

18.1	VLAKKE INLEGGER	24x30	100	100
18.2	DRUKVEER			
17.1	VLAKKE INLEGGER	24x30	100	100
16.2	CILINDERSCHROEF	M6x12	100	100
15.1	KOPPELINGSWAAS			
14.1	SEEGEBRING	100x3	100	100
13.1	DRUKVEER			
12.2	HELDOPOR			
11.1	CILINDERSCHROEF	M6x12	100	100
10.1	DRUKVEER			
9.1	LINPER-DRUKVEER			
8.1	TRENVEER			
7.1	WILFVINGERSCHROEF			
6.1	REINER-DRUKVEER			
5.1	TROKSEL			
4.1	CILINDERSCHROEF	M6x12	100	100
3.1	CILINDERSCHROEF	M6x12	100	100
2.1	TEENHOP			
1.1	TEENHOP			

MATERIEEL: **GRANNO DUKSTRA**
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CONAX-KOPPELING

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 Eindhoven

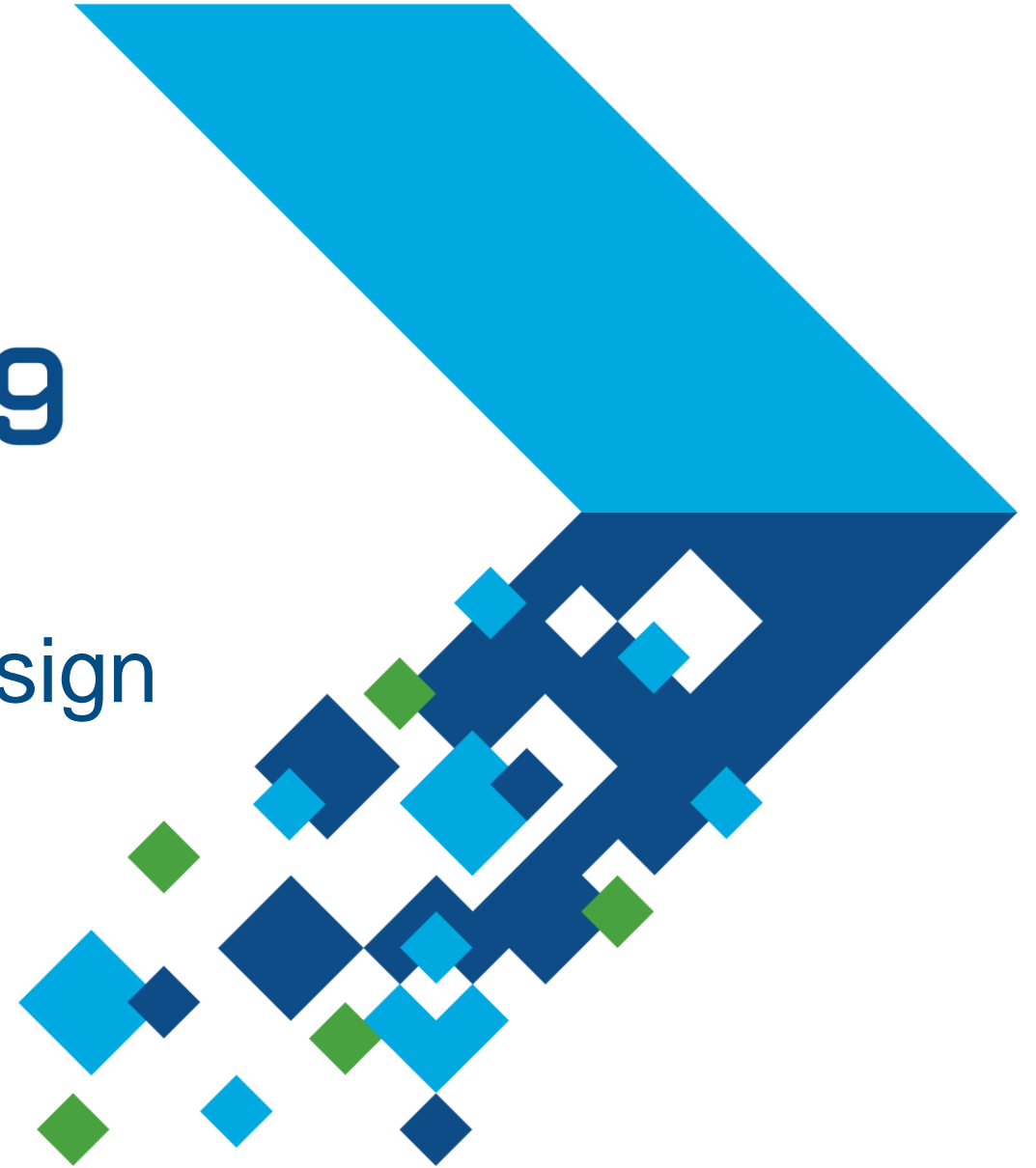
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MATLAB EXPO 2019

