

Tools for Model-Based Design Reduce Project Development Time by 50 Percent

MathWorks announced that Swedish Space Corporation (SSC) reduced by 50 percent the development time of its Prisma project, which tests and validates guidance, navigation, and control (GNC) strategies for advanced autonomous formation flying. SSC adopted Model-Based Design with MATLAB and Simulink to help model and simulate the GNC system, perform real-time closed-loop simulations, and generate production flight code.

The Prisma project uses two satellites, Mango and Tango, to demonstrate autonomous formation flying and autonomous rendezvous and proximity operations. SSC engineers needed new GNC algorithms to take advantage of the advanced sensors and propulsion systems of the satellites. They used MATLAB, Simulink, and Stateflow to develop GNC algorithms, run and verify system-level closed-loop simulations in real time, and generate flight code for both satellites. To rehearse actual mission flight operations and verify flight command sequences, SSC ran simulations against the plant model on xPC Target. The team also used MATLAB Compiler to build standalone applications for displaying and analyzing satellite flight data.

Model-Based Design helped SSC clearly specify requirements and improve communications with its counterparts at the French and German space agencies and the Technical University of Denmark. Model-Based Design also enabled the teams to identify and address design errors early in the development process. Using MathWorks tools throughout the organization helped eliminate data reentry and conversion between models and tools, and introduced additional time savings through reuse of 70 percent of the attitude control models developed for SSC's SMART-1 satellite, a European Space Agency project.

SSC engineers are further streamlining project efficiency by reusing Prisma models for yet a third project, a general-purpose geostationary satellite platform called Small GEO.

“Traditionally, control engineers specify requirements using text and diagrams and someone else codes the software,” said Ron Noteborn, lead engineer at SSC. “With Model-Based Design, we eliminated that step. We work with models from concept to implementation, and we have the automatically generated code flying in space. By reusing the SMART-1 attitude control models, we were able to run tests very early on and reuse those same tests throughout development of the Prisma project. This approach ensured consistency and repeatability helping to eliminate development time almost completely.” “Prisma demonstrates how Model-Based Design lets aerospace engineers focus on higher-level design tasks for industry-benchmark projects like advanced autonomous formation flying,” said Jon Friedman, aerospace and defense industry marketing manager at MathWorks. “By helping these teams

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develop complex systems, verify their design before implementation, and create opportunities to reuse models, MathWorks helps our customers bring higher-quality products and concepts to market faster.”

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