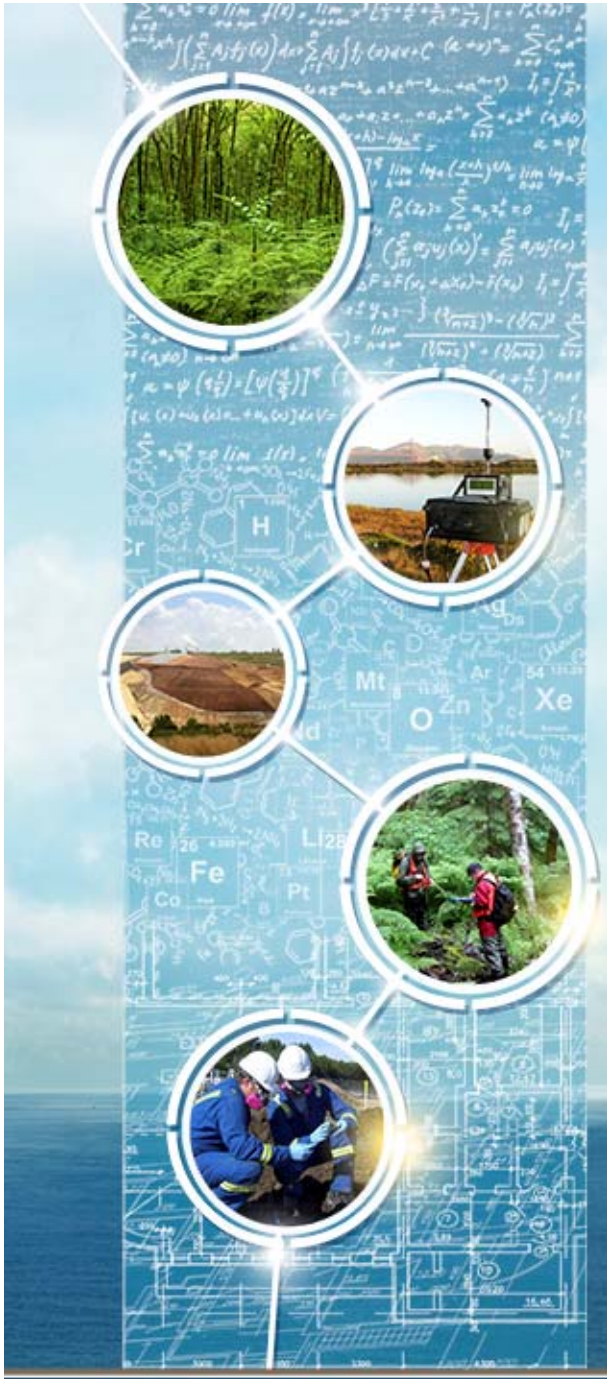

TETRA TECH

Lessons Learned from Live Sites Demonstrations in Challenging Environments

Former Joliet Army Ammunition Plant (JOAAP)

Joliet, Illinois

SAGEEP 2018
Nashville, Tennessee

Matthew Barner
Elise Goggin

Acknowledgements

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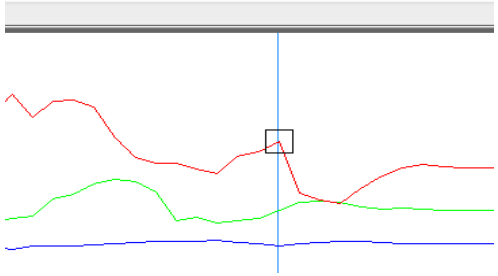
A special thanks to:

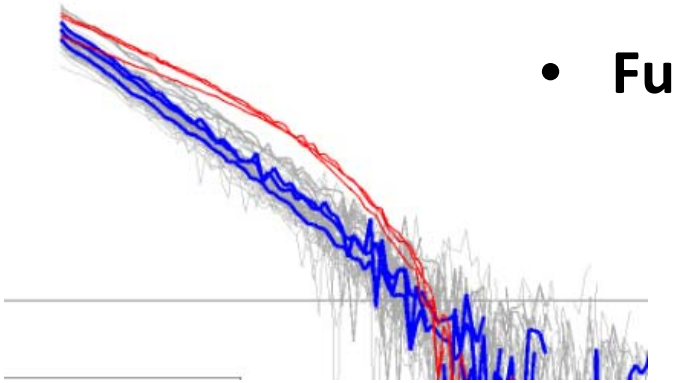
- T. Jeff Gamey
- Jeannie Norton
- Erin Atkinson

Specific Challenges Encountered

- **Site Conditions**
  - Wooded site
  - Tall/dense grasses
  - Tree logs on ground
  - Micro-terrain

