

A Chronology of RCAs with New AGC Technology in Challenging Environments

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US Army Corps
of Engineers®

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Brief Croft Overview

Project Objective

- MMRP Remedial Action

Area/Location

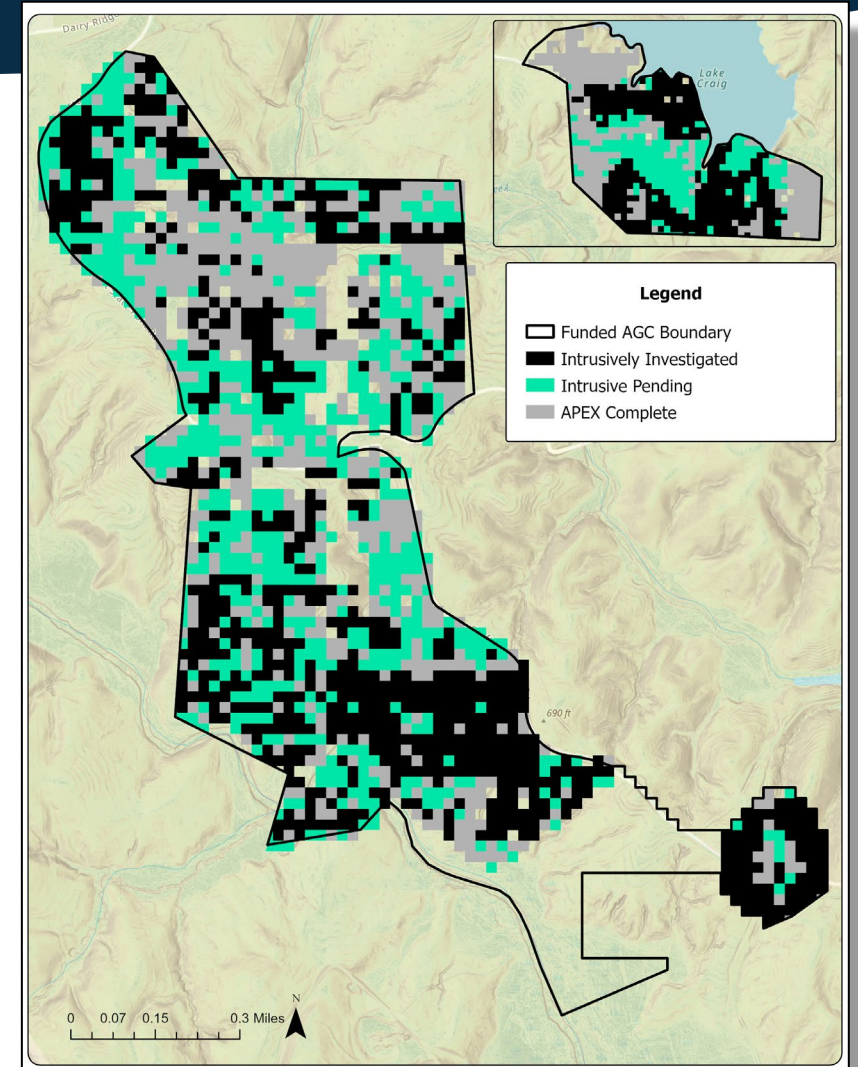
- 609 Funded Acres, Croft State Park – Spartanburg, SC

