REMEDIAL INVESTIGATION
OF THE CLOSED RANGES
AT F.E. WARREN AFB:
A CASE STUDY

Joint Services
Environmental Management Conference
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Overview

- F.E. Warren Air Force Base History
  - 1867 Fort Russell, U.S. Army Outpost
  - USAF Space Command
- Historic Ranges
- Munitions and Explosives of Concern (MEC)
- Remedial Investigation (RI)
  - Approach
  - Findings
  - Future steps
FEW Historic Range Photos

Services to Support One Mission
Services to Support One Mission

Closed Range
~ 3,000 acres
Historic Ranges

- 1912 Training Ranges
- Artillery
- Anti-Aircraft/Tank
- Machine Gun
- Rocket/Rifle Grenade
- Live Grenade
- .22 cal/.30 cal
- Pistol
- Active Ranges (x3)
MEC Types

- 37 millimeter (mm) Projectile Rounds
- 40mm Grenades
- Hand Grenades
- M-9 Rifle Grenades
- 2.36-inch Bazooka Rocket Mortar
- 75mm Artillery Rounds [Low-explosive with Grape Shot; High Explosive (HE) with Point Detonating (PD) Fuze]
- 3-inch Stokes Mortars
- Cannonballs
- M-1 Anti-Tank Mines
- Small Arms
Current
- Open Space
- Limited Industrial
- Perimeter Fence & Signs

Future
- Mission Support
- Development?

Land Use
Remedial Investigation

- USAF Environmental Restoration Program (ERP)
  - Air Force Center for Environmental Excellence
- CERCLA (Superfund)
  - Process: RI – Feasibility Study (FS) – ROD – RD/RA
- Investigate and delineate extent of:
  - MEC - Partial “clearance” of range through investigation
  - Munitions Constituents (MC) - Explosive residues, Lead
- Assess human and ecological risk
- Support for FS and future Remedial Action (formal clearance)
  - Optimize approach for future land use
General RI Approach

- **Dynamic**
  - Continuous spatial analysis
    - Boundary delineation
    - Correlation of target anomaly density to investigated MEC
  - Dataflow (digital tools)
  - Evolving Conceptual Site Model (CSM)

- **Strategic**
  - Collect data to optimize resources & estimate resources for remaining investigation and future remedy
  - Strategic redeployment of resources
    - Information vs. production & acres cleared
RI Approach (Cont.)

- Range Reconnaissance (2003)
- Initial CSM
- Intrusive investigation & MEC response
- Analyze MEC distribution
- Define Munitions Response Sites (MRS)
- Strategic MC soil sampling
- Risk assessment (MEC & MC)
- Reporting
Range Reconnaissance

- Records Review
  - 2001 Range Inventory
  - Historic range maps
  - EOD clearance reports
- Geophysical (Geo) Investigation
  - Geo Prove-Out (GPO)
  - Transect survey – 58m
  - Target anomalies
- RI Work Plan
  - CSM
  - Investigation approach
  - Data/risk evaluation

Services to Support One Mission
General CSM

- Zone 1 – Probable MEC
  - Full coverage
- Zone 2 – Possible MEC
  - Transects & stepouts
- Zone 3 – Outlying Area
  - Transects & stepouts
Geophysical Prove-Out

- Demonstrate capabilities
  - Instrument validation
  - Site-specific capabilities
- Seed items
  - Historic MEC items
  - Various depths and orientations
- Geo Survey
  - Response values
  - Threshold value for target anomaly

Services to Support One Mission
GPO Plot

Transect

Full

Services to Support One Mission
Site-Specific Remediation Depths

- How clear is clear?
- SSRDs recommended for unrestricted use by DoD Explosives Safety Board (DDESB)
- Determining SSRDs – DoD 6055.9-STD
  - GPO
    - Site-specific data – MEC, depths and response values
  - UXO Recovery Database (USACE & CTC)
    - MEC/UXO data from multiple sites
    - Recovery Depths – mean, median, maximum
- Comparison of site GPO data to UXO database
  - Can we “see” deep enough to recover all MEC?
  - Recommend SSRDs for “unrestricted” use
- Comparison of RI data to database and SSRDs
Field Investigation
General Strategy

- Mission support
  - Wind Farm, Storm water, JFHQ
- Evaluate target densities in suspected range areas & strategically deploy UXO teams
- Delineate hotspots & boundaries
  - Optimize resources
- Refine CSM
- MEC Response
Field Investigation

- Explosives Safety Submission (ESS)
  - Approved by DDESB
  - Mobilized March 21, 2005

Personnel
- SUXOS, SSO, QC
- 4 Dig Teams (7 each)
- 3 Geo Teams (2 each)

Equipment
- EM-61, Schonstedt, Fisher
- ATVs & Hand Tools
- E-Tools
  - GPS Receivers
  - Hand-held PDAs
  - Website
  - GIS

