

# Quality Reviews of FUDS MMRP GIS Data

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## Environmental Monitoring and Data Quality Workshop

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# Report Documentation Page

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# Presentation Outline

- **FUDS-MMRP Geospatial Data and Standards**
- **Project Data Reviews – Historical Photos & Metadata**
- **GIS Metadata Tools**
- **Summary**



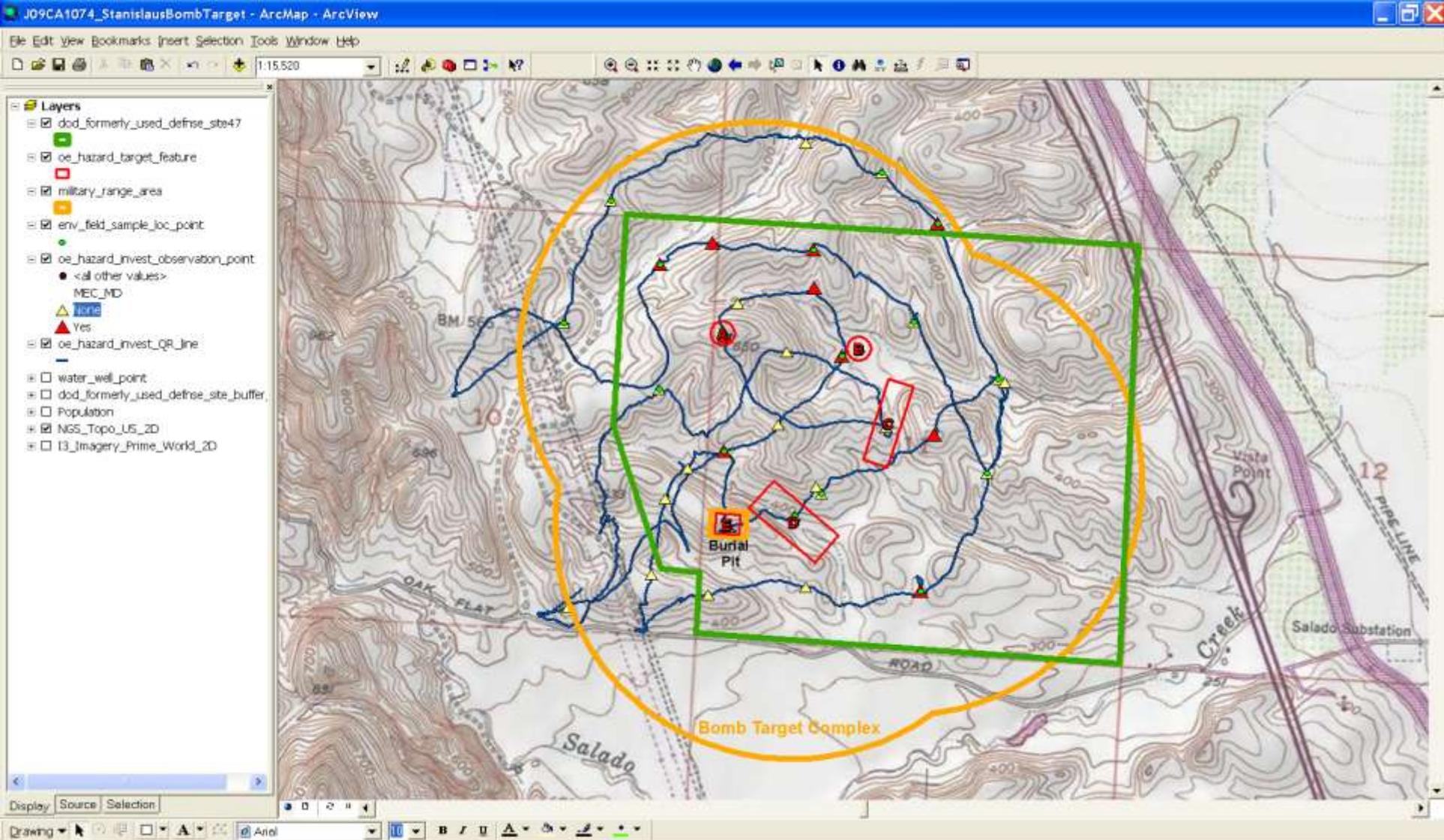
Kirtland Simulated Oil Refinery Target

# Types of FUDS MMRP Geospatial Data

- Initial Identification – Inventory Project Report (INPR)
  - Archive Search Report (ASR)
    - Property Boundaries
    - Range Features (e.g., firing lines, bombing targets)
    - Some Field Data Locations and Photos
- Site Inspection (SI) - Sample Designs and Field Data
  - Qualitative Reconnaissance (QR Tracks)
  - Field Samples (soil, water)
  - Other Existing GIS Data – water wells, population, sensitive habitats, etc.
- Geospatial Data Sources
  - Text Descriptions (e.g., legal property descriptions)
  - Historical Maps (plans and as-built drawings)
  - Aerial Photos
  - GPS and other Survey Equipment

# Example of California SI GIS Dataset

(Metadata Review for 54 MMRPs)