Site Conditions

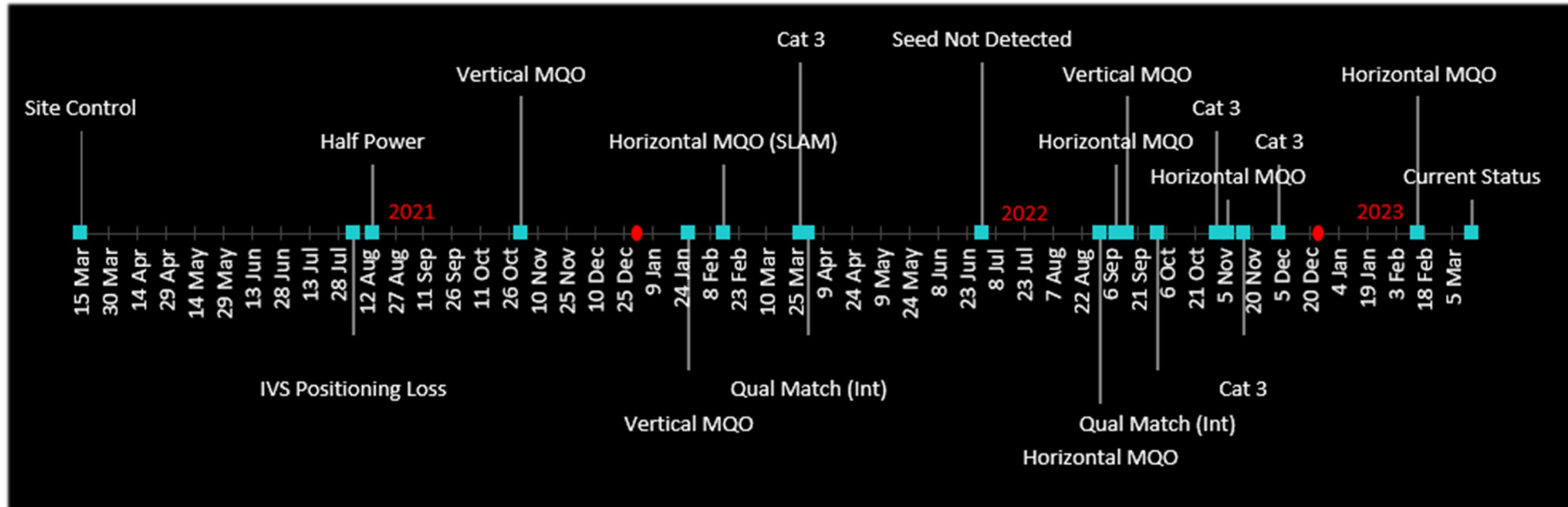
- Dense mature forest, dense understory, diverse terrain (ravines, ridges)

Technology

- Preference to use Dynamic APEX (White River Technologies)
- Simultaneous Location and Mapping (SLAM) – Data positioning
- Robotic Total Station (RTS) – Intrusive operations



Timeline



RCA Timeline

March 2021

Geodetic Control

- PLS RTS surveyed grid corners
- Multiple root causes
 - PLS conducted prior to veg removal
 - Veg removal equipment/personnel moving nails
 - Lack of QC reporting by PLS
- CA: Conduct PLS after veg removal, reestablish control, provide daily PLS QC reporting.