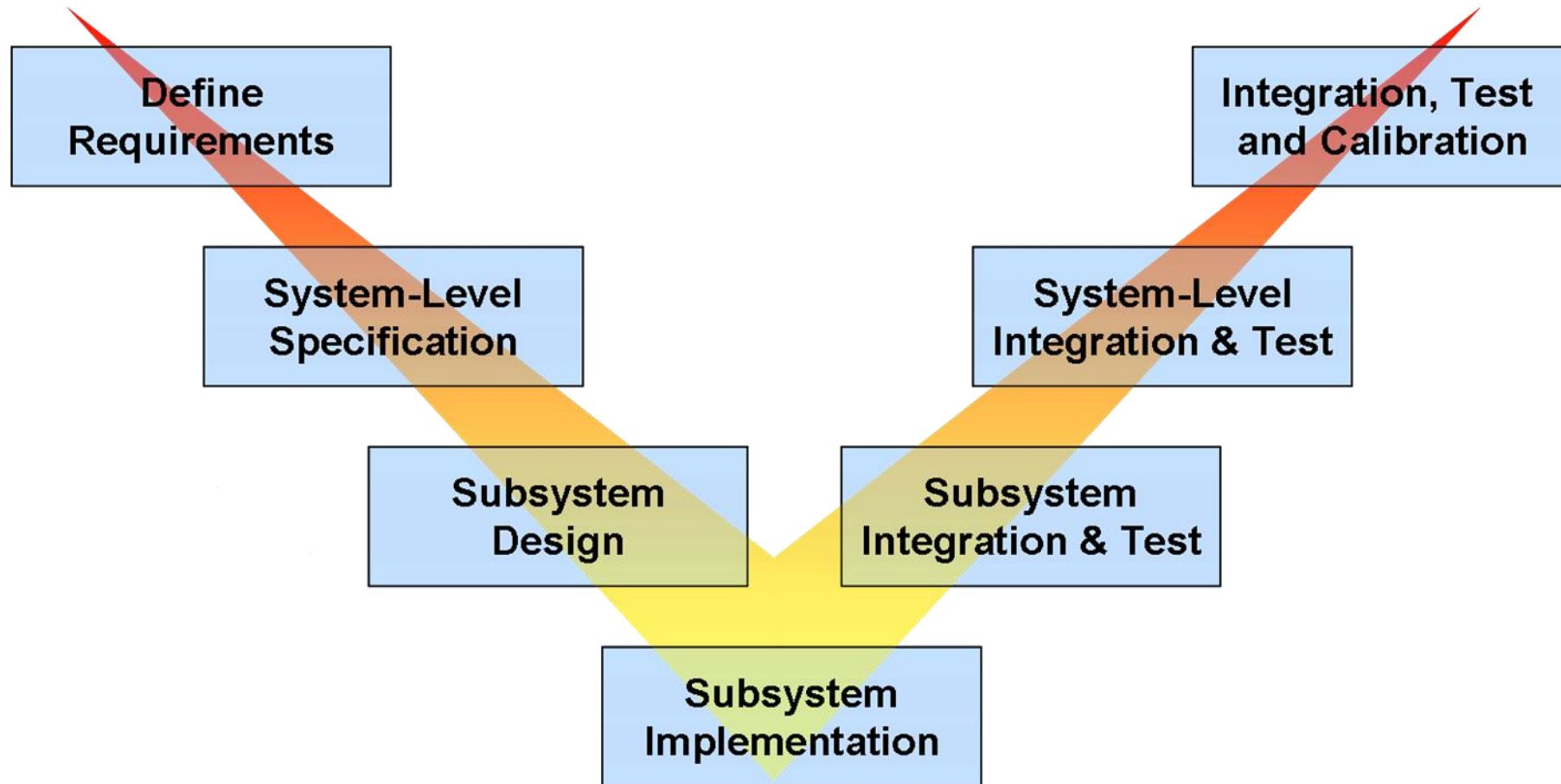
Simulink for Model Based Design

Models at the heart of your work

Branko Dijkstra