# FUDS MMRP GIS Data Life Cycle

- Site Activities Follow CERCLA Process
  - Identification, Investigation, Cleanup, Closure/Monitoring
- Long Timeframes
  - Sites are by definition *historical*
  - Oldest MMRP site dates back to the American Revolution
  - FUDS Program schedule currently spans 150 years
- Many Organizations
  - New Site Owners/Stewards and Many Stakeholders
  - Number likely to increase in later stages
- Importance of Data Quality Documentation (Metadata)
  - Effective standards critical to data use and reuse
  - Standards compliance

# Geospatial Data Standards and Guidance

- USACE Manual EM 1110-1-2909: Engineering and Design, Geospatial Data and Systems
  - SDSFIE Version 2.6
    - *Version 3.0 (11/2010)*
  - FGDC Content Standard for Digital Geospatial Metadata (Version 2)
    - *North American Profile under Development for ISO 19915: Geographic Information Metadata*
- MMRP-09-007 (Data Item Description)
  - Geospatial Information and Electronic Submittals
- Some Issues
  - Ensuring Compliance
  - Major Changes in Standards and Tools
  - Complexity Hinders Uniform Responses

# FUDS MMRP GIS QC Reviews

- New Mexico State FUDS GIS Development (118 MMRPs)
  - ASR and 2005 Orthophotos
- ESTCP Research Project (8 MMRPs)  
(Environmental Security Technology Certification Program)  
“Improved Processing, Analysis, and Use of Historical Photography”
  - Comparison of 3 Photo Interpretation Methods
- California FUDS-MMRP (54 MMRPs)
  - Site Inspection (SI) GIS Data

# CERCLA Implementation Steps

## ■ Identification

- Preliminary Assessment ◀
  - Inventory Project Report (INPR) and Archive Search Report (ASR)
- Site Inspection ◀

## ■ Investigation

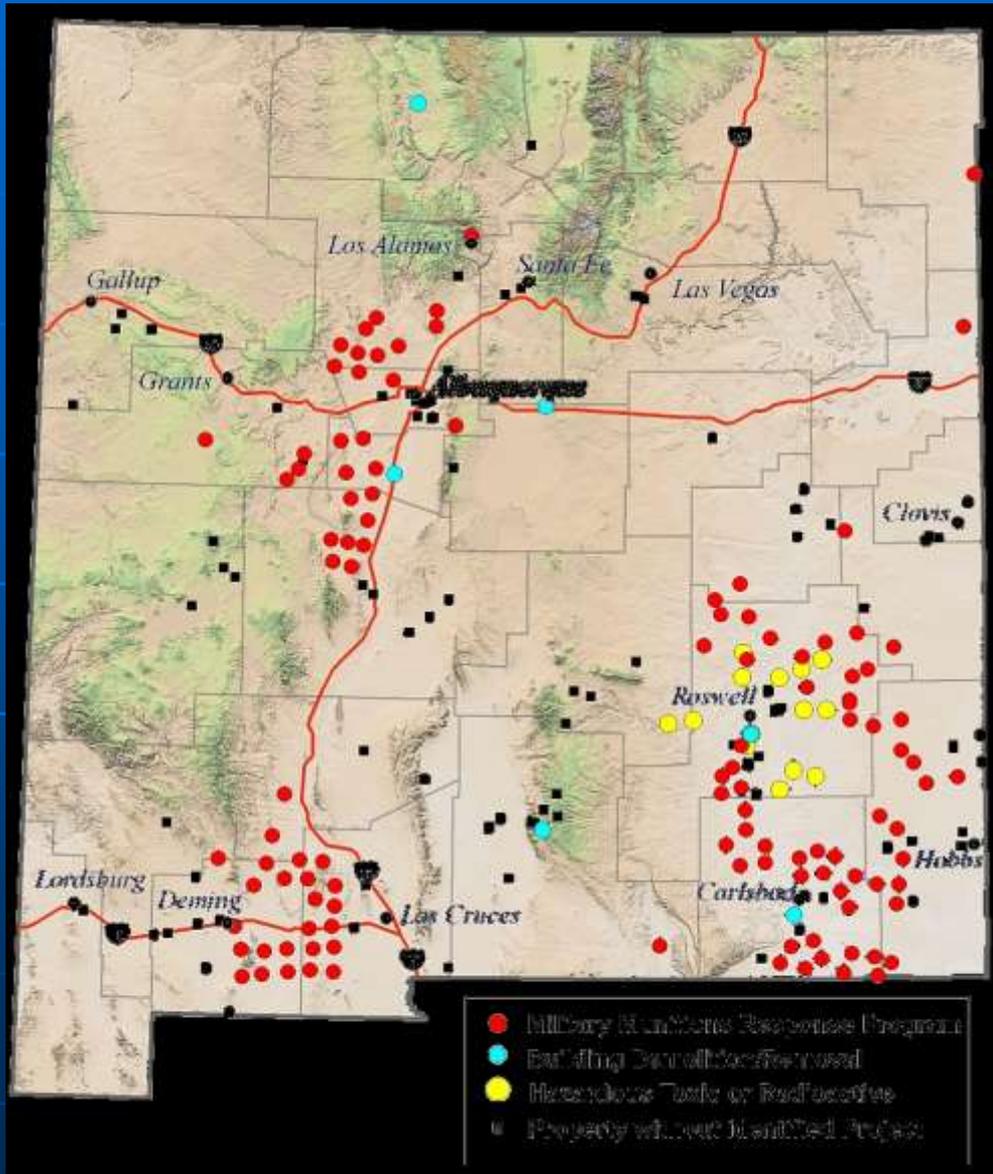
- Remedial Investigation/Feasibility Study
- Proposed Plan
- Record of Decision (ROD)/Decision Document
- Remedial Design

