A Case Study for Geophysics in Difficult Environments: Advanced Geophysical Classification at the Former Vieques Naval Training Range

Focus on Lessons Learned

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USA Environmental, Inc.

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Agenda

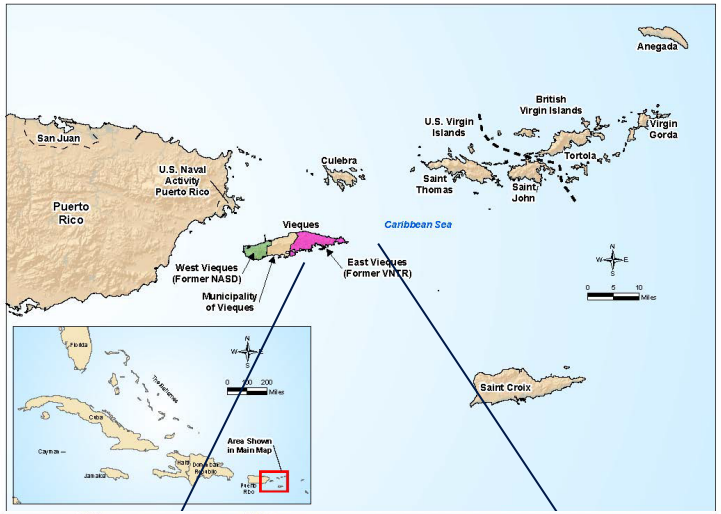
1. Overview of Site – Jenn Weller

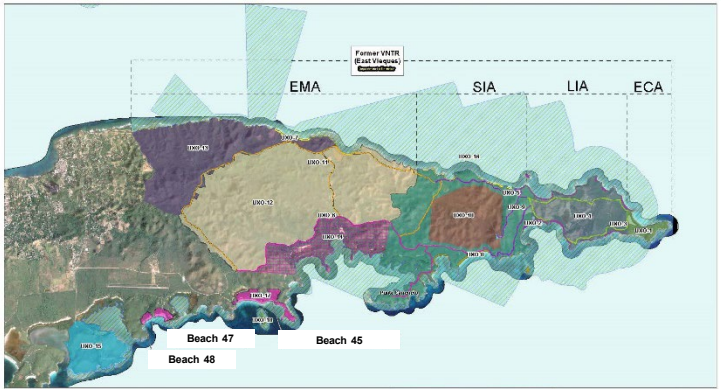
2. Challenges associated with the Focus-area Beaches – Jenn Weller

3. Challenges of project execution – Ric MacNeil

4. Lessons Learned – Ric MacNeil

Former Vieques Naval Training Range (VNTR)





- Former VNTR ~14,600 acres situated on eastern third of Vieques
- Approximately 60 beaches along entire perimeter
- Military operations occurred from 1947 – 2001 included ground warfare and amphibious training, naval gunfire support training, and air-to-ground training
- More than 300,000 munitions were fired onto the land and surrounding waters during military training operations
- Based on historical use, ordnance potentially present includes wide variety of bombs, rockets, mortars, projectiles, flares, and grenades

Focus Area Beaches

- Two individual beaches make up the focus area: Beach 47 and Beach 48; ~ 4 acres
- Historical archival records search indicated blank ammunition was used and no MEC had been found
  - Beaches were opened to public for recreational use
- Munitions were subsequently found at these beaches which ultimately led to AGC-based TCRA
  - Jacobs served as the QA contractor
  - USA Environmental performed the TCRA work

Challenge: Public Beach Access

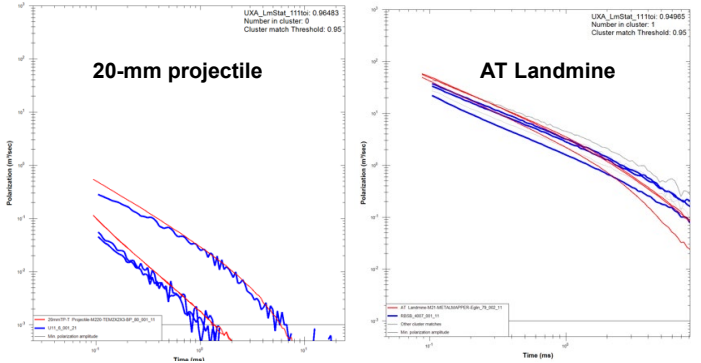
- Focus area beaches popular destinations for locals and tourists
- Man-made structures cannot be removed
- USFWS - beaches closed to public for as short a time as possible
- Major schedule driver – reopen beaches in time for July 4th holiday weekend

