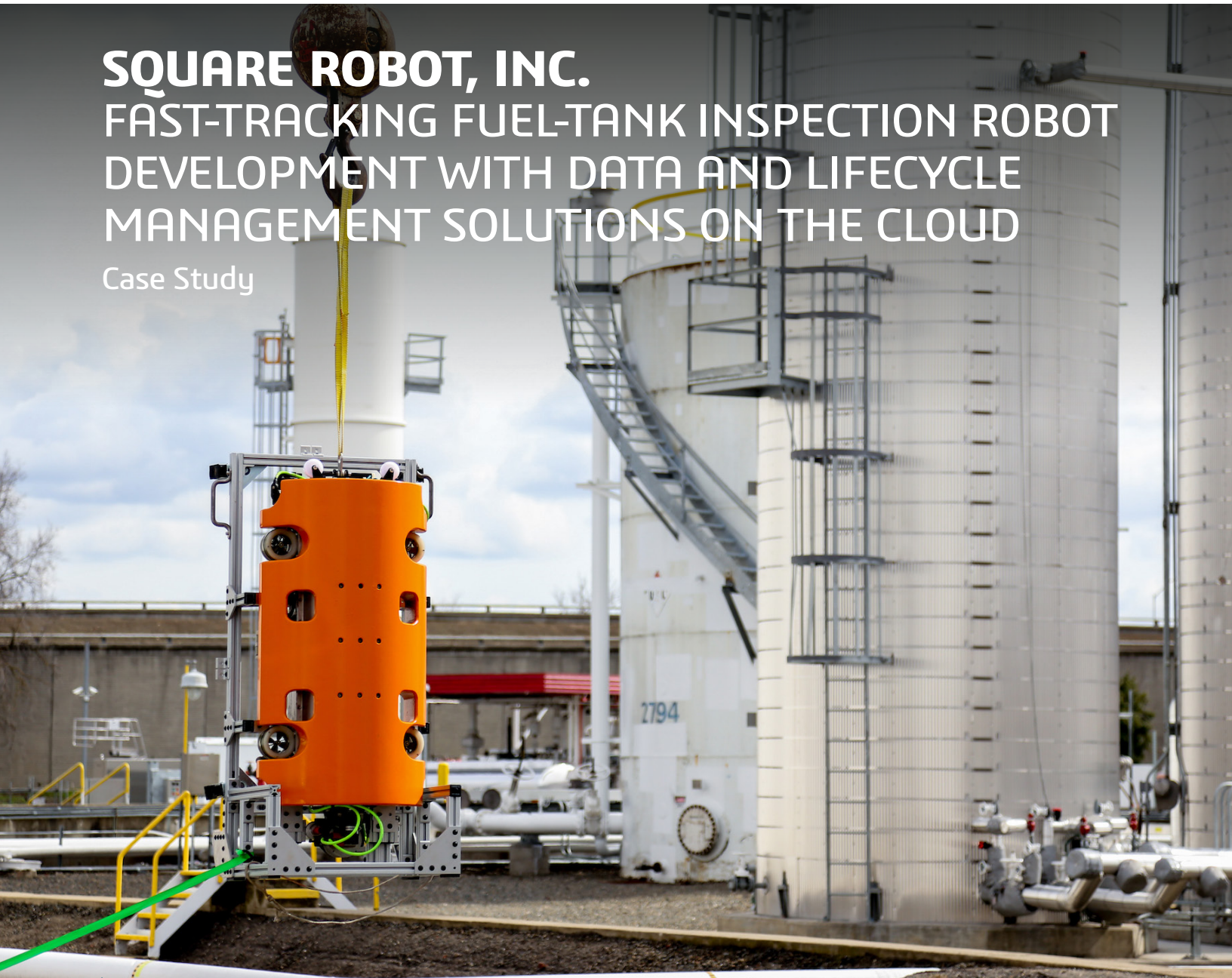


SQUARE ROBOT, INC. FAST-TRACKING FUEL-TANK INSPECTION ROBOT DEVELOPMENT WITH DATA AND LIFECYCLE MANAGEMENT SOLUTIONS ON THE CLOUD

Case Study



Square Robot relies on the 3D Component Designer cloud-based collaboration solution, one of the data and lifecycle management solutions on the **3DEXPERIENCE** platform, and SOLIDWORKS 3D design software to develop swimming autonomous robots for oil and gas applications, such as the robot that inspects the interior of petroleum above-ground storage tanks shown here.

