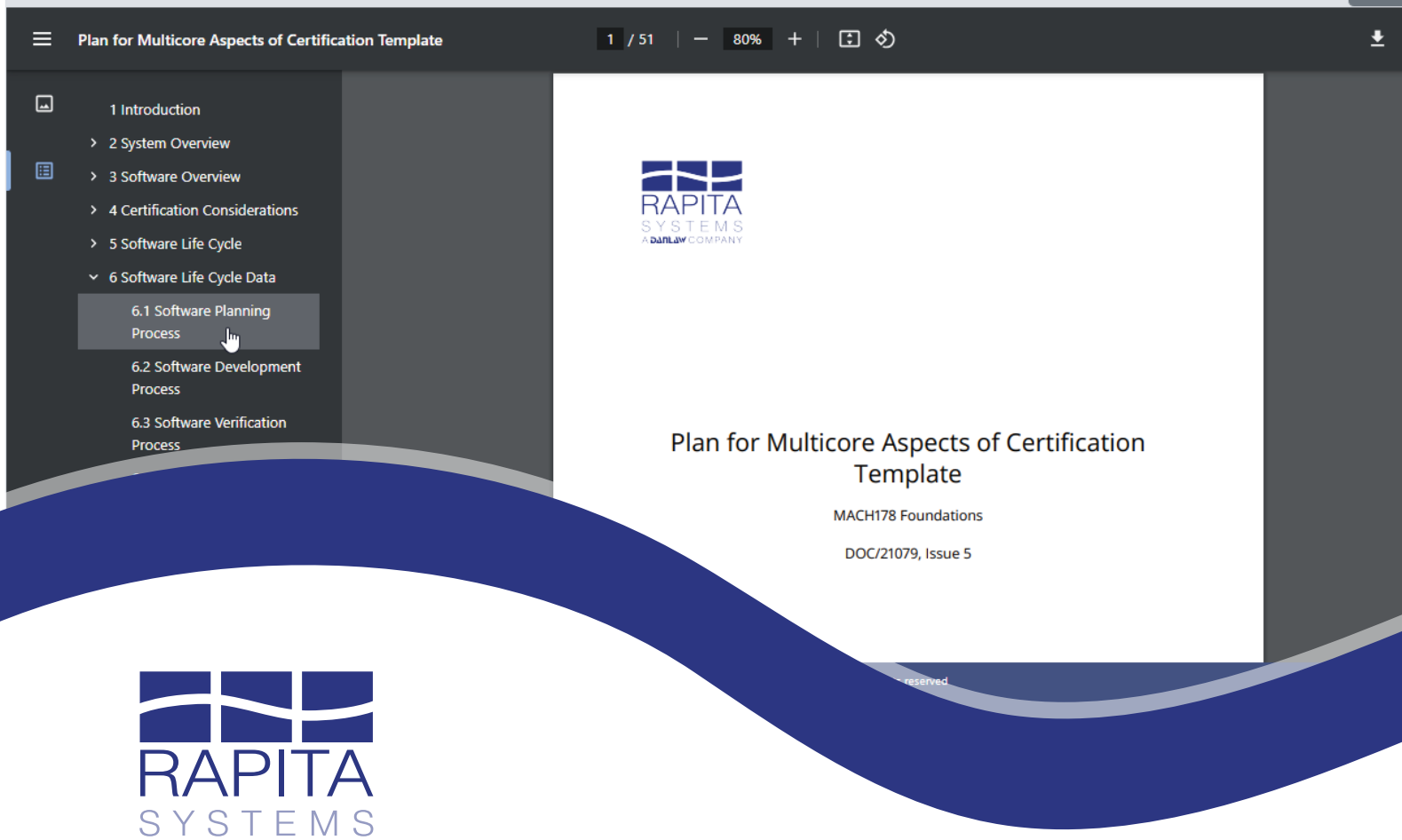
Plan for Multicore Aspects of Certification

This document covers the multicore timing aspects of certification in accordance with A(M)C 20-193 for software developed to DO-178C/ED-12C at Item Development Assurance Level (IDAL) A, B or C. Specifically, it provid
supplement the Applicant's Plan for Software Aspects of Certification (PSAC) with regards to the multicore timing verification aspects of certification. These can be either referenced from the Applicant's PSAC or embedded
Applicant's discretion.

