Early User Testimonials of the Cloud-based, PlantSight Collaborative Engineering Service

ARC White Paper
March 2021

This white paper provides insight into the rationale several engineering and construction companies have used when choosing a cloud-based digital twin for 1D, 2D, and 3D asset information to support the design/build, construction, operation, and maintenance of industrial assets. Users explain their implementation approaches, experiences, and the initial benefits achieved. The white paper aims to guide other users in their respective strategies when choosing and rolling out this new category of applications.

By Valentijn de Leeuw
Vice President, ARC Advisory Group

ARC
Advisory Group

VISION, EXPERIENCE, ANSWERS FOR INDUSTRY

CONTENTS

Executive Overview

In 2018, ARC Advisory Group published a white paper that presented the vision for the PlantSight service that Bentley and Siemens were developing jointly to support cloud-based collaborative processes and 3D design and operations. The PlantSight concept was to provide a unified view into federated data from multiple sources. This view would combine engineering, design, build, constructon, operations, and maintenance data, including 3D representations and quality-related data. The goal was to help clarify relationships and provide context for these data, thus making it easier for users to interpret and understand. The PlantSight service was designed to provide insight into how data changes over time, help enforce data protection policies, and support audits. These qualities suggested that it could also be used to build, deploy, and use digital twins.

This white paper provides insight into the rationale several engineering and construction companies have used when choosing a cloud-based digital twin for 1D, 2D, and 3D asset information to support the design/build, construction, operation, and maintenance of industrial assets. Users explain their implementation approaches, experiences, and initial benefits achieved.
The white paper aims to guide other users in their respective strategies when choosing and rolling out this new category of applications.

When PlantSight was introduced later that year, ARC published a second white paper that focused on creating and deploying digital twins in the process industries. That white paper highlighted how the cloud-based service helps organizations create digital twins and discussed their potential benefits.

Since then, several organizations have tested, configured, and deployed PlantSight. ARC interviewed representatives from three engineering and construction companies and summarizes their experiences using the service in this report.

Key findings include:

- Bentley supports users through testing and configuring, and preparation phases are generally on schedule.
- Go-live experiences have been smooth and Bentley has seen a good user adoption rate.
- The key strengths of the cloud-based PlantSight service appear to be openness and configurability.

- Major benefits reported relate to efficient work processes, in particular improving remote collaboration, access to a single source of up-to-date information, design reviews, data query and entry, alerts, and reporting.

Hatch Transforms Project Delivery Processes Successfully

ARC had the opportunity to speak with Andrew Burt with [Hatch](#), a consulting, engineering, and project implementation company. Hatch, an employee-owned enterprise has a long history of major project delivery and has clearly formulated values regarding quality; health, safety, and environment (HS&E); sustainability; and social matters. The company serves a broad range of industry sectors in metals, energy, and infrastructure. Founded in Canada in 1955, Hatch now has offices on all continents and 9,000 employees.

Mr. Burt has worked at Hatch for 28 years. He started with mechanical design and has used Bentley Systems' applications such as ProjectWise for over 20 years. He assumed the role of enterprise architect for this digital transformation project, with the overarching goal of transforming client delivery processes.

Bentley Systems serves process industries, power generation, utilities, mining, transportation, infrastructure, and smart cities throughout the project and asset lifecycle with digital engineering modeling capabilities. Digital engineering models can be used for design, structural analysis, and construction planning, as well as for asset information, integrity, and performance modeling. Beyond engineering technology (ET), these models are also linked to information and processes in enterprise information technology (IT) and operational technology (OT). Bentley Systems provides a range of products and services for the above-mentioned industries. These include PlantSight, OpenPlant, PlantWise, AssetWise, ProjectWise, ContextCapture, and iTwin Services.

