

CAST-32A Compliance packages



How can CAST-32A Compliance packages help you?

Our CAST-32A Compliance packages provide a complete solution for certifying your multicore aerospace project in accordance with DO-178C and CAST-32A guidance.

The path to DO-178C/CAST-32A certification can be split into 3 distinct phases:

- **Pilot phase** – we set up an environment where evidence for multicore timing behavior can be automatically generated on a *subset* of your system. We perform a preliminary hardware analysis to identify potential interference channels in a subset of your system. We either characterize your hardware and software for multicore interference effects using the environment we set up, or deliver training that lets you do this.
- **Implementation phase** – we set up an environment where evidence for multicore timing behavior can be automatically generated on your complete system. We perform a hardware analysis to identify potential interference channels in your system. We either characterize your hardware and software for multicore interference effects using the environment we set up, or deliver training that lets you do this.
- **Certification phase** – we expand on the work done in the Implementation phase to prepare the project for certification. This includes deploying tool qualification kits and qualified target integration services, reviewing artifacts and traceability generated in the Implementation phase, and, where desired, assisting you in producing your SAS and liaising with certification authorities.

Benefits

- Reduce the cost and effort of certifying your multicore aerospace project
- Streamline and automate your multicore verification using the proven **RVS** toolsuite and Rapi**Daemon** technology
- Get started quickly with our wide range of pre-supported multicore processor architectures
- Reduce certification risk with independent verification of your project
- Produce robust certification artifacts

Use cases

- End-to-end process to address all CAST-32A objectives
- Interference channel characterization and quantification
- Evaluate and select multicore hardware and RTOS
- Software performance characterization and optimization
- Generate worst-case execution time calculations
- Verify that interference effects are understood and bounded
- Robustness and sensitivity analysis
- Produce evidence to support DO-178C (CAST-32A) certification

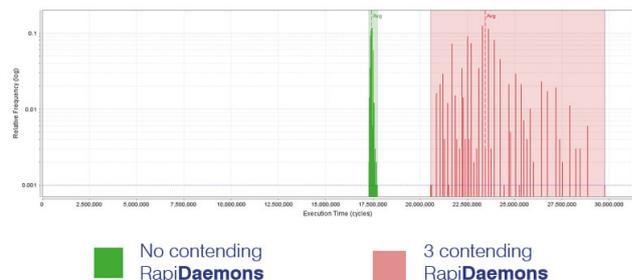


Figure 1. The CAST-32A Compliance package produces evidence on multicore timing behavior

How does it work?

CAST-32A Compliance packages are a combination of software products, documentation, tests, and expert services that can be delivered alone or as part of a complete solution. It comprises:

- Engineering services to:
 - Analyze interference channels on the hardware and characterize interference effects
 - Integrate **RVS** into a multicore environment
 - Select and port Rapi**Daemons** for your target
 - Analyze software worst-case execution times in the context of multicore interference
 - Address other CAST-32A objectives
 - Train your team how to generate evidence on multicore timing behavior through the automated environment we set up
- **RVS** toolsuite to automate collection of timing evidence
- Rapi**Daemons** to support the analysis of interference effects on the multicore system
- Certification evidence

When delivering our CAST-32A Compliance packages, we follow a V-model framework (Figure 2) to produce a clearly structured flow of verification artifacts that satisfy DO-178C traceability requirements and meet CAST-32A guidelines, ensuring a cost-effective and methodical verification process. While the stages initially follow a mostly linear progression, many stages may be returned to later in the verification process – for example to redefine assumptions made about the platform under analysis after testing identifies hidden interference channels. For more information on how this works, see our *Multicore Timing Analysis for DO-178C* White paper.

Engineering services

Our CAST-32A Compliance packages utilize a range of services, including:

- Target Integration Service
- Qualified Target Integration Service
- Hardware Analysis and Characterization Service
- Software Analysis and Characterization Service
- Consulting and Training Services

Target Integration Service

To integrate **RVS** tools to be used within a multicore environment, we provide a Target Integration Service. This is described in our *Target Integration Service Product brief*.

Rapi**Daemons** must be ported for the multicore platform they are used for. This is also provided through our *Target Integration Service*.

Qualified Target Integration Service

To use evidence produced by **RVS** tools for certification, the integration of **RVS** must be qualified to produce evidence demonstrating that **RVS** has been correctly installed and is working appropriately with the system. We support this through our *Qualified Target Integration Service*, which is described in our *Tool Qualification for DO-178C Product briefs*.