Template Outputs

Plan for Multicore Aspects of Certification Template



RAPITA SYSTEMS
A DANLAW COMPANY

Safety through quality

PRODUCT BRIEF

Lay the groundwork for A(M)C 20-193 compliance with **MACH**[178] Foundations

Product brief: **MACH**[178] Foundations

MACH[178] Foundations

How can **MACH**[178] Foundations help you?

MACH[178] Foundations provides a solid foundation for engineering teams working on multicore DO-178C (A(M)C 20-193) projects or related projects e.g. MIL-HDBK-516C (AA-22-01). By providing a collection of plans, procedures, checklists and other resources, **MACH**[178] Foundations supports engineers working towards A(M)C 20-193 compliance using the **MACH**[178] workflow (see *What is the MACH*[178] *workflow?*).

MACH[178] Foundations and the **MACH**[178] workflow are the culmination of tens of person years of work from specialist multicore hardware and verification engineers at Rapita Systems. The **MACH**[178] workflow is a step-by-step workflow for planning for and providing evidence to achieve A(M)C 20-193 compliance, while **MACH**[178] Foundations provides the necessary documentation to apply the **MACH**[178] workflow to a multicore project.

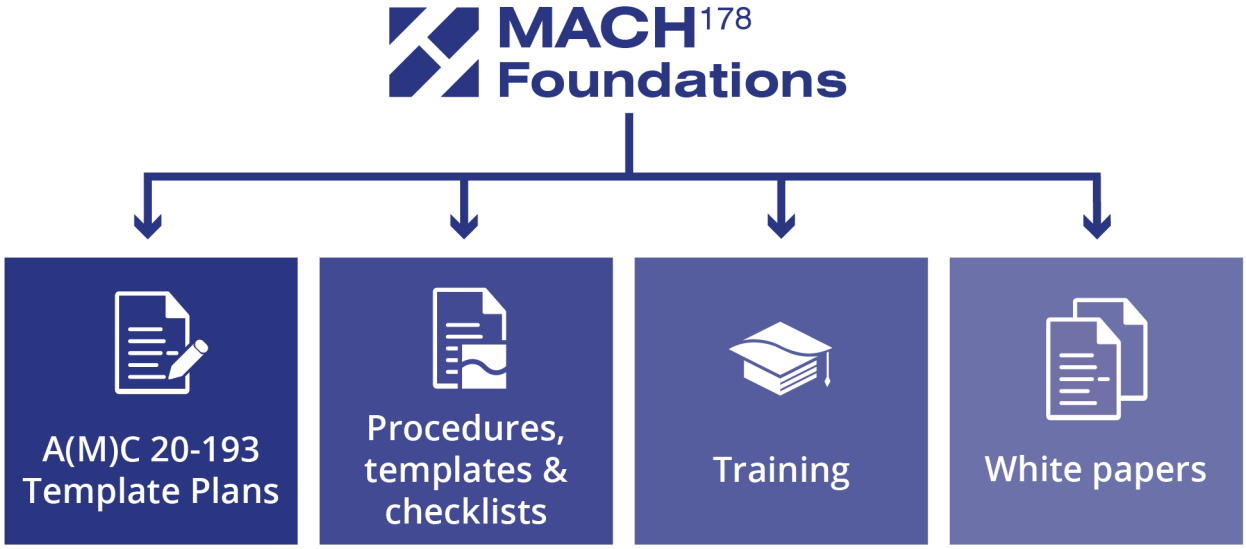
Benefits and use cases

- Reduce time to market for your multicore DO-178C projects
- Derisk your multicore DO-178C projects
- Support your use of the **MACH**[178] workflow for A(M)C 20-193 compliance

Product components

MACH[178] Foundations includes the following components to support your multicore compliance journey:

- Template plans for A(M)C 20-193 certification
- Procedures, templates and checklists to support using the **MACH**[178] workflow for A(M)C 20-193 compliance
- Training resources to help you get started applying the **MACH**[178] workflow to your project
- White papers to provide guidance on specific aspects of multicore certification



Template plans

MACH[178] Foundations includes template plans to help you supplement your DO-178C plans for compliance with A(M)C 20-193 when using the **MACH**[178] workflow. This includes the following documents:

- Plan for Multicore Aspects of Certification (PMAC) – this document provides a breakdown of A(M)C 20-193 objectives and maps them to DO-178C outputs. Information in this document can be integrated into your Plan for Software Aspects of Certification (PSAC) or used standalone and referenced from it.
- Multicore Software Verification Plan (MSVP) – this document lays out the compliance and verification activities you will use for A(M)C 20-193 compliance. Information in this document can be integrated into your Software Verification Plan (SVP) or used standalone and referenced from it.