	UXA_PITCH	UXA_ROLL	XA_HEADING
55	2.89	1.40	93.70
55	2.93	-1.24	94.42
55	2.48	-0.89	94.41
55	2.15	-1.42	95.84
55	3.38	-1.26	92.37
55	3.74	-1.01	91.17
55	4.46	-0.27	88.56
55	0.79	0.47	91.72
55	0.30	0.53	92.83
55	0.00	0.47	94.05
55	1.11	-0.02	93.98
55	1.97	-0.21	92.85





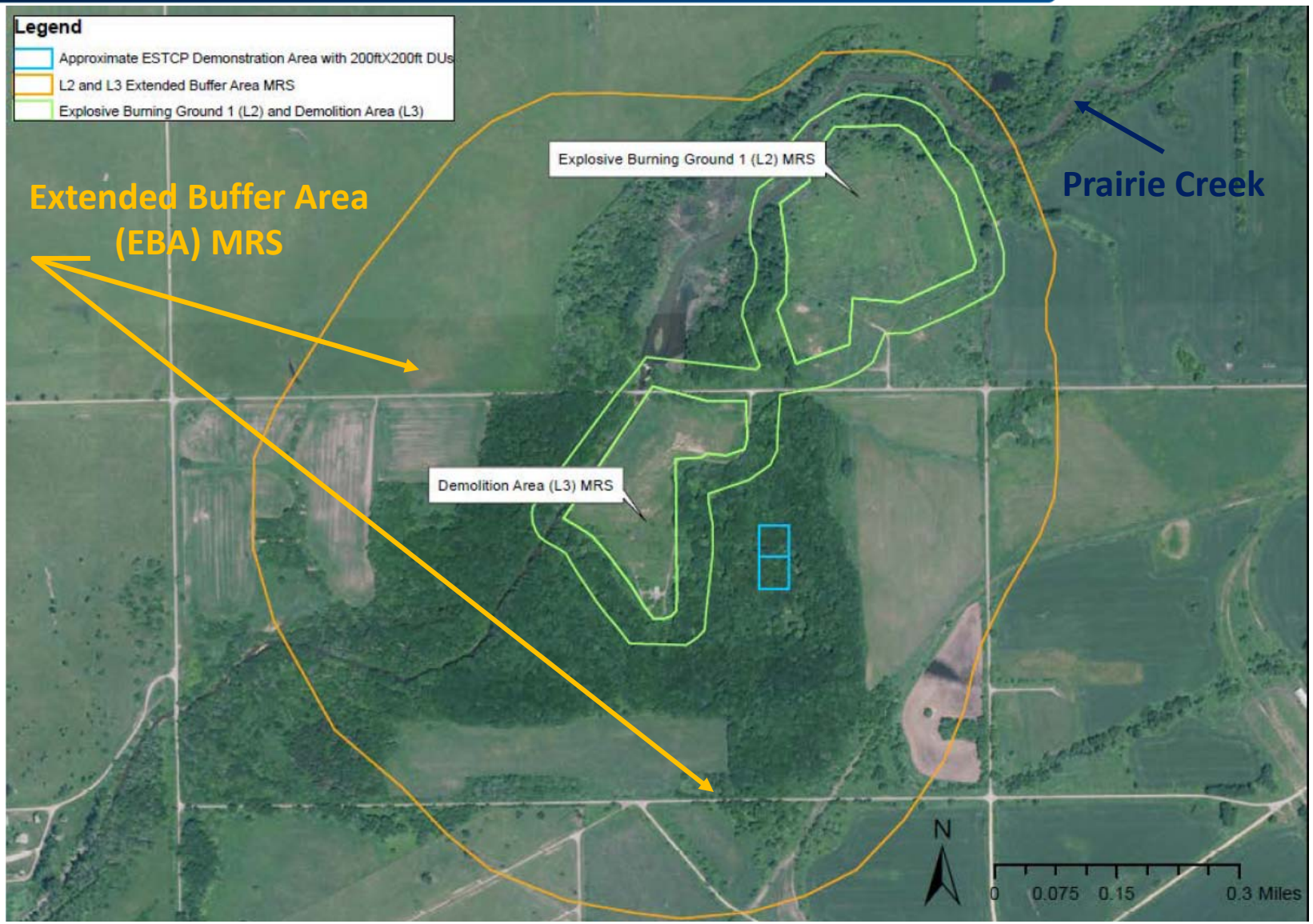
- **Fuzes as TOI**
  - Presence of small TOI that mimic ubiquitous clutter
  - Fuzes not fully intact may still present explosive hazard

