

Aerotech Powers Aviation Software Development with Seapine Solutions

Aerotech, a UK-based provider of aviation software solutions, designs, develops, and tests software entirely within a regulatory environment. The company is required to follow certain industry regulations – in this case, DO-178B and DO-200A, as well as the equivalent standards for European aviation. These regulations, which are published by the Radio Technical Commission for Aeronautics (RTCA) in the United States and EuroCAE in Europe, describe an approach to software development and data handling that enables aeronautical systems to meet defined levels of system integrity.

Highlights

Industry

Software

Challenge

Designing, developing, and testing aviation software solutions entirely within a regulatory environment.

Solution

Seapine ALM, including the ALM Reporting Platform

Benefits

- Configurable workflow demonstrates compliance with DO-178B
- Automatic traceability from requirements to downstream artifacts
- Enhanced analysis and reporting with the Seapine ALM Reporting Platform

Meeting such rigorous standards requires a thorough understanding of the regulatory environment, along with well-defined and enforceable software processes to meet those regulations. In particular, these processes must provide traceability between workflow events and artifacts, auditability of steps and approvals, and repeatability of the deliverables.

To meet their project objectives while also ensuring conformance with regulatory requirements, Aerotech implemented Seapine Software's ALM solutions.

Continuous Development in a Traditional Project Environment

Aerotech builds and markets modular and scalable DO-178B and DO-200A compliant aircraft mission planning, tasking, and performance computation software. Its flagship product is an application that performs load, weight, and balance computations for small emergency aircraft, such as police helicopters, med-evac aircraft, air ambulances, and aerial firefighting aircraft. Aerotech also offers modules to support specific types of aircraft in detailed mission planning activities.

All pilots and mission planners are required to perform load, weight, and balance computations as a part of their preflight activities. For example, when flying in smaller commercial aircraft, passengers are sometimes asked to change seats to improve balance characteristics. Exceeding the weight and balance envelope can be dangerous to an aircraft, and pilots of both commercial and private aircraft are well aware of the need to ensure a properly loaded vehicle. But there's an important difference in Aerotech's market.

"It's especially important for these computations to be done both quickly and correctly," stated Martin Beeby, Engineering Manager at Aerotech. "Because of their use in emergency situations, these are aircraft that often fly very close to the edge of the envelope in terms of payload, and an error can have catastrophic effects. Yet the computations have to be done fast, because of the emergency nature of the work."

Often, the aircraft flight crew has to understand and evaluate load characteristics in a matter of minutes, and sometimes even in real time. It's usually not feasible to delay emergency flights, so the ability to make weight and balance determinations immediately results in better overall safety and a higher level of confidence in the flight parameters.

Developing Safety-Critical Software

Aerotech uses a traditional, Waterfall-like approach to application development and testing, with an important exception. "We're in a continuous development environment," explains Beeby. "The project doesn't end. Every new feature or even defect fix starts as a change request. Once the change is approved, it becomes a part of the project baseline."

When a feature or change is approved, the Aerotech project team creates a design, implements the design, and tests to the requirements defined in the change request. The team tests and stabilizes a particular release version based on the changes accepted in the current development cycle, and delivers it as a formal release. As new changes are requested, they must often be designed and estimated before the previous cycle of changes have been fully implemented and tested.

The project team must be able to manage and track source code and project artifacts carefully. They must be able to branch the code line easily and often, so feature-complete versions can be tested and readied for product delivery without delaying the start of work on newer changes. To further complicate the environment, Aerotech also delivers custom solutions for specific customers, which could mean customization of the current in-progress release or maintenance updates to a previous release. This requires maintaining links between code changes and the customer's change request.

From a regulatory standpoint, the most important need is being able to define a workflow that demonstrates compliance with DO-178B. The team has to be able to definitively demonstrate that the workflow was followed, making both traceability and authorizations for every deliverable a priority.

Seapine's quality-centric ALM solutions make compliance easy and straightforward for Aerotech. To meet its strict regulatory needs while providing flexibility for defined project processes, Aerotech uses the full range of Seapine Software application lifecycle management solutions, including TestTrack and Surround SCM. These Seapine solutions are used throughout the entire development process, from change request to source code management to product delivery.

