

# Advanced Classification at Joint Base Cape Cod (JBCC) – UXO removal in the Central Impact Area

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11 Feb 2015



US Army Corps of Engineers  
**BUILDING STRONG**



# BLUF

- USACE is using Advanced Classification for production-scale UXO removal at Joint Base Cape Cod (JBCC), Formerly Massachusetts Military Reservation (MMR), to support Army National Guard - Impact Area Groundwater Study Program (IAGWSP) requirements
- Source Removal must be completed by DEC 2017 per EPA Decision Document
- Production rates, cost data, and lessons learned are available now



# Discussion Topics

- Advanced classification and the challenge of technology transfer
- Central Impact Area (CIA) source removal and control objectives
- Technological challenges working in the CIA
- Achieving production scale results
- Production rates, cost data, and lessons learned





# Advanced Classification Status 2013

- Environmental Security Technology Certification Program (ESTCP) demonstrations are ending
- Advanced classification is ready for tech-transfer to private industry
- DoD push for rapid deployment of advanced classification for cleanup
- M2S2 community is still developing ideas on how to use metal mapper for cleanup
- Equipment: limited availability and cumbersome





# Technology Transfer Status 2013

- The technology works!
  - ▶ ESTCP demonstration: Objectives were met
  - ▶ Ideal site conditions
  - ▶ Limited scope
- But we aren't sure what to do next...
  - ▶ Limited exposure in industry
  - ▶ Equipment isn't readily available
  - ▶ Challenges remain that complicate implementation



# USACE Mission Status 2013

- Utilize advanced classification for cleanup
- Demonstrate return on investment
- Prepare for the future
  - ▶ Train USACE personnel
  - ▶ Prepare for oversight mission
  - ▶ Become a resource for industry
- Execute - Make it happen!



# Previous Work at JBCC

## Status 2013

- ESTCP Demonstration Project (2012)
  - ▶ JBCC was an ESTCP demonstration site
  - ▶ Advanced classification was possible in the CIA
  - ▶ Very difficult site for the advanced classification
  - ▶ Huge regulatory interest
  - ▶ Project success was basis for regulator buy-in





# Project Approval! 2013

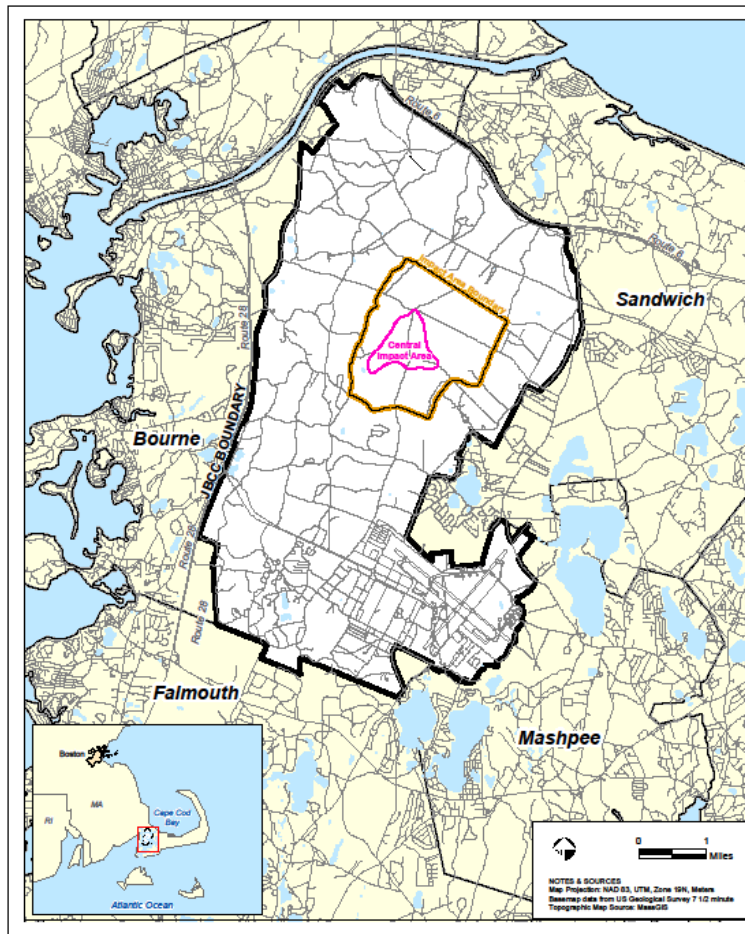
- USACE coordinated approval from the IAGWSP for an in-house advanced classification project
- Objective: to develop advanced classification for use at JBCC
- Major hurdles:
  - ▶ Demonstrate proficiency
  - ▶ Develop equipment and field methods needed to execute
  - ▶ Availability of in-house resources