Site Description

- Located in Will County, Illinois
- Original facility was 36,000 acres
- Production facility from 1940 – 1999
- >50% of former facility now part of Midewin National Tallgrass Prairie (US Forest Service)
- Terrain is relatively flat with minimal relief
- Soils consist of glacial drift deposits of varying thickness
- Inland flooding is common during heavy precipitation events
- Former OB/OD used for:
  - destruction of fuzes
  - destruction of munitions and associated wastes
  - flashing of contaminated pipe and scrap metal
  - burning of munitions crates and MC

AEDB-R Site Identification	AEDB-R Number	Alternative Identification
Explosive Burning Ground 1 (JAAP-0L2)	JAAP-OL2	L2 IRP Site
Demolition Area (JAAP-0L3)	JAAP-OL3	L3 IRP Site
Capped L3 Area MRS (JAAP-001-R-03)	JAAP-001-R-03	L3 Landfill MRS
Explosive Burning Ground 1 (L2) MRS (JAAP-002-R-01)	JAAP-002-R-01	L2 200-ft Buffer MRS
Demolition Area (L3) MRS (JAAP-001-R-01)	JAAP-001-R-01	L3 200-ft Buffer MRS
L2-L3 Extended Buffer Area (EBA) MRS (JAAP-001-R-02)	JAAP-001-R-02	L2-L3 EBA MRS

Demonstration Area



Munitions-Related Items Previously Found

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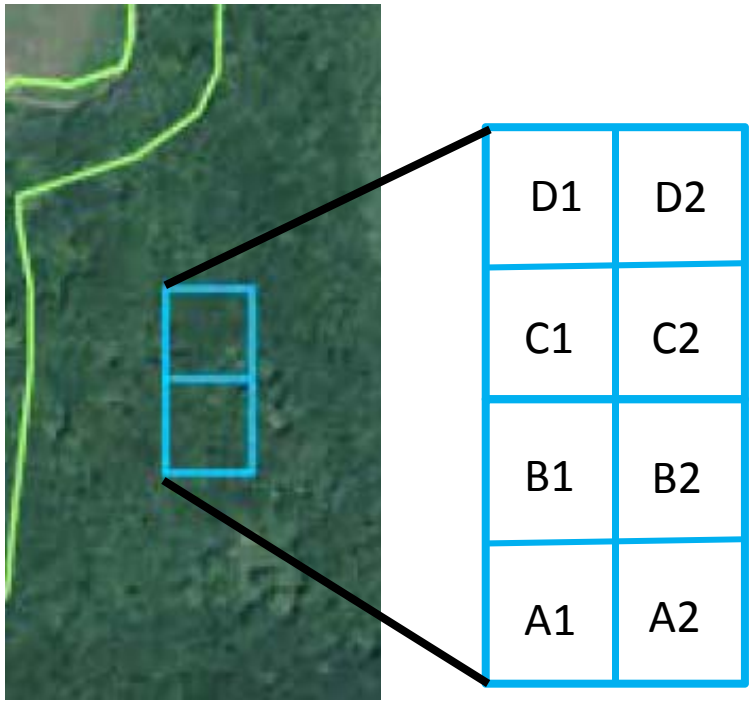
- M48 nose fuzes
- M66 base fuzes
- Various fuze boosters (unspecified)
- 75mm projectiles
- BLU-26/B (1 found; contained no explosives or explosives residue)
- 40mm rifle grenades
- 57mm projectiles
- 155mm projectiles
- 105mm projectiles
- M5 ceramic landmine (1 found)
- 3.5-inch rocket warhead (1 found)

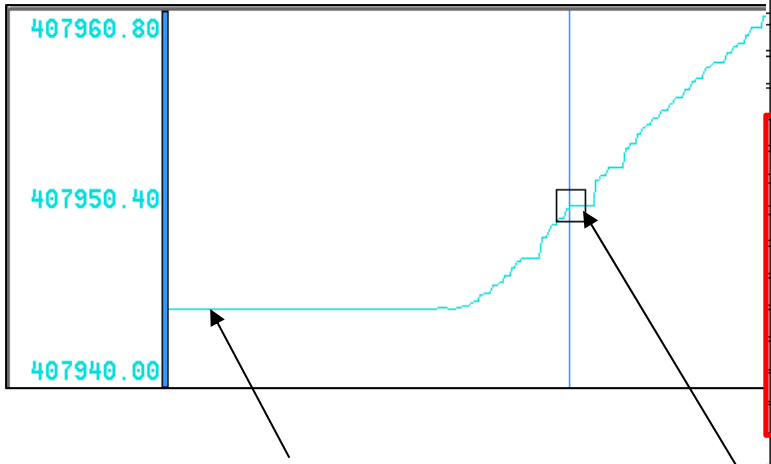
Field Program

- TEMTADS 2x2 for dynamic and cued surveys
- Leica TS16 RTS positioning system
- Microstrain 3DM-GX3-25 AHRS
- GSV process
- Data Management
  - ➢ Divided decision units into smaller operational grids
- ➢ Data firewalling