Challenge: TOI Library

- CSM for TCRA included many munitions used at VNTR
- 20-mms challenging 1) classification 2) matches to small scrap
  - Based on site history unlikely present, needed to confirm
  - Target selection threshold and ISS parameters established to include
  - High confidence matches dug - removed from library
- High confidence matches to landmines also raised some concerns
  - No landmines discovered during intrusive work
- Using broad library also resulted in more digging
  - Intrusively investigated over 1,000 locations
  - 11 MD items recovered
  - No munitions or MEC items were recovered during the TCRA

CSM

- BDU-33
- Bombs: 20-lb fragmentation,100-lb, 250-lb
- Bomblet
- Hand and Rifle Grenades
- Projectiles: 20, 25, 30, 37, 60, 81, 75, 90, 105, 175-mm, 8-in
- Rockets: 2.36, 2.75, 3.5, 4.5, 5-inch
- Mortars: 4.2-inch
- Landmines



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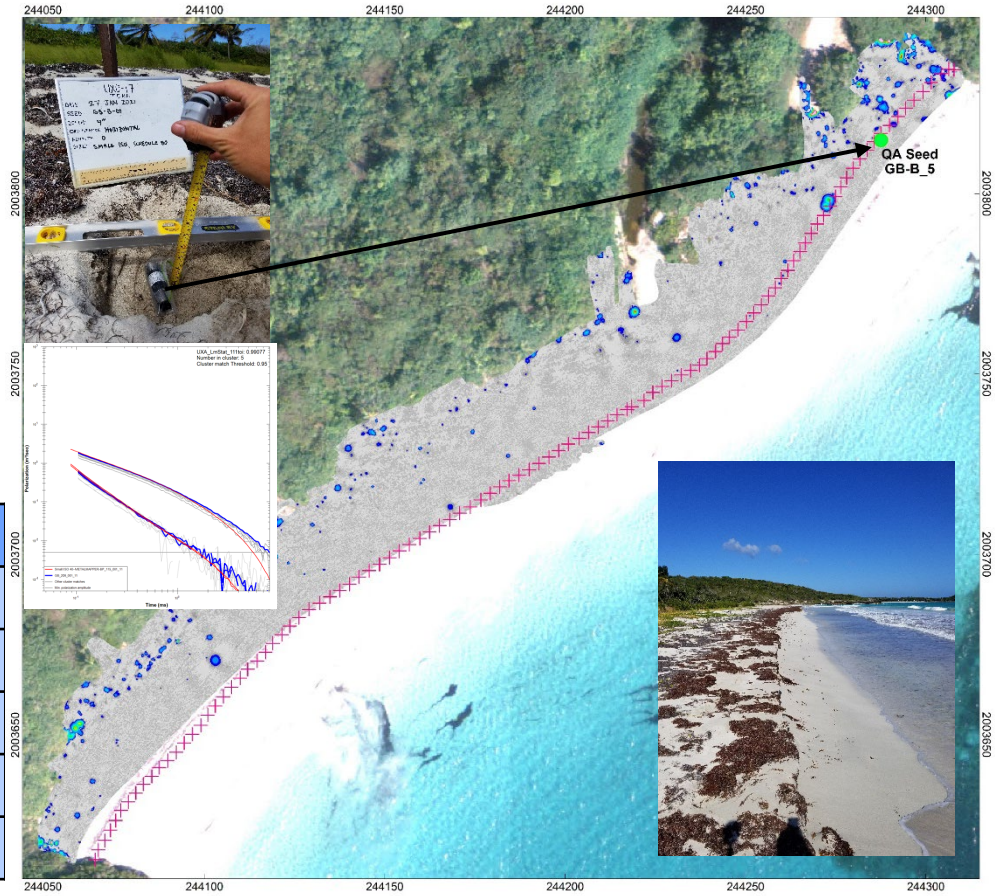
Challenge: Dynamic Near-Shore Environment

