



Insitu Unmanned Aircraft Soars to New Heights with PTC Integrity

Insitu Inc.

Demand for Insitu unmanned aircraft systems (UAS) is soaring due to their portability, small size and customizability. This explosive growth requires a tool that can manage all engineering artifacts in a single integrated solution, while addressing compliance requirements of military and government contracts.

After a comprehensive evaluation, PTC's ALM solution emerged as the best solution to achieve CMMI Level III compliance in a very short timeframe without additional headcount or impacting current business. Shortly after implementation, Insitu was awarded a DoD contract.

Company Overview

Specializing in the design, development, production, and operation of unmanned aircraft systems (UAS) for intelligence, surveillance, and reconnaissance (ISR) objectives, Insitu, Inc., has been a global leader in the UAS industry since 2004. Insitu's family of autonomous UAS solutions has logged more than hundreds of thousands of combat flight hours by land and sea. The impressive field performance and innovative design of these customizable, low-cost systems has contributed to accelerating product demand and dramatic growth for the organization. These small, robotic, pilotless aircraft are used in a wide range of military and aerospace applications in both government and commercial markets. With 800 employees, Insitu Inc. is a wholly owned subsidiary of The Boeing Company.

Insitu has two primary product lines: (1) the ScanEagle® and (2) the Integrator™ (slightly larger), both with unique characteristics that differentiate them from other ISR products and enable a broad range of potential applications. The small footprint and portability allows the aircraft to be launched and recovered without a runway — making it an ideal solution for launch from a ship. In addition, Insitu aircraft can fly for up to 20+ hours. This endurance and easy set-up lends itself to tactical field-based military missions where there is an immediate need to “see what’s over the horizon.”

Executive Summary

Starting in 2002-2003, Insitu began participating in government demonstrations, and in 2004 they were awarded a contract with the Marines to provide surveillance video for convoy and base protection for operations in Iraq and Afghanistan. In 2006, Insitu responded to a government inquiry requiring CMMI Level III compliance, a daunting task for a small company. Using their existing technology limited their ability to integrate all of their complex software systems, since it was only used for defect tracking and change requests. Insitu also needed a tool that would enable them to achieve CMMI Level III compliance without doubling staff or affecting existing development schedules. This led them to a trade study of application lifecycle management (ALM) tools.

The original goal of the evaluation was to identify a solution that would allow them to meet CMMI Level III compliance in 9 months, enabling Insitu to respond to the current inquiry as well as situate them to respond to government contracts in the future. As they progressed through the evaluation process, Insitu discovered that many vendors offered a piece of the solution such as requirements management or test management, but what they really wanted was an “all-in-one” solution — a single tool that could record and manage all the artifacts. After an evaluation of 16 vendors, pared down to a more detailed study of four, PTC emerged as the clear winner.

In order to meet the aggressive schedule, ease of use was a key requirement. Software developers at Insitu were able to learn about the new tool even without a background in ALM. Just by working with the tool, using the manual and having background information from PTC Support, they were able to configure their application to meet their needs in a very short timeframe. Retrieving information is also very straightforward and requires no software engineering background and no training on the tool.

Background

Insitu's UAS are the culmination of the integration of a variety of systems, and software is central to that integration. In fact the Integrator™ was named for exactly that reason. Software is included not only in the aircraft systems themselves, but also in the communication software that links the aircraft to ground control, as well as the software on the ground that flies the plane, controls the payload, and points the camera— involving image processing control and communications and networking algorithms. It is this software that makes the aircraft “smarter”.

These different software domains are where the complexity begins to surface. Several video feeds need to be aligned with data from aircraft navigation systems in order to synchronize the location data with the related video (for example, this frame of video corresponds to this location) and this requires an intricate amalgamation of systems. Decisions made and the resulting coordinated actions of the systems are not unlike those made by a human in manned aircraft. Despite this complexity, all these software modules must work cooperatively for effective operation of the UAS.

In a high precision, safety-sensitive system such as this, the software may have hundreds of specifications related to safety contingencies. Insitu needed a tool that could link all processes including requirements management, traceability of requirements, change control, creation of specifications, and test plans, as well as a tool that could scale to meet demand. An integrated tool would enable Insitu to test and verify that a range of products delivered to a growing customer base met the individual customer's product specifications.