Strategy and Rationale

Mr. Burt has been a leader in technology development at Hatch his entire career. Hatch was an early adopter of 3D design and introduced data-centric processes in engineering workflows to improve the efficiency of the design process. Hatch also developed a complete suite of integrated tools related to project delivery. However, it became clear that its clients were showing increased interest in digital twins and leveraging asset information. This required the company to rethink its digital environment. Hatch implemented cloud hosting in a common data environment (CDE) to provide a platform to transform the digital tools being used in project delivery. The platform also provided the opportunity to build

digital twins, driving value well beyond engineering and construction into asset operations. Hatch's actions drove decisions in digital transformation, including the decision to use PlantSight to change the way it executes projects.

The company has traditionally covered all engineering, procurement, and construction management (EPCM) functions to support capital project delivery. These include process consulting, design engineering, building information management, procurement, construction, and commissioning. In Hatch's broader vision, the company aims to provide increased services along the entire asset lifecycle, from engineering and operational readiness to critical asset management. The goal is to sustain the capital investment and support operations and maintenance, data analytics, and - ultimately - the asset owner's strategy. Clients contribute the in-depth knowledge of their own processes to bring the digital twin to life. Clients build their business case around lower operating costs, high reliability, and uptime, all empowered by easy access to data. These are the main selling points for Hatch's services.

Hatch aims to maintain its leading edge by helping clients meet their business goals through innovation in project delivery and the creation of digital twins. Examples include paperless construction projects, data-centric designs, continuous delivery and review, and delivering digital services using cloud-hosted services. In this case, justification for this digital transformation project was strategic, rather than involving a specific business case. The project was approved unanimously by Hatch's board of directors, which also supports and reviews the company's overall digital transformation program.

Vendor Selection

The company looked at SAP, [Hexagon](#), [IBM](#), and [OpenText](#) for content management, as well as several smaller solutions. Hatch's two main priorities for the tool were to provide online 3D visualization and act as a common data environment. The company also wanted an open, application-agnostic, cloud-based solution. The iModelHub technology and iTwin Services behind the PlantSight service drove the decision. Hatch needed to manage documents, data, and design content in a federated architecture and over the lifecycle of the asset. The federated architecture means that sources are not replicated, but just linked to and possibly cached. As an open solution, the PlantSight service can capture design information from whatever design tool

the client dictates, from whichever vendor. This allows use of the same process, regardless of the design tool used. In this federated model, most information remains within the tools and applications, but PlantSight acts as part of the CDE, making information visible from anywhere in a complete and consistent manner.

Implementation and Change Process

The open source nature of the solution enables Hatch to develop its own integration routes into certain packages using open, published APIs. Integration with broader business tools is still in progress. Functions such as procurement, cost control, project control, cost estimation, and plant maintenance require connectivity with SAP, Oracle's Primavera, ProjectWise, or other tools. Hatch estimates the program will take five years to implement completely and the company is about halfway there. One challenge of this digital transformation is that Hatch has projects, small and large, across all regions of the world. These range from studies to construction and many will need to be supported with legacy systems while the new digital tools are being developed. The company expects its digital systems innovation to be a continuous process, as technologies and processes will keep evolving.

Revisiting the work processes is one of the program's benefits. This led to removing manual processes and managing business processes through automated workflows, providing an ideal opportunity to optimize the processes before automating them (always a best practice) and helped Hatch improve its project execution and delivery processes.

Acid Plant investment value

Value	Delivery	
Rapid ramp up	With in one week	⬆
Design capacity exceeded	Exceeded	⬆
Production	3 months early	⬆
Operation cost	To plan	
High EPCM Cost	10% over budget	⬇
CAPEX cost	9% under budget	⬆
Overall Investment Savings	**Larger than total EPCM fees**	⬆

Copyright © Hatch 2019. All Rights Reserved.

HATCH

Business Case for a Sulfuric Acid Plant in the Democratic Republic of the Congo (Source: Hatch)

A dedicated organizational change management unit at Hatch engages constantly with all levels of the business, explaining the technical and functional changes. As long as the users were engaged, the company reported no real issues. A good training program generated questions, but little pushback. Internal change agents were given expert support and now inspire others by showing the possibilities. Internal stakeholders now understand and share the program's goals and vision. Third-party providers with access to the system also required change management.

