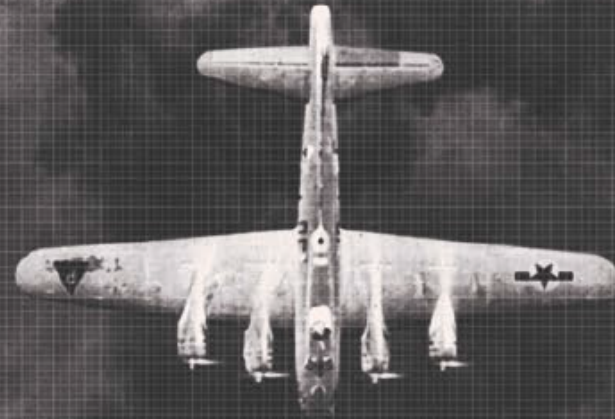


LOCATION
ERKNER
GERMANY

HISTORICAL PHOTO ANALYSIS



JOY POCHATILA, PG
ARMY GEOSPATIAL CENTER
LEAD, ENVIRONMENTAL ANALYSIS TEAM
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Army Geospatial Center



ORGANIZATION

- Conducting photogrammetric research and development since the 1920s
- Army Geospatial Center (AGC) created in 2009
 - ✓ **Major Subordinate Command (Center) under the US Army Corps of Engineers**
 - ✓ Co-located with ERDC's Geospatial Research Laboratory (formerly Topographic Engineering Center)
 - ✓ Provides geospatial information, domain expertise, training, and reach back capabilities
 - ✓ Engages in system development, acquisition, and geospatial technology integration
 - ✓ Designs and implements the Army Geospatial Enterprise (AGE)

FUNCTIONAL AREAS

- Enterprise Development and Acquisition Support
- Warfighter Geospatial Support and Production
- Systems Acquisition and Program Management
- Research, Development, Technology and Evaluation

FACILITIES

- Time Critical Users Site
- SECRET and TS/SCI (60k sq ft SCIF)

STAFF

- 350 Scientists and Engineers
- Professionally Certified/Licensed in:
 - ✓ Acquisition
 - ✓ Contracting
 - ✓ Engineering
 - ✓ GIS, Surveying, Geology
 - ✓ Program Management

FOOTPRINT

- Office of the Chief of Engineers; Pentagon, VA
- Transatlantic Division; Winchester, VA
- National Reconnaissance Office; Chantilly, VA
- US Army Intelligence Center of Excellence; Ft. Huachuca, AZ
- TRADOC Capability Manager – Geospatial; Ft. Leonard Wood, MO
- NGA Campus East; Springfield, VA (OCE/GGB Staff)
- High Res/3D Collection Lead (Afghanistan)

AGC has a VITAL MISSION to provide geospatial engineering in direct support to DoD.





AGC'S HISTORICAL PHOTO ANALYSIS



- **Why is HPA important?** GIS-based historical photo analysis (HPA) can focus restoration and remediation efforts, leading to overall **cost savings!**
- Identify potential areas of environmental concern on U.S. Military installations:
 - Hazardous, Toxic and Radioactive Waste (HTRW)
 - Unexploded Ordnance (UXO) under the Military Munitions Response Program (MMRP)
 - Landfill Locations, Groundwater Contaminate Pathways, and Shoreline and Land Use Changes

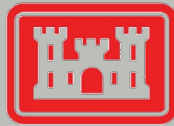


“The Environmental Analysis Team serves a critical role as part of our Project Delivery Teams. They find information that allows us execute our projects more strategically and reduce our needs for repeat site visits.” USACE Customer

