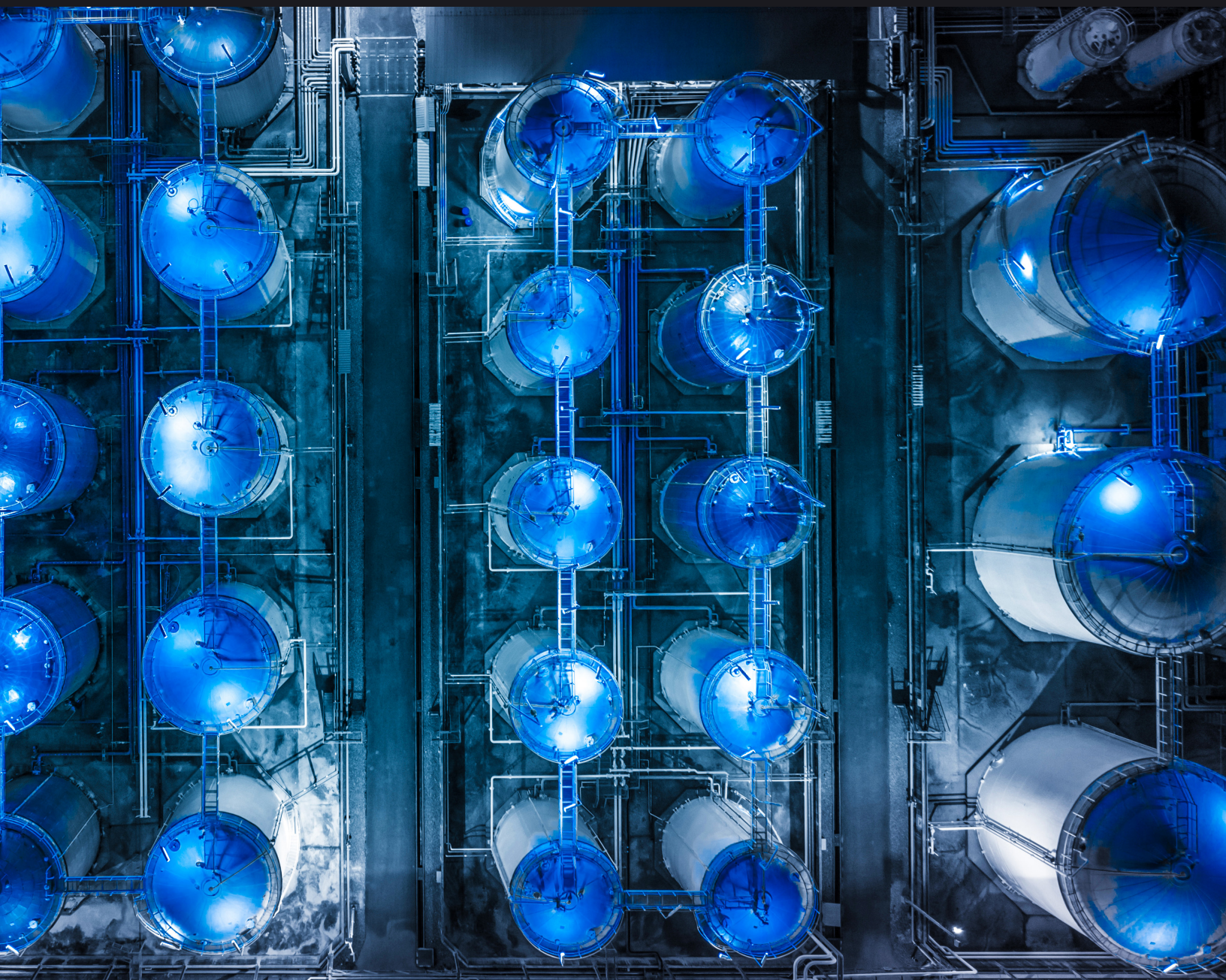
OCTAVE

WHITE PAPER

Digital transformation engineering and design solutions



Contents

1. Introduction

The main objective of digital transformation is to increase the value and margins of assets to help mitigate owners' increasing project costs and higher risks that come with operating facilities in the traditional manner. There are clear business cases for moving to a digital plant, such as producing a reduction in operating expenditures — along with other examples — highlighting a reduction in the time it takes for engineers to find and verify data, reportedly by three to four hours per day.