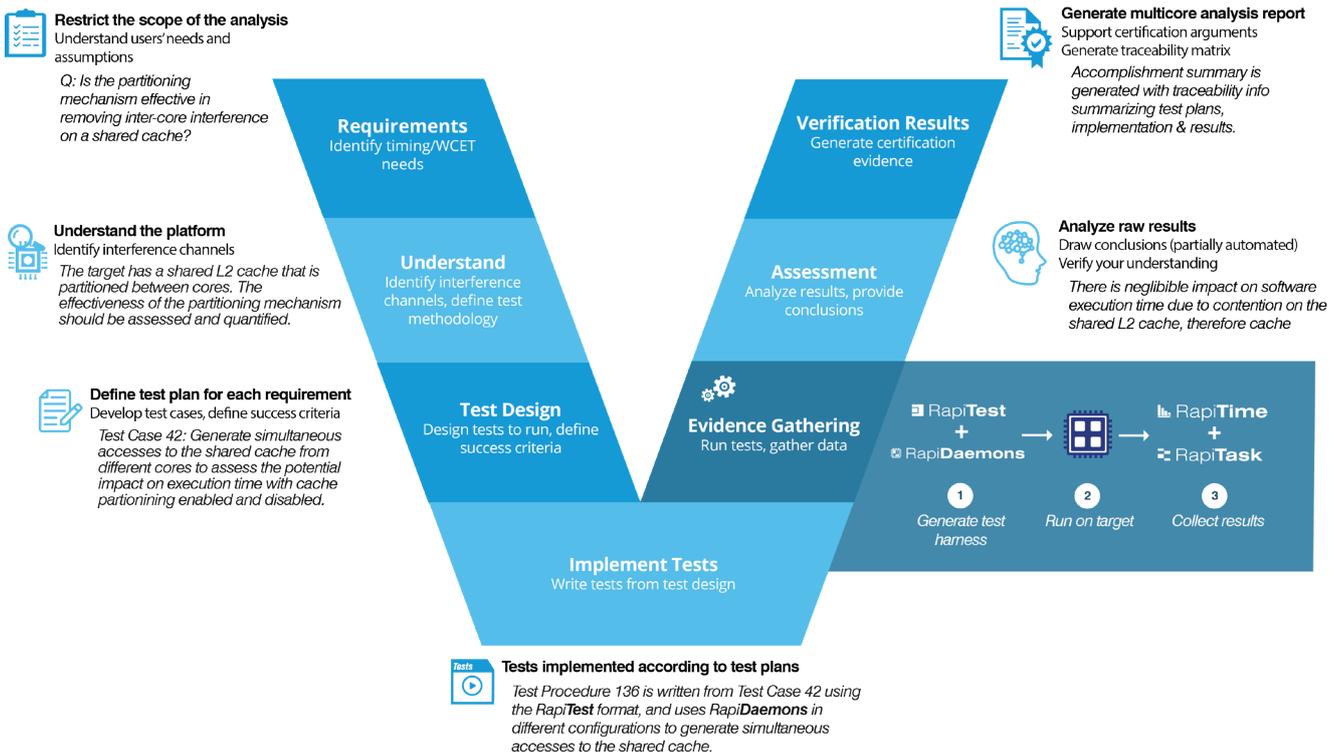


Figure 2. How we address CAST-32A multicore timing objectives

Hardware Analysis and Characterization Service

Our expert engineers analyze a multicore system to identify its interference channels, working with chip manufacturers and board developers to analyze the CPU and peripherals in depth. We review CPU and board documentation to produce a detailed and complete list of interference channels that must be characterized and quantified for a given combination of critical configuration settings.

We then use the **RVS** toolchain and **RapiDaemons** to quantify and characterize the hardware platform. We deliver a document that system engineers can use to justify hardware configuration settings and architectural decisions for avoiding and/or mitigating multicore interference effects.

Software Analysis and Characterization Service

Our expert engineers create and run tests using **RVS** tools and **RapiDaemons** to investigate the effects of interference on software applications and determine software worst-case execution times.

We deliver a document that systems engineers can use to address the CAST-32A objectives related to worst-case execution time calculation.

Consulting and Training Services

We provide consulting services and custom training on DO-178C and CAST-32A compliance including gap analysis consultancy, and custom training on the processes and tools we use to investigate the effects of multicore interference.

RVS toolsuite to automate gathering timing evidence

We use our software verification toolsuite – Rapita Verification Suite – to apply tests to multicore hardware (**RapiTest**) and collect timing data (**RapiTime**) and scheduling data (**RapiTask**) from them (Figure 3). Using these tools, we automate various stages of the multicore timing analysis process. In some situations, we may also use our **RTBx** datalogger to collect trace data from your multicore platform during testing.

See our related *Product briefs* for more information on these tools.

RapiDaemons

RapiDaemons are small applications that run on multicore hardware and generate accesses on specific resources within the system (Figure 3). Each **RapiDaemon** targets a specific resource, for example caches, interconnects, memory and other on-chip or off-chip shared resources. This lets you identify and quantify the effects of multicore interference by running different **RapiDaemons** in different configurations.