BUILDING STRONG®

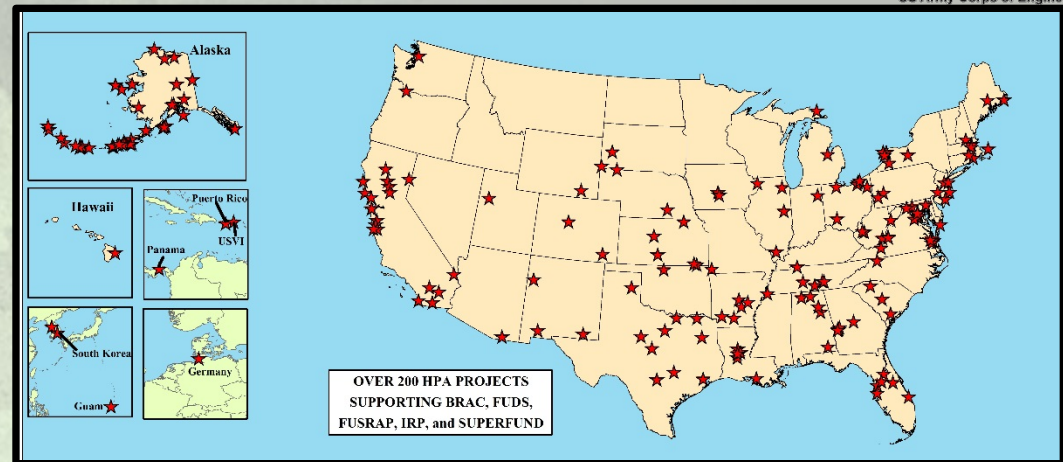


Historical Environmental Photo Analysis

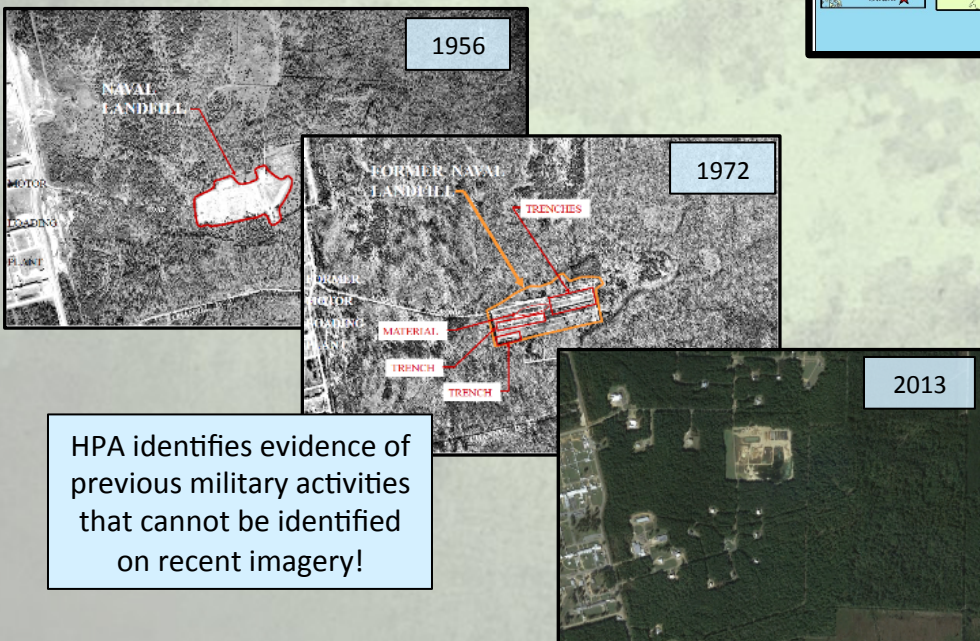


US Army Corps of Engineers

Historical Photo Analysis helps our customers identify potential areas of environmental concern on U.S. Military Installations using GIS-based historic photo analysis. The HPA can focus restoration and remediation efforts, **resulting in a significant cost avoidance for our customers. One customer stated that an HPA can save them as much as 10 dollars in RI efforts for every dollar spent on this analysis.**



- HPA uses historical aerial photography and satellite imagery to locate chemical warfare material (CWM), unexploded ordnance (UXO), radioactive material, landfill locations, surface features (such as rock fractures influencing the migration of contaminants), as well as land cover and shoreline changes.
- Products include reports, GeoPDFs, and GIS packages which include ortho-rectified aerial photography and imagery.
- Programs supported include Remedial Investigations (RI), Base Realignment and Closure (BRAC), Formerly Used Defense Site (FUDS), Formerly Utilized Sites Remedial Action Program (FUSRAP), and Recovered Chemical Warfare Material Program (RCWM) efforts.