Before



After

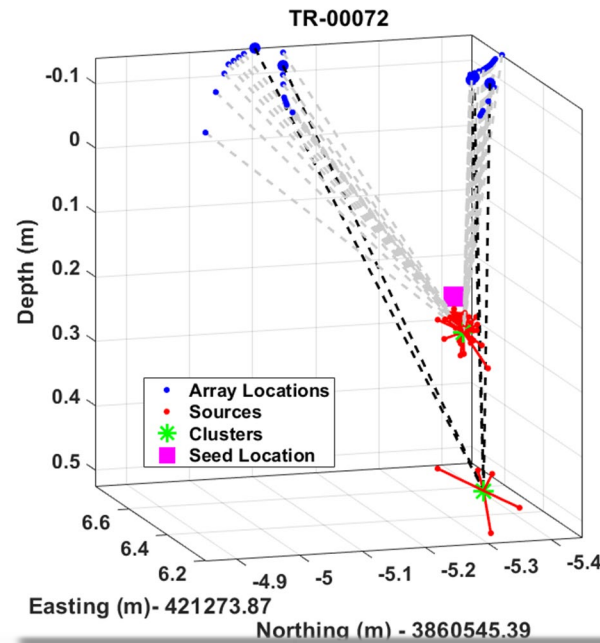


RCA Timeline

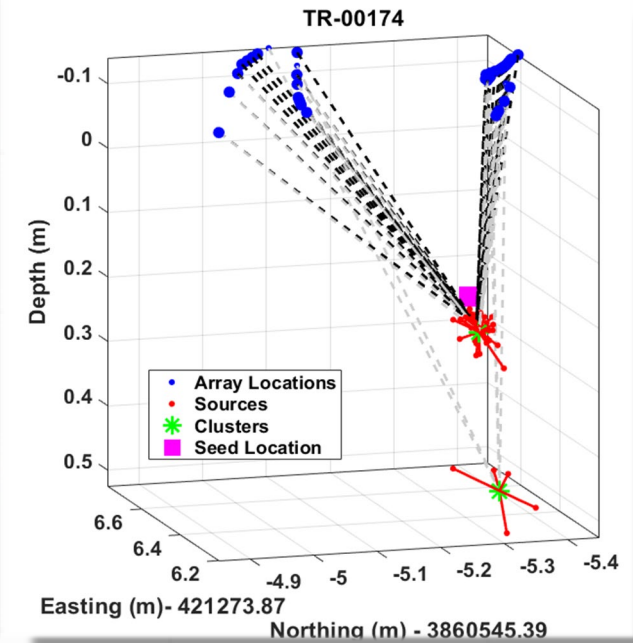
Nov 2021

Vertical MQO > 15 cm

- Two clusters close in X/Y space, but depths are different.
- Minor difference in cluster Confidence by 0.01 resulted in picking the wrong cluster as TOI
- CA: Use 3D distance (X/Y/Z) for Clusters when Confidence above threshold. Same X/Y but different Z.



- Deep cluster chosen as TOI based on 0.94 Confidence.
- Vertical offset of 21.2 cm to QC seed



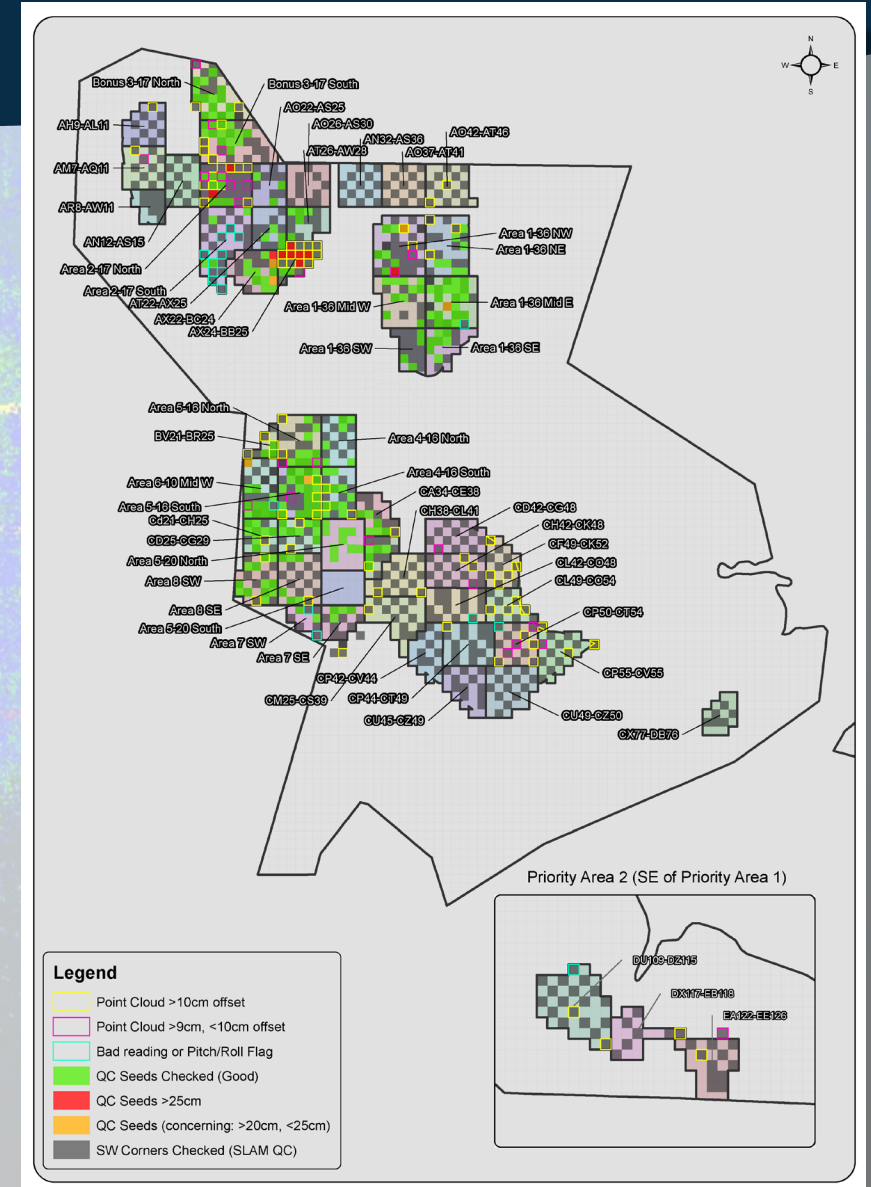
- Shallower cluster chosen as Cat 3 based on 0.93 Confidence.
- Vertical offset of 6 cm to QC seed

