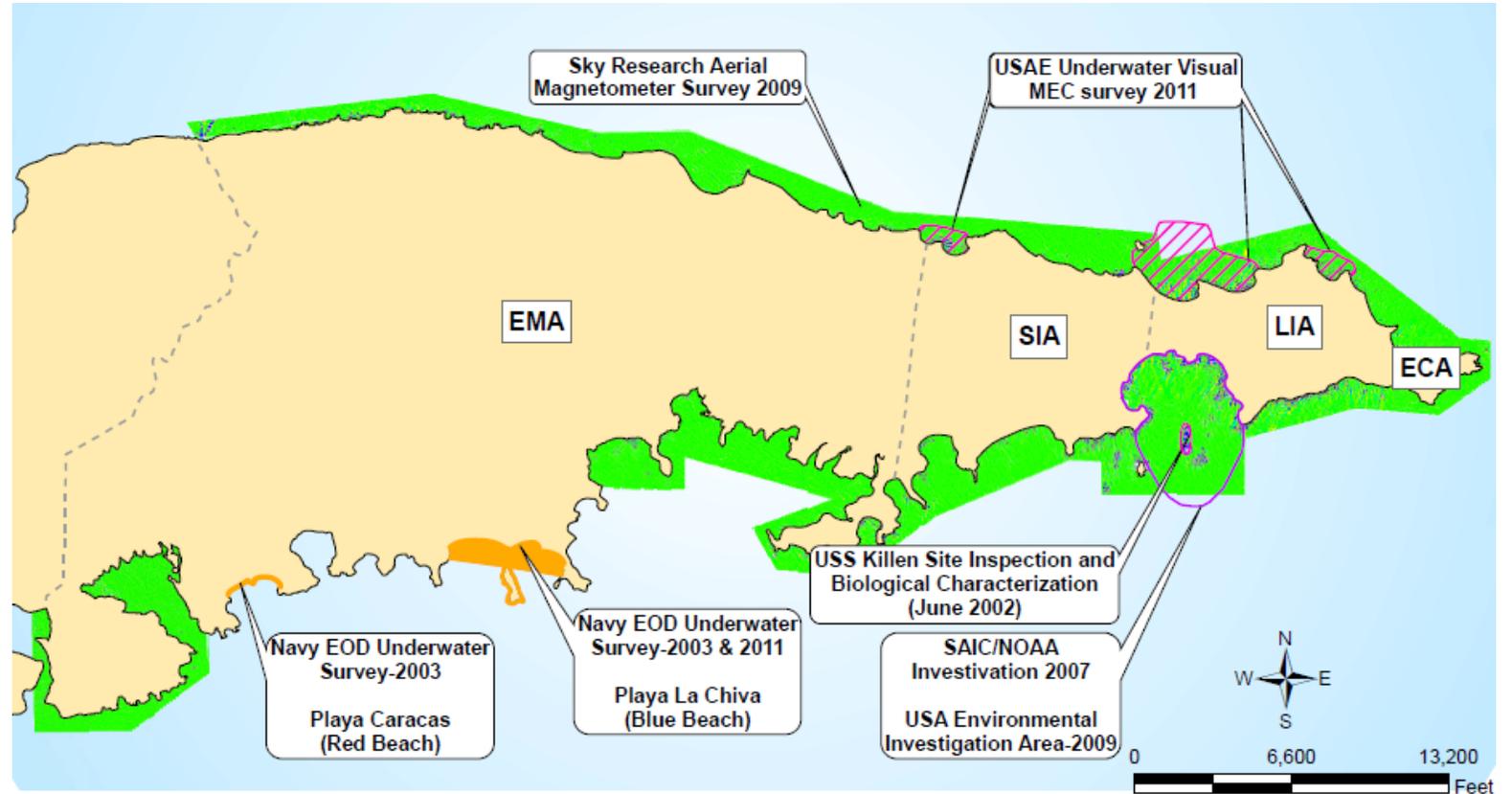
Aerial Magnetometer



Side Scan Sonar



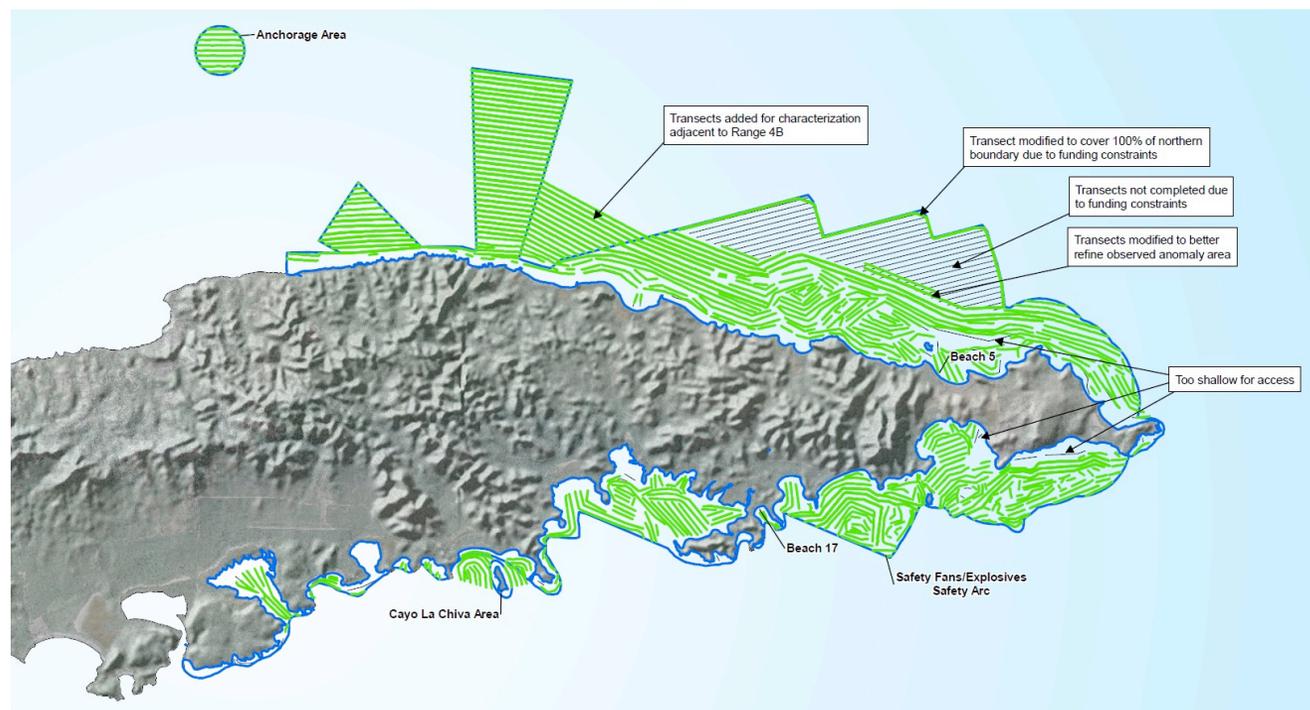
Underwater Magnetometer



Underwater Wide Area Assessment

Design and Purpose

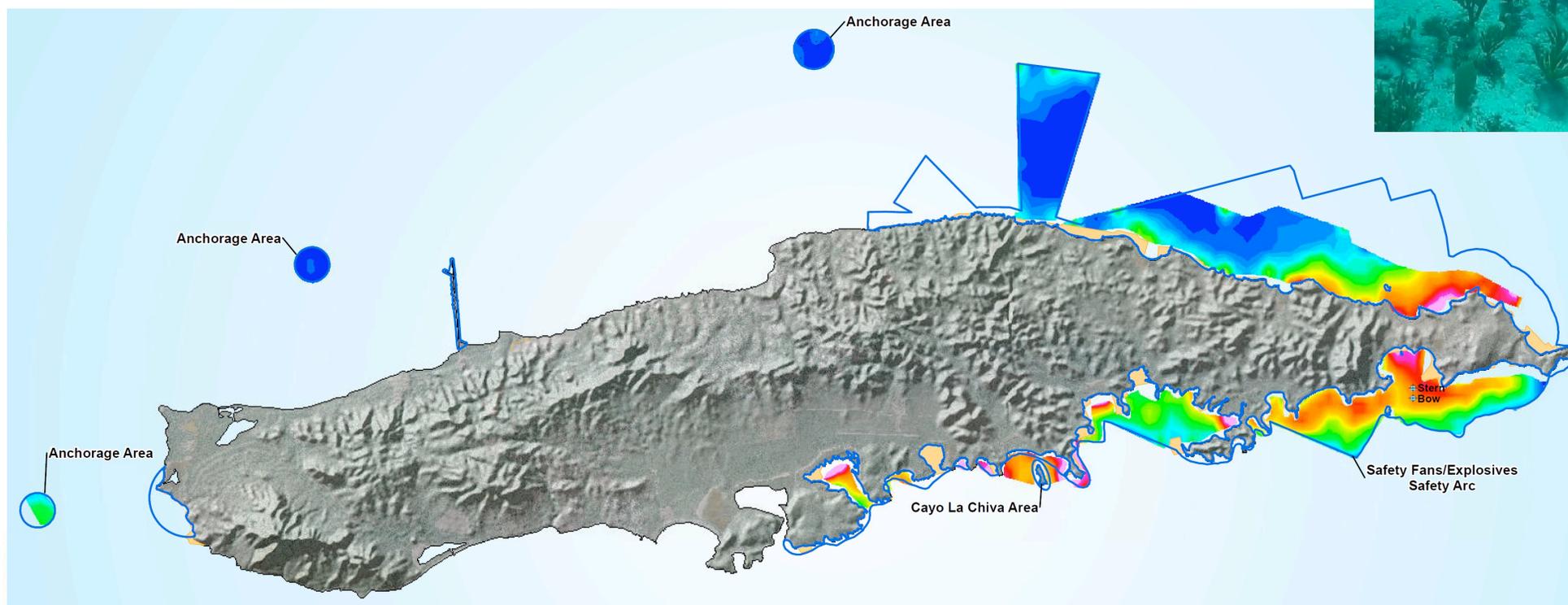
- Underwater magnetometer and video towed by boat
- 208 miles of transects across 12,000 acres
 - 100m spacing provided ~10% coverage
 - Used to map anomaly density and support underwater Biological Assessment



Survey Boat

Underwater Wide Area Assessment Results

- 15,000 anomalies - high densities where expected, but also in public areas
 - Public areas likely cultural debris, but requires further investigation
- Video showed 234 munitions (suspected) proud on bottom
 - Will be further investigated and removed if necessary by NTCRA



Beach Dynamics Investigation

Design and Purpose

- Understand interaction between beach and underwater environment
 - Measure beach elevation, waves, currents, rainfall
 - Track mobility of MEC surrogates