Positioning Challenges

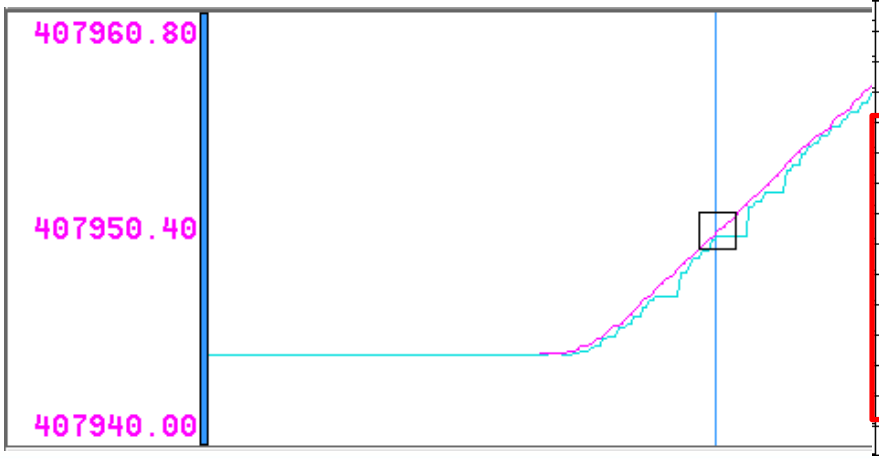
- Gaps in recorded positions
  - Frequent loss of prism lock (trees)
  - Refresh rate for RTS
- Linear interpolation
- Low pass filter used
  - Looks forward 25 points
  - Looks for speed of 0.05m/s or less



X	Y
407949.36	4579469.75
407949.36	4579469.75
407949.91	4579469.73
407949.91	4579469.73
407950.07	4579469.73
407950.07	4579469.73
407950.07	4579469.73
407950.07	4579469.73
407950.07	4579469.73
407950.07	4579469.73
407950.07	4579469.73
407950.07	4579469.73
407950.07	4579469.73
407951.49	4579469.90

Sensor remains stationary

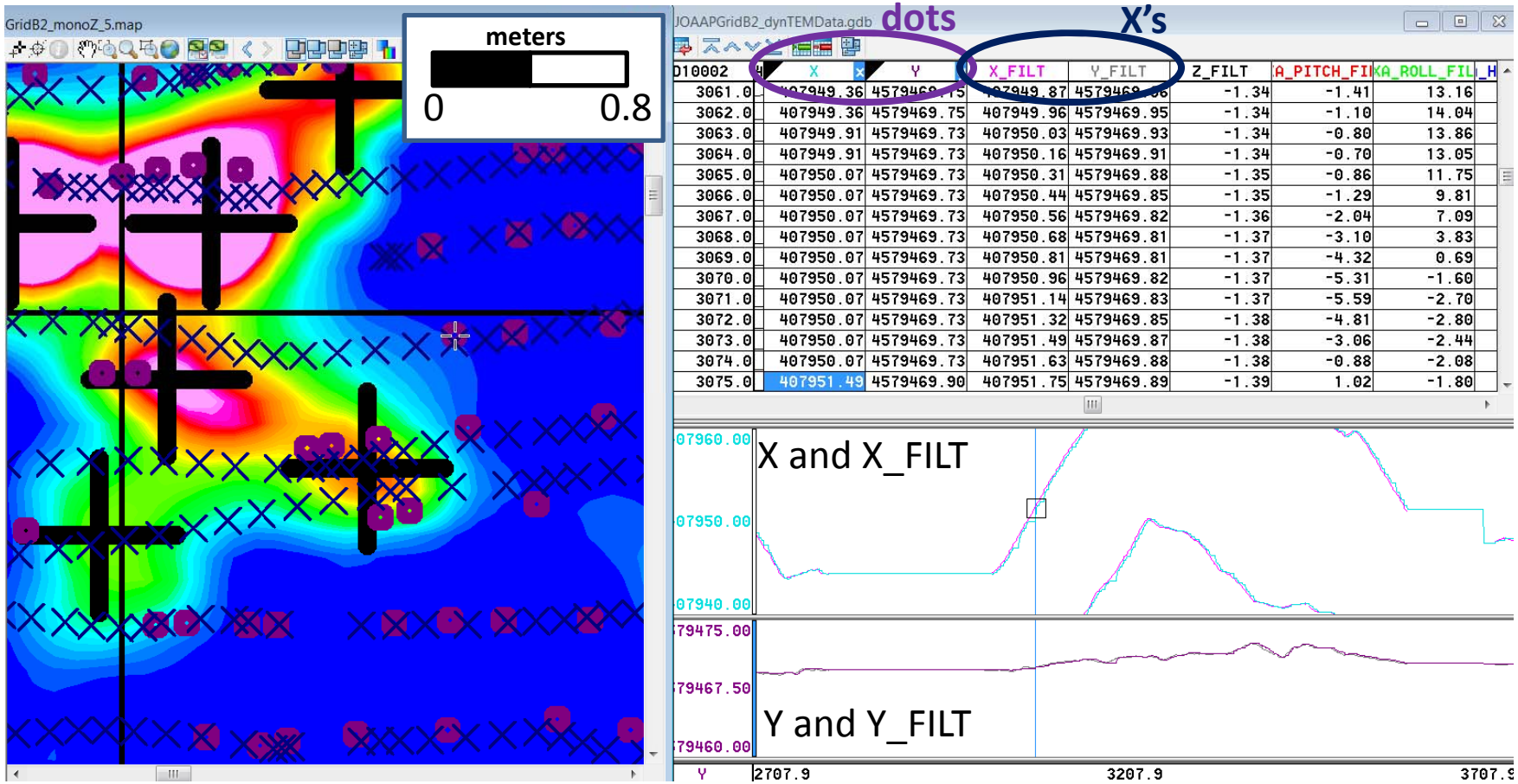
Loss of prism lock (likely tree)



