The MathWorks in Aerospace and Defense

Aerospace and defense organizations worldwide rely on MathWorks products and services to develop and deploy sophisticated, mission-critical components for aircraft, spacecraft, naval, and land systems.

Systems Engineering

Model-Based Design with MATLAB® and Simulink® software enables engineers to explore and analyze ideas, model and simulate systems, rapidly prototype design concepts, and generate code for deployment to production hardware. The products improve communication by providing a common platform for sharing data, models, designs, and system specifications.

Engineers use MathWorks tools to design and test intelligent systems, including airframe and mechanical, avionics and GN&C, C4ISR mission, and propulsion systems. Activities include:

- System architecture development
- Integration of requirements and specifications
- System simulation
- Trade study analysis
- Verification and validation

Control System Development

Using Model-Based Design, control system engineers design algorithms, simulate and test complete systems, and then implement embedded software for:

- Flight guidance, navigation, and control
- Fault detection, isolation, and recovery
- Physical modeling
- Rapid prototyping and hardware-in-the-loop
- Developing code for safety-critical applications

Engineering Data Analysis

Analysts investigating the performance and behavior of aerospace, defense, and intelligence systems rely on MATLAB to perform the following key tasks:

- Signal and image processing
- Algorithm development
- Geospatial data analysis

Signal Processing and Communications System Development

Engineers use Model-Based Design for algorithm development, simulation, code generation, and verification to accelerate the design of products such as:

- Software-defined radios
- Secure and satellite communications systems
- C4ISR systems
- Avionics and navigational systems

Test and Evaluation

With MathWorks products, engineers compare post-flight data results with models and iteratively test, analyze, and modify designs. Core activities include:

- Data acquisition and instrument control
- Telemetry and test data analysis
- Database connectivity and reporting

Customer Successes

Argonne National Laboratory reduced R&D time from one year to two weeks when they developed a multiagent chemical microsensor that can identify air-bound gaseous chemicals.

Dutch Space used MathWorks tools for Model-Based Design to develop the Herschel/Planck control system software and to set up a simulation environment that facilitated reuse and rapid updates to subsystem models during the project.

EADS designed a radar signal processor that was implemented on an FPGA. The deployed system is up to four times more compact than previous versions.

Lockheed Martin Space Systems engineers used MathWorks tools to design and simulate the GN&C system for the Mars Reconnaissance Orbiter and to automatically develop a real-time simulation model of the spacecraft, which originated from a CAD mechanical model.

NASA Jet Propulsion Laboratory automatically generated hundreds of thousands of lines of code for a fault-protection system that monitors the Deep Impact spacecraft.

Hispano-Suiza, a SAFRAN Group company, developed engine control laws and test routines for their packaging, handling, and transportation test platform.

Learn how these and other aerospace and defense companies are using MathWorks tools:

www.mathworks.com/aero/userstories

"With MathWorks tools, we could run four simulations in 15 minutes, and it cost us nothing. Four landings in a real jet would take an hour and cost between 5,000 and 10,000 dollars."

– Alan Johnson, Cessna Aircraft Company

MathWorks Products for Aerospace and Defense

The MathWorks core products are MATLAB, a high-level programming language and technical computing environment, and Simulink, a block diagram environment for multidomain simulation and Model-Based Design. A range of add-on products support specialized applications, including systems engineering, engineering data analysis, model test and verification, control systems development, and signal processing and communication systems development.

Aerospace Blockset™
Model and simulate aircraft, spacecraft, and propulsion systems

Aerospace Toolbox™
Aerospace reference standards, environmental models, and aerodynamic coefficient importing

Control System Toolbox™
Design and analyze control systems

Image Processing Toolbox™
Perform image processing, analysis, and algorithm development

Instrument Control Toolbox™
Control and communicate with test and measurement instruments

Simulink® Verification and Validation™
Develop designs and test cases mapped to requirements and measure test coverage

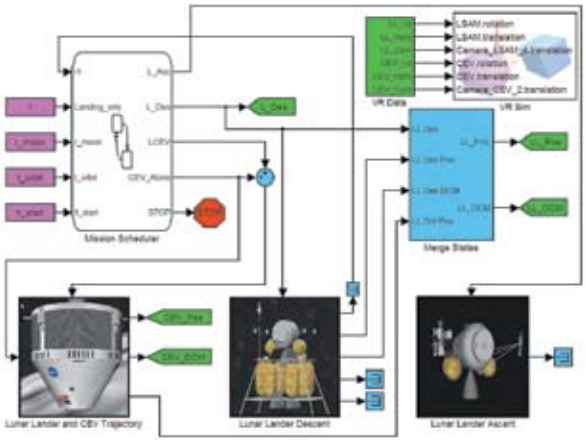
Signal Processing Toolbox™
Perform signal processing, analysis, and algorithm development

Simscape™
Model and simulate multidomain physical systems

Real-Time Workshop®
Generate C code from Simulink models and MATLAB code

xPC Target™
Perform real-time rapid prototyping and hardware-in-the-loop simulation using PC hardware

For a complete list of products for Aerospace and Defense applications, including information about compatible third-party products, visit ***www.mathworks.com/aeroproducts***



Simulink model of the Lunar Surface Access Module (LSAM) component of NASA's Project Constellation.

Resources

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