## ■ Cleanup

- Remedial Action
- Response Complete or Long Term Management

## ■ Five Year Reviews

# New Mexico FUDS GIS



(118 MMRPs)

- Compilation of ASR CAD Files
- Conversion to GIS Format (snapped to PLSS)
- Visual Cross-Check Against 2005 Color Orthophotos
- ASR method (1990's) involved transfer from uncorrected photos to topographic maps (2005 orthos were not available)

# 2005 Orthophoto



Former Walker Air Force Base (AFB) Precision Bombing Range (PBR) #21

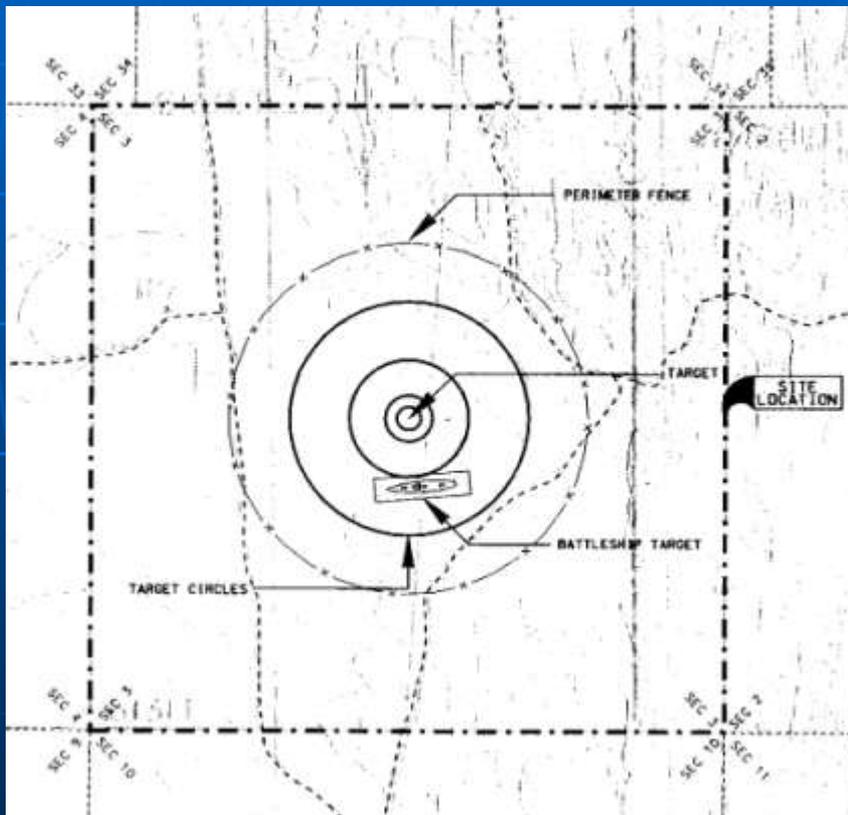
# 1945 Photo and 2005 Orthophoto



Former Kirtland Air Force Base (AFB) Precision Bombing Range (PBR) West Mesa Site – Engine Roundhouse and Switching Yard Targets