# Now What?!!!!!!!



# The Site - Central Impact Area



Central Impact Area Location

FIGURE  
1-1

Impact Area  
Groundwater Study Program



- Former Impact Area
- 330 acres
- Used for live-fire training from the early 1930's to 1997
- Concentration of artillery and mortar shells
- Located above a sole-source aquifer





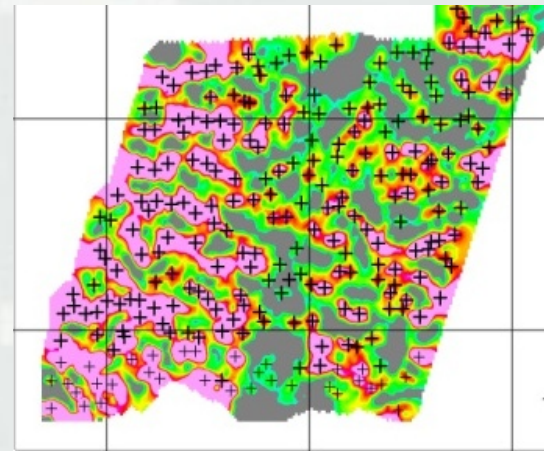
# Long-Term Source Area Response Action

- UXO is considered a potential source of groundwater contamination
- Decision Document requires:
  - ▶ Source removal and control
  - ▶ Develop a plan and implement technologies to maximize the reduction of UXO, while minimizing impact and destruction of environmentally sensitive habitat
  - ▶ Remove 75-95% of UXO



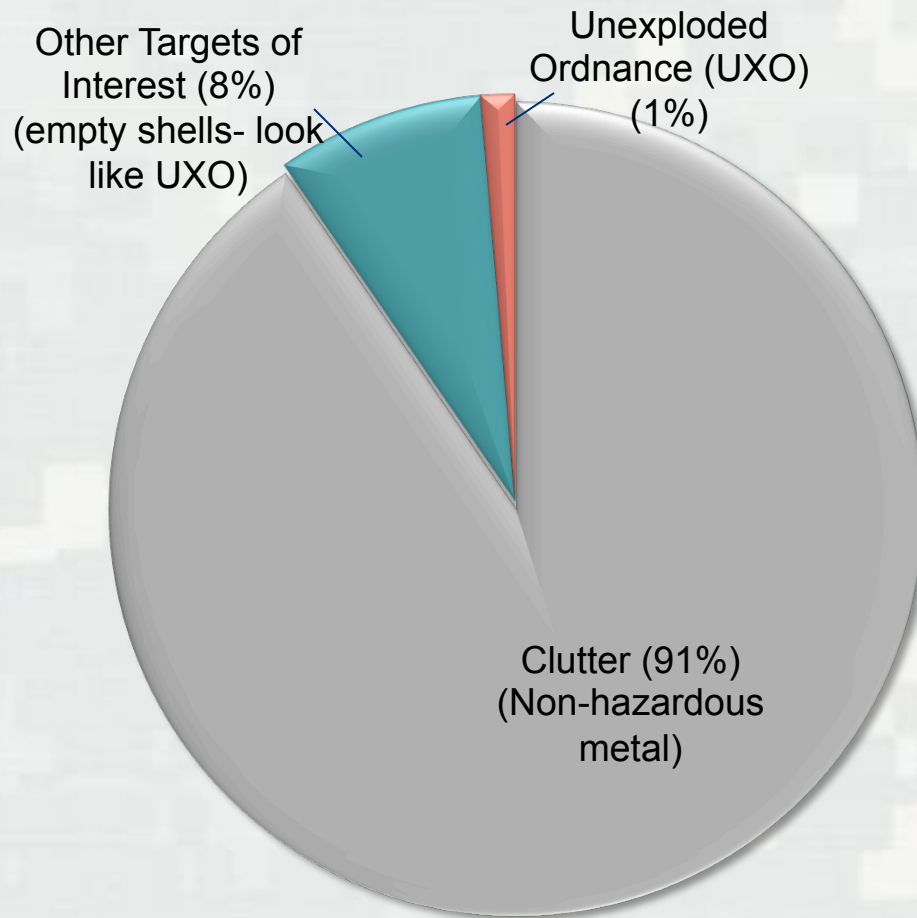
# Site Conditions

- Why the CIA is a challenging site:
  - ▶ Large Area: 58 acres
  - ▶ Very high MEC/MPPEH density
  - ▶ Very high clutter density
  - ▶ Wide variety of munitions
  - ▶ Difficult terrain (vegetation / impact craters)





