



Safety through quality

BROCHURE

MACH¹⁷⁸ – Multicore Avionics Certification for High-integrity DO-178C projects

MACH¹⁷⁸ is a unique solution to support the certification of multicore DO-178C projects. By helping projects meet the objectives of AC 20-193 and AMC 20-193, **MACH¹⁷⁸** lets users reduce migration risks and open up the performance benefits that multicore processors offer, while building a robust certification case.

“

Multicore systems are becoming more popular in critical embedded system development due to the increased performance they offer.

Our MACH¹⁷⁸ Solution solves an important challenge in using these complex systems; ensuring that the software execution time meets timing deadlines and satisfies certification objectives.

”

Dr. Guillem Bernat, CEO of Rapita Systems

A unique solution

With the increasing adoption of multicore systems in the critical software industry, new methods are needed to analyze the timing behavior of these systems in line with DO-178C, AC 20-193 and AMC 20-193 objectives.

Combining expert knowledge from dedicated engineers with products from ground breaking academic research and our industry-leading software tool support, our solution to DO-178C compliance for multicore systems is truly unique.

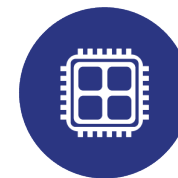
Use cases

Our solution supports a variety of use cases when migrating to, using and verifying multicore systems:



Produce certification evidence

Produce verification evidence for multicore systems to meet DO-178C, AC 20-193 and AMC 20-193 objectives.



Evaluate multicore hardware

Evaluate candidate multicore hardware architectures against performance criteria, taking into account the effects of multicore interference.



Optimize code for performance

Optimize multicore code for execution time behavior, ensuring that it meets timing deadlines and can be verified against safety objectives.

Benefits of our approach

Our approach not only identifies interference channels in multicore systems, but also quantifies them and takes them into account during verification. We deploy our industry-leading tool automation support to provide a cost-effective solution to verify software performance and produce evidence for DO-178C, AC 20-193 and AMC 20-193 certification of multicore systems.