# Archive Search Reports (ASR)

NOTE: AREAS DEPICTED ARE BASED ON BEST AVAILABLE DATA



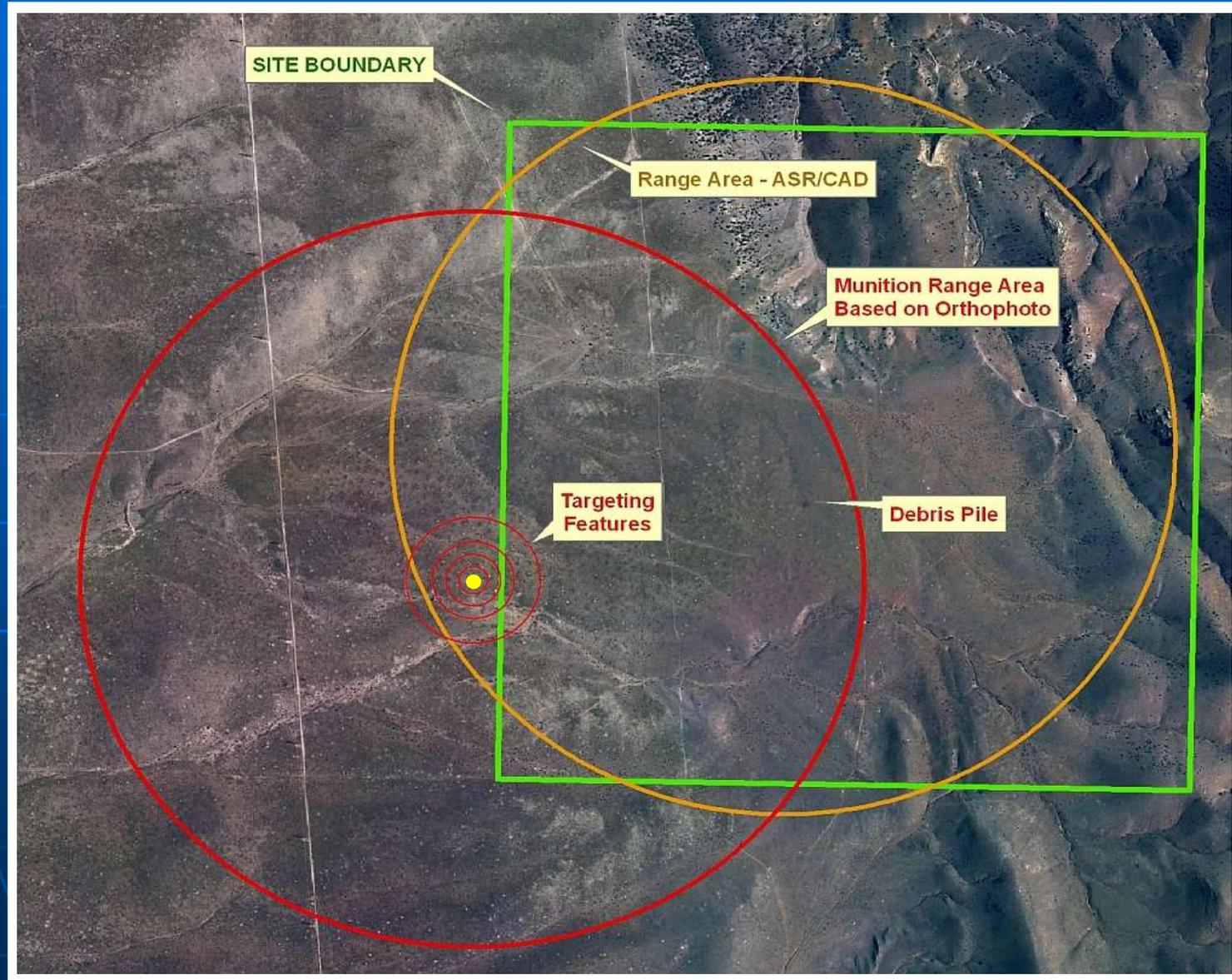
Primary Source for FUDS Property and Range Feature Data



Assumed "Target Center" based on 1952 photo prints and pocket stereoscope viewing