Services to Support One Mission
Geo Teams

- EM-61
  - Towed Array: tri-coils
  - Hand-held
- Data Flow
  - Collected
  - Upload/download Daily
  - Processed & targets picked
  - Target density maps
  - Upload/download to PDAs for investigation

Services to Support One Mission
Geo Teams

Services to Support One Mission
Services to Support One Mission

Dig Teams
Reacquiring Anomalies
Digging Anomalies

Services to Support One Mission
Services to Support One Mission

Safety Zones

- Buffer (1701 ft) - MGFD
- Potential Evacuation (300 ft)
Investigating Safety Buffer Zones

‘Bud Light’
MEC Discoveries at F.E. Warren AFB
75mm Fuzed
Services to Support One Mission

75mm HE Fuzed
37mm HE Fuzed
Stokes Mortar, Unfuzed
X-Ray MEC – EOD Support
Chemical Agent Identification Set

- K955 Sniffer Kit
- 1988 finds, burn pits
- Relatively harmless, but classified as CWM
- Coordinating with:
  - Wing Safety
  - HQ AFSPC Safety
  - AFSC
  - USATCES
  - DDESB
- Exclusion Zone
- Chemical Safety Submission (3/2/06)
Investigated Anomalies as of 10/3/05

### Investigated Items

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<tr>
<th>Classification</th>
<th>Count</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>MEC Scrap</td>
<td>26,996</td>
<td>69.3</td>
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<tr>
<td>Non-MEC: Other</td>
<td>3,843</td>
<td>9.9</td>
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<td>Small Arms</td>
<td>2,893</td>
<td>7.4</td>
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<tr>
<td>Non-MEC: Geologic</td>
<td>2,083</td>
<td>5.3</td>
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<tr>
<td>False Positive</td>
<td>2,206</td>
<td>5.7</td>
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<tr>
<td>MEC</td>
<td>532</td>
<td>1.4</td>
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<tr>
<td>Utility Lines</td>
<td>196</td>
<td>0.5</td>
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<tr>
<td>Non-MEC: Historical</td>
<td>203</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>38,952</td>
<td>100.0</td>
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### MEC Items

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Count</th>
<th>Percentage</th>
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<tr>
<td>75mm</td>
<td>221</td>
<td>41.5</td>
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<tr>
<td>m1907 PTTF</td>
<td>219</td>
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<td>37mm</td>
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<td>fuze</td>
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<td>3.9</td>
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<tr>
<td>Other</td>
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<td>0.6</td>
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<tr>
<td>grenade</td>
<td>2</td>
<td>0.4</td>
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<tr>
<td>40mm</td>
<td>1</td>
<td>0.2</td>
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<tr>
<td><strong>Total</strong></td>
<td>532</td>
<td>100.0</td>
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</tbody>
</table>
Findings

- As of 03 October 2005, 38,952 investigations
- Majority of items MEC scrap and Non-MEC
  - MEC Scrap
    - Frag, frag and more frag, expended fuze
  - Non-MEC
    - Rocks, wire, nails, horseshoes, bolts, cans
    - Small arms
Target Anomaly Density

75mm MEC/Scrap

Services to Support One Mission
GIS Spatial Analysis

75mm MEC/Scrap

37mm MEC/Scrap

Services to Support One Mission
Quality Control

- Geo-processing
- Hole Clearance
- Seed Item
- Confirmation Survey and Investigation Verification (CSIV) – Limited

- Adapted to RI vs. Clearance
MEC Storage

Services to Support One Mission
Demilitarization Operations

Services to Support One Mission
Explosive Ordnance Disposal (EOD)

- Successful partnering
- Blow In Place (BIP)
  - Fuzed items (per USACE guidance)
  - Provide GPS coordinates
  - Blast and frag mitigation (sand bags)
  - EOD places charges and detonates

BIP – May 24, 2005

Services to Support One Mission
Where Next?

- Complete MEC investigation (2nd field season)
  - Increased optimization
    - UXO Discrimination – Linear Genetic Programming
  - Delineate MRSs for:
    - FS/future RA (mechanized removal? Small arms – lead?)
    - Focused MC investigation

- MC Sampling Plans & Sampling
  - Surface & Subsurface soil sampling
  - Delineate extent of soil contamination

- RI Report
  - Risk evaluation – MEC & MC
  - Document process & findings
FEW Lessons Learning

- Integrate ERP (RI/FS) & UXO expertise
- Strategic approach
  - Optimize resources
  - Predictive geophysical evaluation
  - Spatial analysis
  - Delineate boundaries
  - Dynamic planning & CSM
    - Rapidly shift and deploy dig teams
- E-Tools & Data Management
  - PDAs, website, database, GIS, GPS
- Updated Projections: Level of effort & costs

Services to Support One Mission
FEW Lessons Learning (Cont.)

- Partnering
  - Mission Support: Wind Farm, Joint Forces Headquarters, Stormwater;
  - EOD
- Triad Approach (manage decision uncertainty)
  - Systematic project planning ("strategic planning")
  - Dynamic work strategies
  - Real-time measurement strategies

QUESTIONS