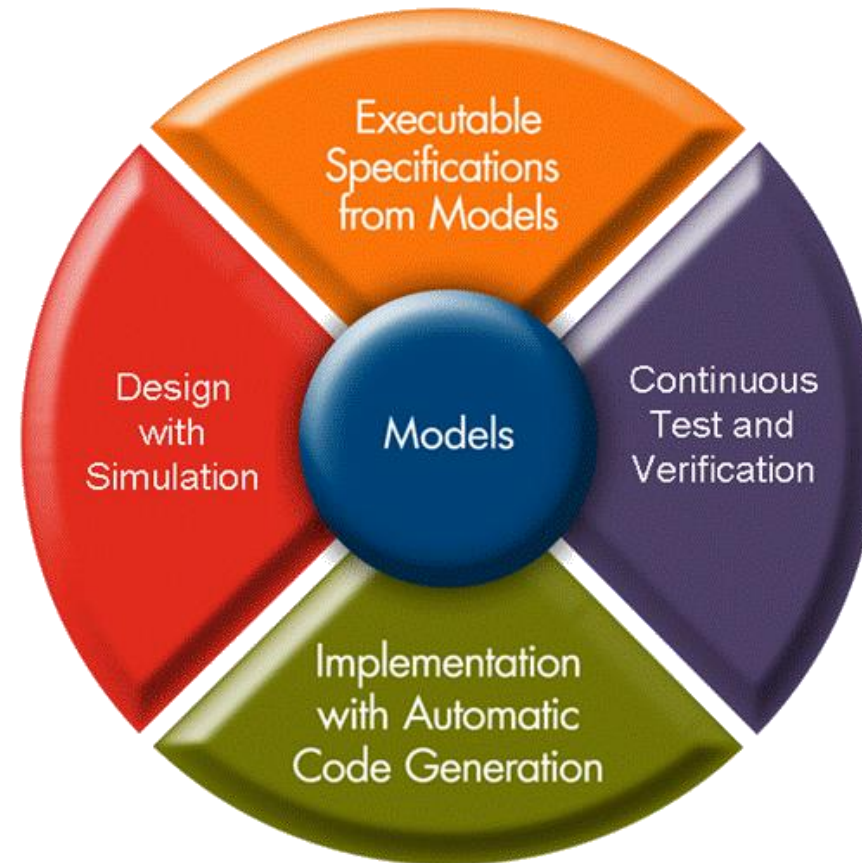


Traditional Design Workflow

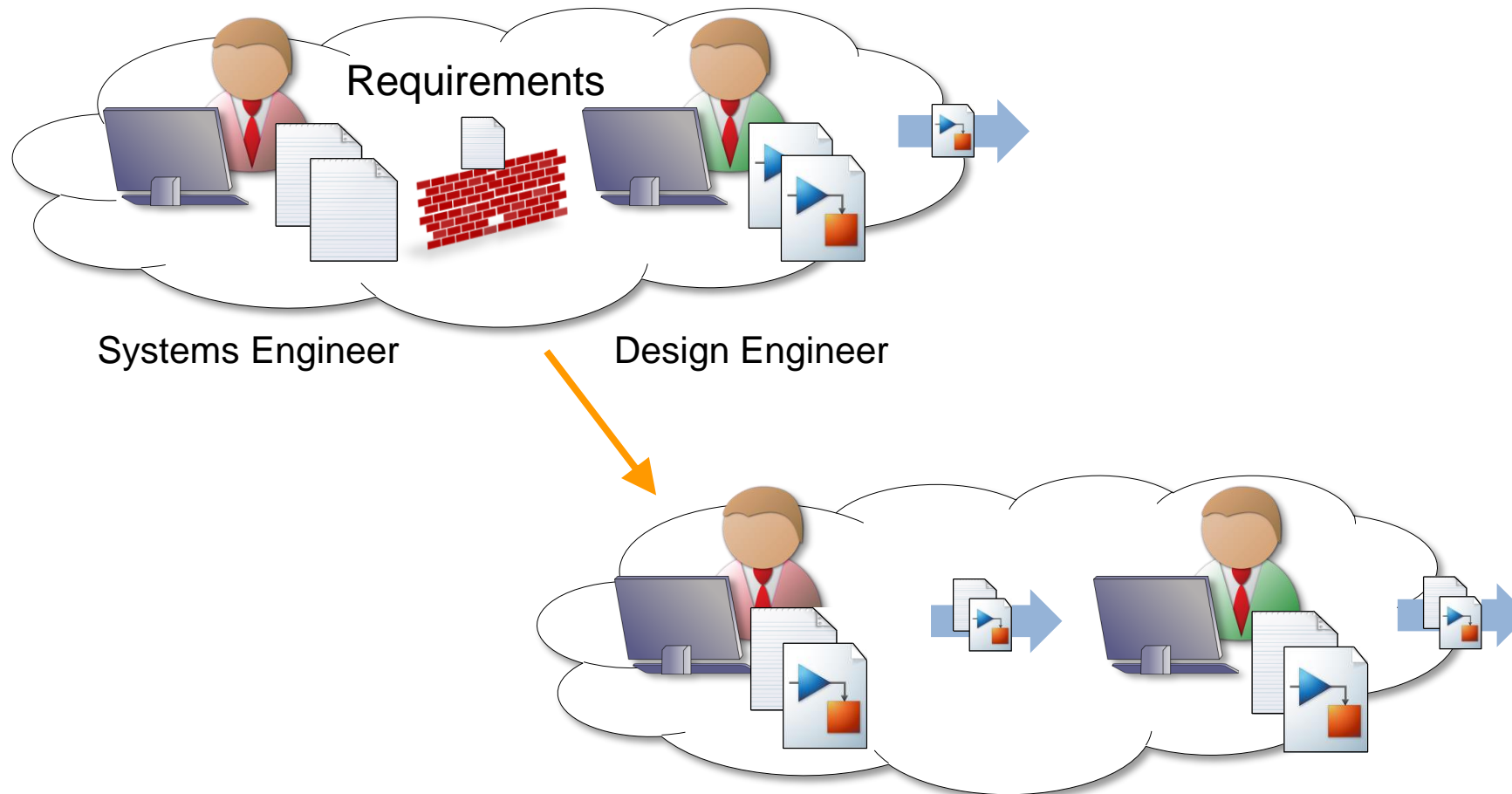
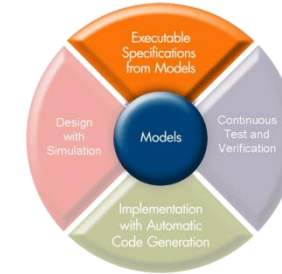