ASR Map and NOTE for KAFB PBR 22 TRGT S-9

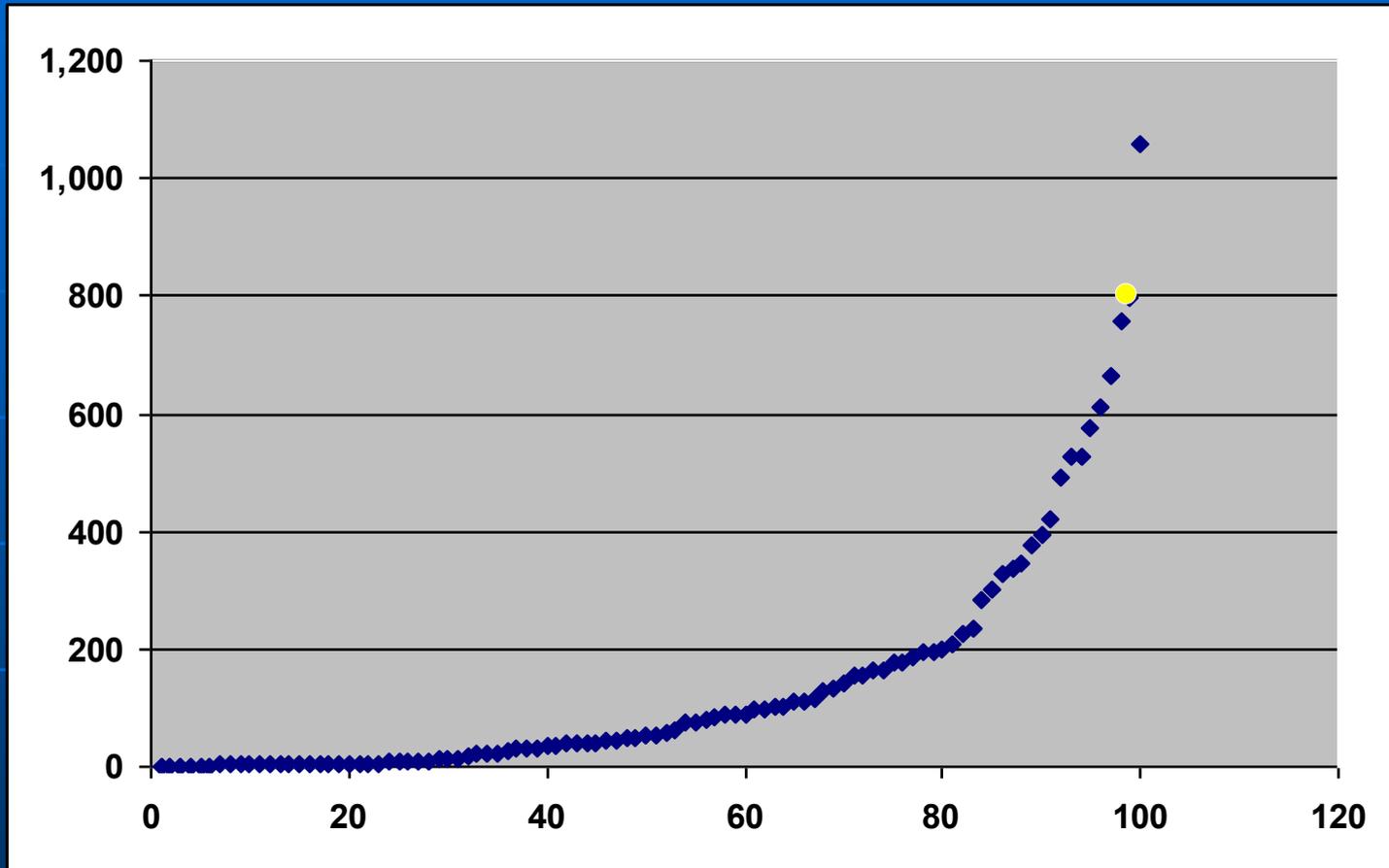
# 2005 Orthophoto



K06NM0623: KAFB PBR 22 TRGT S-9 [1 Section = 1 sq mile = 640 acres]

# Range Centroid Orthophoto Adjustments

**Offset  
Distance**  
(meters)  
ASR/CAD  
to 2005  
Orthophotos



**Sort of Site Centroid Location Offsets**

Over 65% of NM FUDS MMRP Range centroids checked had apparent offsets >25 meters

# ASR Observations

- Data Sources and Procedures Well Documented
  - But source details not carried forward as metadata
  - Confidence statements not carried forward as metadata
- Historical Photography
  - Dates used were sometimes decades after site operational periods – some features not very persistent and some affected by land use changes
  - Use of Photo Prints and Pocket Stereoscope viewers instead of Film Diapositives (transparencies) and Zoom Stereoscope equipment affects dynamic range and resolution available – some range features missed

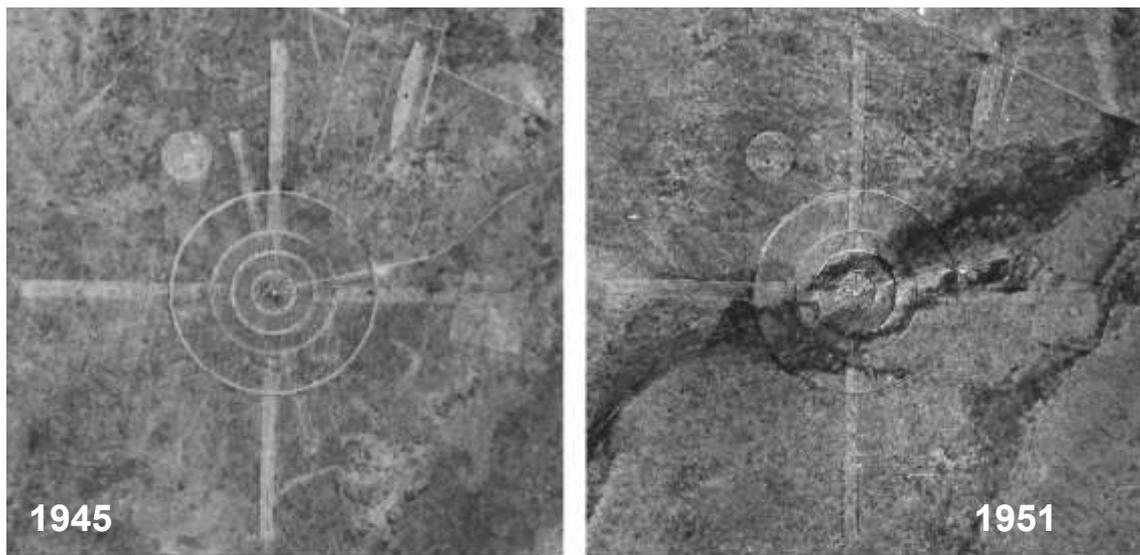
# ESTCP Project

## ESTCP Research Project

(8 MMRPs)

- Environmental Security Technology Certification Program
  - "Improved Processing, Analysis, and Use of Historical Photography"* (2010)
  
- Comparison of 3 Photo Interpretation Methods
  1. ASR Photo Interpretations – Prints and Simple Viewers
  2. ESTCP – Film Diapositives/Zoom Stereoscopes
  3. ESTCP – Digital Restoration/Enhancements 3D Viewers