Working with us

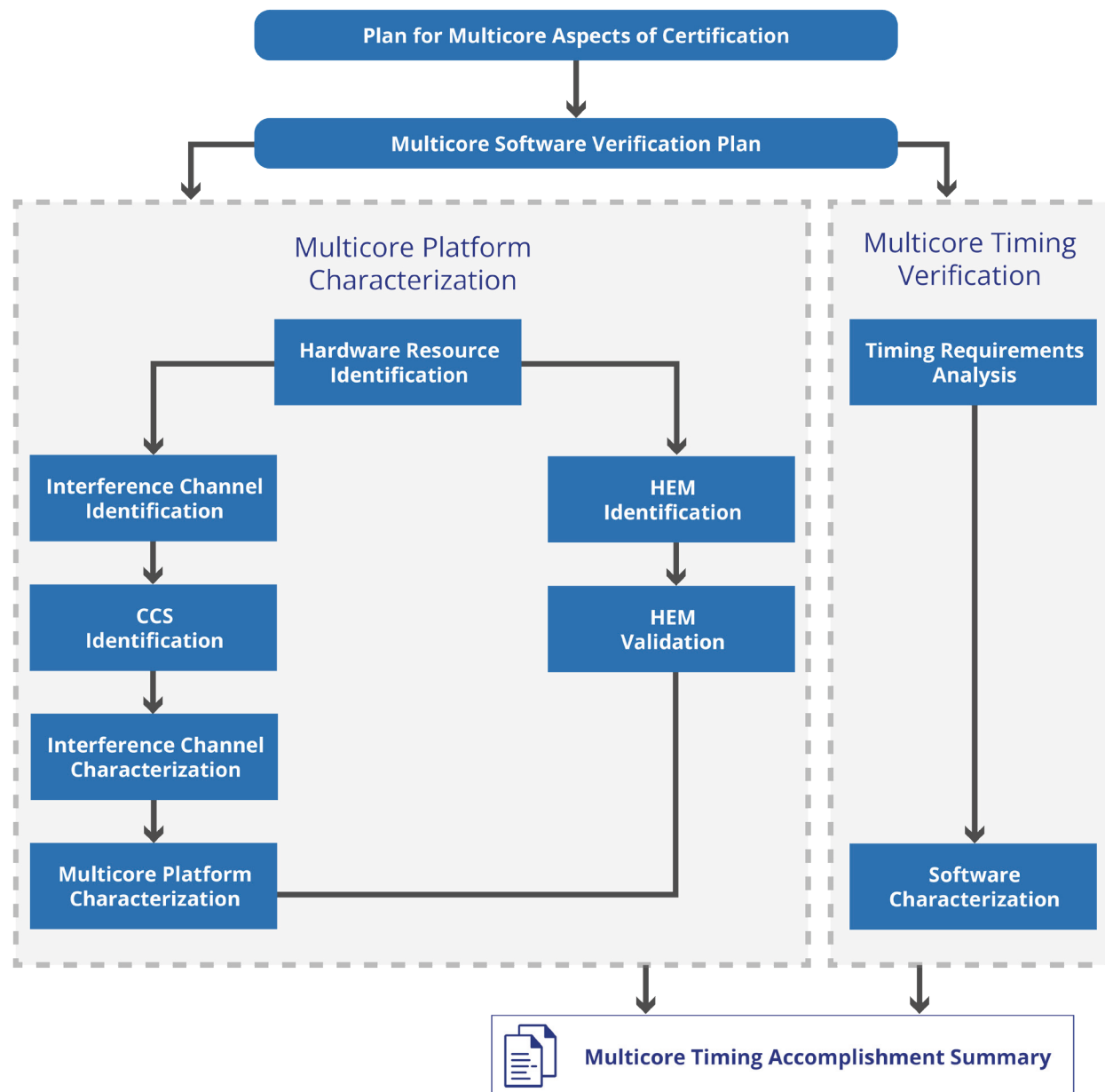
- We recognize that every project is different, and work with you to meet your needs.
- We run services at our engineering facilities in the UK or US. We can support projects with **UK / US eyes only** requirements.
- We can provide services to produce evidence needed for AC 20-193 and AMC 20-193 compliance for you, or implement the **MACH¹⁷⁸** workflow and provide you with training so you can do so yourself.



How it works

The MACH¹⁷⁸ workflow

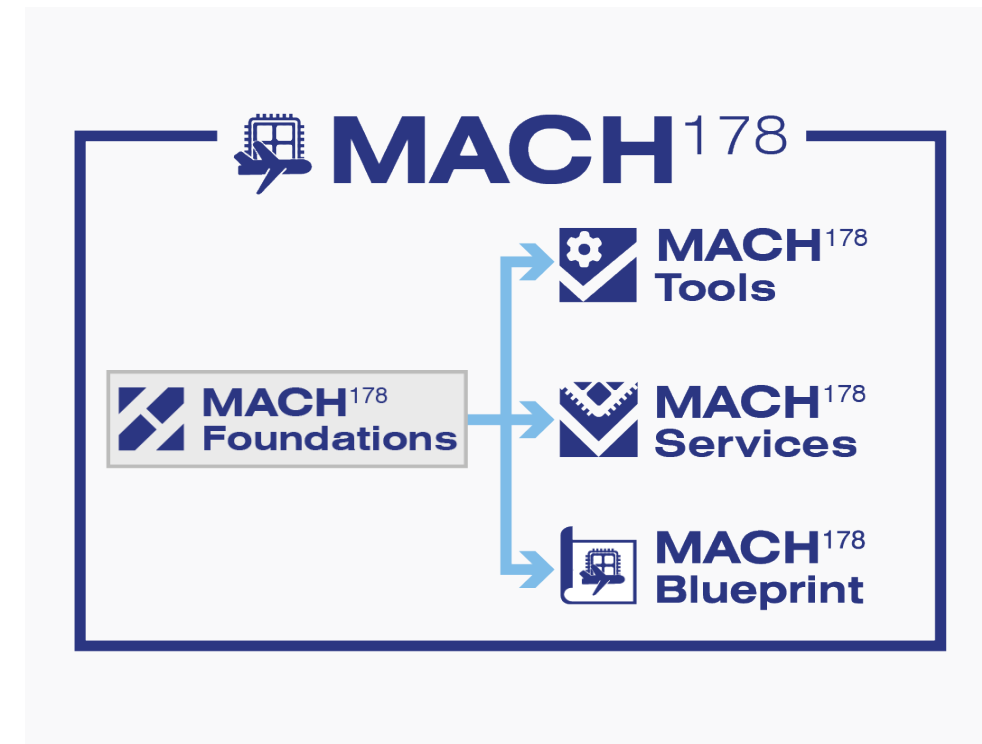
The **MACH¹⁷⁸** approach uses a step-by-step workflow to achieve A(M)C 20-193 objectives for multicore DO-178C projects.