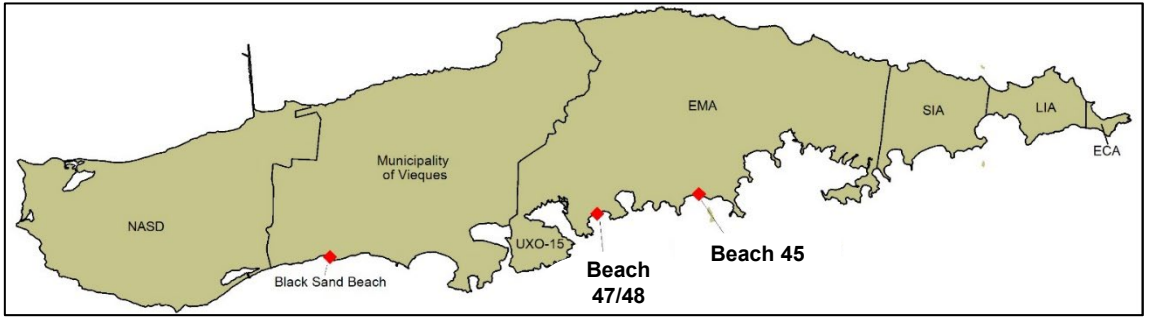
- During intrusive investigation at Beach 48, QA seed listed as a no find – was identified as a TOI on dig list
- RCA performed, included remapping of shoreline
  - ~166 sq meters of shoreline had eroded
- 5 anomalies located within erosion zone
- 3 categorized as TOI
  - One item was recovered
  - Two items were not, including the QA seed

Target ID	Predicted Item	TOI Status	Decision Statistic	Note
GB_225_001_21	-	Non-TOI	0.0000	-
GB_203_001_22	-	Non-TOI	0.5791	-
GB_216_001_33	66mm Incendiary Rocket	TOI	0.8787	Not recovered
GB_209_001_11	Small ISO 40	TOI	0.9932	QA Seed – not recovered
GB_246_002_11	105mm Projectile	TOI	0.9082	Steel Pipe Recovered



Challenge: Geology

- Vieques is volcanic in origin
- Volcanic outcrops and black sand exist at Beach 45 ~3 km (1.8 mi) from Beaches 47/48
- Playa Negra (Black Sand Beach) located 8 km (5 mi) from Beaches 47/48
  - Tourism website dedicated to this beach recommends bringing a magnet!
  - High iron content of minerals in sands derived from volcanic rocks can interfere with classification

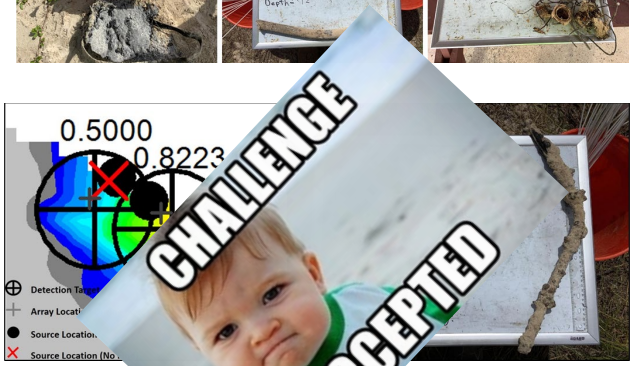


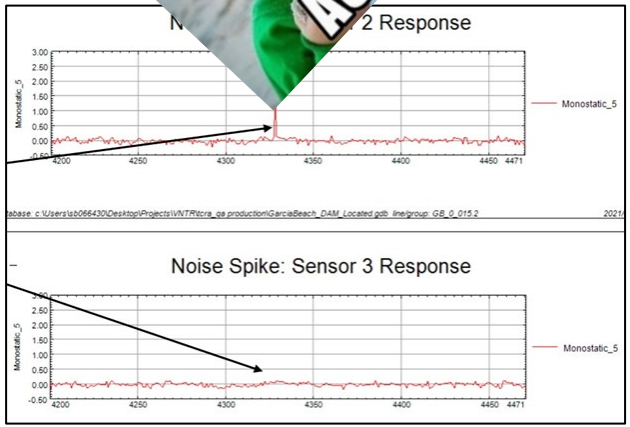
Challenge: Threatened and Endangered Species

- 13 federally listed species are known to occur or have the potential to occur at site
- Hawksbill sea turtles, leatherback sea turtles, and green sea turtles have been documented as nesting along the beach habitat
- Monitored daily for sea turtle nests – turtles tend to lay eggs at night
- Any turtle nest found would have needed to be relocated or avoided during the TCRA
  - Turtle nests have been discovered during previous geophysical surveys

