Using MathWorks Products to Generate Code for DO-178B Applications

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Frequently Asked Question

Do MathWorks products generate DO-178B certified code?
   This is not a valid question, because code does not get certified.
What is certification?

- Certification applies to (ARP-4754/DO-178B):
  - A Product
  - A Service
  - An Organization
  - A Person

- Certification involves (ARP-4754/DO-178B):
  - Compliance demonstration
Demonstrating DO-178B Compliance

- Planning process (7 objectives)
- Software development process (7 objectives)
- Verification of requirements process (7 objectives)
- Verification of design process (13 objectives)
- Verification of coding and integration process (7 objectives)
- Testing of outputs of integration process (5 objectives)
- Verification of verification process results (8 objectives)
- Integral processes (12 objectives)
The Bottom Line

- Total objectives = 66
- Source code objectives = 7
- Must address the entire software lifecycle, not just source code
DO-178B Development Process

- Planning
- System Requirements & Design (ARP 4754)
- Software Requirements
- Software Design
- Code Integration
- Coding
  - Source
  - Object
- Hardware/Software Integration
- Software/Software Integration
- Verification of Objectives

Integral Processes
Planning Process for Model-Based Design

- Model standards and guidelines
- Mapping to DO-178B
  - High-level requirements?
  - Low-level requirements?
- Configuration management
- Traceability
  - Models trace to higher-level requirements
  - Source code traces to models
- Testing independence
Requirements Process for Model-Based Design

- Functional, operational, and safety requirements
  - Exist one level above the model
  - May be systems requirements or high level software requirements
  - Models trace to these using Simulink® Verification and Validation - Requirements Management Interface

- Requirements validation
  - Prove requirements are complete and correct
  - Modeling is a validation technique using Simulink and Stateflow®

- Examples
Design Process for Model-Based Design

- Model-Based Design
  - Simulink and Stateflow used to create the design
  - Simulink® Report Generator used to document the design

- Traceability
  - Design traces to requirements using Simulink® Verification and Validation - Requirements Management Interface

- Example
Coding Process for Model-Based Design

- Automatic code generation
  - Source code is generated from model using Real-Time Workshop® Embedded Coder

- Traceability
  - Source code is traceable to model using HTML Code Report generated by Real-Time Workshop Embedded Coder

- Example
Integration Process for Model-Based Design

- Executable object code generation
  - Source code is compiled, linked, and loaded using third party tools
  - Real-Time Workshop Embedded Coder may be used to generate a makefile for use in the build process
  - Run-time libraries are supplied with Real-Time Workshop Embedded Coder for use with generated code
Verification Process for Model-Based Design

- **Design verification**
  - Design complies with standards using manual reviews and Simulink Verification and Validation - Model Advisor
  - Design complies with requirements using Simulink Verification and Validation, SystemTest, and Simulink Report Generator

- **Source code verification**
  - Source code complies with standards using third party tools such as PolySpace MISRA-C Checker
  - Source code complies with design using manual reviews

- **Executable object code verification**
  - Reuse test cases from design verification produced by Simulink Verification and Validation and SystemTest for PIL testing
  - Eliminate traditional software unit testing

- **Examples**
MathWorks products can assist with:

- Planning and integral processes: 1 out of 7 objectives
- Software development process: 6 out of 7 objectives
- Verification of requirements process: 7 out of 7 objectives
- Verification of design process: 12 out of 13 objectives
- Verification of coding and integration process: 1 out of 7 objectives
- Testing of outputs of integration process: 5 out of 5 objectives
- Verification of verification process results: 7 out of 8 objectives
Conclusion

- MathWorks products can be used to accelerate software development for products that must comply with the DO-178B guidelines for certification.
- MathWorks products can assist in satisfying 38 of the 47 development and verification objectives required by DO-178B (ignoring the 19 Planning and Integral Process objectives).
- Third-party tools can be used to address additional objectives.