These documents directly support meeting A(M)C 20-193's MCP_Planning_1 objective.

Procedures, templates and checklists

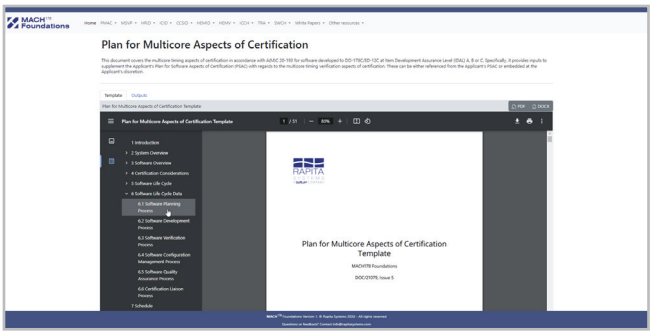
MACH[178] Foundations includes procedures, templates and checklists for key A(M)C 20-193 compliance and verification activities that can be achieved using the **MACH**[178] workflow.

Procedures, templates and checklists are included for the following activities:

- Hardware Resource Identification
- Interference Channel Identification
- Critical Configuration Settings Identification
- Hardware Event Monitor Identification
- Hardware Event Monitor Validation
- Interference Channel Characterization
- Timing Requirements Analysis
- Software Characterization

These procedures support the following A(M)C 20-193 verification objectives:

- MCP_Resource_Usage_1
- MCP_Resource_Usage_3
- MCP_Resource_Usage_4
- MCP_Software_1



Training

MACH[178] Foundations includes training resources to help you understand multicore compliance, and understand the **MACH**[178] workflow and how to apply it on a project.

To further support your use of **MACH**[178] Foundations, we provide 5 hours introductory training and a free seat on our popular public multicore DO-178C (A(M)C 20-193) training courses, which operate in Europe and the USA.

Additional training is available through **MACH**[178] Services (see the *MACH*[178] *Services Product brief*).

If you're wanting to get hands on experience in performing multicore compliance activities with the **MACH**[178] workflow, for example to support your research and development, this is supported by the **MACH**[178] Blueprint (see *More MACH*[178] *solutions*).

White papers

MACH[178] Foundations includes white papers that provide guidance on various aspects of multicore DO-178C (A(M)C 20-193) certification. This includes papers on the following:

- Multicore Processor Selection Considerations
- Multicore RTOS Selection Considerations
- Software Architecture Considerations
- Interference Generator Selection
- Methods of WCET Determination
- Considerations for Deployment of Multicore Processors with a Single Active Core

New white papers may be developed over time and added to **MACH**[178] Foundations.

What is the **MACH**[178] workflow?

The **MACH**[178] workflow is a compliance workflow designed to support DO-178C (A(M)C 20-193) compliance activities. It has been developed to provide an optimized path to planning for understanding, mitigating and quantifying multicore interference, and producing A(M)C 20-193 compliance evidence. The workflow includes the following stages:

1. Planning – where planning documents for the compliance process are developed
2. Platform Analysis – where platform resources and interference channels are identified
3. Platform Characterization – where the impact of interference on each interference channel is quantified
4. Software Analysis – where requirements on software timing behavior are identified
5. Software Characterization – where software timing behavior is measured when subjected to multicore interference
6. Certification – where compliance results are collated, automation tools are qualified, and results are submitted to a certification authority