# Why we need Advanced Classification at JBCC



- Reduce cost
- Reduce time
- Meet cleanup objective



# Project Delivery Team

- U.S. Army Corps of Engineers
  - ▶ Customer – Army National Guard - Impact Area Groundwater Study Program (IAGWSP)
  - ▶ Project Manager - New England District
  - ▶ Technical Lead / Logistics - Baltimore District
  - ▶ Advanced Classification Experts - Huntsville Center
  - ▶ Technical Support and Guidance - USACE CX
  - ▶ Explosive Safety - Baltimore District
  - ▶ Geophysics
    - Baltimore District
    - Huntsville District
    - Sacramento District
    - Fort Worth District
    - Omaha District



# Timeline

- Year 1 – Proof of Concept (2013 - 2014)
- Year 2 – Production (2014 - 2015)
- Year 3 – Standardization (2015 - 2016)
- Year 4 – Optimization (2016 - 2017)



# Year 1 – Proof of Concept

- Demonstrate proficiency
  - ▶ USACE processed ESTCP data from 2012 Demo
  - ▶ USACE collected & processed MM data on two ¼ acre test grids
  - ▶ Submitted results to ESTCP for official scoring
  - ▶ USACE achieved greater than 95% TOI identification and greater than 75% reduction in clutter digs
- Quality Assurance
  - ▶ EPA selects one ¼-acre grid per 6 acres for full intrusive investigation for ongoing validation.





# Year 1 - Data Processing and Equipment

- Data Processing
  - ▶ Contractor collects DGM data
  - ▶ Huntsville does QA review, develops target list
  - ▶ Baltimore collects metal mapper data
  - ▶ Baltimore develops initial dig list
  - ▶ Huntsville does QA on dig list, sends to contractor
  - ▶ Contractor excavates Targets of Interest
- Field Equipment
  - ▶ GEN 1 MetalMapper
  - ▶ ESTCP Mobilization platform / configuration
  - ▶ Real Time Kinematics (RTK) GPS



# Year 1 – Equipment (cont.)

- Tractor mounted (3-point hitch)
  - ▶ Open to the elements
  - ▶ Uncomfortable seating position
  - ▶ High center of gravity
  - ▶ Hard to maneuver
  - ▶ Limited ability in difficult terrain
  - ▶ Potential for roll-over
- Metal Mapper
  - ▶ Showing signs of wear
  - ▶ Sensitive to moisture





# Year 1 – Fieldwork





# Year 1 – Fieldwork





# Year 2 – Production

- Improved mobilization platform
  - ▶ Reconfigured to front-mount for tracked skid steer
  - ▶ Redesigned cradle for increased strength
- Improved operator comfort and safety
  - ▶ Purchased Volvo skid steer with single lift arm
  - ▶ Climate controlled cabin
- Mobilize second Metal Mapper Unit
  - ▶ Borrowed second unit from HNC
- Repaired failing Metal Mapper Units



# Year 2 – Fieldwork





# Year 2 – Fieldwork





# Year 2 – Fieldwork





# Year 2 – Fieldwork



# Year 3 – Standardization

- Improve mobilization platform
  - ▶ Purchased second Volvo skid steer with single lift arm
- Field Staff Roles and Responsibilities
  - ▶ Standardize field tasks
  - ▶ Train operators from all technical backgrounds to operate the equipment
  - ▶ Transition geophysicist to oversight role
- Keep aging equipment in working order
  - ▶ Keep both units operating



# Year 4 – Optimization

- Continue to train operators
- Improve methods to optimize data collection
- Most importantly: Make it to the finish line with existing equipment!
- Address any new requirements - EPA may require additional acreage based on UXO density



# Work Status

Project		
Area	Acres	Performer
PHASE I	6	ESTCP/MM
PHASE I	8^	NAB MM
PHASE I	16	NAB MM
PHASE II Area 1	10*	NAB MM
PHASE II Area 2	10	NAB MM
PHASE II Area 3	8	NAB MM
<b>TOTAL:</b>	<b>58</b>	
^: Prior Removal Action conducted at site *: Work in progress		
MM and Excavation Complete		
MM Complete		
Work Underway		