X	Y	X_FILT	Y_FILT
407949.36	4579469.75	407949.87	4579469.96
407949.36	4579469.75	407949.96	4579469.95
407949.91	4579469.73	407950.03	4579469.93
407949.91	4579469.73	407950.16	4579469.91
407950.07	4579469.73	407950.31	4579469.88
407950.07	4579469.73	407950.44	4579469.85
407950.07	4579469.73	407950.56	4579469.82
407950.07	4579469.73	407950.68	4579469.81
407950.07	4579469.73	407950.81	4579469.81
407950.07	4579469.73	407950.96	4579469.82
407950.07	4579469.73	407951.14	4579469.83
407950.07	4579469.73	407951.32	4579469.85
407950.07	4579469.73	407951.49	4579469.87
407950.07	4579469.73	407951.63	4579469.88
407951.49	4579469.90	407951.75	4579469.89

Positioning Challenges

- Results allowed for plotting of data where there are valid geophysical data
- Interpolation honors the latency-corrected data and uses filtered sensor pitch and roll
- Interpolation may not be 100% perfect; still may have gaps to contend with (but will be a lot fewer)



Classification Challenges

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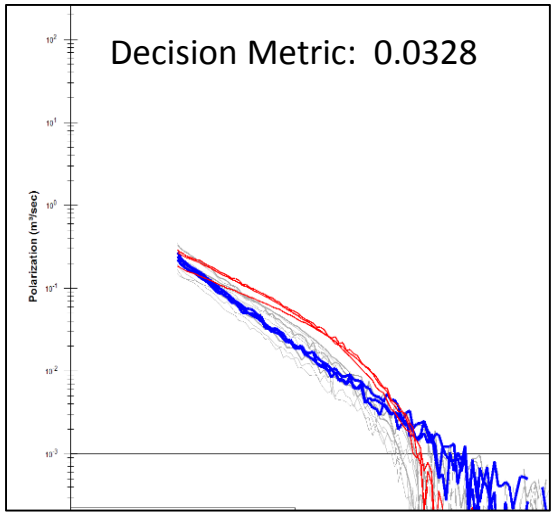
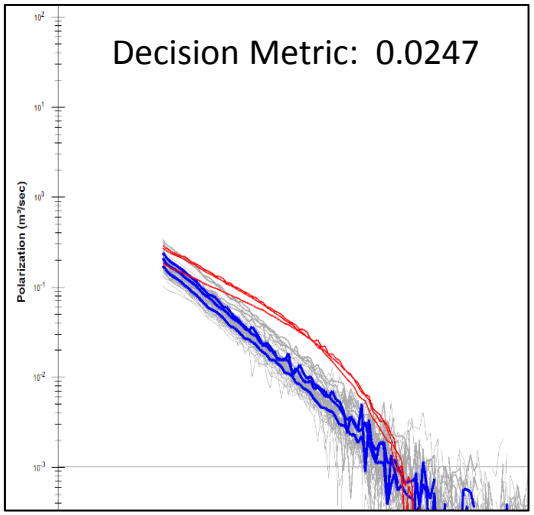
- Approximately 1,100 targets interrogated
- Onsite RI contractor provided a fuze for use after determining it was safe to move
  - Cued measurements recorded at blank space in the IVS
  - Added to site-specific library
- Also recorded data from inert 40mm grenade, 57mm and 75mm projectiles obtained from Tetra Tech warehouse
- Cluster analysis first using threshold of 0.9
  - High target counts in clusters (>99 each)
  - Numerous overlapping clusters identified
  - ACDs identified from these original clusters
  - Added fuzes found in ACDs to site-specific library
  - Debris also found in ACDs added to a separate clutter library
- Cluster match threshold revised to 0.95
  - Approximately 10-20 targets per cluster