Another key part of digital transformation is connectivity. Just having everything in a digital format won't provide business benefits. Connecting it in a smart way to present fit-for-task information is the key. This information can come from many sources: engineering data, process data, business data, etc. Only Octave's platform, InConcert Core (formerly HxGN SDx), enables the complete digitalization and connectivity of so many inputs and creates a foundation for success with companies looking to ensure a successful digital transformation.

The necessity of moving to a digital plant setting is obvious, and many owners have started that journey. There are two ways to begin the path to a fully digital plant:

- When a plant is built from scratch, the end goal must be front of mind; this means ensuring the engineering and design deliverables fit in the digital plant scenario and providing the right information to support the operational tasks.
- Also, it's vital when the plant is already in operation. Owners must capture the existing situation and ensure the consistency and quality of the digital plant, as this will be the basis for making key decisions related to safety.

At Octave, we are not new to either engineering, procurement and construction (EPC) or owner operator scenarios. We are excited to deploy our technology and capabilities, make digital plants a reality and help owners improve their margins and lower their operational risks.

2. Capture and verify

Existing plants have a mass of documents, often duplicated and inconsistent. Data is stored in different systems with numerous contractors within a variety of tools. Keeping everything up to date is a huge task; in most cases plants are not up-to-date with the current or as-built/operated situation.

To achieve a digital plant, we can capture the physical assets using laser scanning technology. This capability has made fantastic progress, as the speed and resolution of the point clouds now come close to picture-like images of the facility. CAD models are also a good basis. Octave has the technology to integrate different formats in the common smart solution.

Once the 3D models are consolidated in the Octave format and stored in the single smart engineering environment, they must be compared with the point cloud to ensure the models are as-built, i.e., represent the "as-is" in the field. To provide the best experience for our customers, Octave is investing in AI technology to create a more automated comparison between the point cloud and the engineering data, which will then ensure that lines and plant items are also on the piping and instrumentation diagrams (P&IDs) and vice versa. So now we have the consolidated 3D as-built model verified against the point cloud (true as build) and synced with the P&ID (process design). Next, the Octave teams are looking how to automate the creation of the 3D as-built using AI technology and the point cloud as the basis.

The benefits of digital transformation can only be derived if the base data is accurate.

The point cloud and combination of the existing CAD models, if available, provide a true representation of the actual as- built. In addition, we must consolidate and convert the P&IDs into intelligent P&IDs so we can facilitate the connection with the different data sources; the P&IDs are important legal documents that represent the logical representation of the plant. They are basically a license to operate.

There are a few options to make the conversion to the intelligent data-centric P&IDs, such as redrawing them. Automate the conversions with some utilities and use a slow move to the fully intelligent P&ID with the hybrid option. The fully intelligent P&ID is the ultimate goal as it offers optimal benefits.

Next, we must verify the P&ID against the company's engineering and safety practices by using a rule-based checker. This will quickly highlight inconsistencies and errors. A solid P&ID is the basis for many operational decisions; it is a legal document and a license to operate, so it must be correct.

With the verified P&ID and model in hand, we can consolidate many data sources, such as process data, line data and equipment data into a single environment. This greatly reduces cost while increasing data quality and consistency.

Another important engineering source is the control system. Gathering, consolidating, and managing instrument data in one system is crucial, as instruments are necessary for safety and product quality. A Distributed Control System (DCS) is vital for creating a true as-built status for instrumentation information.

We have the technology to connect to the DCS and upload the instrument data into the instrument solution. That is a good start and a solid basis. Because field items, such as junction boxes, are not coming from the DCS, these must be entered or imported from existing systems and or documents.

The same rule checking we used for P&IDs can be used for instrumentation and electrical designs to ensure quality and consistency.