We provide different types of **RapiDaemons** and **RapiDaemon** tools, which support multicore timing analysis in different ways. These include:

- Standard **Daemons**
- Advanced **Daemons**
- Tuneable **RapiDaemons**
- Discovery **RapiDaemon** tool
- Surrogate **RapiDaemon** tool

For more information on **RapiDaemons**, see our *RapiDaemons Product brief*.

Certification evidence

Our CAST-32A Compliance packages produce evidence to satisfy all CAST-32A objectives.

Our **RVS** automation tools are classified as Tool Qualification Level (TQL) 5 tools as per DO-330. Qualification support is available for **RapiTest** and **RapiTime** through our DO-330 Qualification kits, which have been used for certification in many DAL A aerospace projects certifying against DO-178C. For more information, see our *Tool qualification for DO-178C Product briefs*.

Evidence to satisfy certification requirements for the use of **RapiDaemons** is produced during the tooling qualification process.

We support you in extending your PSAC to address CAST-32A objectives and producing a SAS including all evidence and traceability of artifacts used in our process that are needed to support certification.

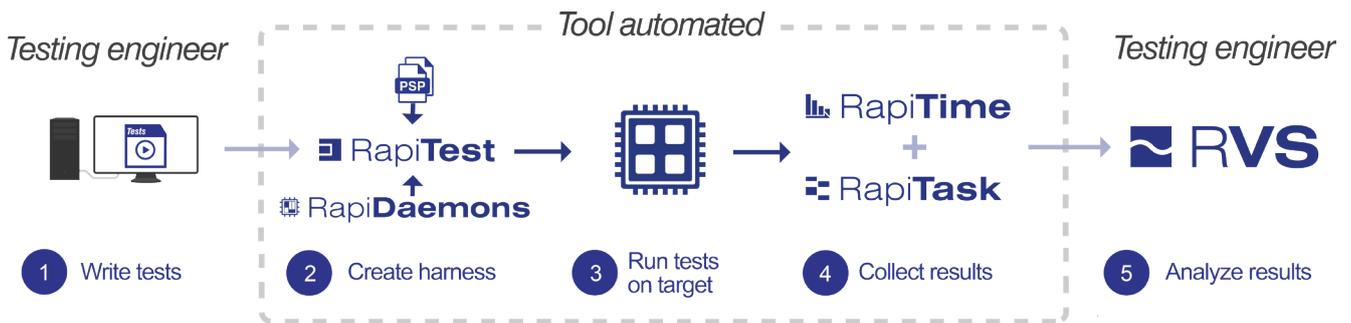


Figure 3. How **RVS** tools and **RapiDaemons** are used to gather multicore timing evidence

Packages

We provide standard packages for CAST-32A Compliance, which are suitable for a range of use cases. All packages include the following:

- Integration services for the **RVS** toolsuite
- Porting and configuration services for Rapi**Daemons** and Rapi**Daemon** tools included in the package
- Hardware Analysis and Characterization Service
- Software Analysis and Characterization Service

Bronze package

This supports exploratory testing into multicore interference and the evaluation of a single multicore configuration.

This package includes a single *Annual license* for Rapi**Test**, Rapi**Time**, and Rapi**Task** and a *Single configuration annual license* for Standard Rapi**Daemons**.

Silver package

This supports detailed analysis of multicore interference in a single project that is aiming for DO-178/CAST-32A certification.

This package includes a single *Perpetual license* for Rapi**Test**, Rapi**Time**, and Rapi**Task**. It includes a *Multiple configuration perpetual license* for Standard Rapi**Daemons**, Advanced Rapi**Daemons** and the Discovery Rapi**Daemon** tool.

This package includes *Re-usable* tool qualification kits for Rapi**Test**, Rapi**Time** and Rapi**Task** and certification evidence for included Rapi**Daemons** and Rapi**Daemon** tools.

Gold package

This supports detailed analysis of multicore interference for multiple projects that share the same multicore platform and are aiming for DO-178/CAST-32A certification.

This package includes 3 *Perpetual licenses* for Rapi**Test**, Rapi**Time**, and Rapi**Task**. It includes a *Product line perpetual license* for Standard Rapi**Daemons**, Advanced Rapi**Daemons**, Tuneable Rapi**Daemons** and the Discovery and Surrogate Rapi**Daemon** tools.

This package includes *Product line* tool qualification kits for Rapi**Test**, Rapi**Time** and Rapi**Task** and certification evidence for included Rapi**Daemons** and Rapi**Daemon** tools.

Custom packages

In addition to the standard packages listed above, we can work with you to tailor these packages to meet your needs.



Rapita Systems Inc.

41131 Vincenti Ct.
Novi, MI 48375

Tel (USA):

+1 248-957-9801

Rapita Systems Ltd.

Atlas House, Osbaldwick Link Road
York, YO10 3JB

Tel (UK/International):

+44 (0)1904 413945

Registered in England & Wales: 5011090

Email: enquiries@rapitasystems.com | Website: www.rapitasystems.com

Document ID: MC-PB-112 CAST-32A Compliance v5