- The CIA is subdivided into 6 primary parcels
  - ▶ CIA Total Acres: 58
  - ▶ Number of Phases: 2
  - ▶ Number of Parcels: 6
- Work is progressing concurrently in multiple parcels
- Scheduled Completion Date: DEC 2017





# Production Data

Year			Anomalies				Targets of Interest	
Field Season	Acres	Production Days	Total	Per/day/unit			Targets	TOI/Total
				AVG	MAX	MIN		
ESTCP Demo Site	6	na	na	na	na	na	na	na
Year 1 (2013-2014)	8	90	15,230	156	248	46	4527 <sup>^</sup>	30%
Year 2 (2014-2015)	16	91	27,702	161	248	55	11,176	40%
<b>Year 3 (2015-2016)</b>	<b>10</b>	<b>94</b>	<b>22,202</b>	<b>157</b>	<b>277</b>	<b>25</b>	<b>8881*</b>	<b>40%</b>
Year 3 (2015-2016)	10							
Year 4 (2016 - 2017)	8							
<b>TOTALS</b>	<b>58</b>	<b>275</b>	<b>65,134</b>	<b>158</b>	<b>277</b>	<b>25</b>	<b>24,584</b>	<b>38%</b>

- Typical Production Rate: 180 Targets/Day
- Variables: Weather, Repairs, Terrain, Data Quality, Military Training

<sup>^</sup>: Prior Removal Action conducted at site

\*: Work in progress

MM and Excavation Complete

MM Complete

Work Underway



# Cost Data

Year		MM			Excavation			Totals		
Field Season	Acres	Number of Anomalies	Cost per Anomaly	Total Cost	Number of Anomalies	Cost per Anomaly	Total Costs	Total Cost w/ MM	Total Cost w/o MM	Cost Avoidance
ESTCP Demo (2013)	6	na	na	na	na	na	na	na	na	na
Year 1 (2013-2014)	8	15,230	35	\$533,050	4527^	\$151	\$683,577	\$1,216,627	\$2,299,730	\$1,083,103
Year 2 (2014-2015)	16	27,702	37	\$978,207	11,176	\$160	\$1,788,160	\$2,766,367	\$4,432,320	\$1,665,953
Year 3 (2015-2016)	10	22,202	38	\$841,900	8881*	\$132	\$1,172,292	\$2,014,192	\$2,930,664	\$916,472
Year 3 (2015-2016)	10									
Year 4 (2016 - 2017)	8	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
<b>TOTALS / AVERAGES</b>	<b>58</b>	<b>65,134</b>	<b>37</b>	<b>\$2,353,157</b>	<b>24,584</b>	<b>\$148</b>	<b>\$3,644,029</b>	<b>\$5,997,186</b>	<b>\$9,662,714</b>	<b>\$3,665,528</b>

- Cost Avoidance: 38%
- Advanced Classification: \$37/anomaly
- Anomaly Excavation: \$148/anomaly
- Cost per acre: \$5.99M / 34 acres = \$176,000 / acre

^: Prior Removal Action conducted at site

\*: Work in progress

MM and Excavation Complete

MM Complete

Work Underway



# Recovery Data

Project			Recovery		Cost	Cost/Unit	
Area	Acres	Performer	UXO	HE (lbs)	(\$)	UXO	HE (lbs)
PHASE I	6	ESTCP/MM	70	209.35	NA	NA	NA
PHASE I	8 <sup>^</sup>	NAB MM	159	430.8	\$1,216,627	\$7,651.74	\$2,824.11
PHASE I	16	NAB MM	279	960	\$2,766,367	\$9,915.29	\$2,881.63
PHASE II Area 1	10*	NAB MM	81	225	-	-	-
PHASE II Area 2	10	NAB MM			TBD	-	-
PHASE II Area 3	8	NAB MM			TBD	-	-
<b>TOTAL:</b>	58		589	1825.15	-	-	-

<sup>^</sup>: Prior Removal Action conducted at site

\*: Work in progress

MM and Excavation Complete

MM Complete

Work Underway



# What does the data tell us?

- Many variables affecting the project:
  - ▶ Complexity of site
  - ▶ Learning curve
  - ▶ Evolution of equipment
  - ▶ Funding/Overlap in working seasons
- Bottom line cost/anomaly are consistent with ESTCP estimates
- Data trends?
- Consistent results





# Questions?