Challenge:

To accelerate development of autonomous, submersible, hovering robots that can inspect the interiors of full petroleum above-ground storage tanks and dramatically reduce the costs associated with inspecting these tanks.

Solution:

Extend SOLIDWORKS CAD with data and lifecycle management solutions on the **3DEXPERIENCE** platform to facilitate online design and collaboration.

Results:

- Accelerated collaborative development process
- Reduced errors through improved revision control
- Improved team collaboration and productivity
- Developed certified robotic system for inspection within C1D2 hazardous locations

Square Robot, Inc. is a leading robotics manufacturer that successfully submerses battery-powered robots inside in-service fuel storage tanks and inspects the tank floor for corrosion and integrity flaws through its Veritank subsidiary. Three robotics professionals founded the company in May 2016 to address the growing need for swimming autonomous robots for oil and gas applications. In addition to inspecting the interior of above-ground petroleum storage tanks, the Boston-based startup's autonomous hovering technology has broad-ranging applications for offshore infrastructure inspection.

The robotics manufacturer has initially focused its product development on hazardous location vehicles for petroleum tank inspection applications, due to the high cost of inspecting these tanks manually. The need to inspect these tanks—as required by government regulations and to ensure safety—creates a real market opportunity for Square Robot, whose robots can more cost-effectively inspect full tanks without emptying them, according to Senior Mechanical Engineer Charles O'Connell. "Before we developed our hovering technology, most tank inspections required taking a tank out of service, so it can be drained, opened, cleaned, and inspected through manual nondestructive testing, with waste processed and repairs made as necessary," O'Connell explains. "In addition to being highly disruptive to operations, this manual inspection process is time-consuming and costly, with many refineries budgeting \$2 million (US) to inspect a 150-foot-diameter tank."

By developing hovering robots for use by its Veritank subsidiary, Square Robot can offer more accurate inspections of in-service tanks without disrupting operations at a fraction of the cost. Developing these inspection robots posed substantial design and engineering challenges beyond the need for certification for use in hazardous locations. When you're dropping a battery-powered robot into a tank of oil, gasoline, or diesel fuel, the robot must be certified as electrical equipment that can safely pass through an area where ignitable vapors exist.

Square Robot conducted its early product development with SOLIDWORKS® 3D design software, because its engineers were all experienced users. However, since the company's five SOLIDWORKS users work from multiple locations, the company needed cloud-based solutions for design collaboration, revision control, and product lifecycle management.

"We initially began working by developing parts, assemblies, and drawings in SOLIDWORKS, and storing them in the cloud via Google Drive, using the SOLIDWORKS Pack and Go feature for large datasets," O'Connell recalls. "Google Drive is capable of storing CAD data but not in an intelligent way that maintains revision history and relationships between assemblies and their child items. Working this way, a main organizer—me—had to diligently manage all of the data and revisions locally by deciding what local files to override. This was not only time-consuming and burdensome for the main organizer, but also prone to human error and counter to collaboration. What we needed was a cloud-based solution that enabled us to collaborate, maintain revision controls, and lock down approved CAD data."

