Twins Key to Digital Transformation

Digital-twin technology helps you scale systems, standardize assets, and develop sustainable operations to deliver fast ROI.

Mart Berutti
Emerson

Offshore oil-and-gas facilities are well suited for digital twins because the technology makes it possible to safely train workers on land instead of incurring travel expenses for in situ training.

MANY ORGANIZATIONS ARE implementing digital-twin simulation technologies as a core part of their digital-transformation initiatives. For these companies, the heart of a digital-transformation plan is deploying technologies to move critical procedures—such as engineering, modifying, testing, and training—from physical equipment to a digital workspace.

Moving these procedures into a virtual environment empowers personnel and keeps them safe while simultaneously delivering operational benefits. As organizations implement simulation technologies, including those taking advantage of augmented and virtual reality (AR/VR), the clearest path to success is one focusing on scalability, standardization, and sustainability.

SELECT FOR SCALABILITY

Digital-twin technology needs to be functional and cost effective. This means not only justifying ROI, but ensuring effective programs can be scaled up to improve other areas of a plant without incurring excessive costs. Starting with a pilot program that identifies a success case and allows rapid expansion is the recommended way to leverage simulation technology and build momentum for digital transformation.

Digital-twin technologies fit the pilot model perfectly. They can be built using existing equipment specifications to create realistic, dynamic models that provide value for testing and training. When a plant is ready to scale up, the existing digital twin can be expanded to other business areas or plants, or it can be enhanced with VR capability to provide an even more immersive experience.

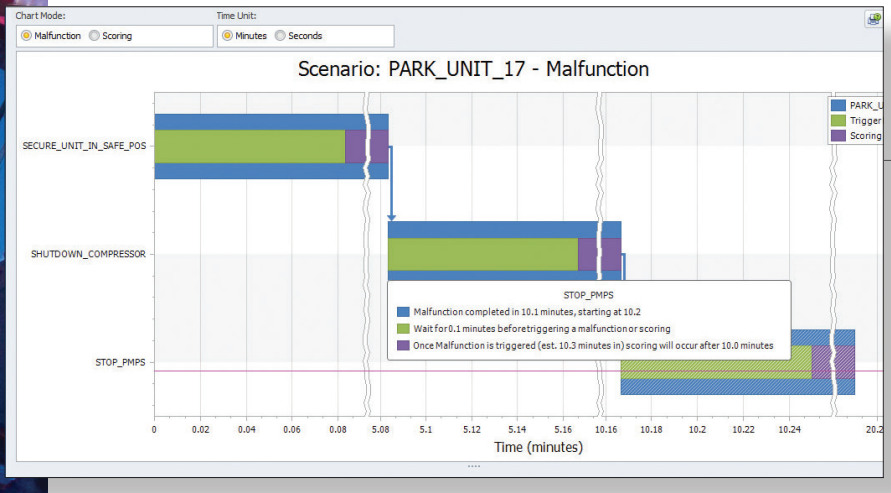
As digital twins expand across the enterprise, they will face changing requirements, depending on the complexity of their simulation models. Modern simulation platforms take advantage of selective fidelity, allowing the software to apply the required level of model complexity to fit the requirements of a specific unit operation or task.

Similarly, as organizations grow, their simulation investments need to grow with them. Simulation software that seamlessly integrates into plant-automation systems minimizes setup time and complexity, making it easier to use the system throughout the lifecycle of a plant's automation system—ultimately delivering an even greater ROI.

Operations teams should look for digital-twin projects that will show successful results in identified problem areas and take advantage of existing infrastructure to ease implementation and reduce costs across the equipment lifecycle.

SCALABILITY IN ACTION

For one large oil-and-gas manufacturer, developing a pilot project using digital-twin simulation was a critical step toward improving safety, cost, and performance. The organiztion owned



Digital-twin simulations, such as this one from Emerson's Mimic simulation software, use actual control data to build advanced training scenarios that rapidly upskill personnel.

an offshore vessel that required extensive safety training for operators and maintenance crew. Knowing digital technologies reduce the hours the crew spent practicing on live equipment and save the costs of flying inexperienced personnel to and from the offshore vessel, the organization implemented a pilot program to turn its existing digital-twin simulation into a VR immersive-training experience.

The manufacturer began a proof-of-concept project with Emerson Automation Solutions, St. Louis (emerson.com/en.us), to install and configure Mimic Field 3D technology to improve its digital-twin simulation. The VR simulator used the vessel's existing digital-twin architecture and CAD drawings to create a three-dimensional model of the vessel. By combining the plant's digital twin with VR technology, the resulting solution created an immersive and interactive training system.

In the virtual environment, operators can perform the same tasks they would in the real world, gaining familiarity with the locations of valves, pump controls, and other operable devices. The fully interactive VR environment trains them for offshore work from the safety of an onshore facility.

This 3D digital-twin project set up the organization for the future. While it was targeted at specific operations on the vessel, the system now allows the team to vary the levels of model complexity and apply it to other use cases.