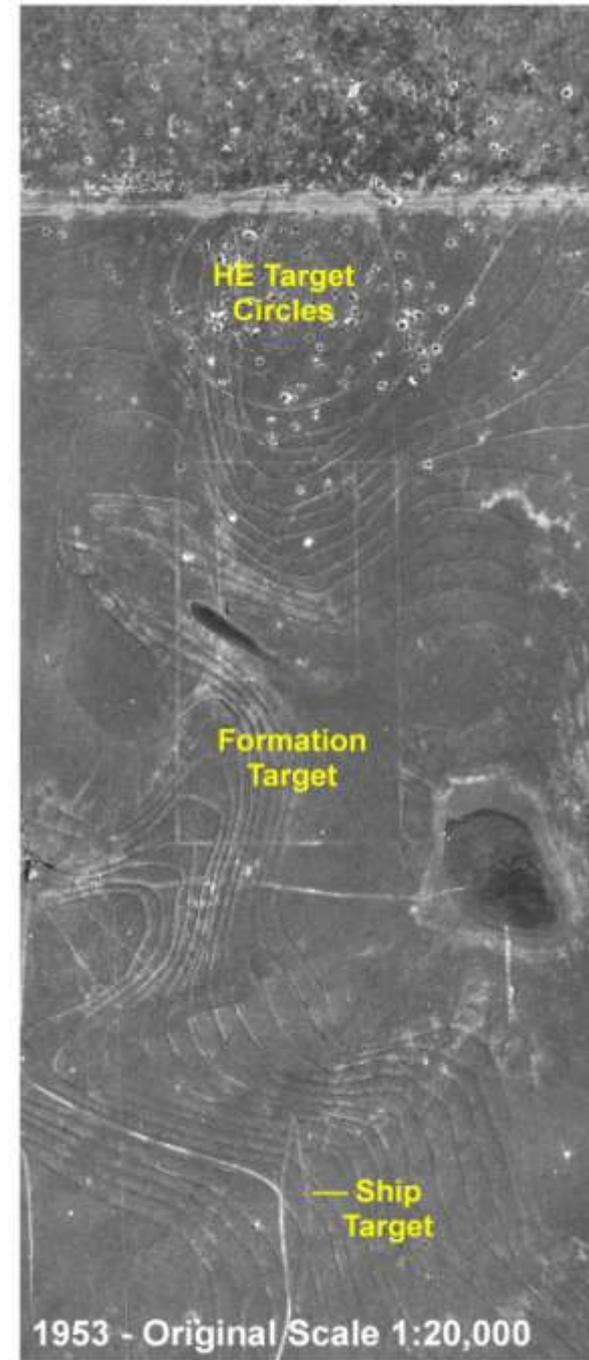
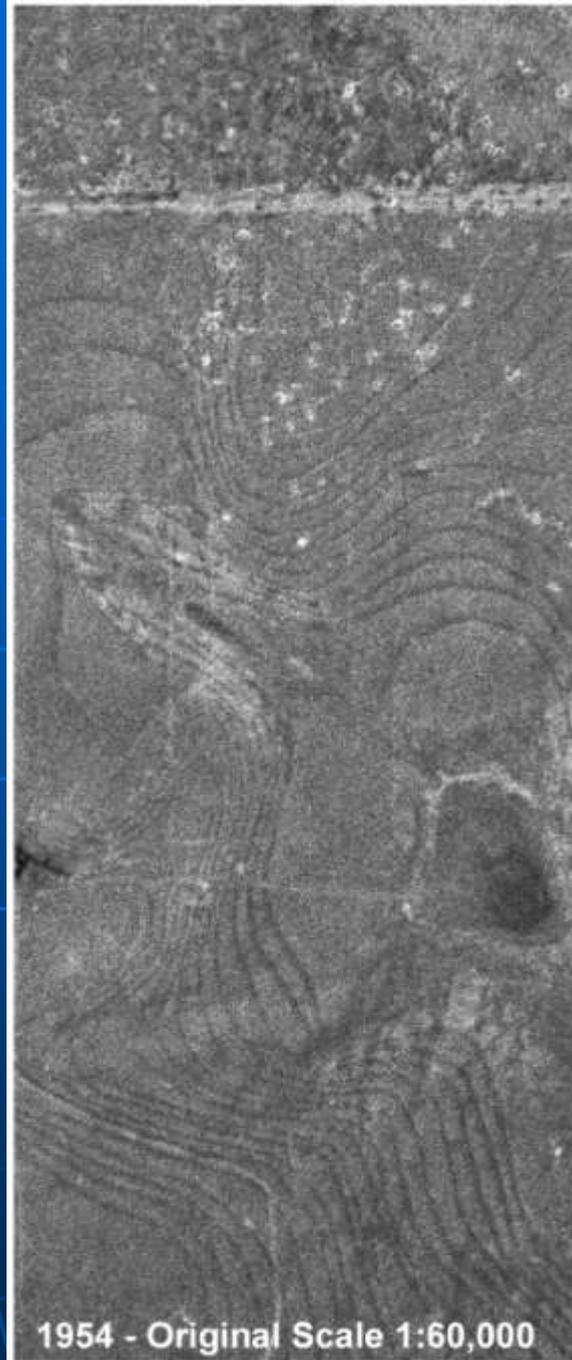
# Dates of Photography