RCA Timeline

Feb 2022

Horizontal MQO > 25 cm

- 9 QC seed failures in close proximity
- Due to inaccurate point clouds (SLAM)
 - New tech – learning QC procedures, not enough PLS control points used
 - Sparked site -wide assessment. 33 grids ID'd.
- CA #1: Establish collection method using more control points (every PLS corner)
- CA #2: Evaluate offsets for individual grids vs entire point cloud during post -processing (< 10 cm)
- CA #3: Conduct SLAM reaq measurements in static mode to verify offsets are acceptable (< 10 cm)

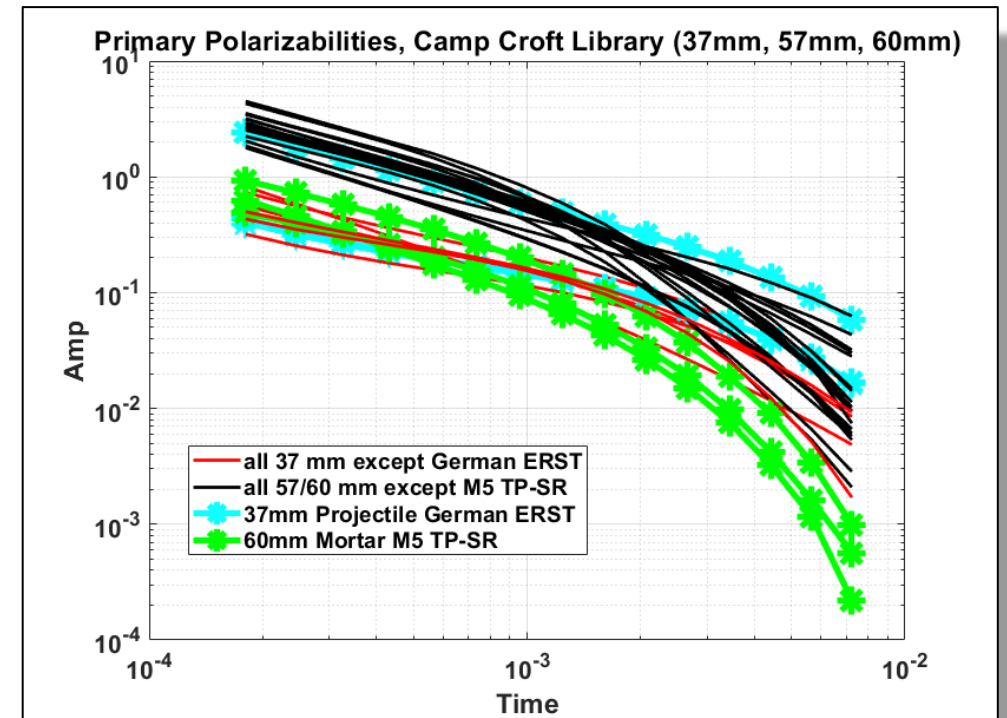


RCA Timeline

April/May 2022

Qualitative Match (Intrusive)

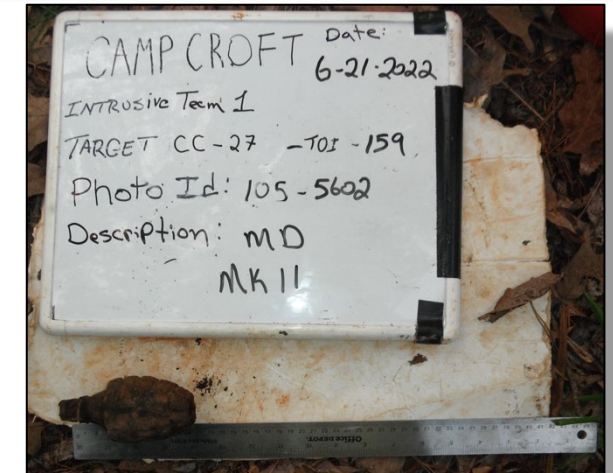
- Polarizability signatures at TG 3 very similar across 37mm-60mm
- Due to amplitude
- CA: Tailor acceptable size-bands for one-pass classification
 - 37-81mm, >81mm



CK49-22, TOI, 60mm Mortar , 24.6 cm



CO50-49, TOI, 57mm Projectile , 10.8 cm



CC27-27, TOI, 37mm Projectile , 6.8 cm

RCA Timeline

Jul 2022

Seed Not Detected

- QC seed not detected at all
- Wildlife removing seeds becoming more common
- CA: None. However, UXOQCS using cayenne pepper during seeding.