Model-Based Design Workflow

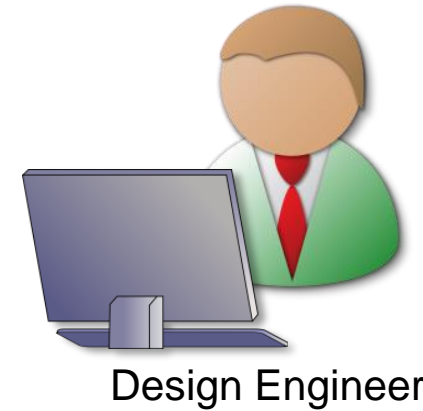
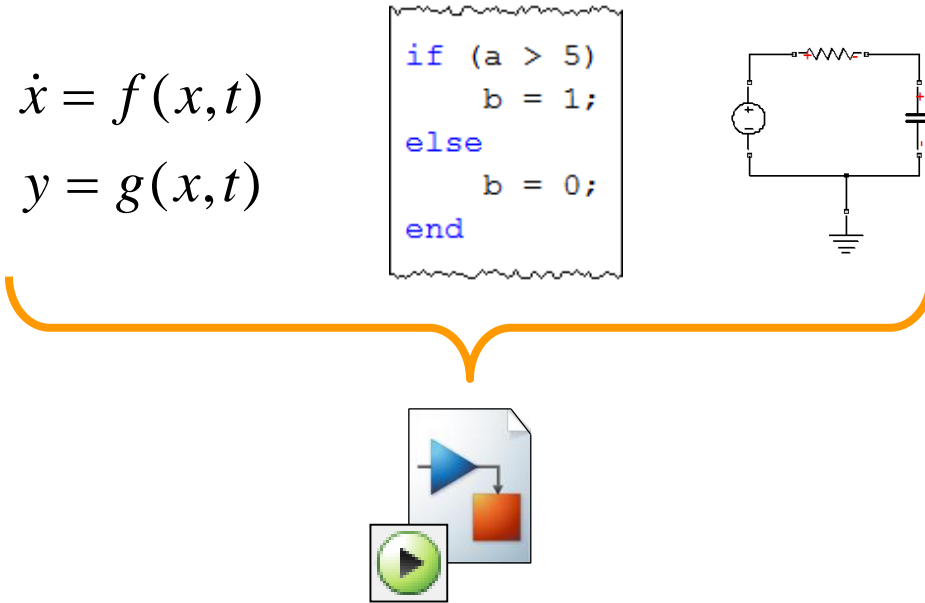
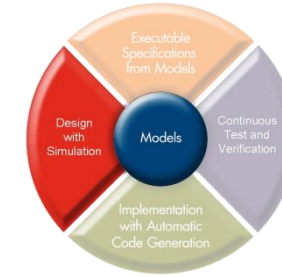
Use the same Simulink® models in multiple design phases



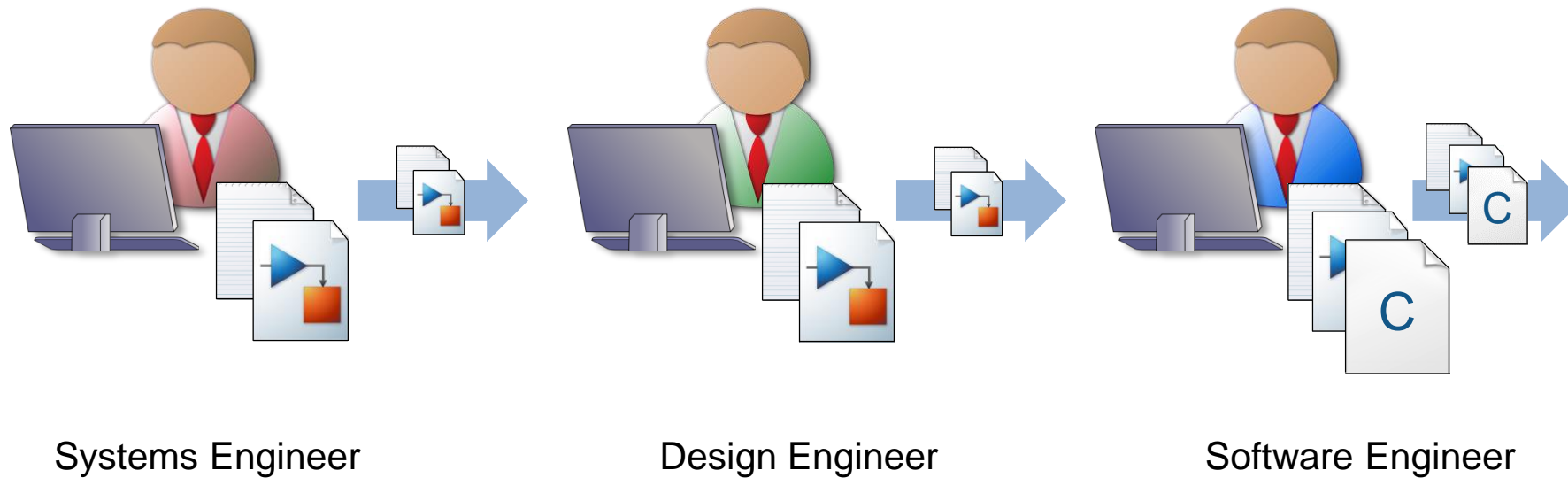
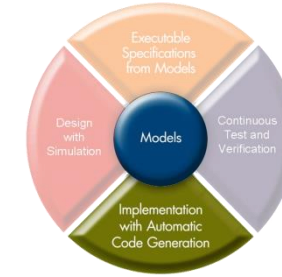
Executable Specifications from Models