Benefits

The value of Hatch's digital transformation was realized in the design and delivery of a sulfuric acid plant in the Democratic Republic of the Congo. Digital delivery reduced the project duration from over 12 months to just six months. This helped increase ROI by 20 percent by reducing CAPEX risks and enabling earlier-than-planned production. The plant achieved its full capacity within a week of hot commissioning. In general, Hatch now finds it has increased quality time for engineering and reduced time spent on lower-value data- and IT-related tasks. Project duration and effort were reduced and information quality and consistency increased. The digital transformation led to improved efficiencies and increased competitive advantage for Hatch, while helping improve its client's business.

With many existing tools still in place, the application landscape remains heterogenous. Nevertheless, issues are very rare overall. As a Microsoft partner, Bentley can use the [Microsoft Azure] platform to make vendor application upgrades painless and transparent.

Overall, Mr. Burt expressed pride in the project, which has made his original white board project a reality.

Engenium's Step-by-step Approach

ARC also spoke with Chris Senior from [Engenium,] another EPC company. Based in Australia and with offices across the country, Engenium's vision is to be the world's best project delivery company. As we learned, the company strives to achieve the key values of integrity, proactivity, commitment, and excellence. Engenium provides feasibility studies, engineering design, project management, procurement and construction, and operations improvement and support services. The company is particularly active in the mining, minerals, and metals processing sector as well as in rail, ports, and other infrastructure. Engenium also provides asset health assessment and management, as well as automation solutions across industries.

Mr. Senior has used Bentley products for 22 years and now manages Engenium's engineers across Australia.

An Opportunity to Seize

Mr. Senior explained that Engenium saw the opportunity to provide engineers, managers, and clients with a seamless view of the latest state of project information. This includes "the metadata behind the graphics." The company wants to provide reviews of information without multiplying systems and data. The data must be of high quality and auditable. Mr. Senior recognizes there are no shortcuts; discipline is required to keep the data up to date. He added that this does not necessarily prevent them from getting up to speed quickly.

Bentley Systems' iTwin Services enables users to incorporate engineering data, reality data, and other associated data from diverse design tools and other sources into a living digital twin, without disrupting their current tools or processes. Users can track and visualize changes, including real-world conditions from instrumentation, sensors, IoT devices, or drones. According to Bentley, iTwin Services facilitate actionable insights for decision makers across the project and asset lifecycle. The platform leads to users making more-informed decisions, while anticipating and avoiding issues before they occur, and reacting more quickly and accurately. This helps reduce costs, improve service availability, lower environmental impact, and improve safety.
iTwin Services are based on iModelHub, a cloud-based distributed, relational database of an entire project or asset. Asset information includes physical and functional models, drawings and documents, specifications, and analytics. The database maintains a timeline of changes and an accountable record of who made those changes and when.

Cloud databases and reality modeling tools have made fast ramp-up possible, with auditable, high-quality, up-to-date data. A cloud-based system provides Engenium with the seamlessness, location independence, and speed it aims for. Obviously, the response times depend not only on the tools employed, but also on the quality of the connection and the distance between users and servers. With these objectives in mind, Engenium discovered the PlantSight service and seized the opportunity. PlantSight provides the timeline of auditable changes made to the data.

Choosing a Vendor

According to Engenium, the basic functionality of PlantSight is not a differentiator. In theory, any software provider could offer such a system. However, the open source nature of the underlying iModelHub technology, which includes Java scripting-access to data within any application from anywhere (including data in applications used by fabricators and operators), represents unique added value.

Engenium sees the transition to PlantSight as part of a continuous improvement process. Ultimately, the solution will have a positive impact on the customer experience through seamless access and continuous reviews. In addition, Engenium's corporate strategy includes having the best tools to deliver quality projects, with particular attention to the customer interface.