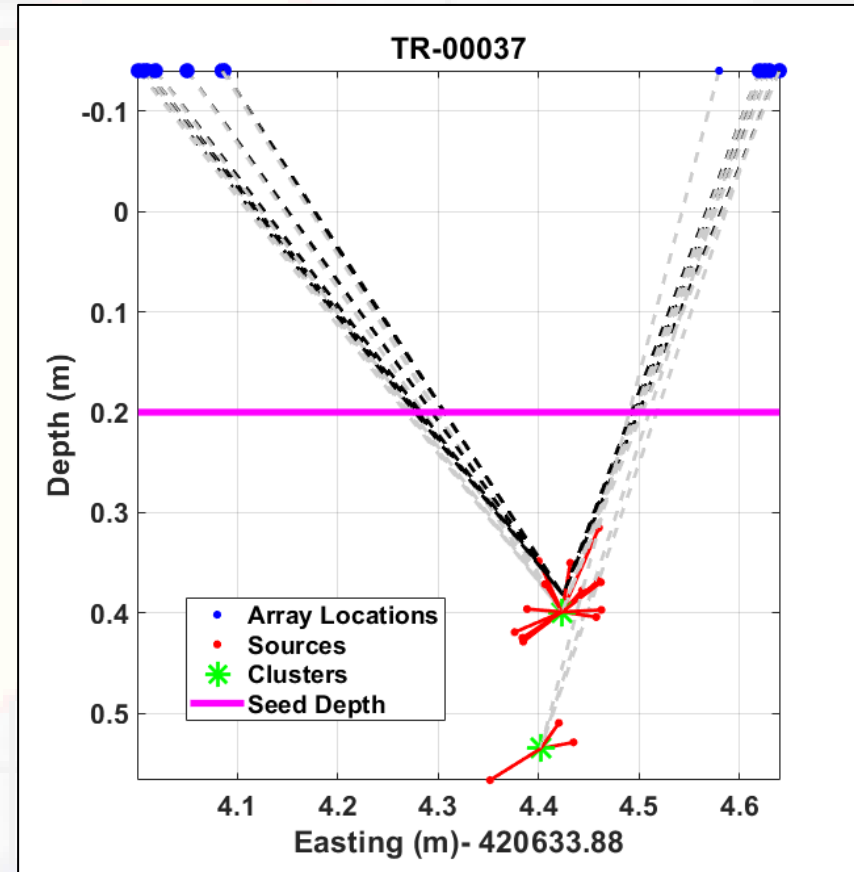


RCA Timeline

Sep 2022

Vertical MQO >15 cm

- Sensor stand off distance was elevated
 - Terrain
- CA: Select multiple clusters when 'best' cluster is not obvious



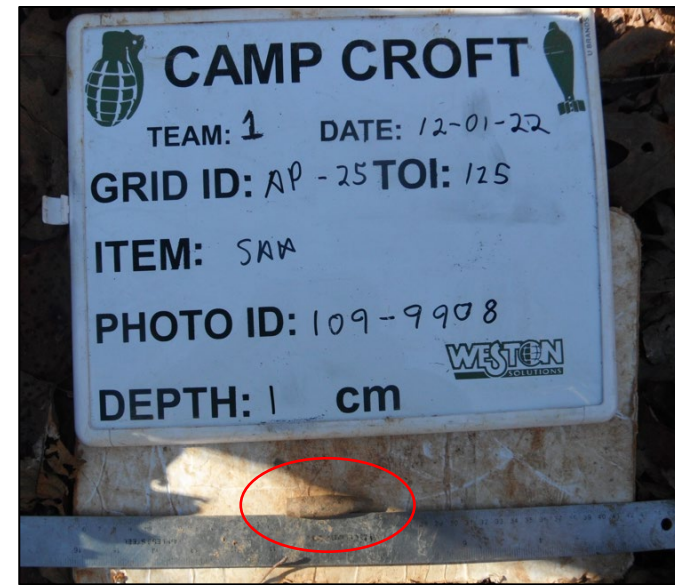
- Ground truth of seed was 20 cm.
- Prediction was 40 cm

RCA Timeline

Oct 2022

Qualitative Match (Intrusive)