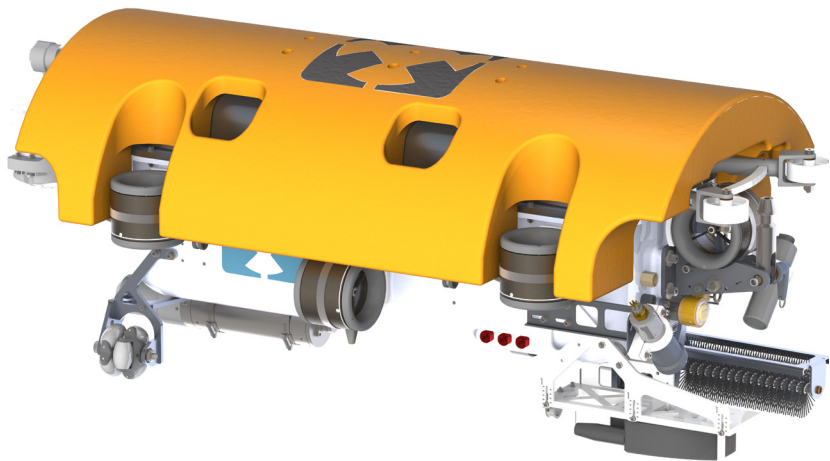


"With the 3DEXPERIENCE platform, we are well on our way to developing a fleet of robots that can inspect fuel storage tanks across the country and world—one tank at a time."

— Charles O'Connell, Senior Mechanical Engineer

Square Robot found its cloud-based collaboration solution in 3D Component Designer, one of the data and lifecycle management solutions on the **3DEXPERIENCE**® platform, which works seamlessly with SOLIDWORKS desktop software. "We had reached the point in our development—with more engineers and additional robot designs—at which the previous approach was untenable, and the timing of the 3DEXPERIENCE solutions, which our SOLIDWORKS reseller Trimech Solutions introduced us to, couldn't have been better," O'Connell notes.

"If you are not designing your systems and not setting up your business such that you can get the best people working together wherever they are, you're going to have problems", says Square Robot Co-Founder Will O'Halloran. "Technology like the cloud-based **3DEXPERIENCE** platform can help you get there. It made it drastically faster to share design changes and gave us instant visibility into who is doing what. And, we've just scratched the surface. There is so much more to explore, especially when it comes to connecting design with the other steps in product development."



EFFECTIVE COLLABORATION SPEEDS DEVELOPMENT

Because 3D Component Designer connects SOLIDWORKS desktop users to the 3DEXPERIENCE platform, it enables Square Robot to manage product designs and documents directly from the desktop authoring application. Using 3D Component Designer, the company can collaborate more effectively on a cloud-based platform without costly IT overhead and without replacing its SOLIDWORKS design tools, resulting in an accelerated development cycle and faster times to market. "The 3DEXPERIENCE platform allowed us to fast-track collaboration by providing instant access to data uploaded by multiple users without the need for a top-level assembly organizer or archiving data using SOLIDWORKS Pack and Go," O'Connell stresses.

"The solutions enabled us to improve communication within and efficiency across the development team, eliminated the delays that we previously encountered, and helped us accelerate development" O'Connell adds.



With 3D Component Designer and the cloud-based 3DEXPERIENCE platform, Square Robot designers and engineers can collaborate on robot development from different locations more efficiently and effectively, resulting in an accelerated development cycle and faster times to market.

TIGHTENING REVISION CONTROLS

3D Component Designer helped eliminate the tedium of maintaining revision controls at Square Robot by providing the ability to maintain the revision history of a component or assembly in one location. The solution provides the robotics manufacturer with tight revision controls and a formalized workflow, which is critically important for a product manufacturer seeking regulatory approvals and certifications.

"The Square Robot tank inspection vehicles must go through a detailed regulatory process to get a specific revision of a robot certified for operations in Hazardous Locations," O'Connell points out. "3D Component Designer is now embedded into our engineers' daily workflow and helps us easily manage the lifecycle changes to our CAD data. This means we can prevent edits to approved and released revisions without ever leaving the SOLIDWORKS environment."

SUCCESSFUL FUEL-TANK, FLOOR-MAPPING INSPECTION BY ROBOT

Leveraging the **3DEXPERIENCE** platform to accelerate the development and certification of its first robot, Square Robot successfully deployed its autonomous robot in May 2019. This marked the completion of Square Robot's first in-service inspection of the interior of an above-ground diesel storage tank, for Phillips 66, a diversified energy, manufacturing, and logistics company. In addition to evaluating tank bottom integrity without draining the tank—resulting in significant cost savings—the robot captures high-clarity visual images of the tank interior and provides insight into the tank's sediment levels and coating condition.

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