The workflow is supported by DO-178C-compliant plans and procedures, which are available off-the-shelf for use in your DO-178C projects.

Solutions overview

MACH¹⁷⁸ includes a range of products and services to support your A(M)C 20-193 compliance journey.



MACH¹⁷⁸ Foundations gives you access to plans, procedures, templates and checklists to apply the **MACH¹⁷⁸** workflow to your project, as well as white papers on specific multicore topics.



MACH¹⁷⁸ Tools support the targeted generation of multicore interference and the automated collection of compliance evidence during A(M)C 20-193 verification activities.

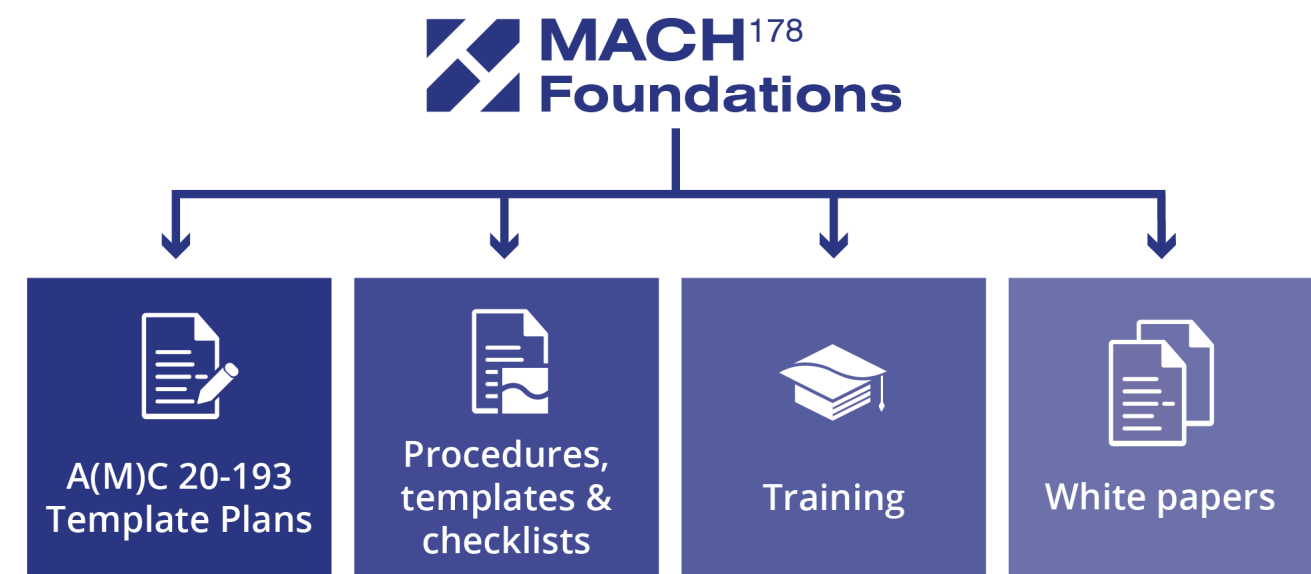


MACH¹⁷⁸ Services help you produce A(M)C 20-193 verification evidence for your multicore platform, as well as training and consultancy to answer any questions you have.