0 500 1,000 Feet

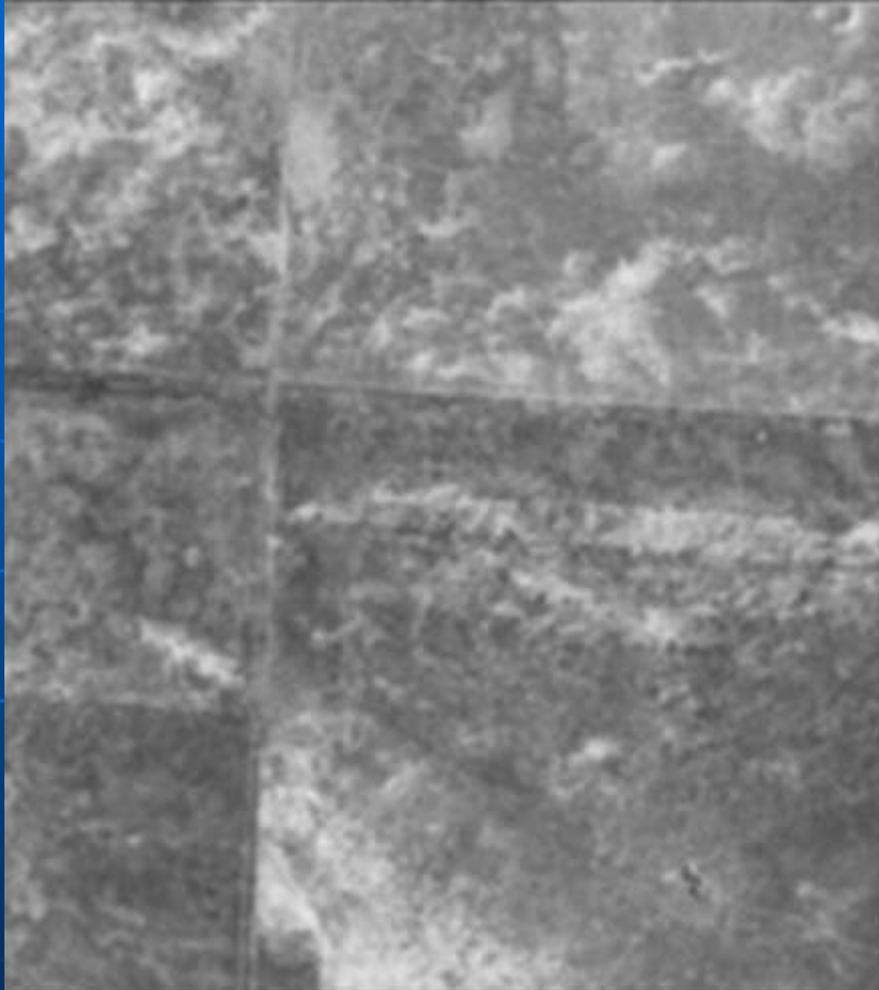


# Photo Scale (Resolution)



0 250 500 1,000 Feet

# Scanning Resolution



1000 DPI



3629 DPI

1954 Photo for Dalhart PBR #3 & #4 (1:60,000 scale)

# ESTCP Observations

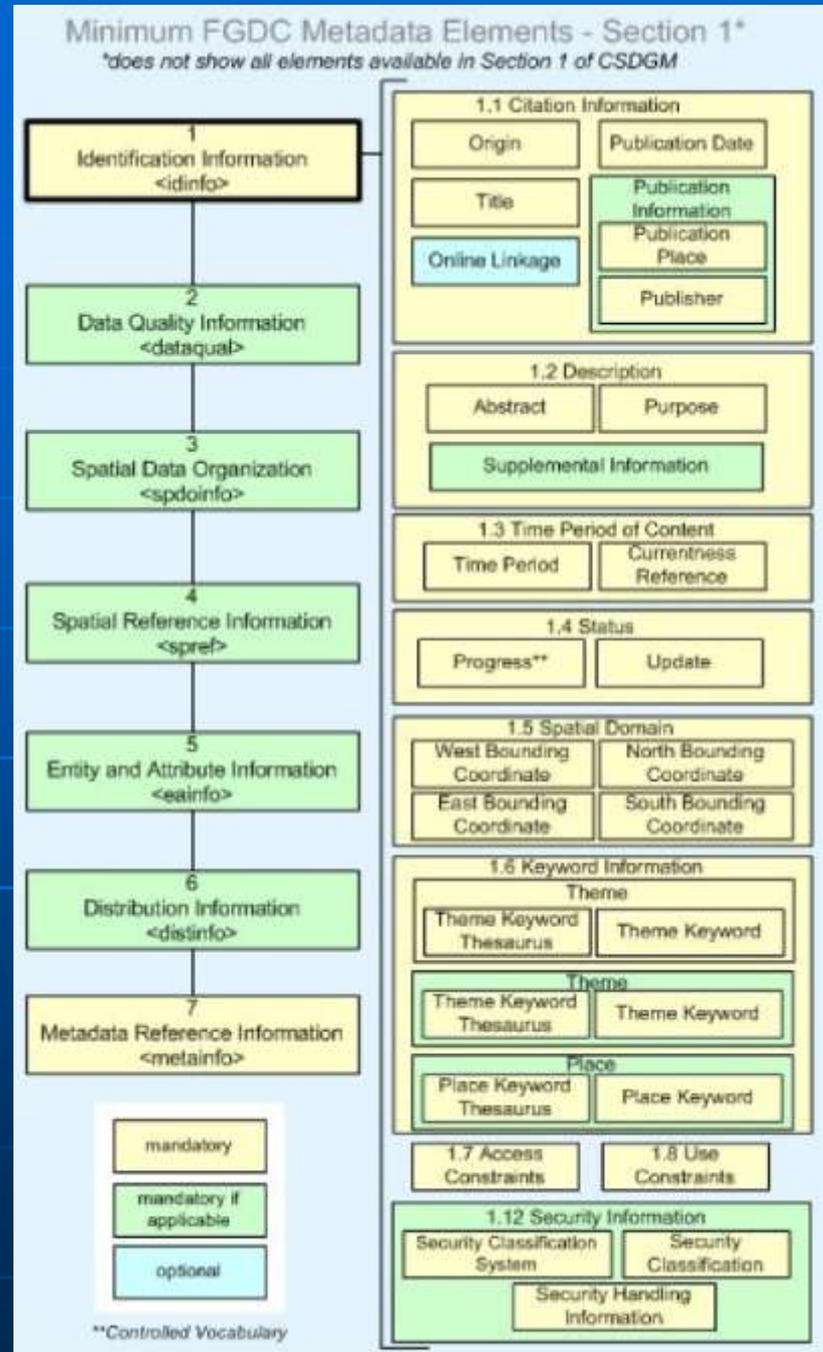
- Some historical photo searches need to be updated and more extensive – photo search results are not static as archive additions are made and search tools are improving
- Use of historical film diapositives and digital analysis techniques can result in improved target feature interpretations and proper range definitions
- Image registration or ortho-correction provides a useful basis for analysis and use of historical photos in Geographic Information Systems
- Historical photo analyses can provide a cost-effective baseline component prior to any Wide Area Assessment (WAA) of World War II era Bombing Ranges