- SAA being recovered from larger predictions
- CA # 1: Add explanations to dig results to better explain qualitative mismatch (single item recoveries only)
 - Magnetic soil, below threshold, low amp
- CA # 2: UXOQCS to conduct in-field QC checks when predictions are 81mm or larger.
- SAA - 883 targets



AP25-125, TOI, **Hand Grenade** , 1 cm



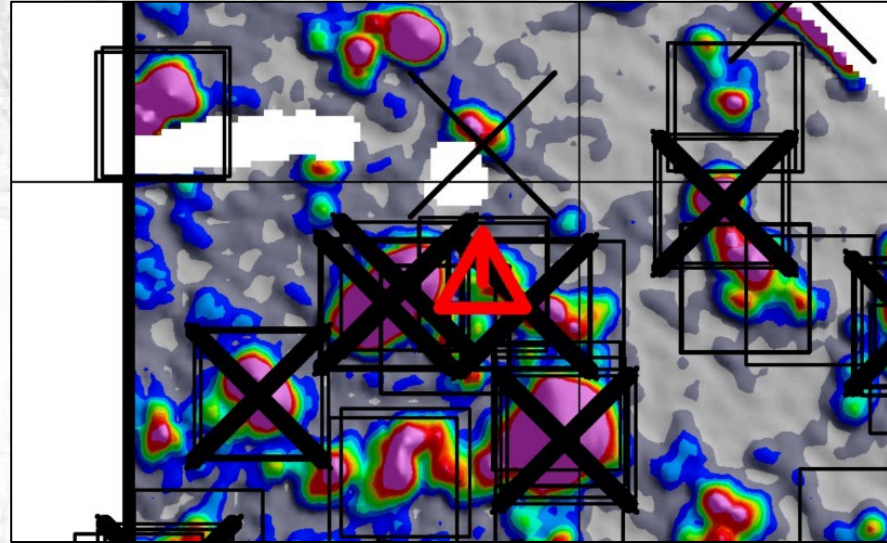
AR10-48, TOI, **57mm Projectile** , 44.3 cm

RCA Timeline

Nov 2022

Cat 3 QC seed

- Originally thoughts we seeded in cluttered area (not following SOP)
- Root Cause: Power line interference
- CA: Developed coherent noise filter



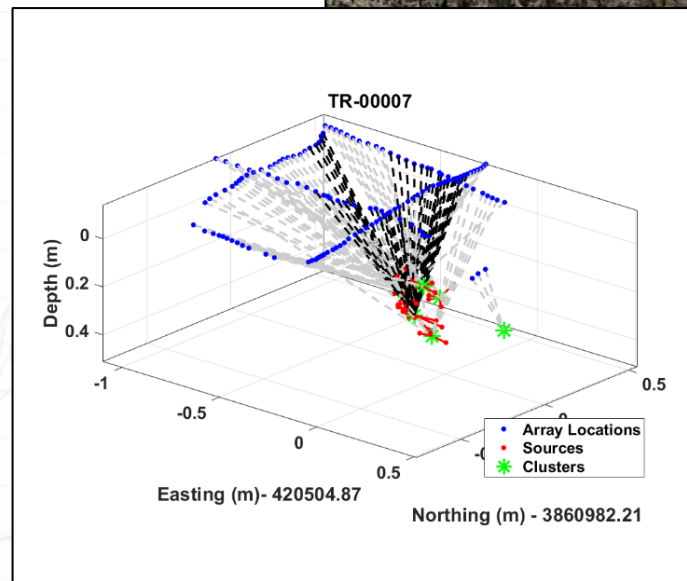
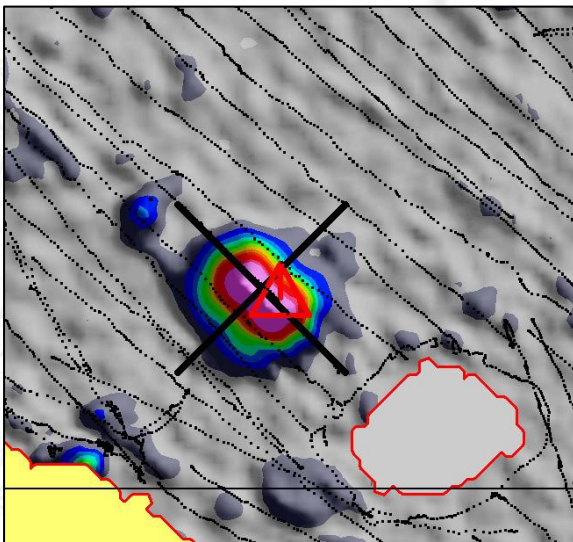
ID	Category	Confidence	AutomatedUXOType	UTM_E_m_	UTM_N_m_	Depth_m_	ModelFit
TR-00134	3	0.84928	37mm Projectile	422148.51	3858938.44	0.173	0.886
TR-00134	1	0.8911	Small ISO80	422148.51	3858938.43	0.139	0.97079