If the team decides to add new operations or units to the digital twin, selective fidelity technology provides the flexibility to vary model complexity—low, medium, or high—to support new operations and equipment. The team can add processes and add, upgrade, or replace equipment, knowing any changes will be supported by the digital twin.

Cloud-ready simulation technologies increase system sustainability, making it easy to manage, maintain, and upgrade assets.

STANDARDIZING SYSTEMS

One of the key components of efficient digital transformation is the ability to use and reuse the same project work, processes, systems, and equipment across the enterprise. Simulation technology can help create pilot projects that are not simply independent experiments, but also a part of the connected whole.

Digital-twin simulations make it easy to standardize across business units, plants, and even world areas with reusable project libraries, assets, and models. Organizations can save significant time and cost as projects are scaled up. Modern digital-twin technologies are hardware agnostic and can be used with many different automation systems. To achieve the fastest ROI, standardization should be planned from the earliest stages of a pilot project to enable replication with the least amount of rework.

Adopting cloud-ready simulation technology simplifies the standardization process. Cloud-based systems remove the need for a facility to maintain its own expansive IT infrastructure, making digital-twin projects easier to replicate, no matter where they are located. Remote facilities and locations with limited space are no longer barred from using the same simulation technology implemented at the company headquarters, making it much easier for reliability teams to standardize across the enterprise.

STANDARDIZATION IN ACTION

The oil-and-gas project team selected digital-twin simulation with VR for its expected ease of implementation in other programs, in addition to the vessel project. Because the VR software can generate simulations using existing CAD drawings, laser scans, and photographic surveys of plants—the organization knows it can be used successfully at any of its facilities.

The team will also build a process model component library to be used for other projects that rely on the same equipment, dramatically shortening the time it takes to build new models in future digital twins as the pilot expands to other locations.

By standardizing on one technology across the organization, the team can increase efficiency by cutting installation and implementation time, and by reusing libraries. They can also reuse developed training procedures across similar projects.

Most important, the team will be able to quickly familiarize personnel with the system. Engineers, operators, and technicians can travel from site to site, confident that the underlying software will be the same, every time and place.

SUSTAINING SUCCESS

No project can be successful in the long term if gains cannot be sustained. Most capital projects are expected to operate for decades and will require attention as time passes. After project implementation, the individual components still need to be used, updated, maintained, and expanded to

A digital-twin simulation provides a replica of the operating environment for interaction by users. With the addition of VR, users feel as if they are actually on site.

include changes as technology advances and the facility evolves.

Organizations must plan system maintenance, whether they intend to do the work themselves or rely on a trusted vendor. Successful sustainability means establishing a support network with a wide scope of automation expertise. As assets and sensors change, the underlying systems that personnel rely on for operations, monitoring, and maintenance will need to be adjusted. Managing these changes will require internal or external automation experts. Choosing cloud-ready simulation technologies can increase system sustainability by making it easy for the system to be managed and maintained by the organization or by an outside vendor.

SUSTAINABILITY IN ACTION

The vessel team chose the digital-twin project because it focused on increasing personnel safety and operator confidence. This focus had a direct impact on buy-in from the people charged with making the project a success.

As staff members see how the simulation improves their performance, they will support use of the digital twin throughout the asset lifecycle. Moreover, as personnel gain familiarity and comfort with the new system, they will be able to go beyond training to use the system in unique ways. In time, the team will use the digital twin to develop process and maintenance improvements to keep the vessel running safely, effectively, and efficiently. These changes will translate directly to improved ROI.

This organization chose Emerson as a trusted partner to help maintain and scale the project across its lifecycle. The reliability team had already selected other projects where it might implement VR once the pilot project is completed, and not all of those projects are vessels. Knowing this, the organization wanted a vendor that offered a deep knowledge of automation across multiple industries and project types to speed future project planning and help maintain momentum.

Sustainability will also be bolstered by the software's seamless automation-system integration. As digital twins change or automation systems are upgraded across the enterprise, the team will not have to worry about managing complex configurations. Plants, processes, and systems will stay up to date and the digital twin will easily evolve with these changes.

There are many paths to digital transformation, but success lies in finding efficient, cost-effective ways to implement digital technology projects and quickly demonstrate attractive ROI. Simulation technologies, when implemented correctly, can be key drivers for improved digital-transformation projects.

Rather than starting a simulation project from scratch, consider ways to begin projects that take advantage of standard systems and equipment already in place across the enterprise. Think about the ways to prepare in advance to eventually scale up projects when they are successful, and the expertise necessary to keep projects delivering on their return for years or even decades. When executed properly, short-term simulation projects can lead to long-term gains. **EP**

Mart Berutti leads Emerson's Process Simulation Center of Excellence, based in Chesterfield, MO. Berutti helps customers understand how a digital twin of a manufacturing plant can digitally transform organizations and improve operations. He is a chemical engineering graduate from Missouri Univ. of Science and Technology, Rolla, where he also serves on the Academy of Chemical Engineers.