A committee of key technical profiles at Engenium, including engineers and draftsmen that use CAD in different disciplines, justified the project based on internal benefits such as efficiency, improved workflows, and increased robustness. Clients will ultimately experience the result of these internal benefits but will get involved in a later stage.

Deployment

As part of its extensive review, Engenium tested the software fully for four months alongside Bentley's development team. This enabled Bentley to streamline existing workflows by configuring them in the software. Engenium is now in early deployment stages, looking for suitable projects on which to roll out the cloud-based software and implement those streamlined workflows. The company still uses server-based design tools, but personnel interact with the cloud-based platform.
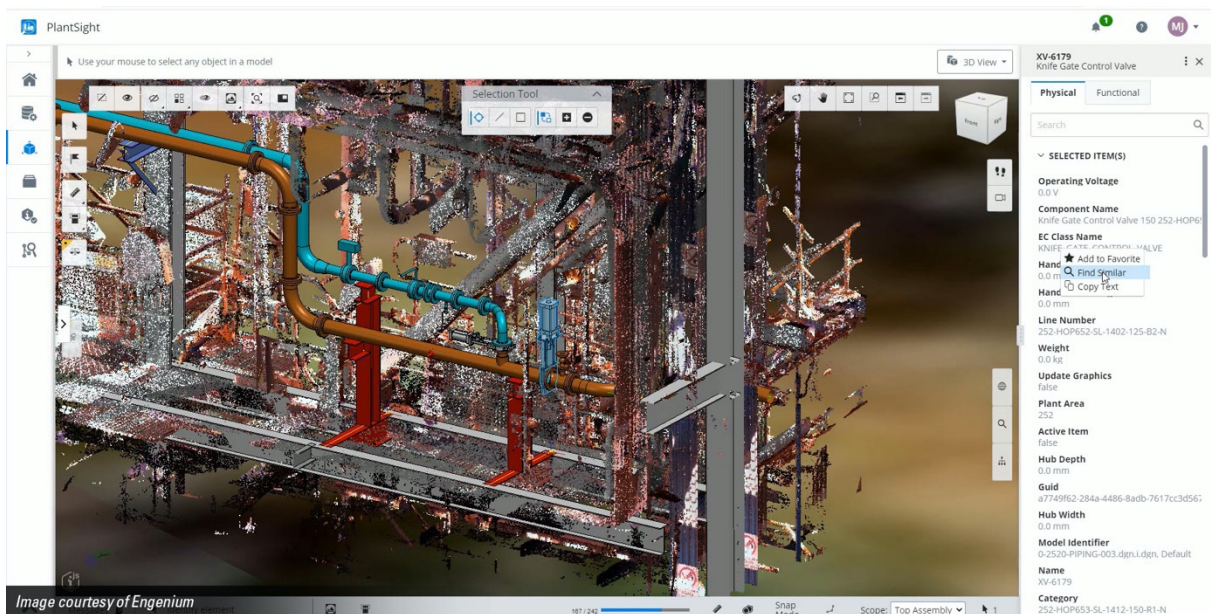
Combining Point Clouds with New Design Elements (Source: Engenium)

The company tries to stay as close to the out-of-the-box-version of the software as possible, minimizing customization. Engenium found that the standard version provides connectors for most applications, and Bentley keeps adding new ones. While Engenium does not intentionally reproduce past workflows, users have expectations based on earlier experiences.

Engenium considers that all project data is client data and therefore has no inhibitions about sharing it with the client. This does not apply to its own intellectual property (IP), which provides the capacity to solve tasks

efficiently and is not explicit or easily extractable from the data. The company recognizes that some data might need IP protection. PlantSight can enforce this on a record-by-record basis if needed. For the most part, non-intelligent digital information, such as drawings, can be substituted with 3D-scanned reality modeling for reference. However, this does not solve the need that process and electrical engineers have for P&IDs and electrical diagrams, respectively, in the early stages of projects.