The **MACH¹⁷⁸ Blueprint** provides a platform that you can use to learn more about A(M)C 20-193 compliance and run multicore research and development projects with the **MACH¹⁷⁸** workflow.

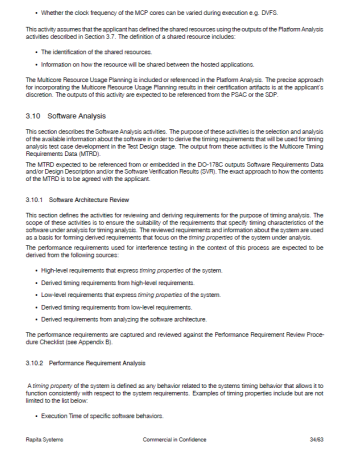
MACH¹⁷⁸ Foundations is the starting point for multicore DO-178C (A(M)C 20-193) compliance with the **MACH¹⁷⁸** workflow. It includes a library of documents to help lay the foundations for your A(M)C 20-193 compliance journey, including template planning documents, procedures, templates and checklists, and white papers. The package includes training to help you kickstart your compliance journey.



Procedures

MACH¹⁷⁸ Foundations includes Procedures, checklists and templates for key A(M)C 20-193 compliance and verification activities that can be achieved using the **MACH¹⁷⁸** workflow.

Procedures, templates and checklists are included for activities in each stage of the **MACH¹⁷⁸** workflow.



Training

MACH¹⁷⁸ Foundations includes training to help you kickstart your A(M)C 20-193 project.

This includes free training to help you get the most of the documents included in **MACH¹⁷⁸** Foundations, and free attendance at our popular public multicore DO-178C training events.

Template A(M)C 20-193 plans

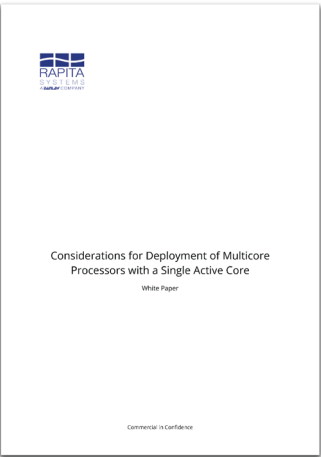
Our template A(M)C 20-193 plans can help you supplement your DO-178C plans for compliance with A(M)C 20-193 when using the **MACH¹⁷⁸** workflow. **MACH¹⁷⁸** Foundations includes the following template plans:

- Template Plan for Multicore Aspects of Certification, which provides a breakdown of A(M)C 20-193 objectives and maps them to DO178C outputs
- Template Multicore Software Verification Plan (MSVP), which lays out the compliance and verification activities in the **MACH¹⁷⁸** workflow

White Papers

White papers on specific multicore topics help you on your compliance journey.

White papers are available for topics including considerations for processor and RTOS selection, consideration for software architecture for multicore systems, and considerations for deployment of multicore processors with a single active core.



Procedures

Training

White Papers

1 Write tests

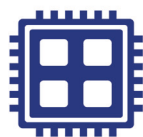


TESTING ENGINEER

2 Create test harness



3 Run tests on target



TOOL
AUTOMATED

4 Collect results



5 Analyze Results

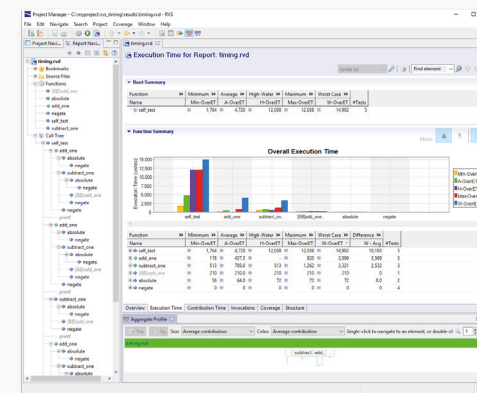
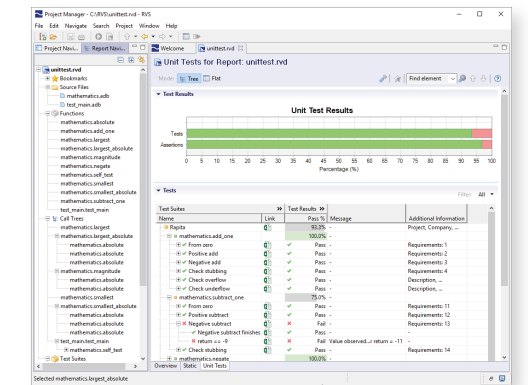