Challenges of Project Execution

-Ric MacNeil





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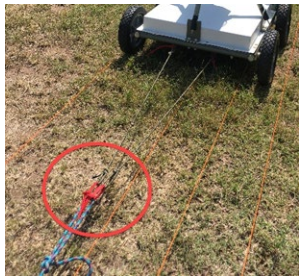
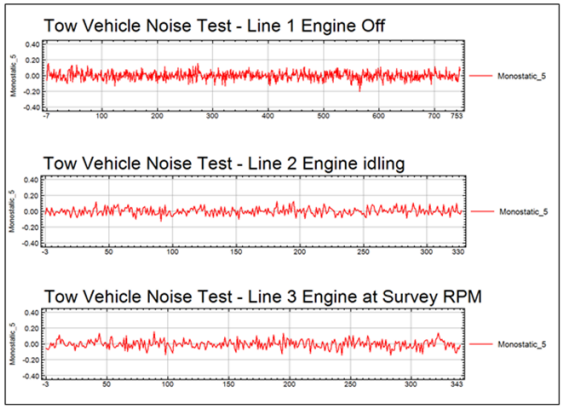
Challenge: Loose Sand

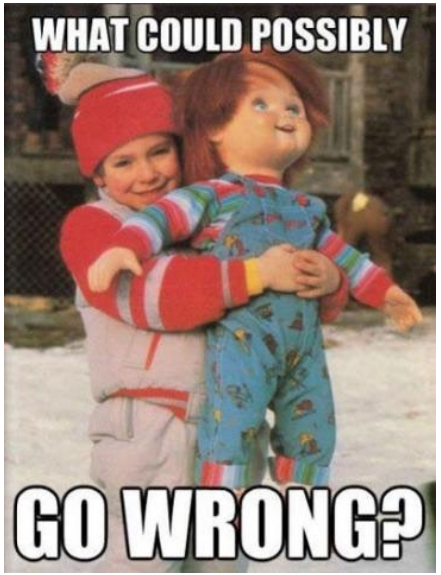
- Tow the sensor (push vs. pull)
  - Pulling prevents sensor tires from sinking in the sand
  - Preserves operator endurance
  - Anchor points on sensor (this is key)
  - Strain relief to prevent sensor damage
  - Quick release to allow for easy turn arounds
- Install winch on tow vehicle
  - Sand anchor + winch = safe from the surf
- Ensure tow vehicle does not introduce noise





Field Change in Approach at Beach 48

- 308 targets identified from detection survey
- Decision made to dig all targets without performing ISS
  - MR-QAPP stipulated:
    - 200 anomalies excluded based on ISS interrogated
      - Would have required cuing almost 100% of the targets
    - 200 verification digs and 200 validation digs
      - Some ambiguity in whether that was per beach or per site
      - If per beach, more ver/val digs than actual targets!
  - Schedule drivers necessitated the need for immediate work for the intrusive team or demobilization
- Most conservative outcome – dig all targets, no downside immediately apparent

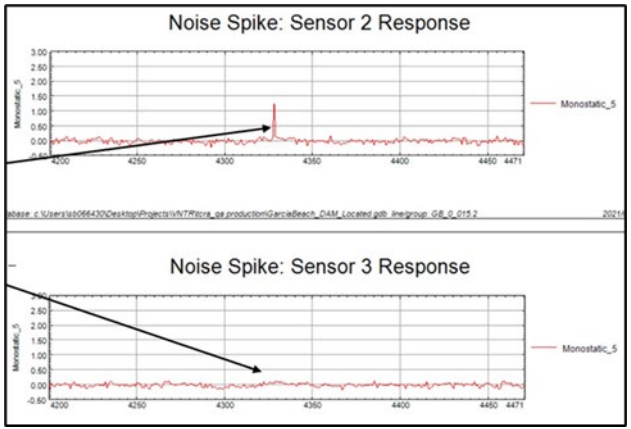


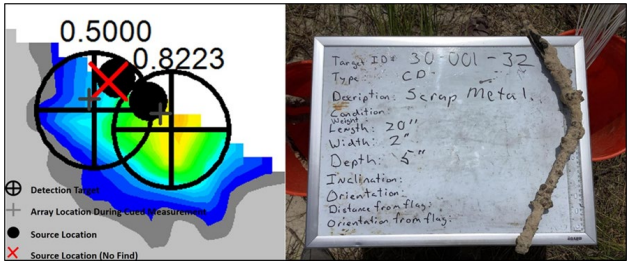
Unexpected Technical Challenge due to Changed Approach