Experiences and Benefits

Engenium's engineers found the visual review portal to be powerful and useful. One of the good surprises was to discover the query builder. This allows users to easily find, access, and manipulate any data in iModelHub. Generally, the data comes from CAD and is supplemented through direct input in PlantSight. Then, all information is available through the query builder. The planned roll out at Engenium will be for significant multi-discipline detail engineering design projects, with conceptual design to follow.
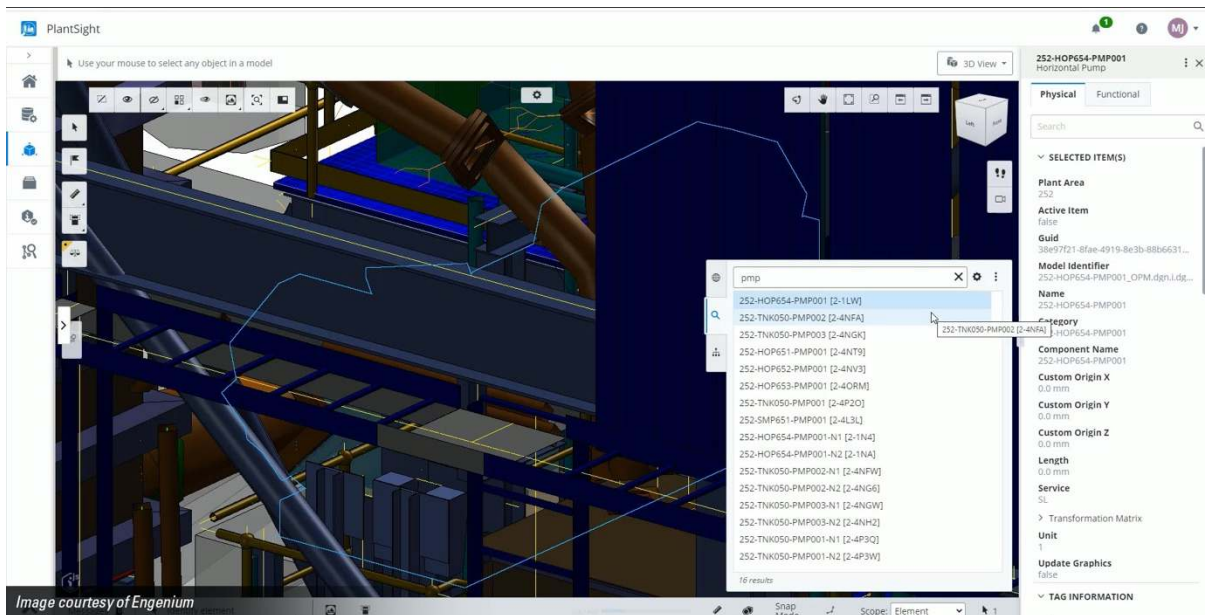
Placement of a Horizontal Pump (Source: Engenium)

A single source of truth is one of the key benefits for engineers. They can now look for, find, or complement information without replicating it, reducing data entry, and improving reuse. In addition, the software reduces the work related to producing and formatting reports, since it is automated. Because engineers can now find needed information themselves, they report that they lose less time waiting for information from draftsmen, and draftsmen report that they get fewer interruptions from engineers' requests for information.

As ARC learned, the change process has been smooth for Engenium so far, not only due to the qualities of the service but also because only the keenest users have been involved.

Other benefits include streamlined communication within the project teams. Where communication would previously be via email, auditable notifications are now provided inside the system and with helpful context. As communications can become very complex, especially in larger teams, notifications reduce management cost to a considerable degree. Engenium believes that improved communications alone could recover the cost of the project.

Support and maintenance are needed, mainly to support the various naming rules, standards, units, and other specifics required by many clients. PlantSight allows organizations to maintain all of those separately. Mr. Senior reports that, when executed in the cloud, upgrades do not create any issues. He appreciates Bentley's responses to requests.