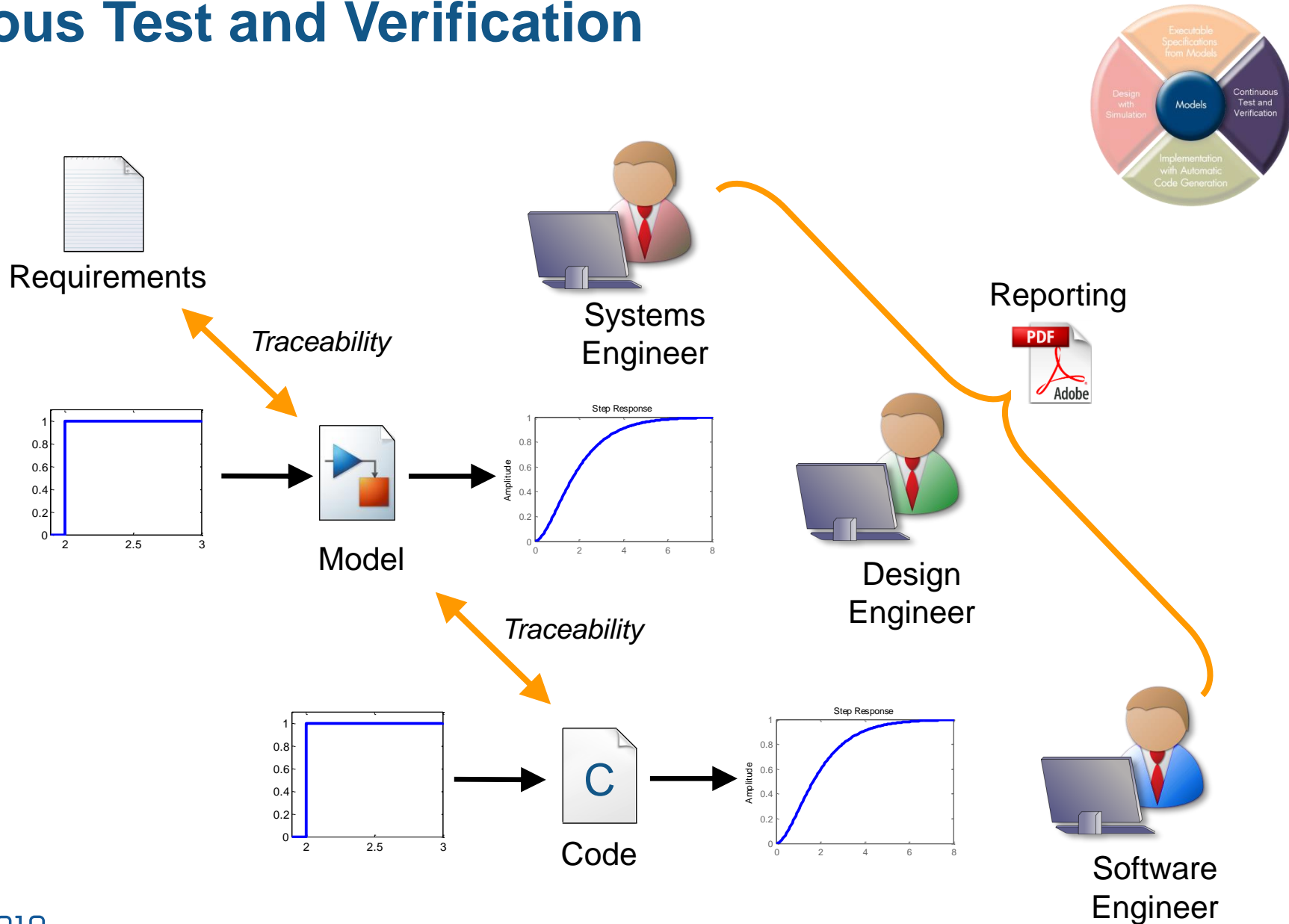
Design with Simulation



Implementation with Automatic Code Generation

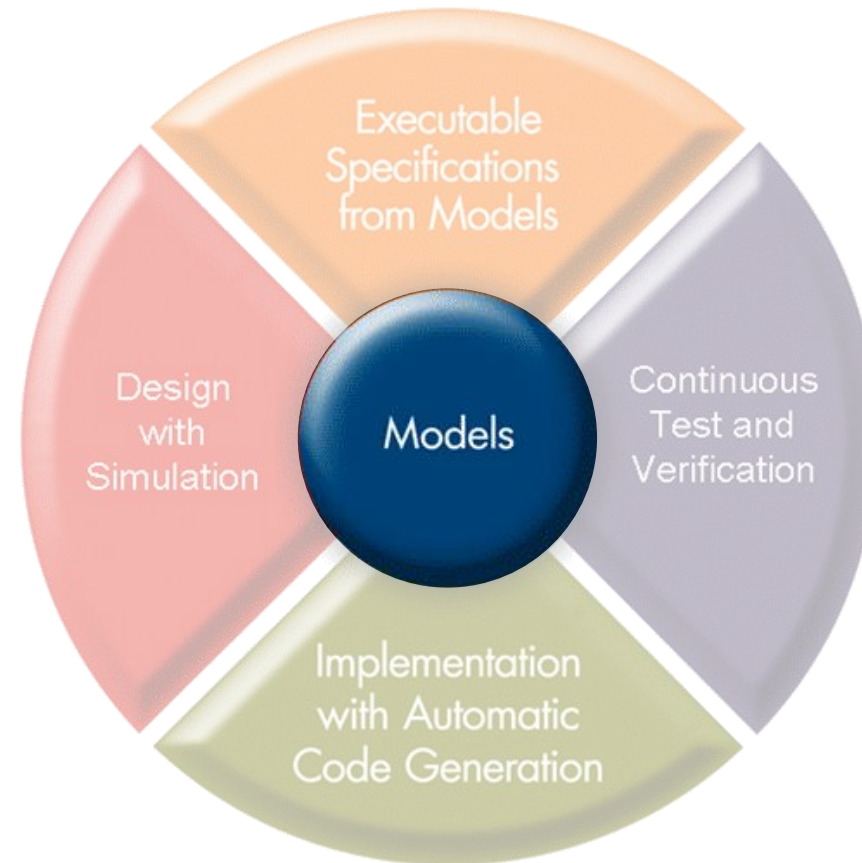


Continuous Test and Verification

