Bentley
Advancing Infrastructure

Shell Polymers Utilizes Drone Technology to Capture Real-time Data on a Large Ethane Cracking Plant

Bentley's ContextCapture Processes More than 8,000 Images into an Orthophoto and 3D Reality Mesh

Project Summary

Organization:
Shell Polymers and Eye-bot Aerial Solutions

Solution:
Reality Modeling

Location:
Pennsylvania, United States

Project Objectives:
- Construct a world-scale ethane cracking plant to create polyethylene
- Conduct aerial surveys of the site to capture accurate data in real time
- Generate 2D orthophotos and 3D reality meshes using aerial photos of the site

Project Playbook:
ContextCapture

Fast Facts

- In total approximately 7.5 million yards of soil will be moved during construction.
- Three-hundred miles of the pipe used on the project could stretch across Pennsylvania.
- The project team used drone technology to capture more than 750,000 images to date.

ROI

- Using ContextCapture allowed the team to produce reality meshes in less than 48 hours.
- Construction engineers reduced analysis time on the backfill by using the technology.
- Shell Polymers used the reality mesh to monitor the soil erosion, manage inventory, improve emergency response management, and identify hazards.

Planning a Multibillion Construction Project

As a full-service unmanned aerial vehicle service provider, Eye-bot Aerial Solutions captures highly accurate reality data at a rate of 250 acres per hour. The Pennsylvania-based company produces high-resolution 3D reality models and images for organizations in the telecommunications, construction, power and utilities, insurance, and infrastructure industries. Its services include inspection, monitoring, aerial survey, and 3D modeling.

In June 2016, Shell Polymers, one of the organizations Eye-bot serves, took the Final Investment Decision to construct a world-scale ethane cracking plant in western Pennsylvania, United States, to create polyethylene. The multibillion Pennsylvania Chemicals Project is positioned in a strategic location where 70 percent of North America's polyethylene demand is within 700 miles. With proximity to rail, river, and interstate transportation, Shell Polymers can easily bring heavy equipment onto the site and, when the project is completed, easily transfer the polyethylene offsite.

The plant is being built where a former zinc smelting facility had been on a 386-acre plot that is approximately 3-kilometers long and 1-kilometer across at its widest point. The Pennsylvania Chemicals Project includes the ethylene cracker unit (ECU) with seven furnaces and three polyethylene manufacturing units producing high- and low-linear density polyethylene. The process is driven by the power co-generation unit consisting of the three 250-megawatt gas-fired turbines.

The project's scale is impressive with 300 miles of pipe, more than 1,600 items of manufactured equipment (the largest lift – 1,400 metric tons), and 294 pre-assembled modules. The organization will employ 6,500 workers at the peak of construction in 2019 – 2020. The plant will support 600 full-time permanent jobs when it is operational.

Finding a Solution

To manage a project of this size, the project team knew it needed to conduct aerial surveys of the site to capture accurate data in real time. The organization awarded Eye-bot Aerial Solutions a multiyear contract to provide unmanned aerial survey services. The commercial drone services provider used Bentley's ContextCapture to generate 2D orthophotos and 3D reality meshes on a weekly basis using aerial photos of the site. The company also produced 2D and 3D deliverables of the staging areas and laydown yards.

Eye-bot faced several challenges performing the aerial surveys, including capturing the data while workers are on-site, negotiating the varying heights of more than 120 cranes (one of them 695 feet tall), and dealing with the often cold and unpredictable weather in western Pennsylvania. Moreover, when the data is captured the team has less than 48 hours to process 8,000-plus images into an orthophoto and 3D reality mesh.

The project team took more than 8,000 aerial photographs weekly and processed them as 2D and 3D deliverables within a 48-hour window using ContextCapture.

High-speed Processing Engines Create an Accurate Reality Mesh

To keep the project on schedule, Eye-bot utilizes ContextCapture Center, which supports parallel processing using multiple high-powered computers. The high-speed processing engines produce a dimensionally accurate 3D reality mesh and digital twins, which enables the team to identify and resolve the root cause of construction clashes. The software application is an integral part of the project, allowing the team to process the collected data into a 3D reality mesh, enabling the Pennsylvania Chemicals Project team to compare the mesh

"The 3D mesh modeling technology available from Bentley was above and beyond anything else that was available in the marketplace."

– Dmitry Gurevich, IT Director, Shell Polymers, Pennsylvania Chemicals Project

Find out about Bentley at: www.bentley.com

Contact Bentley
1-800-BENTLEY (1-800-236-8539)
Outside the US +1 610-458-5000

Global Office Listings
www.bentley.com/contact

with 3D snapshots of the site on a weekly basis. In addition to the 3D reality mesh, Eye-bot generates a 2D orthophoto that is processed into a series of formats. The availability of this data helps the team plan and execute the construction. The 3D reality mesh of the existing site condition serves as a single source of truth for lookahead and retrospective progress analysis, which helps to optimize collaboration and decision-making between the client and the engineering, procurement, and construction (EPC) contractors.

The variety of output formats available in ContextCapture makes organizing the vast amount of data into an easily consumable format much more manageable. The reality mesh format, .3MX, can be analyzed in ContextCapture Viewer, which enables users and stakeholders to seamlessly access and share content with others, without the hardware and software limitations of desktop systems.

Establishing a Single Source of Truth

"The level of penetration that the 3D/2D digital deliverables are gaining with a myriad of stakeholders is profound," Jake Lydick, CEO of Eye-bot, said.

Dmitry Gurevich, information technology manager with Shell Polymers, said, "Constructing the plant of the future means embracing digitalization. In construction, digital is about advancing the technology that helps us stay on top of the progress and assures quality, while keeping people safe. In that respect, the 3D reality mesh modeling technology has made a profound impact on how we work on the project, rendering benefits above and beyond of what we had imagined when starting the modeling program at the onset of the main construction phase. "The 3D/2D data generated has helped maintain a strategic perspective of the existing site condition and progress, giving a common truth between the client and the EPC contractors," he added. "The results are shared among 30+ companies, a community of 1,000+ end users across construction, procurement, safety, quality, engineering, and project management teams."

"The level of penetration that the 3D/2D digital deliverables are gaining with a myriad of stakeholders is profound."

— Jake Lydick, CEO of Eye-bot

The project team used the 3D models to measure the amount of backfill needed along with stockpile volumes, distances, slopes, and available laydown area. For example, using the reality mesh resulted in an eight-fold reduction in the amount of time the construction engineers spent analyzing progress on the backfill. The reality mesh is also used to monitor the soil erosion, manage inventory, improve emergency response effectiveness, and identify hazards.

Bentley
Advancing Infrastructure