The project team uses TestTrack to begin a change request process. After the change is approved, it becomes a requirement for the next release. There is a sign-off on the requirement and an authorization to proceed with development. Source code is maintained in Surround SCM, which seamlessly integrates with other Seapine solutions, and enables links from source code to other project artifacts including requirements and test cases. This transparent traceability is a key requirement of DO-178B.

In addition, because Surround SCM does not impose a pre-defined branching process on the project team, they use their own branching strategy that supports frequent branching and merging. The team also uses labels to mark specific configurations of files, making it easier to create branches.

During development, the testers create test cases based on the requirements defined as a part of the accepted changes. Because test cases are created from the applicable requirement, traceability is automatically maintained from requirements to downstream artifacts with no manual linking or external documentation required. Test cases are executed when code is ready, and the data is maintained by test case, date, person running the test, and result.

Change Request → Requirements → Test Cases → Test Results → Code + Defects

Any defects found during test case execution are automatically added to TestTrack, with the failed test steps, tester, and any other relevant information needed to reproduce the defect included with the defect report. Management can quickly look upstream and identify the requirements and specific change request each defect is associated with to help determine the impact of a defect on the release.

The development team assigns the defect to the appropriate engineer, who identifies and fixes the source code responsible for the defect. After the source code

is fixed and tested locally by the engineer, the code changes are checked in to Surround SCM and the defect is marked as fixed and ready for testing. Testers are automatically notified of the fix by TestTrack, and can easily run associated test cases to verify the fix.

When quality goals for the code base are met, the project team creates a branch so that a release can be prepared. Surround SCM enables the team to submit defect fixes and other changes in either the release branch or project mainline, making it easy to work with multiple code streams until the software is ready for release.

A key part of meeting regulatory requirements is the workflow. Aerotech uses workflow to define how an artifact moves through the development and testing process, and follows the workflow to ensure repeatability. In addition, workflow helps ensure that actual tasks performed meet regulatory requirements.

All the workflow steps are traceable through sign-offs, including electronic signatures if necessary. The workflow tracks these steps and provides gating and approval before moving to the next step in the process.

Configuring Terminology and Processes for Increased Efficiency

Configurability was one of the key characteristics that led Aerotech to adopt Seapine's ALM solutions. According to Beeby, the company was able to easily configure fields and workflows to better reflect their approach to developing software. This was critical to ensuring regulatory compliance in adopting a new solution.

To expand project visibility beyond the development and testing teams, the company has recently begun using the Seapine ALM Reporting Platform, which pulls information from the Seapine suite on a scheduled basis and warehouses

it for custom analysis and reporting. The ALM Reporting Platform addressed Aerotech's unique information reporting needs. "There were some reports that didn't come naturally with the built-in Seapine reporting features, and customizing these reports didn't give us quite what we wanted. With the reporting platform, we can dump project data into a relational database, and query the database to get exactly the reports we need ready for publishing," said Beeby.

A combination of traceability features plus the extensive configuration capabilities enables Aerotech to achieve its project goals in a strict regulated environment. "Overall, we were able to do 80 to 85 percent of what we needed to right out of the box," says Beeby. "We had to perform some customization to get the rest of the way. It's not difficult, but it does require an explicit understanding of your process, as well as the regulatory requirements."

Managing Regulated Software Projects for Success

Software development in general isn't easy. Whether it's done through a Waterfall, Agile, or homegrown approach, it is vitally important to manage and track artifacts throughout the lifecycle. This makes it easier to ensure work is accomplished and that any changes are identified and tracked through completion.

Developing software while following formal regulations adds an additional layer of complexity to projects. In addition to tracing artifacts, most regulations, such as DO-178B, require proof that each step in the process was completed, and in many cases was approved by the responsible team member. Specific and accurate reports are also a key part of regulatory requirements.

Aerotech accomplishes traceability, auditability, and reporting with Seapine's ALM solutions, making it possible for the company to deliver certified and reliable software in its safety-critical aviation market. The reports include the documenting of workflows, the approval of events and milestones, project status at milestones, and details of defects and defect status. The ability to track processes and artifacts, and demonstrate both processes and approvals to regulatory authorities, makes the critical difference in ensuring regulatory compliance.