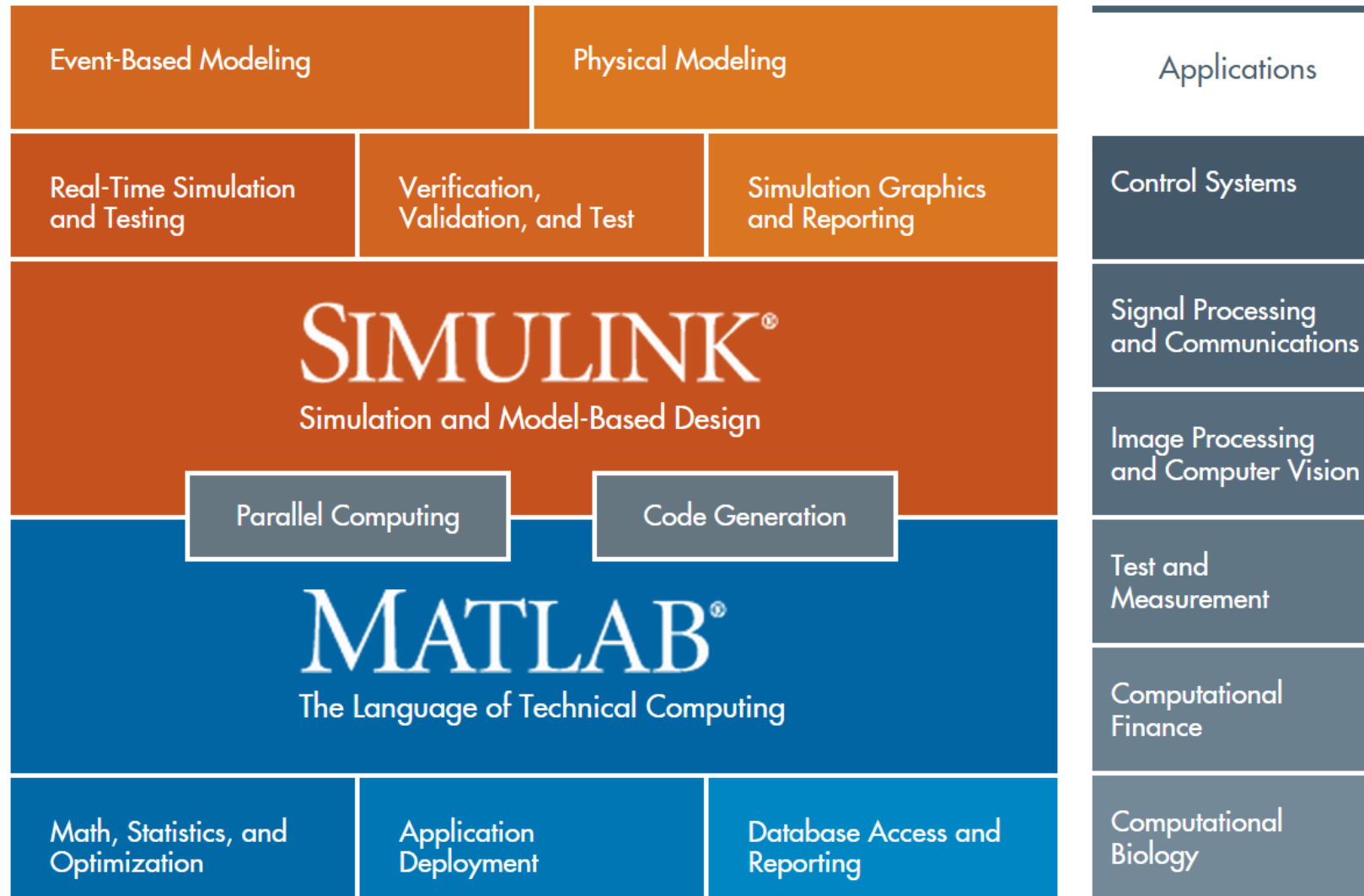


Model-Based Design Workflow

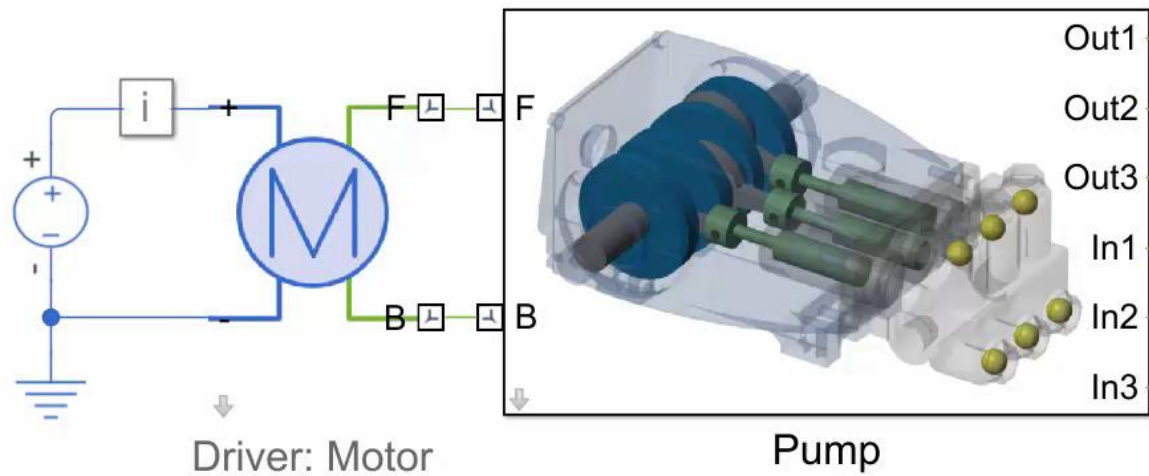
Use the same Simulink® models in multiple design phases