Next Steps

Engenium wants to maximize the value it receives by deploying the software most efficiently to projects. The company needs to determine whether it should employ the solution for all cases, or just for medium-to-large projects. Once the major client is optimally served using the software, the company plans to roll it out to other clients.

NOV Goes Live with PlantSight

NOV Inc., a global company headquartered in Houston, Texas, delivers technology-driven solutions to empower the global energy industry, including solutions supporting digital and smart oilfield initiatives. For more than 150 years, NOV has pioneered innovations that enable its customers to produce abundant energy safely, while minimizing environmental impact. Throughout every region in the world and every area of drilling and production, NOV's family of companies provides the expertise, equipment, and operational support necessary for success.

ARC spoke with Kjell Hundeide, manager of CAD and associated systems in the Process and Flow Technologies group of NOV Wellstream Processing in Norway. NOV Wellstream Processing supplies equipment and solutions for

all the activities NOV performs for separating and treating oil and gas as part of an upstream production facility. For design and engineering, the company previously used Bentley's PlantSpace tool, but now uses OpenPlant. Mr. Hundeide learned about Bentley's MicroStation in 1993 and later worked at Bentley as a lead application engineer for PlantSpace and then OpenPlant. In 2010, he took his expertise to Aker Solutions in Norway. Since then, NOV acquired the business unit at which he worked.

Challenges and Opportunities

A real challenge for NOV was the need to split designs into multiple files to enable multiple people to work on the same design. PlantSight provided this multi-user capability.

In the past, NOV used Navisworks to share designs with fabricators or sub-contractors since it was the only application in the oil and gas sector that can accept many different file formats. However, sharing files can create data security challenges, since other parties could potentially extract information from them. In addition, when several files circulate with different versions, it is difficult to keep track of those versions and reconcile them after review. PlantSight models for the project can be easily shared with partners and are always up to date. Models are protected and it is even possible to control which parts of the project a partner or client can see.
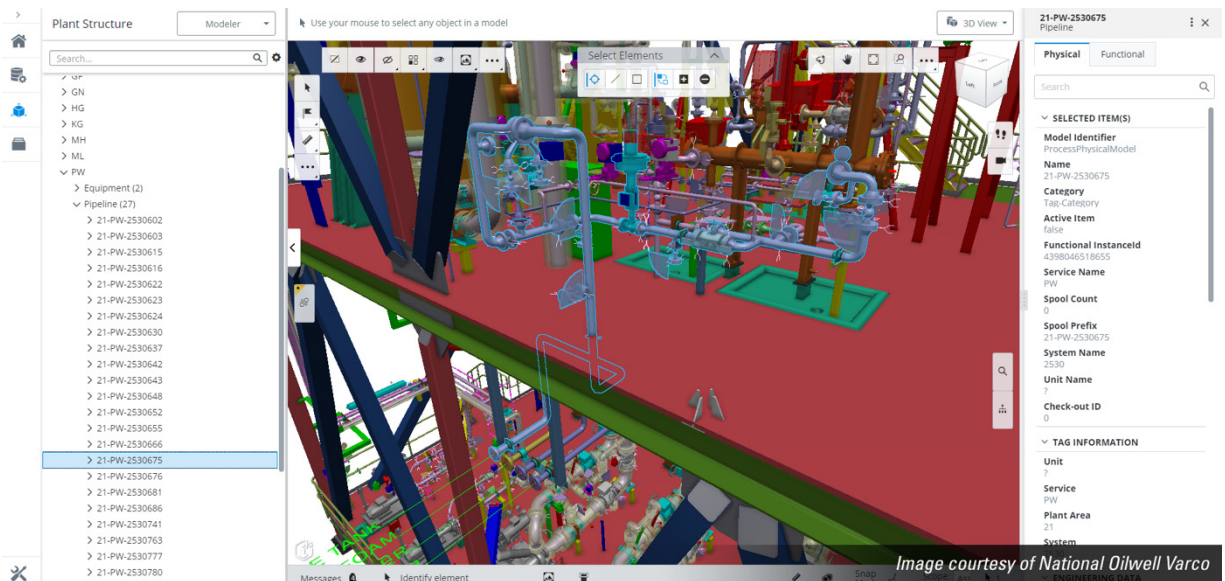
3D Design in PlantSight with 1D Context Information of the Selected Object (Source: NOV)

