Drones, LiDAR, and 3D Models:
A New Paradigm for Data Visualization and Analysis and the Project Management Benefits for Large Hazardous Waste Remediation Projects

Former Chambers Works FUSRAP Site
Deepwater, NJ
US Army Corps of Engineers
Philadelphia District

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Site Location

The DuPont Chambers Works FUSRAP Site under remediation is a 6.5-acre area located within the 680-acre Chambers Works property, in Salem County, New Jersey.
Former Chambers Works FUSRAP Site History

• In the 1940s, U.S. Army Corps of Engineers (USACE) Manhattan Engineer District (MED) and Atomic Energy Commission (AEC) contracted E. I. du Pont de Nemours and Company (DuPont) to support the nation’s atomic energy program.

• In 1997, USACE was directed by Congress to conduct assessment, remedial action, and site closure activities for FUSRAP sites.

• The USACE is currently addressing residual radiological contamination in multiple Areas of Concern (AOCs) under the Formerly Utilized Sites Remedial Action Program (FUSRAP).

• As lead agency for the response action, USACE selected a remedial action, consistent with CERCLA, that includes excavation and offsite disposal of contaminated soil (beginning in 2014).
The Challenge

- Improve upon the conventional radiological data collection techniques and rudimentary 2D data representations.
- Find a better way to collect, process, and utilize the remedial action radiological data that would enable the project team to optimize operations, perform predictive planning and document expectations.
- Develop a more precise and robust visualization of radiological contamination, to support remediation efforts.
- Enable real-time decision-making, with real-time data. Avoid very expensive stand by time for contractors.
Solution 1: Geographic Information Systems

- REMEDY MOSAIC BASEMAP
- SPATIAL ANALYSIS RESULTS
- DEPTH OF CONTAMINATION
- ANALYTICAL INTERPOLATIONS
- AVERAGE CONCENTRATION
- REMEDIAL DESIGN (CAD DATA)
- EXCLUSION ZONES
- EXCAVATION AREAS
- BORING LOCATIONS (GPS)
- LIDAR-DERIVED DIGITAL ELEVATION MODEL
- PLANIMETRIC DATA
- DRONE ORTHOIMAGERY
Solution 1: Geographic Information Systems
Delivering Powerful Capabilities Across Organizations

Building Blocks . . .
For a Responsive System

Credits: Esri, 2019 User Conference Plenary

OCTOBER 26-28, 2020
Key Highlights of ArcGIS Online

• Features real-time data access, querying, and visualization capabilities

• Incorporates all available data sources (orthoimagery, LiDAR, 3D field data, GIS, CAD, GPS, etc.)

• Provides a common operating picture to all team members in a secure, online platform

• Allows mobile access and enables adaptable electronic field data collection

• This is the hub for GIS data, maps, and apps for the Chambers Works project. This site is dynamically updated and can be customed tailored to meet ever-changing project needs.
Solution 2: Electronic Field Data Collection

Recent improvements include:

- Wireless communications with radiation detection equipment
- Real Time Kinematic GNSS GPS equipment for cm-grade accuracy
- Mobile data logger
- Improved field software for data processing
In the Field
Live Data Streams
Solution 2: Electronic Field Data Collection

Collector for ArcGIS
- Accurate data collection made easy

Survey123 for ArcGIS
- Smarter forms, smarter data collection

Tracker for ArcGIS
- Know what happens in the field

Navigator for ArcGIS
- Advanced navigation and routing for your workforce

Explorer for ArcGIS
- Maps at your fingertips

Workforce for ArcGIS
- Smarter field workforce coordination at your fingertips

Operations Dashboard for ArcGIS
- Make decisions at a glance

Solution 3: Drones for LiDAR and Imagery

New Technology Platform includes:

- 8-rotor UAV (octocopter) with gimbal and sensor array mount
- Velodyne-32MR LiDAR sensor
  - Light Detection and Ranging (LiDAR)
  - 1.2 million points per second; 100 meters +/-10 cm accuracy
- Sony A6000 24MP Digital camera
  - RGB image collection for orthophotos
  - Tied to IMU/GPS for precise image location and seamless image matching
Solution 3: Drones for LiDAR and Imagery

High-resolution aerial imagery (Orthomosaic)
• Low altitude imagery collection from a highly adaptable platform. Very quick turn-around-time.
• < 0.5-in per pixel, best available imagery today!
• No comparison to modern satellite imagery or other commonly available basemaps.

LiDAR point-cloud and Digital Elevation Models (DEM)
• High sample density for increased accuracy and precision
• Point-cloud classification and enhanced post-processing
• Near-real-time volumetric analysis and interpretation
• Allows easy access and full coverage in inaccessible places
Solution 4: Centralized Database Management

- Comprehensive data reporting of project information
- Capable of automated spatial analyses

Scalability
- Adaptable for other needs, such as GIS mapping & 3D modeling
- Scalable for exponential expansion
- Can accommodate new data-types and new data-collection methods

Centralization
- Client-owned data resource
- Flexible multi-user environment

Record keeping
- Perpetual documentation
- Multi-discipline data repository
- Secure, cloud environment

Reporting
- Capable of automated spatial analyses
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Solution 5: 3D Visualization and Modeling
2/12/2020 Drone DEM and Imagery and Interpolated Gamma Scans
Former Chambers Works FUSRAP Site Team

- **USACE**
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  - George Bock - US Army Corps of Engineers Philadelphia
  - Dave Watters, CHP - US Army Corps of Engineers Baltimore

- **Ramboll**
  - Thomas Cornuet, PG
  - Tim Cushman, GISP
  - Christopher Bowles (Founder and Director of Galago)
  - Kyle Kohler (FAA certified UAV pilot)

- **Sevenson**
  - Don Wadsworth, MSHP
  - Daniel Caputo, CHP