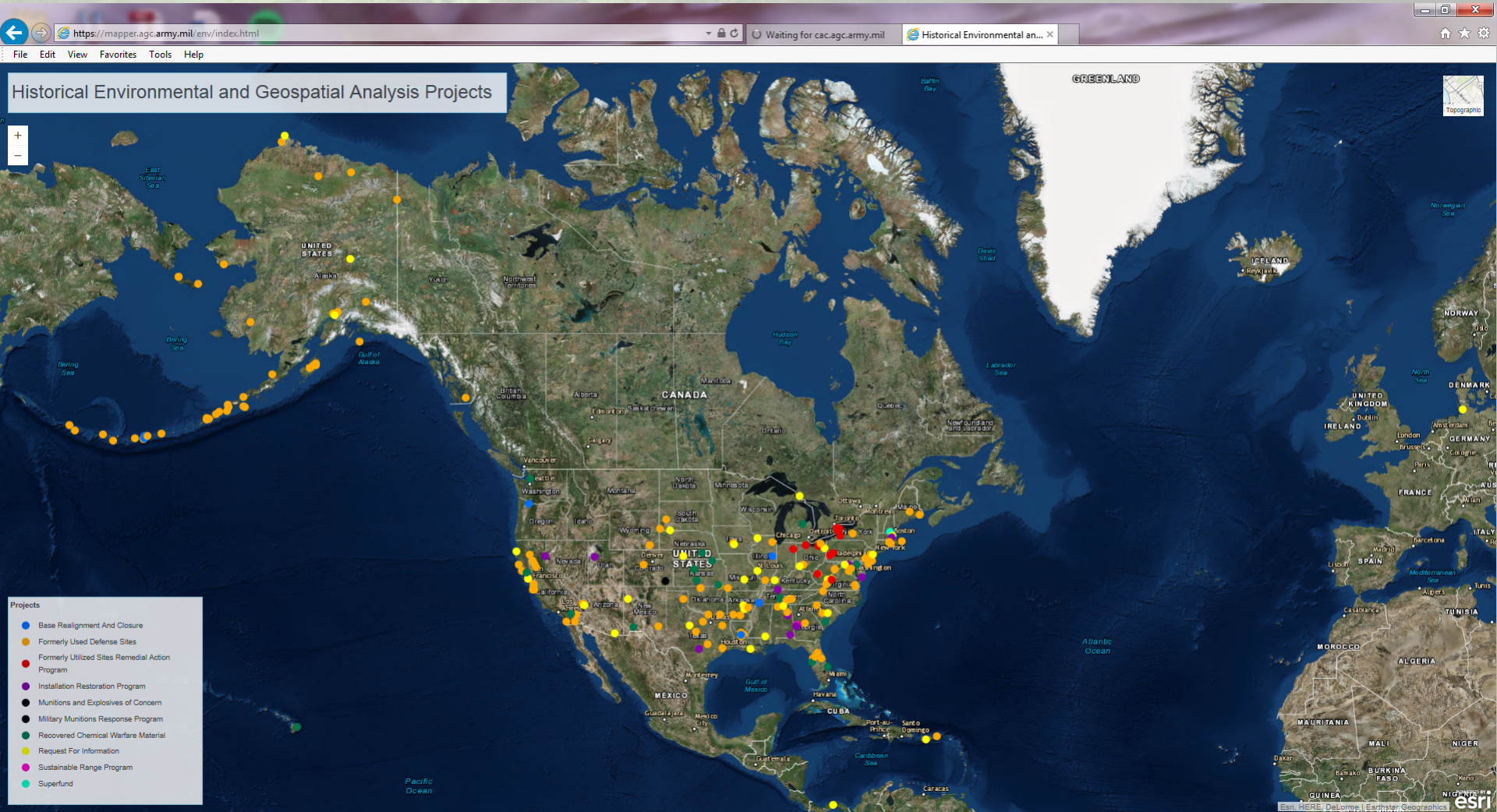


"With the imagery and analysis performed by the AGC team our District is able to better scope and execute our remote project work. Saving even a single site mobilization can be a 2-3 million \$ in project savings."