Solution Selection and Justification

As Bentley users, PlantSight came at a relatively low cost for NOV because it didn't have to replace desktop tools or incur the associated training costs. With PlantSight, the company could build upon its know-how and the transition caused minimal disruption. NOV had scanned the market and did not find any other tools with the same level of openness as PlantSight. The capability to integrate the service with many other tools increased NOV's confidence in the software.

Since management was not involved with projects on a day-to-day basis, it was challenging to convince them of PlantSight's implications and potential for savings. However, management did realize the benefits of digital transformation and digital twins and understood that it would be inefficient to create a digital twin using the old work process.

The increased design review efficiency is, in itself, a substantial benefit. When the COVID-19 pandemic struck just after the start of the project, the case became even more convincing, as all project team members could contribute from their homes while working on shared design information. It also greatly helped the collaboration with fabricators that NOV could no longer visit in person since the start of the pandemic.

Implementation

The preparation phase took about half a year. The challenge was working with a product that was not yet officially released. The CAD manager and a few key personnel worked on testing and iterated versions with Bentley. Overall, the project remained close to schedule. The implementation was done in phases. NOV decided to start with layout, the latest stage of its projects. At this point the 3D layout department and associated personnel were involved. Since this is a smaller group, transition was easier to control. Process design and schematics were tackled in the next phase, which should create further ease of use for the piping designers as more information from the upstream design process will be available to them. Previously, designers had to enter all information from scratch.

Experiences Since Go Live

The company went live with PlantSight shortly before we spoke, transitioning from server-based to cloud-based software. Using files on local servers had limitations, as designs were often split into multiple files that different disciplines worked on independently. This created inconsistencies and

required rework. With PlantSight, personnel can work simultaneously on a single, large design and are immediately notified when clashes are detected. PlantSight eliminated the limitations of local files. The cloud-based system uses a file in the cloud, but has no size impact or access limitations when accessed online. If needed, the file can be copied to a local server.
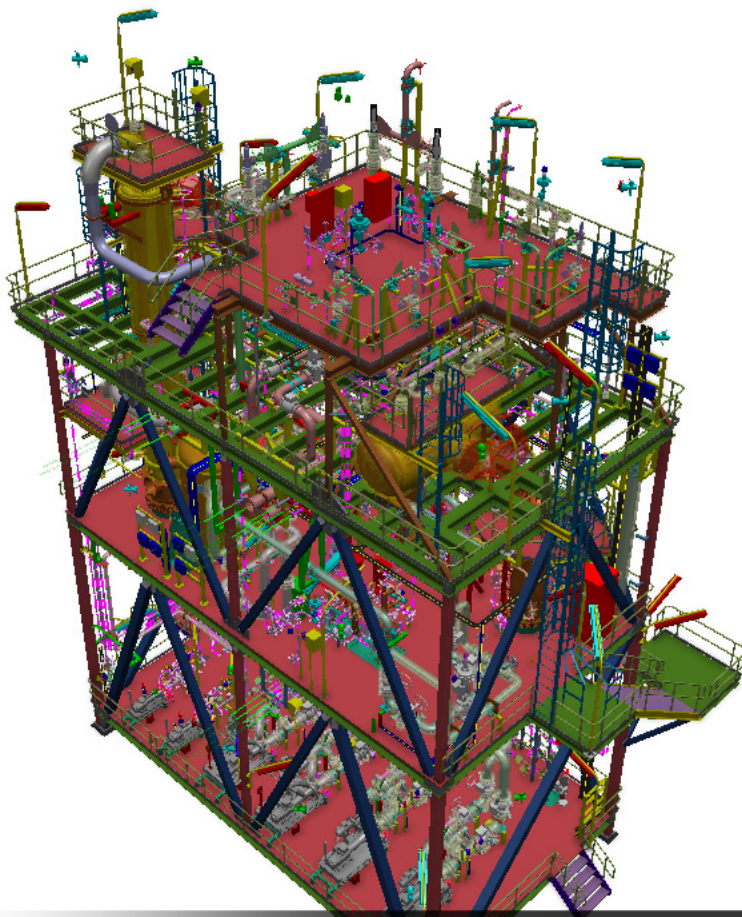
As ARC learned, PlantSight was well received, even by the seasoned designers and engineers who were used to using MicroStation. Mr. Hundeide expected some hesitation, but the transition was very smooth. None of the users had used PlantSight before the go live. They received a two-hour training course, participated in some hands-on exercises, and resumed working on their projects in the cloud. PlantSight makes it faster and easier for users to drill into details.