MK 118 submunition



MK76 practice bomb /
81mm mortar



5/38 projectile



MK 82 bomb

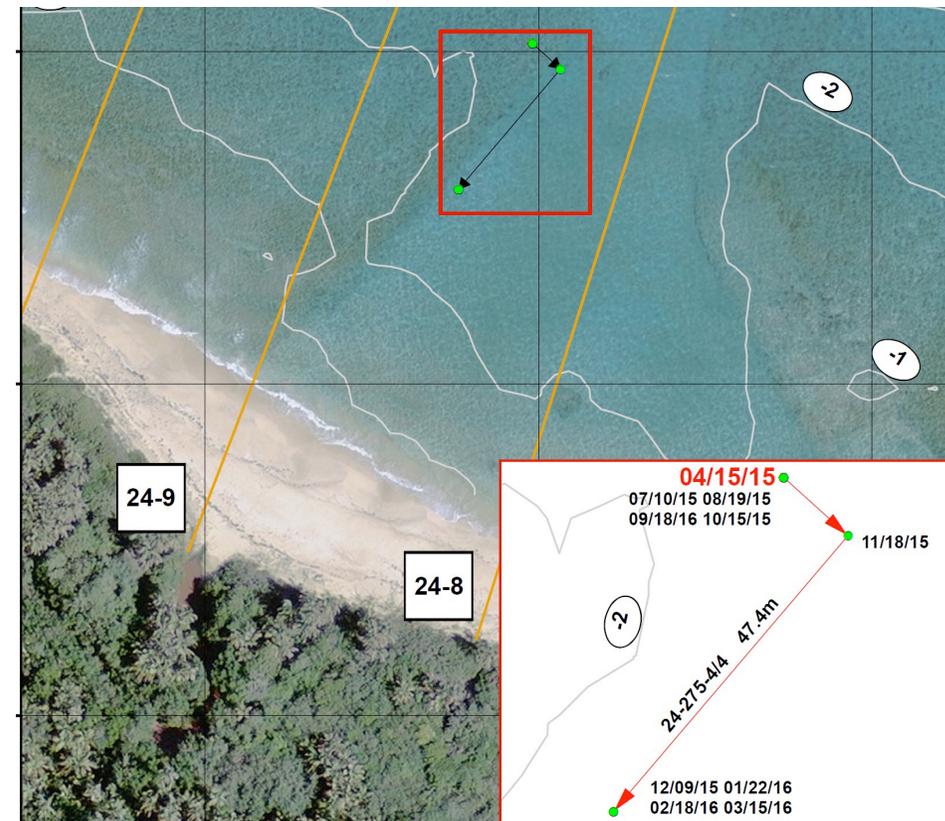


2.75-inch rocket

Beach Dynamics Investigation

Results

- Items on sand self-buried
- Most items moved very little or not at all
 - Munitions don't tend to move with the sand
 - Exception: 50m in sand channel
 - No significant movement alongshore
- Effects of Hurricane Maria
 - Still investigating, but so far, little movement of munitions



Implications for Detection and Classification

Physical

- Limited transport of munitions
 - Detection and classification data may be “durable”
- Surf zone and shallow water is the highest priority
 - Highest risk of UXO encounter (it’s where most people are)
 - May address beaches and surf zones together
- Access and placement of sensors may be difficult
 - Strong currents, reefs, rough water, surf
- Visibility (no problem on Vieques)
- Logistics
 - Underwater work is slow, costly, and prone to delays and mishaps



Implications for Detection and Classification

Ecological

- Minimize ecological impacts during investigations and remedial actions
 - Endangered species of coral, sea turtles, manatees, etc.
 - Desirable species and critical habitat
 - Significant role for natural resources agencies (in addition to EPA and state environmental agencies)
- Toxicity of munitions constituents (MC)
 - Research indicates minimal MC effects (see next session)



SWMU 4 – Elkhorn coral



SWMU 4 – Staghorn coral



Implications for Detection and Classification

Programmatic

- CERCLA process is just beginning for underwater sites at Vieques
 - Opportunities related to investigations and remedies
- Need to manage underwater munitions in place
 - As final remedy or while working on a different final remedy (underwater work takes time!)
 - High risk items are white phosphorus, submunitions, and 40mm grenades
- Potential applications of underwater classification at Vieques
 - Investigating anomalies in public areas
 - Long term management of munitions in place
 - Distinguish high explosive vs. inert rounds
 - Support for sub-bottom digs, as on land?
- Possible to acquire huge amounts of underwater data
 - Need automated tools for evaluation
- Safety (remote controlled equipment vs. divers)



Questions and Discussion