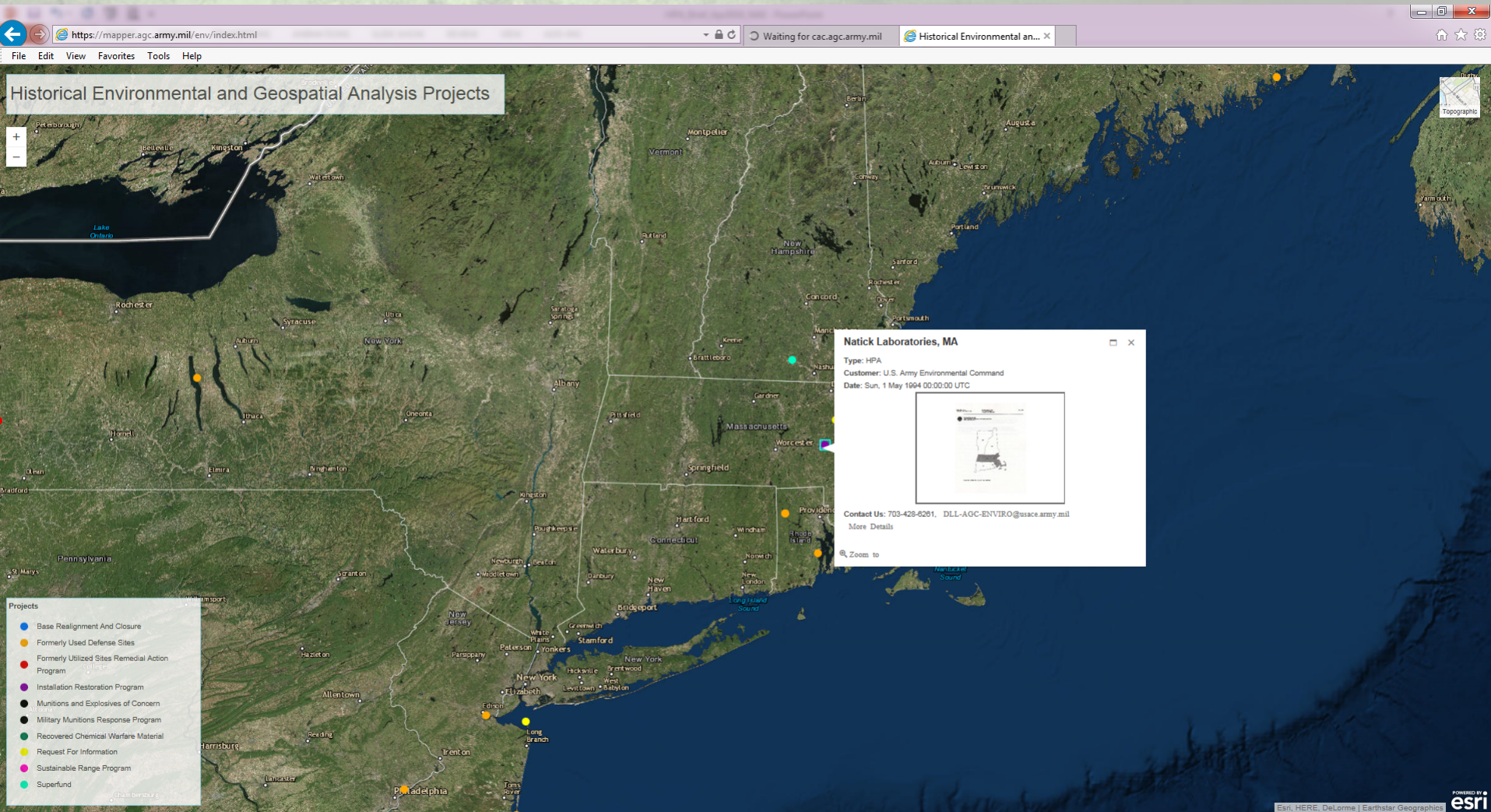


Historical Environmental and Geospatial Analysis Web Portal



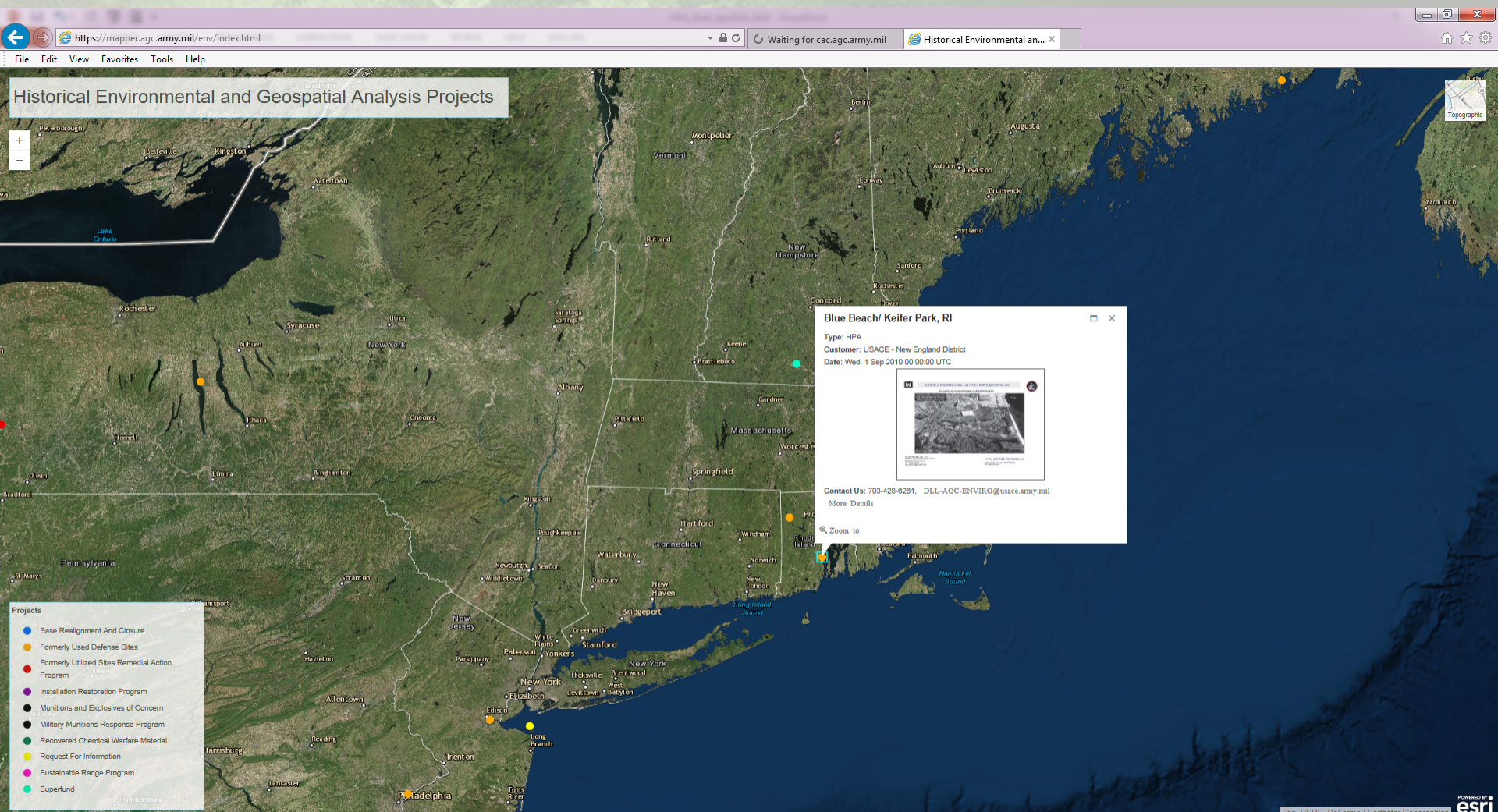


Historical Environmental and Geospatial Analysis Web Portal



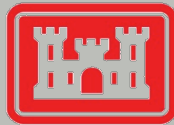


Historical Environmental and Geospatial Analysis Web Portal





CUSTOMIZED HPA SUPPORT



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Research

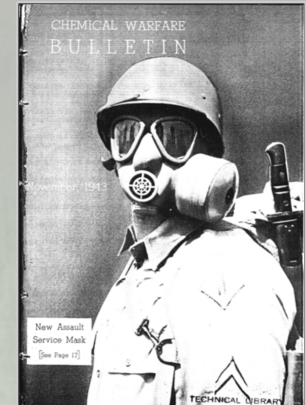
What were the previous military activities onsite?