Image courtesy of National Oilwell Varco

Plant Overview in 3D Using PlantSight (Source: NOV)

Currently, NOV is starting to look into new functionalities, such as reporting. Another promising possibility is to get a better view of "deck penetration," an information capsule indicating where to make the openings in each deck. NOV found that when modifications need to be made, that information can be exported to Excel, modified there, and imported. This is a far more efficient process than making changes deck by deck.

With the PlantSight service, NOV keeps information in one place and controls it in a single environment. For example, 3D design information, the attributes of piping specification, and installation notes for the piping are all visible and manageable from within PlantSight. Previously, if a piping manager wanted a piping layout report, they had to involve a piping designer. Now, the piping manager can use self-service dashboards and reports. The new software also reduces interruptions and waiting times.

With two dedicated resources, NOV supports 100 engineers on projects that typically have 20 contributors who don't need much assistance or support. Currently, Bentley personnel provides systems support and runs backups, while NOV personnel becomes more familiar with the tools before they can restore from backups.

Mr. Hundeide said this project was one of his most satisfying achievements.

Outlook

The digital twins in PlantSight might generate new ideas for products and processes. NOV can modify designs to include remote equipment operation, and operations can be monitored by feeding live data to the models.

Recommendations

Operating companies, engineering and construction companies, and equipment fabricators all have multiple reasons to review their design, qualification, and support processes and compare the performance of server-based tools with cloud-based software. As the end user testimonials in this white paper demonstrate, it is not only a matter of "server vs. cloud." In fact, the additional functionalities of a modern architecture and the design of cloud-native digital twin services can add significant efficiency and efficacy.

Based on ARC research and analysis, we recommend the following actions for EPCs and owner-operators:

- Review design, qualification, construction, operations, and maintenance processes for performance and challenges. In particular, manual workflows can often be improved.

- Compare how cloud-based solutions can help address challenges of remote working. Look for opportunities that facilitate collaboration among personnel in offices and home offices, to improve quality and efficiency.

- Talk with your peers about their strategies and experiences, and join the end user-focused ARC Digital Transformation Council to benefit from peer-to-peer discussions and networking opportunities.

Bentley, PlantSight, OpenPlant, PlantWise, AssetWise, ProjectWise, iModelHub, and iTwin are registered trademarks or trademarks of Bentley Systems, Incorporated. All other trademarks mentioned are the property of their respective owners.

Analyst: Valentijn de Leeuw

Editor: Sharada Prahladrao

Acronym Reference:

API	Application Programming Interface	**EPC**	Engineering, Procurement & Construction
BIM	Building Information Management	**ET**	Engineering Technology
CAD	Computer Aided Design		
CAPEX	Capital Expenditure	**HS&E**	Health Safety and Environment
CDE	Common Data Environment	**IT**	Information Technology
COVID19		**P&ID**	Piping and Instrumentation Diagram
	Disease caused by the SARS-CoV-2 virus since 2019	**ROI**	Return on Investment

ARC
arcweb.com

3 Allied Drive   Dedham, MA 02026   USA   781-471-1000