Classification Challenges

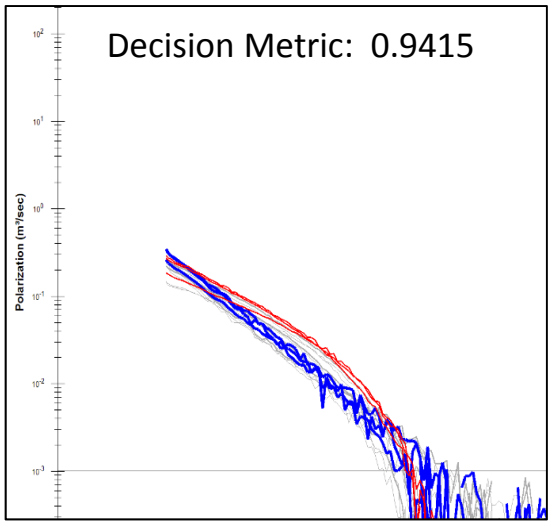
- Visual difference between fuze from IVS (red) and suspected clutter (blue)
- UX Analyze unable to consistently differentiate
- Some agreement between betas in bottom targets displayed in early time
- Manual adjustments by the data analyst
  - ➢ Linear decay interpreted as indicative of clutter
  - ➢ All of these examples ultimately classified as non-TOI by analyst