When and where did the activities take place?

Photography/Imagery Acquisition

Convert hardcopy photos and
film negatives into digital formats.

Imagery Geo-Rectification

Adding geographic reference to digital photos.



Analysis

What information can be learned from the photography?
Determine changes in activities over time and geographic extent.

GIS Data Production

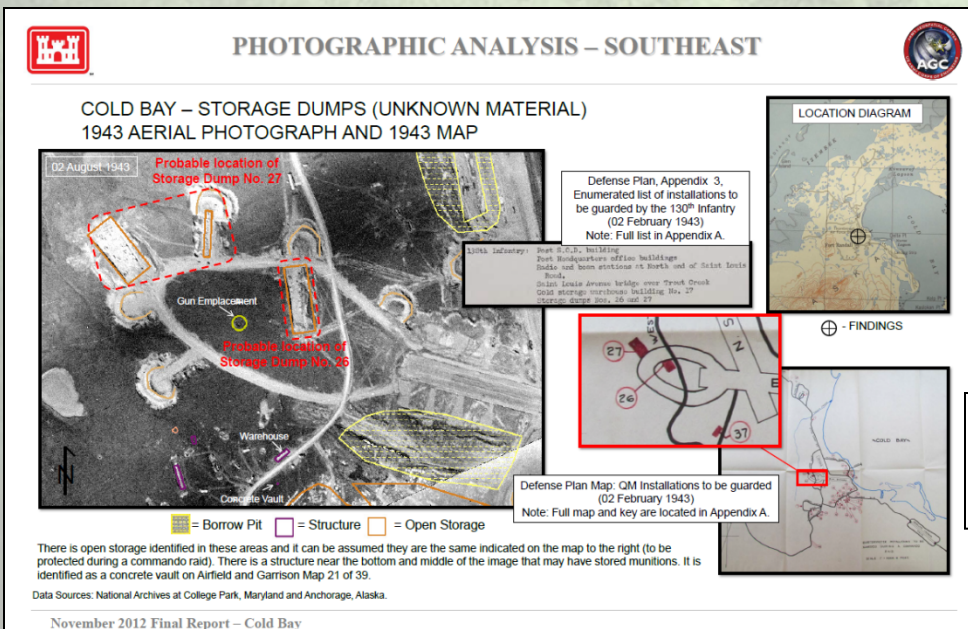
Results of analysis delivered in SDSFIE-compliant GIS package.
GIS data are used in the field to ground truth analysis.