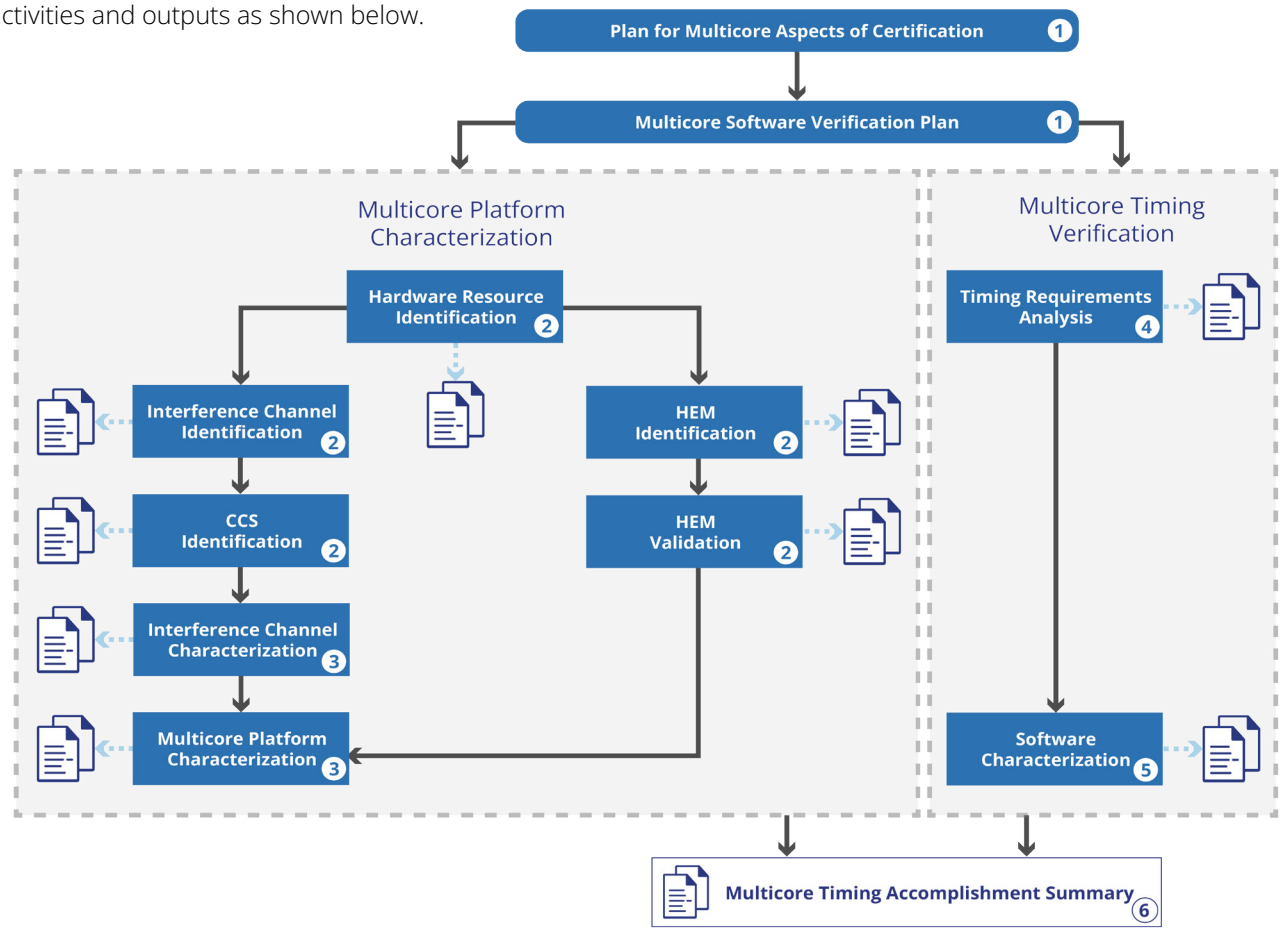
These stages map to DO-178C (A(M)C 20-193) plans, activities and outputs as shown below.

MACH[178] Tools

Multicore DO-178C projects require additional testing, making it more crucial than ever that efficient tools and automation are used wherever possible. The following tools from Rapita Systems directly support the **MACH**[178] workflow:

- Rapi**Daemons**, which support the targeted generation of interference on specific hardware resources, allowing the observation of interference effects
- Rapi**Test**, which supports the authoring and execution of multicore timing tests on a multicore platform
- Rapi**Time**, which supports the observation and analysis of execution time data and values from Hardware Event Monitors on the target hardware during tests
- Rapi**Task**, which supports visualization and analysis of task sequencing and scheduling behavior on a multicore platform

DO-330/ED-215 qualification kits and a Qualified Target Integration Service are available for Rapi**Daemons**, Rapi**Test** and Rapi**Time** to support the use of these tools in DO-178C projects.