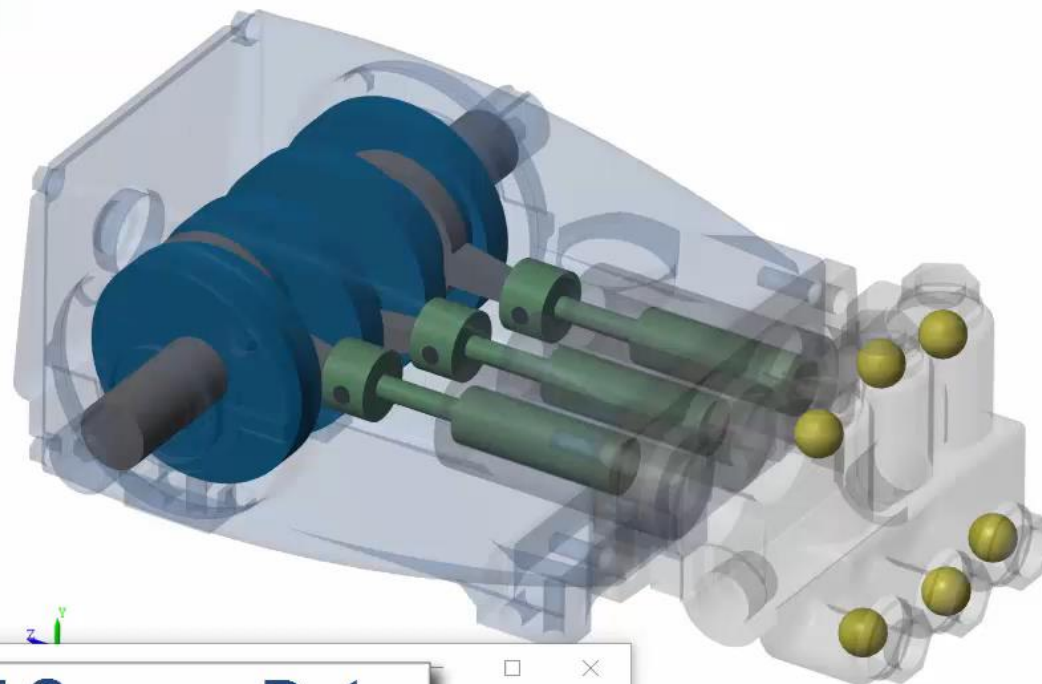
Product Map



Simulation Model



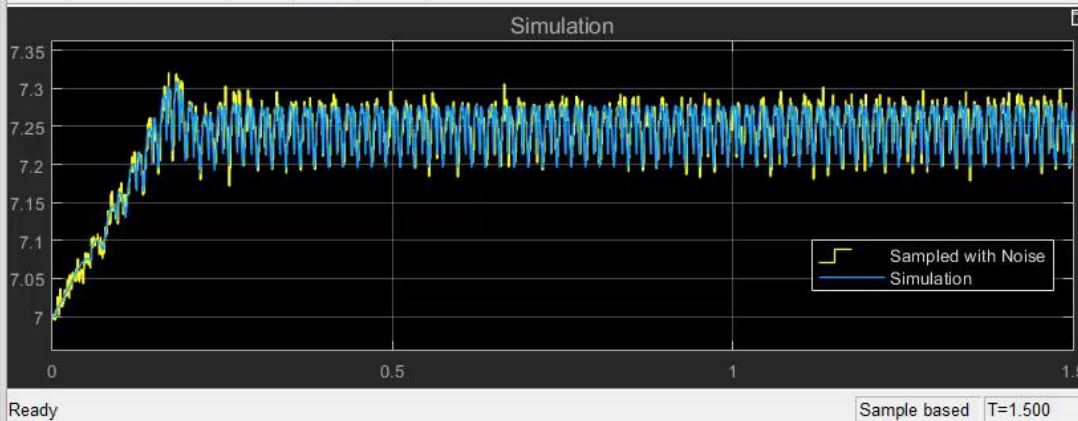
Multibody Animation



User Interface

All Faults Off	Plunger 1	Plunger 2	Plunger 3
Seal Leak	Off, On	Off, On	Off, On
Blocked Inlet	Off, On	Off, On	Off, On
Worn Bearing	Off, On		
Broken Winding	Off, On		

Virtual Sensor Data



Simulink for Model Based Design

- What models are you currently using?
- How are these models helping your work?

- Create Models with no knowledge of the system equations
- Tune parameters to match real data
- Use model beyond original scope – testing/data generation

Voyage Auto Develops Longitudinal Controls for a Self-Driving Taxi Using Model-Based Design

Challenge

Reduce time-to-market for a self-driving taxi service by speeding control design and implementation

Solution

Use Model-Based Design to model, simulate, and generate C++ code for the taxi's longitudinal control system

Results

- Initial control design implemented in three days
- Gigabytes of ROS data imported, filtered, and analyzed
- ROS node for simulating virtual barriers developed in hours



A Voyage self-driving taxi on the road in Florida.

"After downloading [the MATLAB adaptive cruise control system example] model and running some preliminary simulations in Simulink, I generated C++ code from the model for a standalone ROS node with Robotics System Toolbox and Simulink Coder... Within three days we were running the generated code for the ACC in our vehicle."

- Alan Mond, Voyage Auto

Tessella Designs Attitude and Orbit Control Algorithms for Solar Orbiter Spacecraft Using Model-Based Design

Challenge

Design algorithms for the attitude and orbit control subsystem for the Solar Orbiter spacecraft capable of maintaining pointing stability to within a few tenths of an arcsecond

Solution

Use Model-Based Design with MATLAB and Simulink to model spacecraft sensors, actuators, and control algorithms; run simulations to optimize and tune the algorithms; and guide the creation of a detailed software specification

Results

- ECSS compliance demonstrated
- Complex analysis completed on schedule
- Models reused on follow-on projects, cutting design effort by up to 80%



Artist's rendition of the Solar Orbiter.