Hardcopy Report Production

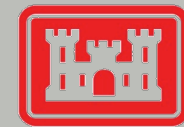
All research, photos, and analysis are presented in a report that can be
used in-house and for public meetings.



- Review materials provided by customer.
- Literature review.
- Find and order film cans for viewing and scanning (National Archives, USGS, NOAA).
- Visit National Capital Area and local repositories to collect data (maps, documents, textural records, ground photos, etc).



Collection of aerial photos, maps, and textural records



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IMAGERY ACQUISITION NATIONAL ARCHIVES & RECORDS ADMINISTRATION

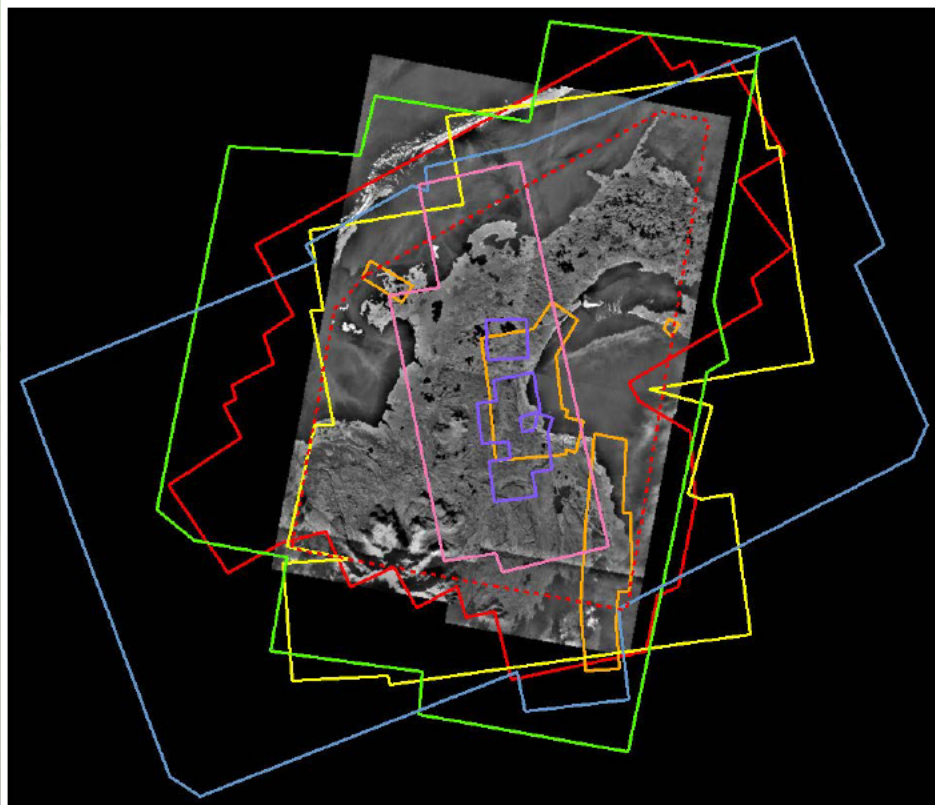
- AGC has capability to obtain digital scans of film negatives at the National Archives & Records Administration in College Park, MD.
- AGC Advantage: Digital scans can be obtained rapidly in order to meet customers' mission requirements.



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PHOTOGRAPHY/IMAGERY RECTIFICATION



Aerial Photograph Coverage over Cold Bay AOI

- 1940's (1942-1944)
- 1950's (1953, 1955-1958)
- 1960's (1962, 1966)
- 1970's (1973, 1975-1976)
- 1980's (1983, 1987)
- 1990's (1995)
- 2000's (2001)
- - - Cold Bay HPA Project Boundary

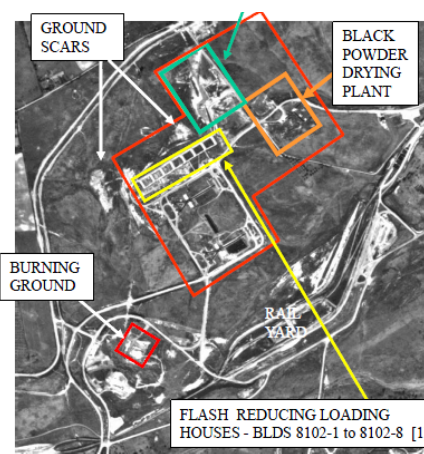
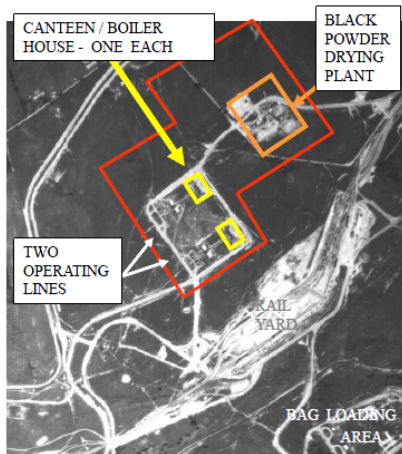
Analysis: Military Munitions