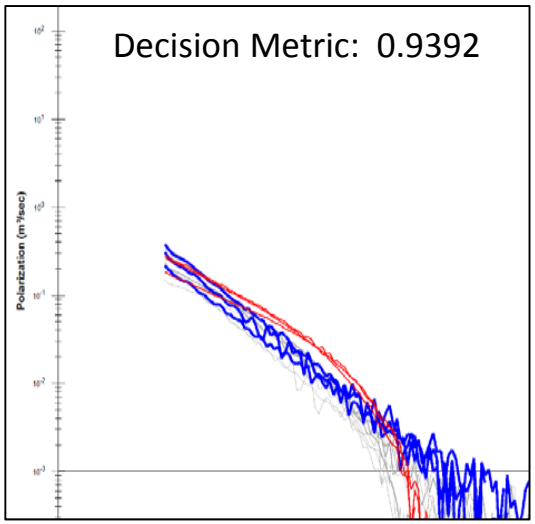
Non-TOI





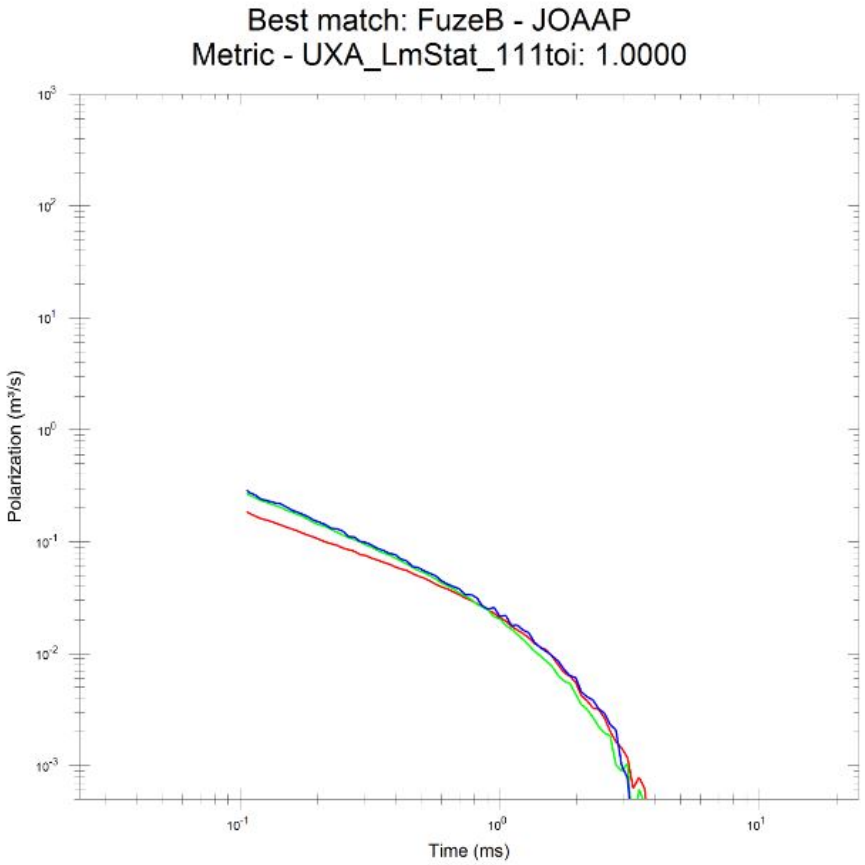
TOI

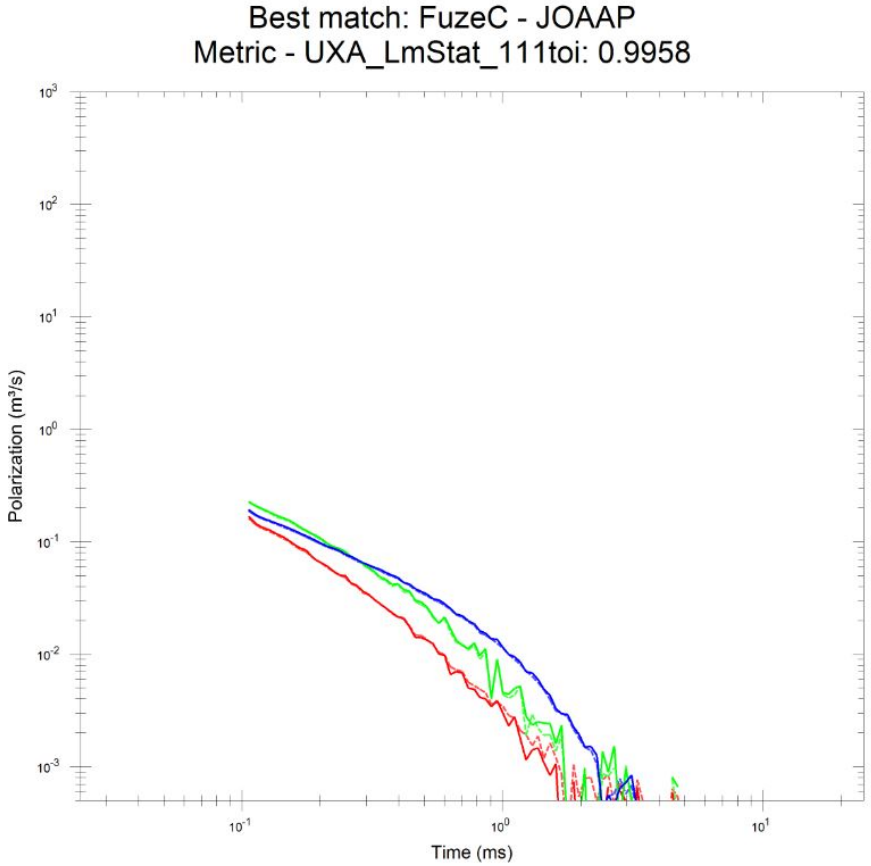




Classification Challenges

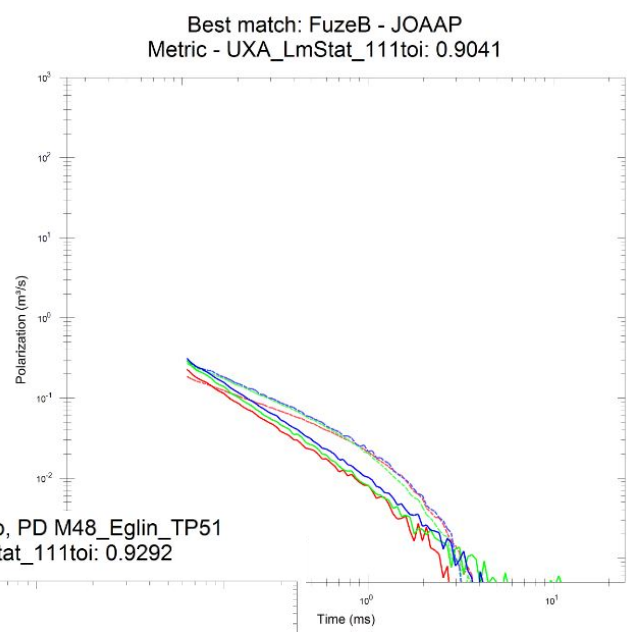
- ACDs – confirmed fuzes

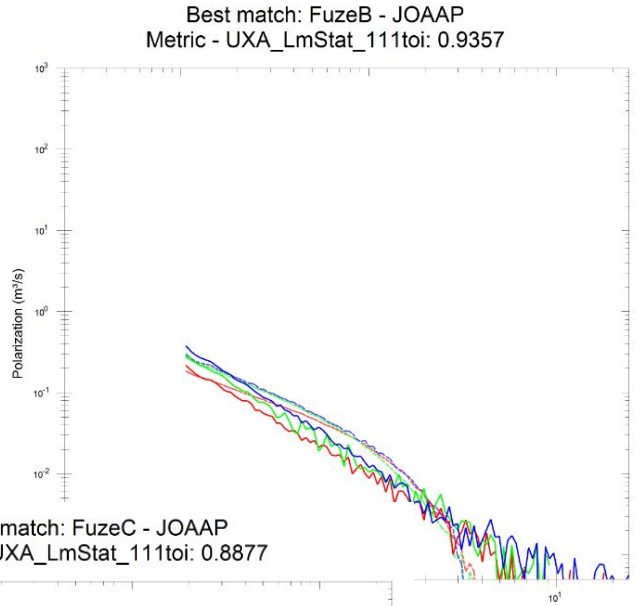


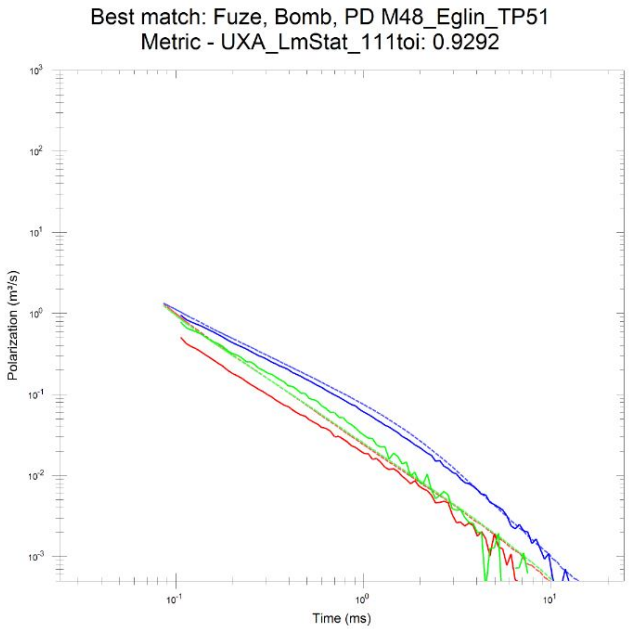


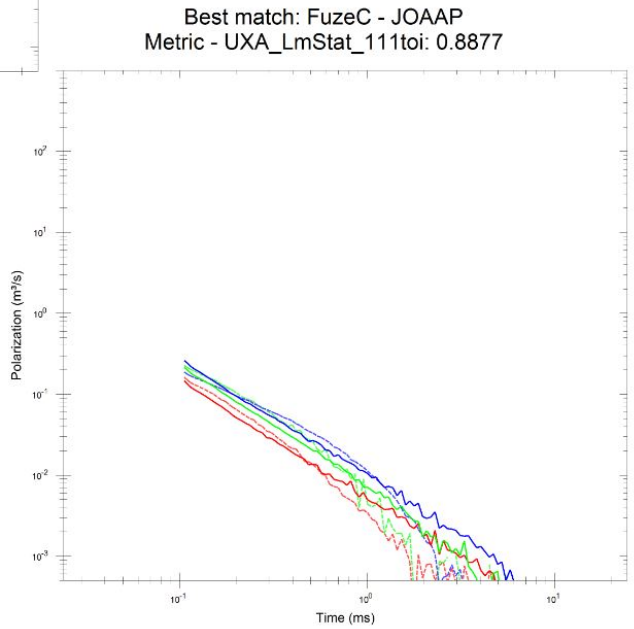
Classification Challenges

- ACDs – confirmed clutter









Conclusions and Discussion

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- Lesson learned: Interpolation of positions can be successfully performed in these conditions to be able to use all the sensor data gathered
  - No missed QC seeds in dynamic detection survey
- Lesson learned: manual overrides of UX Analyze classifier by data analyst was needed to optimally reduce number of clutter digs
- Final results awaiting scoring
- Cost and schedule considerations for dynamic surveying in wooded sites
- Defining TOI during project planning stage
  - Cost implications of AGC for sites where fuzes are concern
  - Information needed to make informed decisions (all fuzes, specific fuzes?)
- Impact to DODLIB when fuzes are TOI
  - Process by which an object makes its way into the library
- Impacts by accreditation process under ISO 17025
  - Failure criteria involving fuzes
  - Software upgrades during project life cycle
  - Degree to which manual overrides are considered acceptable

Questions

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- Elise Goggin: *elise.goggin@tetratech.com*