TESTING ENGINEER

RapiTest

RapiTest helps to produce and run tests that exercise multicore software for execution time behavior while taking into account the effects of resource contention and interference (through applying RapiDaemons).

RapiTest automatically converts tests into a test harness that can be run on the multicore hardware.



RapiTime

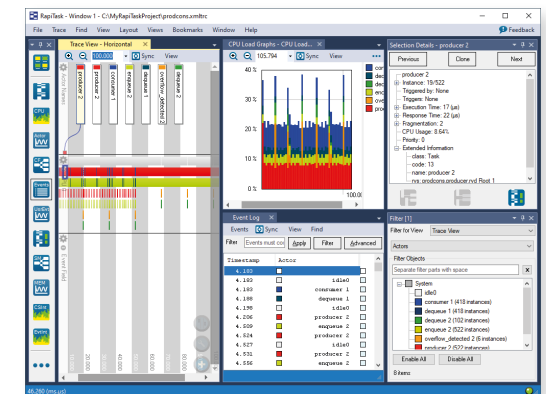
RapiTime automatically calculates execution time metrics when multicore software runs on its target hardware, and reports them in a format that is easy to understand.

These metrics can be used to optimize code for timing behavior and provide evidence for DO-178C certification in line with AC 20-193/AMC 20-193 objectives.

RapiTask

RapiTask automatically measures and reports scheduling metrics for each task under analysis when multicore software runs on its target hardware.

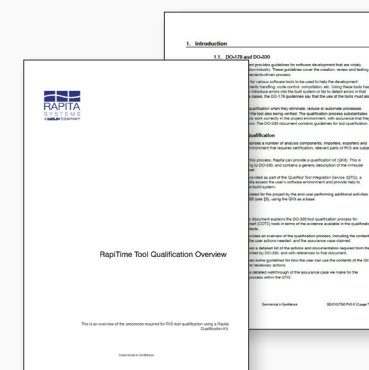
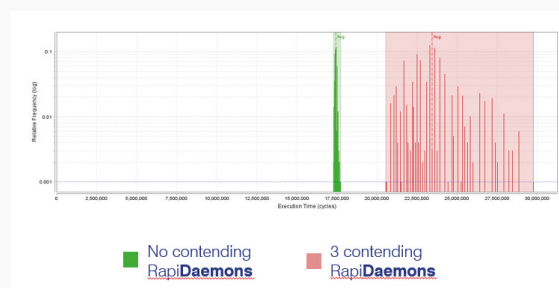
These metrics can be used to identify system capacity issues and rare events such as race conditions in the software.



RapiDaemons

RapiDaemons create resource contention while analyzing a multicore task under analysis.

Some micro-benchmarks are generic and are available as a standard library, while some are platform-specific and must be adapted to the platform under analysis through an integration service.



Qualification

RapiTest, RapiTime and RapiDaemons are classed as Tool Qualification Level 5 tools according to DO-178C.

We provide support for qualifying these tools for use in DO-178C (A)(M)C 20-193 projects with off-the-shelf DO-330 qualification kits, and our Qualified Target Integration Service (RVS tools) and RapiDaemon Qualification Service.

Platform Analysis & Characterization

Software Analysis & Characterization

Analysis and Characterization Services

Our Platform Analysis and Characterization and Software Analysis and Characterization Services support generating A(M)C 20-193 compliance evidence on your multicore project using the **MACH¹⁷⁸** workflow.