Historical Photographic Analysis (HPA) supports change detection and temporal examination of man-made or naturally-occurring features. Analysts locate historical activity on the current landscape in order to isolate and categorize areas for appropriate clean-up, as well as focus remediation efforts. HPAs are facilitated through the collection of historical photography and GIS capabilities which **significantly enhance the investigation of military features such as landfills, burial pits, targets, ground scars, and facilities.**

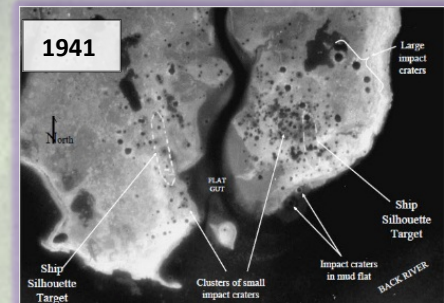


Impact craters are observed in the images below as a result of military activity

Various Activities



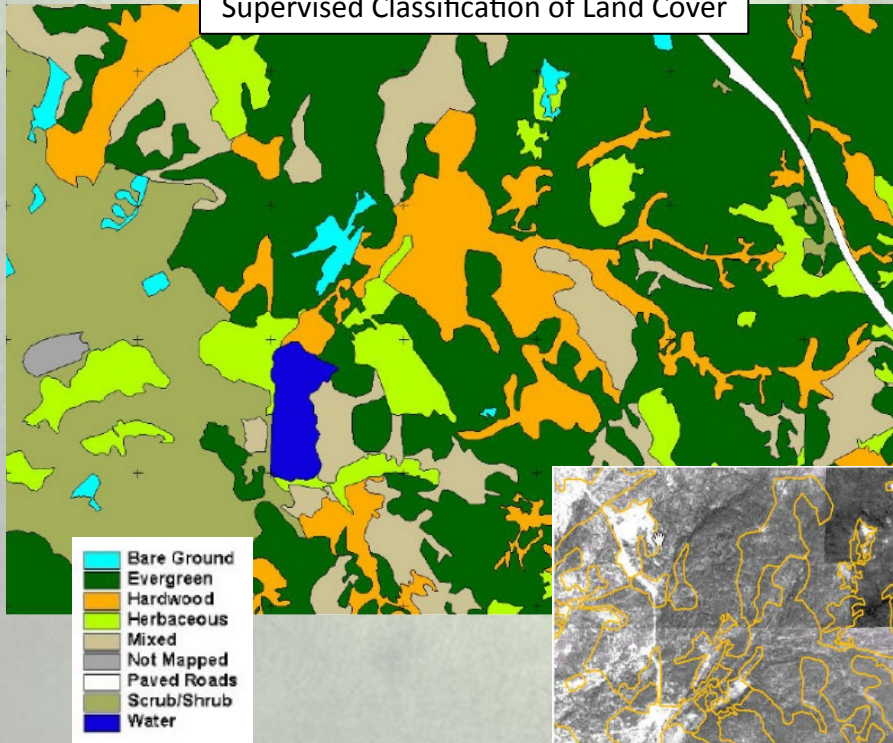
1943, 1949, and 2013



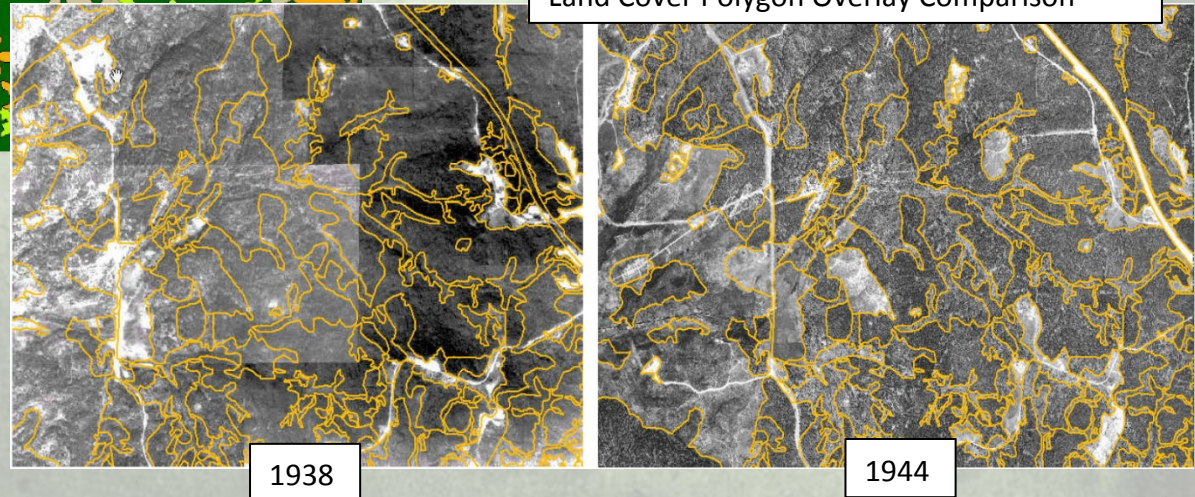
Analysis: Land Cover

Historical Photographic Analysis (HPA) provides documentation of the changing landscape over time and is a **useful tool for land use and wetlands delineation and management**. This technique also supports the long-term viability and utility of Army ranges and training lands by determining the **recovery rate of vegetation** after training maneuvers and documenting the effects of a variety of training types in different environments.

Supervised Classification of Land Cover

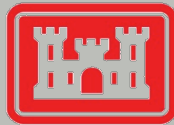


Land Cover Polygon Overlay Comparison





Analysis: Shoreline Changes



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Over time the riverbank is observed encroaching on land occupied by airport runways

An analytic study of shoreline change over time.

Shoreline analysis evaluates historical, photography to delineate shoreline change over time. Typically, historical imagery is collected, rectified, and managed in a GIS to perform the analysis.

Change detection of shorelines provides customers with helpful insight into; erosion patterns, climate impacts, environmental planning, and land development issues.

In the past, the Army Geospatial Center has performed shoreline detection to locate points of erosion and determine how land was used prior to submergence and erosion.

YEAR	