- Approach changed from classification to detection/dig survey
  - No MEC recovered during intrusive investigation
- 111 targets were reported as no finds (approximately 32%)
  - All QC and QA seeds detected and targeted per MQOs
  - One QA seed not recovered
- Necessitated a root cause analysis to determine why so many no finds

Results of Jacobs' Comprehensive No Find Analysis

- Beach erosion
  - Shoreline erosion resulted in a small percentage of no finds
- Ferrous sand created pockets of localized ground response
  - Some no finds attributed to ground response
  - Likely contributed to issues validating backgrounds, 23% passed
- Intermittent sensor related noise spikes identified in data
  - Data analysis performed – 81% of no finds associated with these
- Shared sources
  - As a conservative measure, large footprint anomalies were tiled with targets
  - Review of data demonstrated that often, following source removal, the second target was documented as a no find



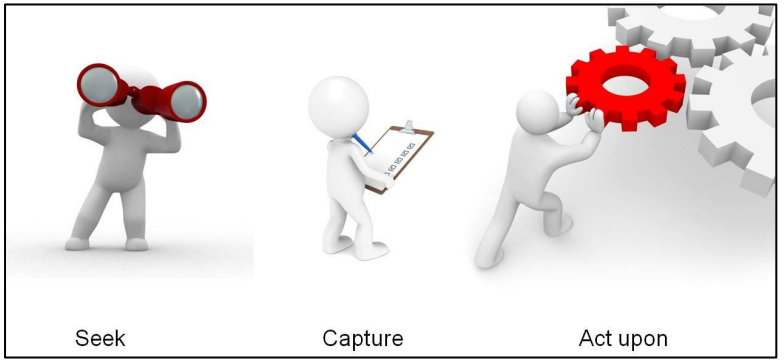


Successful Application of CAs to Beach 47

- Beach 47 targets close to the shoreline were intrusively investigated first to minimize erosional issues
- ISS used at Beach 47 - helped mitigate issues with noise spikes and ground response
- Documentation procedures were reviewed with dig teams leading to better outcomes for shared source anomalies
- No MEC recovered at either beach

Lessons Learned: What would we do different next time?

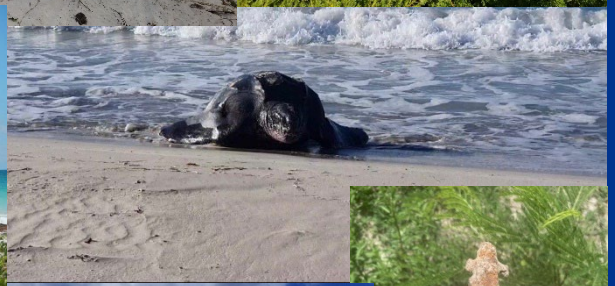
- Better understand and thoroughly discuss the potential issues involved in changing the field approach (even if more conservative)
- For smaller sites and/or sites with few expected targets, adjust quantities for ver/val digs and ISS confirmation -- clearly define deliverable units in terms of these metrics
- Even for sites with low anomaly density where the determination is made to dig all targeted anomalies without doing a cued survey, ISS can be utilized to screen out small, thin-walled targets and noise spikes

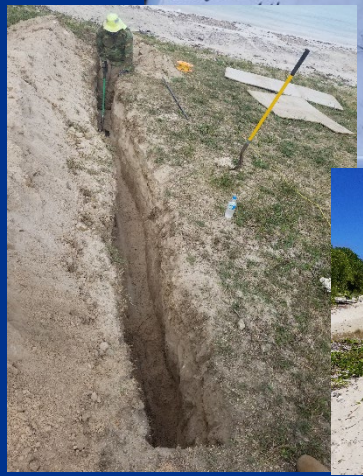


Lessons Learned: What would we do different next time?

- Review redundant targets selected during the classification process
  - If result of spurious modeling or are within a certain radius of each other (based on the requirements in the QAPP) remove lower decision stat solution
  - Review documentation requirements regarding shared sources with the intrusive team prior to commencement of intrusive work
- Consider one-pass surveys in dynamic environments to reduce the time between survey and intrusive investigation
- Minimize your TOI library to the extent possible to achieve better AGC results
- Manage intrusive team schedule to minimize pinch points

Thank you





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