How can **MACH**[178] help you?

The **MACH**[178] Blueprint is part of the **MACH**[178] solution. **MACH**[178] is a package of products and services designed to support the certification of multicore DO-178C software according to relevant airworthiness guidelines:

- DO-178C / ED-12C
- AC 20-193 / AMC 20-193 / CAST-32A (superseded)
- DO-330 / ED-215

As these guidelines represent the "gold standard" for certification of critical embedded software, **MACH**[178] can also be used to support airworthiness certification in other contexts such as eVTOL or military & defense avionics certification, e.g. MIL-HDBK-516C (AA-22-01).

Support for System Integrators and Certification Applicants

MACH[178] allows System Integrators to perform verification activities demonstrating that a multicore Platform along with its integrated Applications is compliant with the multicore DO-178C objectives in A(M)C 20-193. When combined with the incremental assurance evidence provided by Platform Providers and Application Suppliers, this forms a complete set of certification evidence.

We help develop supplier frameworks and processes that can be used as acceptance criteria for activities to meet A(M)C 20-193 objectives performed by Platform Providers and Application Suppliers on the project.

Support for Platform Providers

MACH[178] allows Platform Providers to produce evidence demonstrating that their Platform meets the objectives of A(M)C 20-193. This evidence can later be used by Application Suppliers, System Integrators and Certification Applicants to support multicore DO-178C compliance.

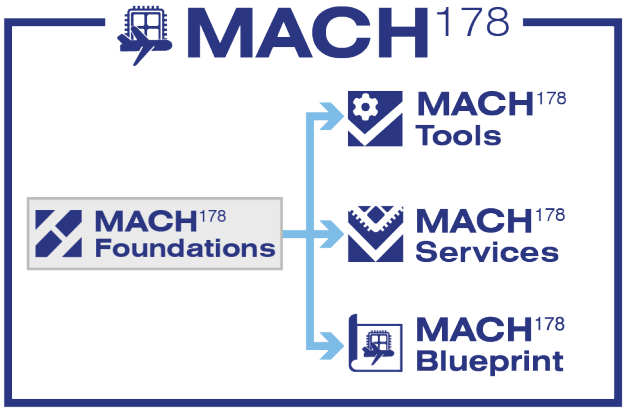
Support for Application Suppliers

MACH[178] allows Application Suppliers to produce evidence demonstrating that their Application, running on the target Platform, meets the objectives of A(M)C 20-193. This evidence can later be used by System Integrators and Certification Applicants to support multicore DO-178C compliance.

More **MACH**[178] solutions

As well as **MACH**[178] Foundations, **MACH**[178] includes other solutions to support your A(M)C 20-193 compliance journey:

- **MACH**[178] Tools – software tools to support applying the **MACH**[178] workflow on a multicore project, with DO-330/ED-215 qualification kits and services (see *MACH*[178] *Tools*).
- **MACH**[178] Services – services to support applying the **MACH**[178] workflow to your multicore project. For more information on **MACH**[178] services, see the *MACH*[178] *Services product brief*.
- **MACH**[178] Blueprint – an off-the-shelf example multicore project and related materials that you can use to learn how to achieve A(M)C 20-193 compliance using the **MACH**[178] workflow. For more information on the **MACH**[178] Blueprint, see the *MACH*[178] *Blueprint Product brief*.



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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:

Tools	Engineering Services	Multicore verification
Rapita **Verification Suite**:	V&V Services	**MACH**[178]
Rapi**Test**	Integration Services	Multicore Timing Solution
Rapi**Cover**	Qualification	
Rapi**Time**	SW/HW Engineering	
Rapi**Task**	Compiler Verification	

Contact

Rapita Systems Ltd.
Atlas House
York, YO10 3JB
UK
+44 (0)1904 413945

Rapita Systems, Inc.
41131 Vincenti Ct.
Novi, Mi, 48375
USA
+1 248-957-9801

Rapita Systems S.L.
Parc UPC, Edificio K2M
c/ Jordi Girona, 1-3
Barcelona 08034
Spain
+34 93 351 02 05

rapitasystems.com

linkedin.com/company/rapita-systems

info@rapitasystems.com