1994	1994
1985	1985
1979	1979
1952	1952



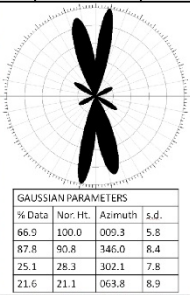
A submerged area is observed where land was formerly visible



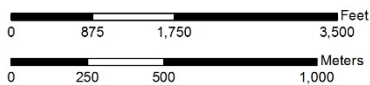
Analysis: Integrated Fracture Trace

Bedrock fractures identified on LiDAR and verified in the field.

Rose diagram showing overall orientation of all fractures



Fracture Trace Analysis (FTA) is tool used to **characterize and quantify bedrock fracture orientation and density** using remote sensing techniques that incorporate LiDAR (or similar DEMs), commercial imagery, and **geologic mapping**. AGC analysts have also deployed to the field to verify bedrock fractures in outcrop formations. The FTA is a tool customers can use to identify potential ground water flow pathways, discharge points, and human and ecological receptors.



Scale: 1:12,000
Projection: StatePlane Rhode Island FIPS 3800 Feet
Datum: NAD 1983

- Outcrop-correlated fracture trace
- Fracture trace
- Bedrock outcrop location
- ⊙ Production well
- ⊙ Residential well





EXAMPLES OF CUSTOMIZED COSTS

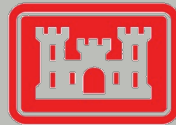
**THE NUMBER ONE FACTOR IN DETERMINING COST OF EACH TASK IS
THE GEOGRAPHIC EXTENT OF THE SITE.**

- 1. IMAGERY RESEARCH AND ACQUISITION - \$5K TO \$25K**
 - 2. SITE SPECIFIC RESEARCH (MAPS, GROUND PHOTOS, TEXTURAL RECORDS) - \$5K TO \$50K**
 - 3. GEORECTIFICATION OF IMAGERY - \$10K TO \$25K**
 - 4. FIELDWORK FOR FTA - \$5K TO \$15K**
 - 5. FULL ANALYSIS WITH GIS PACKAGE AND REPORT - \$25K TO \$50K**
- *AGC ASSISTS THE CUSTOMER IN DETERMINING WHAT TASKS PROVIDE THE GREATEST BENEFIT BASED ON A SPECIFIC BUDGET.**
- *TASKS ARE PAID VIA REIMBURSABLE FUNDING FROM CUSTOMER.**
- *AGC CAN SET UP CROSS LABOR CHARGE CODES AS WELL AS ACCEPT PROJECT ORDERS FOR MULTIPLE YEARS OF FY FUNDING.**





ARMY GEOSPATIAL CENTER



US Army Corps of Engineers
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- Historical Photo Analysis

Visit AGC Website:

AGC Portal: <http://www.agc.army.mil/index.html>

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SIPRNET: <http://www.agc.army.smil.mil>
JWICS: <http://www.agc.ic.gov>