“We saw the benefits of Model-Based Design on several previous projects. On this project, MATLAB and Simulink enabled us to create a detailed specification that minimized deviation between the prototype algorithms we developed, tuned, and tested in Simulink and the final software implementation.”

- Andrew Pollard, Tessella

Preceyes Accelerates Development of World's First Eye-Surgery Robot Using Model-Based Design

Challenge

Develop a real-time control system for robot-assisted surgical procedures performed within the human eye

Solution

Use Model-Based Design with MATLAB and Simulink to model and simulate the control system and use Simulink Coder and Simulink Real-Time to deploy it to a real-time target

Results

- Core controller developed by one engineer
- Patient safety assured
- Road map to industrialization set



The PRECEYES Surgical System. Image copyright and courtesy Preceyes.

“MATLAB and Simulink provided a single platform that supported our complete workflow and all the components and protocols we needed for our robotic system. That enabled us to quickly develop a safe, real-time device, ready for clinical investigation.”
- Maarten Beelen, Preceyes

MATLAB and Simulink Help Land Unpiloted Boeing Spacecraft

Challenge

Design a guidance, navigation, and control (GN&C) system that allows the X-40A to land and come to a full stop on a standard runway without either power or a pilot

Solution

Use MathWorks tools to streamline software implementation, shorten the design-to-software-to-verification cycle, and enable them to make late changes

Results

- Rapid development within budget
- A successful test flight
- A contract to continue development



Boeing X-40A – in test flight (directly above) and on the ground (top).

"I am very pleased with the results of this flight test. It is a significant step in the development phase."

- John Fuller, Boeing

Lockheed Martin Space Systems Develops GN&C System for IRIS Satellite with Model-Based Design

Challenge

Develop the guidance, navigation, and control (GN&C) system for the Interface Region Imaging Spectrograph (IRIS) observatory satellite

Solution

Use Model-Based Design with MATLAB and Simulink to model components of the GN&C system and the IRIS satellite, run closed-loop and processor-in-the-loop simulations, and generate production code

Results

- Development efficiency doubled
- Efficient, defect-free code generated
- Design updates completed in a single day



The IRIS observatory.

“A team of about four engineers designed, integrated, and tested the GN&C system in just 23 months. We were more efficient because we used the same tools for both analysis and code development, and generated 20,000 lines of defect-free code. For us, that makes a compelling case for Model-Based Design.”
- Vincentz Knagenhjelm, Lockheed Martin Space Systems

IntelinAir Accelerates Drone Research with a Ready-to-Fly Hexacopter and Flight Control Software

Challenge

Enable researchers to rapidly prototype, simulate, and deploy control software and jumpstart new drone research programs

Solution

Use Simulink and Model-Based Design to develop a ready-to-fly drone with prebuilt autopilot software that can be customized for specific research projects

Results

- Ambitious project completed by small team
- Flight software development simplified
- Software bugs caught before actual flight tests



The IntelinAir RD-100 drone.

“We could have written the code by hand, but we believe that Model-Based Design is not only the fastest way to develop flight software, it is also preferred by members of the academic research community, who are already comfortable using MATLAB and Simulink.”

- Greg Rose, IntelinAir

NEC Develops Multibeam Sonar Systems for Underwater Vehicles with Model-Based Design

Challenge

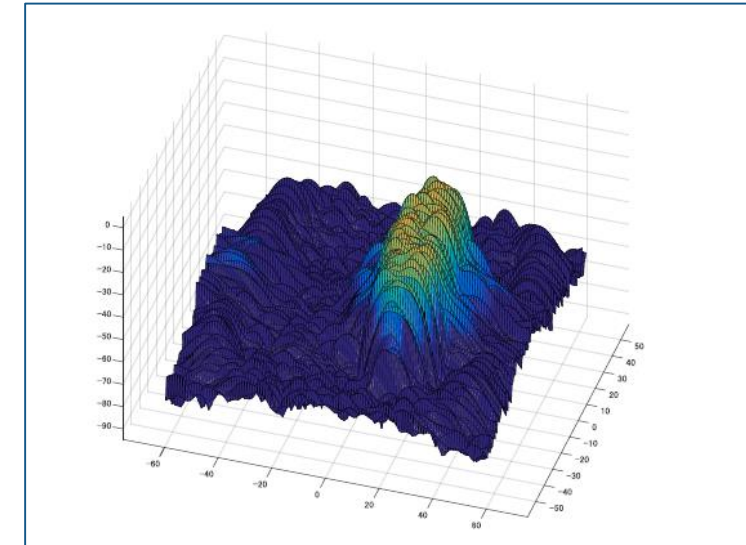
Design and implement a multibeam sonar system for high-resolution acoustic imaging

Solution

Model and simulate the sonar's acoustic environment, analog transducers, and DSP components in Simulink before generating production C and HDL code with Embedded Coder and HDL Coder

Results

- Sound field, analog transducers, and digital components modeled in one environment
- Design verified and optimized via hardware-in-the-loop tests
- C and HDL code generated for prototype and production systems



Sonogram of an ellipsoid target located 50m below the surface and 5m above the seabed.

“[Model-Based Design] enabled us to optimize the entire system design earlier than ever before, verify its functionality and tune parameters on DSP and FPGA prototypes, and deliver the complete system on schedule.”

- Jun Kuroda, NEC