Process data is important engineering data. Because the plant is running, we do not have to design it. However, in most plants, tweaks are made so process data and process flow diagrams (PFD) are kept current as well. We can move the process data from the existing tools — that are often Excel spreadsheets — into our smart process engineering solution. Although this tool is focused on the process design work, the vision is to connect this to the DCS historian to collect the as-run process data and join it with the as-designed to determine necessary adjustments and optimizations.

All of this is a large task, but we at Octave have proven solutions and methods to facilitate digital transformation. And our digital twin technology can be used to facilitate any changes to the business model. You will then see significant benefits in productivity, cost of operations, safety and more.

3. Access

It does no good if we have a great digital twin if we cannot access or see it. This digital information must be made available to the people who make decisions and run the plant. There should be no clutter … just what the engineer needs. Octave focuses on providing the just-right visualization capabilities, which will be easy and fast. They will also be available on different platforms to allow the instrument technician to see the instrument calibration data on a tablet and perform the as-left and as-found right from the single source of truth — the digital plant.

Several visualization methods such as "augmented reality" exist, which offers the combination of what is right there in front of you and the associated information from the digital plant. Virtual reality utilizes devices such as HoloLens to immerse workers in plant safety reviews while still in their offices. Or visualization can be a mix where a maintenance person sees the digital plant and uses the information to make modifications – such as drilling a hole or moving equipment – so he can assess the impact immediately.

Visualization is a key element of the digital twin concept as it helps workers make the right decisions based on the true as-built and related engineering data.

4. Decision-making

Plant workers make hundreds of decisions every day. These decisions can have a massive impact on cost, safety and personnel. To make the right decisions, workers need the right information, and this is where the digital plant comes in. The ultimate goal is to make decisions remotely or even – someday – autonomously.

Let's say we need to change out a tank. We must isolate it from the process, drain it and assess it. This information can quickly help us with LOTO or lock out-tagout. Using the connectivity in the P&ID, the data in instrumentation and electrical quickly reveals what needs to be switched off or closed to isolate the tank. This can be integrated with the solution that documents the procedures for these tasks. The right decision is made.

With hazard and operation studies (HAZOP), we now have the model and the P&ID as main elements to perform the what-if scenarios to ensure we have design for safety and understand what we need to do to mitigate if there are risks. Another big decision-making scenario involves turnarounds, which traditionally have a long planning process to make sure all materials are defined, and the existing situation is correct and current. If a part is missing or an existing situation was not as planned, start-up delays can cost millions of dollars.

For leak detection and repair (LDR), we can use the digital plant to help decide what point to inspect, when, how often and alert us if items need to be replaced.

Do we have the right instrument for this process? We can find the answer by looking at the calibration history, determine how often is it of set point, and perhaps replacing it for less maintenance. Does this create less cost and a higher reliability? By using our digital plant data, we can perform analytics and choose the optimum solution from a cost/reliability/safety point of view.

We can make connections between the engineering data, the control system and maintenance systems to make the best decisions. By connecting the dots with analytics tools, we can optimize operations. This goes beyond looking at the point cloud or the P&ID, though both are elements of making it possible. Next, we can predict when things will go wrong and then schedule maintenance before bad things happen.

We can even optimize the maintenance by predicting, for example that these 10 instruments will go bad in the next two months, so let's replace them all in one go rather than three today and come back in a few weeks for the others. We can even think about outsourcing the maintenance for several plants if these methods will be available for most systems.