These services include activities such as identifying and characterizing interference channels and developing Rapi**Daemons** and characterization tests for a platform, and advising on approaches for multicore worst-case execution time analysis.

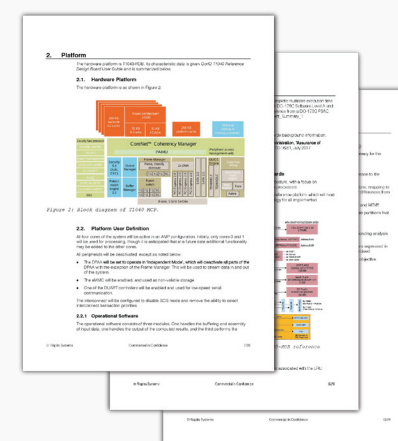
The **MACH¹⁷⁸** Blueprint is an off-the-shelf platform that you can use to support training and research and development in multicore DO-178C (A(M)C 20-193) compliance.

It includes plans and results from running the **MACH¹⁷⁸** workflow on an example multicore project, project files and software tools so you can run select stages of the **MACH¹⁷⁸** workflow on the Blueprint project, and a training package to help you on your compliance journey.

Target Integration Service

Our Target Integration Service integrates **RVS** tools and Rapi**Daemons** into your specific multicore platform and development environment so verification evidence can be generated efficiently and reproducibly.

Integration Services



Plans & Results

The **MACH¹⁷⁸** Blueprint includes A(M)C 20-193 plans, and results and completed checklists from applying the **MACH¹⁷⁸** workflow to the Blueprint project.

This includes a Plan for Multicore Aspects of Certification and Multicore Software Verification Plan, and results and completed checklists from verification activities undertaken at each stage of the **MACH¹⁷⁸** workflow.

Consulting

Training

Consulting and Training

We provide consulting services on DO-178C, AC 20-193 and AMC 20-193 compliance including gap analysis consultancy, certification liaison support and consultancy to satisfy AC 20-193/AMC 20-193 objectives.

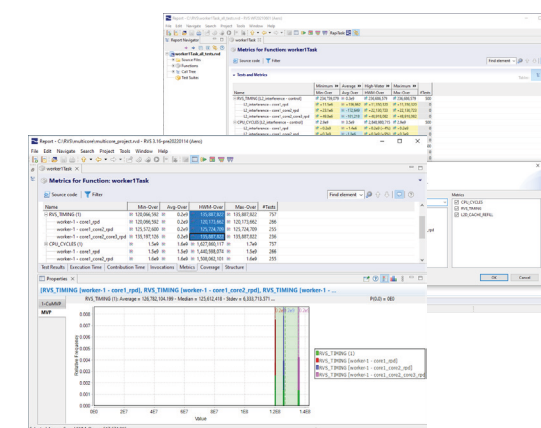
We provide training on using the **MACH¹⁷⁸** workflow and using **RVS** and Rapi**Daemons** to support the workflow.

Tools, Project Files and Training

The **MACH¹⁷⁸** Blueprint includes tool licenses and project files that let you run select stages of the **MACH¹⁷⁸** workflow on the Blueprint project.

This includes licenses for **RVS** tools and Rapi**Daemons**, **RVS** project files and raw results, and multicore characterization tests run on the Blueprint project.

The Blueprint also comes with 40 hours of training in theoretical and practical aspects of multicore DO-178C compliance.





About Rapita

Rapita Systems provides on-target software verification tools and services globally to the embedded aerospace and automotive electronics industries.

Our solutions help to increase software quality, deliver evidence to meet safety and certification objectives and reduce costs.

Find out more

A range of free high-quality materials are available at:
rapitasystems.com/downloads

SUPPORTING CUSTOMERS WITH:

Engineering Services

Rapita **Verification Suite**:

Rapi**Test**

Rapi**Cover**

Rapi**Time**

Rapi**Task**

Engineering Services

V&V Services

Integration Services

Qualification

SW/HW Engineering

Compiler Verification

Multicore verification

MACH¹⁷⁸

Multicore Timing Solution

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