# California MMRP SI Metadata Review

- Frequent Findings (54 MMRPs)
  - Identification of site (FUDSMIS ID) inconsistent
    - 8-digit, 9-digit, 10-digit FUDSMIS
  - Source material references limited
    - Generally just "ASR" or "SI" as source (no titles, dates)
    - No original sourcing – aerial photos, maps, etc.
  - Range areas defined by multiple methods
    - Target features, target features plus property
  - Multiple identical ranges defined for same area
    - One range polygon for each type of munitions
  - Feature naming conventions varied
    - Generally well described, but not SDSFIE compliant
  - SDSFIE attributes generally unpopulated

# FGDC Metadata

- Relatively Complex
  - Basic framework for all possible types of geospatial data
  
- Many “free text” elements
  - Open to individual interpretation without restrictions
  
- Time Consuming
  - Detailed (e.g., 334 elements, many nested)
  - Often “last step” of GIS project



# Metadata Tools

## ■ Examples of Metadata Tools

- USACE Corpsmet (template) – discontinued
- US Geological Survey – Metadata Parser (MP)
- National Park Service – Metadata Tools & Editor (MTE)
- EPA – EPA Metadata Editor (EME)

## ■ USACE FUDSGeoRev (Proposed)

- Goal – “Facilitate development and review of Metadata that meets FUDS MMRP programmatic and FGDC content standards via tools to ensure consistent, simplified, and high quality metadata”

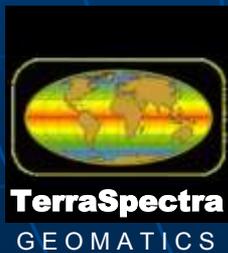
# FUDSGeoRev Design Elements

- Standard Metadata Guidelines and Instructions
  - Identify priority programmatic FGDC metadata elements
  - Develop consistent language and libraries for priority programmatic and mandatory metadata elements
- Metadata Checker utility
  - Online secure server (SSL, 24/7)
  - Downloadable reporting tool
  - Automated review of metadata elements, such as:
    - Theme, place and temporal keywords
    - Use constraints and data quality statements
    - Reference coordinate system
    - Entity and attribute information
  - Upload of compliance results
- Archival Metadata storage
  - Validate metadata against stored templates

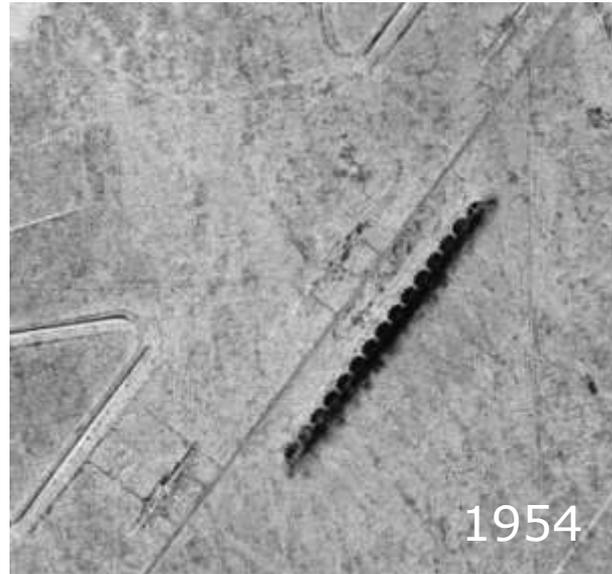
# Summary

- ASR and SI sources of geospatial data for MMRPs are well documented, but key details and confidence statements are generally not carried forward in GIS metadata
- Historical aerial photos are a unique source for FUDS MMRP features locations, but some searches need to be updated; photo search results are not static!
- Metadata tools, such as guidelines, editors, and checkers, can facilitate development and compliance with needed documentation of geospatial data
- Geospatial standards compliance is critical to data sharing, confidence for future (long-term) reuse, and broader enterprise applications

# QUESTIONS?



# Dates of Photography



Kingman, AZ GTG  
Gunnery Range

15-Skeet Ranges

Clay Pigeon Debris  
Apparent on Photos



Used for Field  
Sample Design

# Example of SI GIS Dataset – Orthophoto Base