5. Expansion

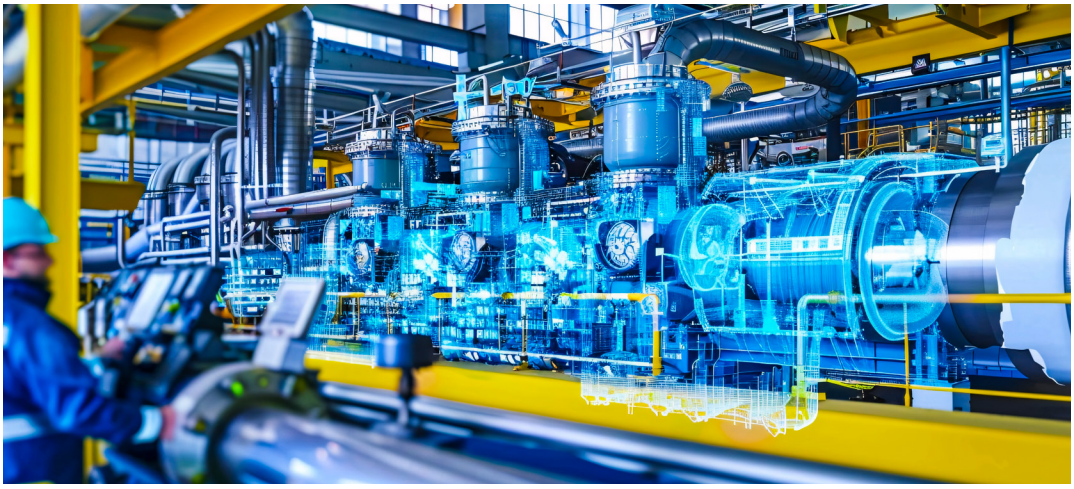
Change is for certain, including in plants, such as expansions with new units or revamps of existing units. We have the unique capability for the engineering and design tools to "carve out" a piece of the digital plant and put that portion in a project. A contractor can then work on this part of the plant while the current as-built is continued to be used in operations. After the project is completed, the owner will decide if and when to implement it.

If the project is implemented, the new and modified project is merged into the as-built to create a new as-built with the modifications. This is a complex work process, especially if after many months of project work, the as-built has changed from the original point we carved out. The selected portion must be consolidated for a consistent engineering model.

This must be managed and resolved, which involves many disciplines. We offer the capabilities to compare between the project and as-built and between the different disciplines on the project to make sure all parties are doing the right thing.

On the process design side, we can use the as-built process design and add new PFDs or use exiting PFDs and re-use those and run additional simulation cases against them to determine the new design cases that will drive specifications for equipment, piping and instruments.

Our solutions have a very long track record of engineering and designing process, power, mining facilities and ships. In this case, we are using the same proven technology in a brownfield workflow scenario which is unique in the market and helps owners better plan and execute expansions to their facilities. This increases the asset's overall value.



6. Maintenance

Creating the digital plant only offers value if it is 100% as-built and correct. Therefore, it must be maintained throughout its life, as changes will definitely occur.

It is much easier to maintain the one digital model versus many different systems and even paper copies. A key component of our solution is integration, which happens at all project stages and also in updates and maintenance consistency. If an instrument changes – such as a new type of instrument like from an orifice to a vortex and the change is made on the P&ID – the change will ripple through to instrumentation; if the data is updated, all documents are updated, and revisions are marked on the deliverables.

With Octave drone technology, we can fly over the plant and capture new laser scans to compare against the digital plant for changes. The collected data can be used in analytics for optimizing operations.

The integration, data-capturing technology and analytics/rules will greatly assist to keep the digital plant current, so it can remain the basis for the operation tasks and maintenance.

7. Conclusion

Transitioning to a digital plant scenario is the right decision for owner operators. With increasing competition and pressure on margins, it is not enough to just cut costs or introduce another software solution. A fundamental shift must be made in the way facilities are run. Using the benefits provided by the digital plant, owners can make the smartest decisions by integrating visualization, analytics and connectivity between the assets and engineering data. The opportunity to create a totally new business model with predictive/remote maintenance even autonomous operations will increase the return on the assets.

Are you ready to take the leap to digital transformation?

About Octave

Octave is a leader in enterprise software, turning data into decisive action and intelligence into your edge. Our software solves for and simplifies complexity, from the design and build to operations and protection of people, property, and assets– for any scope, at any scale. For decades, we've partnered with customers to sharpen performance, elevate efficiency, and amplify results. From factory floors to entire cities, our solutions are tuned to scale up what's possible from day one onward.