RCA Timeline

Feb 2023

Horizontal MQO >25 cm

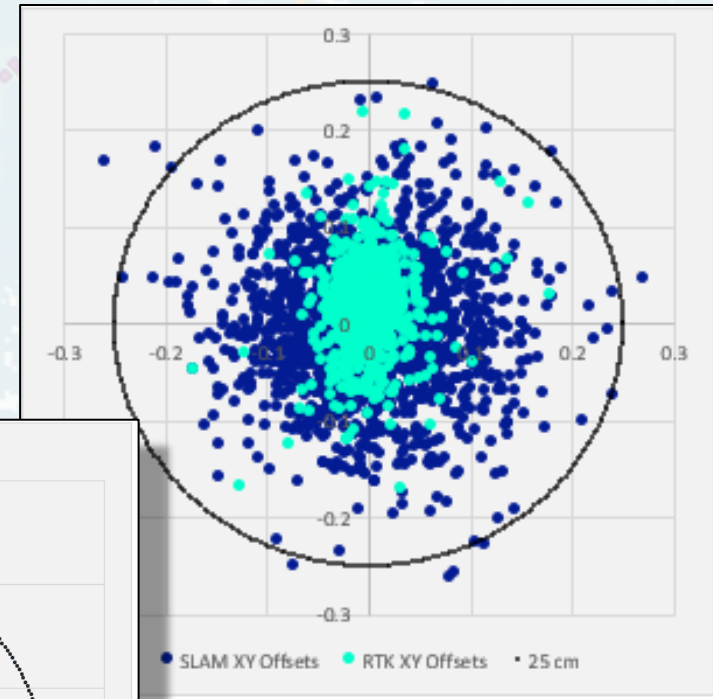
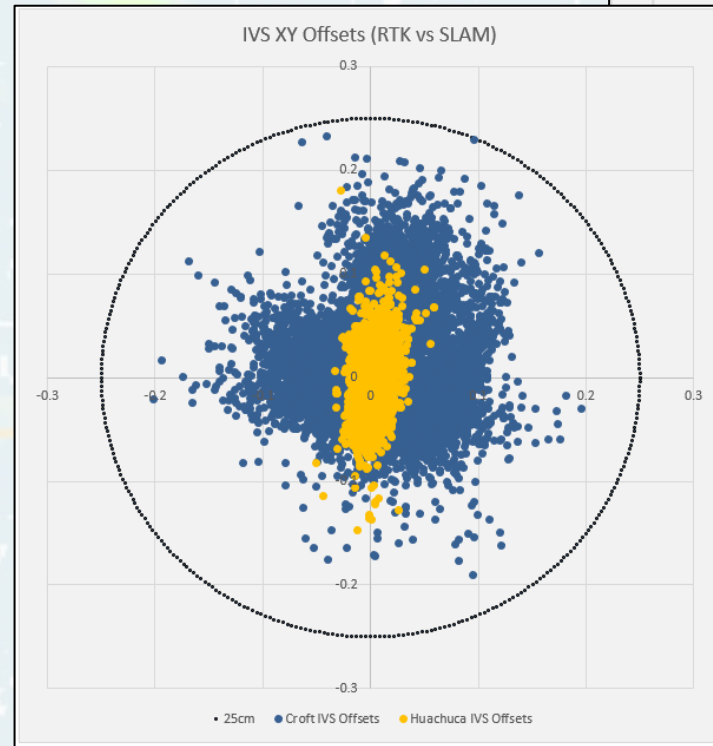
- QA seed
- Compromised positional data kept (inexperienced collection team)
- Led to positional SLAM discussion after recollected data



Current Situation

Horizontal MQO >25 cm

- Small stack of QC seed failures classified as TOI but just outside 25 cm
- Aiming to adjust MQO based on SLAM positioning
- TBD



Project Team Acknowledgements

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White River Technologies

KAARTA

SCPRT



Questions?

