

# Triumph Integrated Systems: DO-178C DAL A Software Verification & Validation

Triumph Integrated Systems, a business unit of the Triumph Group, provides custom integrated systems such as actuators, gearboxes and flight controls to the global aerospace market.



Rapita was contracted by Triumph to perform *verification and validation* of their DO-178C DAL A software, which is being developed for multiple actuation systems as part of a technology demonstration program for a US customer.



## Challenge

The DO-178C DAL A project involved testing several distinct pieces of application software (each with multiple build variants, configurable at compile-time) and a common core layer, comprising an RTOS, board support package, library routines and device drivers.

The software was primarily written in C and C++ and included some components written in assembler. All of the software needed to be tested on an embedded target.

The project was “time-is-of-the-essence”. It took place in parallel with development, while the software and requirements were changing periodically.

## Summary

### Challenge

- Provide V&V evidence for DO-178C Level A software with multiple build variants configurable at compile-time.

### Solution

- Verification and validation activities performed by specialist test engineers and supported by the use of Rapi**Test** and Rapi**Cover** to provide certification evidence.

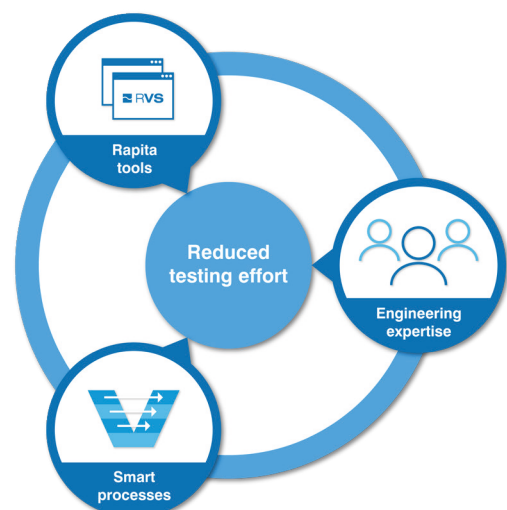
### Benefits

- A high-quality service delivered to meet the customer’s schedule and budget requirements.

## Solution

Rapita provided Triumph with a high-quality, cost-effective solution for software testing and produced clear evidence to meet DO-178C objectives.

V&V activities were performed by teams working at Rapita’s headquarters in the UK and Danlaw’s offices in Michigan (for OPSEC classified parts of the project). This was supplemented by our engineers working at Triumph’s site in the US to support system-level testing activities.



The RVS tools Rapi**Test** and Rapi**Cover** were used to automate testing processes to meet DO-178C objectives:

- Rapi**Test** automatically generated and applied functional tests, checked that test results were correct, and verified functional correctness of the source code as described by its requirements.
- Rapi**Cover** provided evidence that DO-178C DAL A structural code coverage objectives were met, including 100% modified condition/decision coverage (MC/DC).

In addition to those supported by RVS tools, the following activities were performed:

- Specifying the software test process in accordance with DO-178C objectives.
- Setting up an automated test framework for use on the software's embedded target.
- Reviewing high and low-level requirements and software design.
- Writing software requirements.
- Generating and reviewing test cases and procedures.
- Manually inspecting code (critical code sections and assembler)
- Raising and supporting the resolution of software problem reports.
- Producing a target-specific tool qualification kit for Rapi**Test**

## Benefits

Rapita's involvement contributed to a reduction in the program risk and the time and testing effort needed to satisfy certification objectives.

- Requirements review led to improved quality of requirements and a reduction in their number, saving testing effort.
- Efficient test management and traceability enabled rapid regression testing and test rework when new software and requirement revisions were released, keeping the project on track.

The use of RVS verification software was pivotal to the project efficiency.

- Rapi**Test** reduced the effort needed to write and run functional tests, analyze results and link tests with their requirements for easier project management and regression testing.
- Rapi**Cover** collected and reported coverage of the source code achieved during functional tests, and made it possible to automatically merge coverage from separate tests into a combined report, demonstrating 100% coverage.

*"We approached Rapita looking for a complete end-to-end solution for software verification. Rapita delivered this and has also performed a range of system-level activities."*

Jim Pettinger, *Director of Electronic Systems* at Triumph Integrated Systems.

*"We've appreciated their responsiveness from the get-go and the obvious benefits of having testers and tool provider under one roof."*

## Next steps

If you'd like to know more about how our specialist *verification and validation* services can help you reduce the effort of testing your high-criticality systems, please contact us at [enquiries@rapitasystems.com](mailto:enquiries@rapitasystems.com).

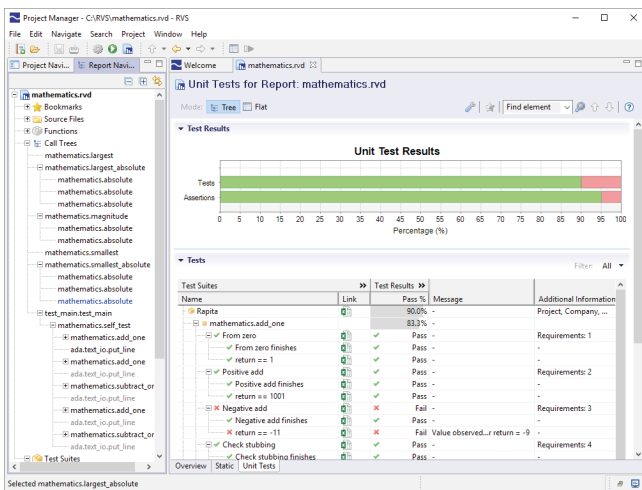


Figure 1: Example Rapi**Test** report



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