Challenges

Insitu's explosive growth rendered existing development tools and development processes obsolete. Their previous tool set was designed for the simplicity of a small company with a limited customer base and was purpose-built for defect tracking and change management. Insitu required a flexible, comprehensive tool that would address the challenges created by accelerating growth and the need to achieve and demonstrate CMMI Level III compliance and several other challenges including:

- Meeting CMMI Level III compliance in 9 months
- Finding a tool that is easy to learn and use
- Scaling without adding additional headcount
- Coordinating and syncing complex software-related functions of the UAS — including the aircraft navigation, video feeds, ground control and communications — as an integrated system is critical
- Demonstrating compliance with safety requirements using end-to-end traceability through the development process
- Creating a single software package per release, including all auto pilot code, payload code and ground station code — hundreds of specifications that must be tested and traced back to original requirements
- Easily adding changes requested by management
- Providing product status to customers in a single unified report
- Enabling the iteration of different software components at different times, allowing safety related features to be updated at a slower cycle to ensure safety requirements are met
- Integrating requirements management, traceability, change management, specifications and test plans so customers are confident that what is delivered, meets specifications
- Accommodating customer's Waterfall requirements while still enabling Insitu's development goal to evolve to a Scrum methodology
- Providing IBM Rational DOORS integration to support customer requirements documents, requiring customization through an API

Business Solution

With the solution from PTC, Insitu designed a software development process that integrates requirements management, traceability of requirements, defect management, user stories, change control, creation of specifications and test suites. This enables the creation of a single software package per release that encompasses the breadth of complex software in the UAS. Because all information is stored and managed within one tool, Insitu can mine data and create a customer specific report (called the verification results report or VSR) that shows a single coherent picture, capturing the scope of a project. The report illustrates work that is complete and how work is progressing, based on the schedule. The VSR shows the size of individual increments of work, but also presents results at a higher level based on the overall project, providing a range of stakeholders a quick snapshot of where the product is at any given point in time.

A single software package per release merges all software code from ground control software, autopilot code, payload code, navigation software and safety-critical code, and allows each of these software components to easily iterate at different times while still tracing a vast and varied mix of specifications and change requests from-end-to-end. This has enabled Insitu to scale with demand, winning larger government contracts and more of them — without adding software development resources or sacrificing quality.

Because all artifacts are integrated, linked and traced from a single source of truth, it can be easily determined that the final product fulfills the original requirements — important in demonstrating safety compliance and ensuring quality. Integrated comprehensive reporting is also helpful in determining how software is progressing toward Insitu’s “standard definition of done”, a key concept in Scrum methodology. This configurability and simple customization also makes it possible to take change requests from both management and the user base and easily implement them.

The flexible architecture and application programming interfaces (APIs) of PTC’s solution have enabled Insitu to satisfy their customer’s need for Waterfall documentation, while still being able to benefit from using Agile Scrum software development methodologies internally. Insitu is able to easily adapt their processes to meet customer’s expectations for Waterfall without incurring any extra work. The depth of the API has also enabled Insitu to provide integration between PTC Integrity and DOORS databases, used in other departments for customer requirements. Insitu can easily access requirements data stored in the DOORS database but is able to manage artifacts using one solution.



Business Benefits

PTC's ALM solution offers Insitu an "all-in-one" solution that provides a single source of truth that records and manages all of their artifacts. Despite the many complexities in their systems, all of Insitu's software modules now work cooperatively together for effective operation of the UAS.

Insitu's current tool now links all of their processes including requirements management, traceability of requirements, change control, creation of specifications, and test plans. PTC's tool scales easily to meet customer demand while still maintaining the flexibility to test and verify that a range of products meet each customer's product specifications. Insitu has achieved this and much more:

- Achieved CMMI Level III compliance in fewer than 9 months without additional headcount
- Awarded a DoD contract for ScanEagle® ISR services
- The depth of PTC Integrity APIs enables integration with DOORS database improving efficiency and collaboration
- Flexibility of PTC Integrity allows for Agile Scrum methodology and the Waterfall approach for the best of both worlds — improving customer satisfaction while providing the benefits of Scrum to the software development team
- Verification & validation of requirements is key to measuring metrics and tracking of workflow states giving the development and management teams detailed reporting
- Support for all artifacts in one tool enables customized reporting to show that the final product meets product specifications, reducing test time and improving time-to-market
- Ease of use features allows stakeholders across the organization to easily get development status information from PTC Integrity, improving productivity and reducing training time

Not only did Insitu reach CMMI Level III compliance in 9 months, the assessors were impressed that they had adopted a single tool and configured it so quickly. The ALM solution from PTC encompasses all the artifacts needed to enable Insitu's systems' to be fully integrated. Since the CMMI assessment, the use of PTC Integrity has grown, evolving to support the growing requirements of the software development group and the company as a whole. Insitu has been able to pursue and win larger government contracts and programs, a testament to PTC Integrity's ability to efficiently scale and flexibly adapt to the company's changing needs.

For more information, visit: [PTC.com/products/integrity](https://www.ptc.com/products/integrity).

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