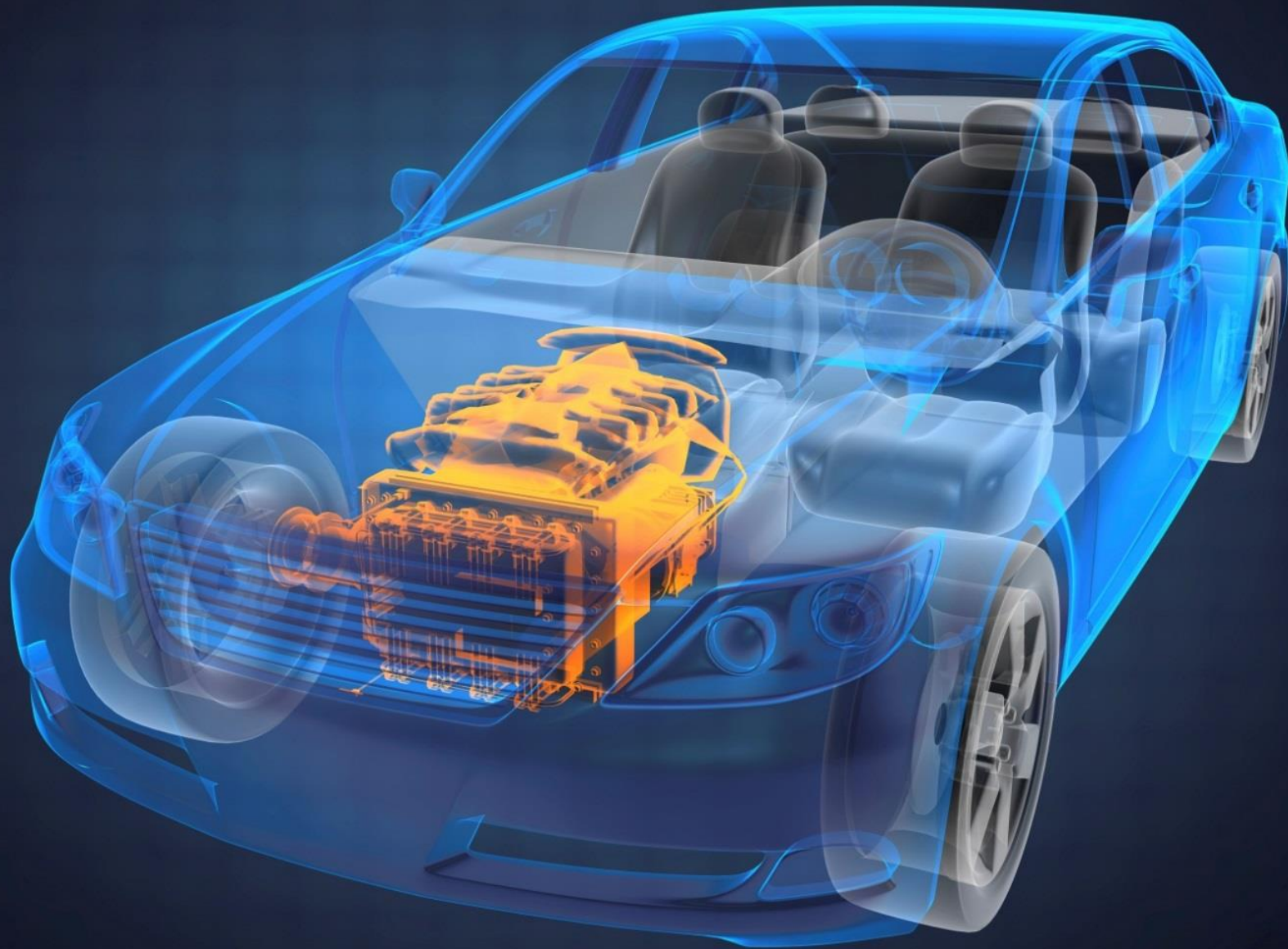


Simulation Test: Are you taking full advantage of it?

Meaghan O'Neil
Simulink Test Product Manager



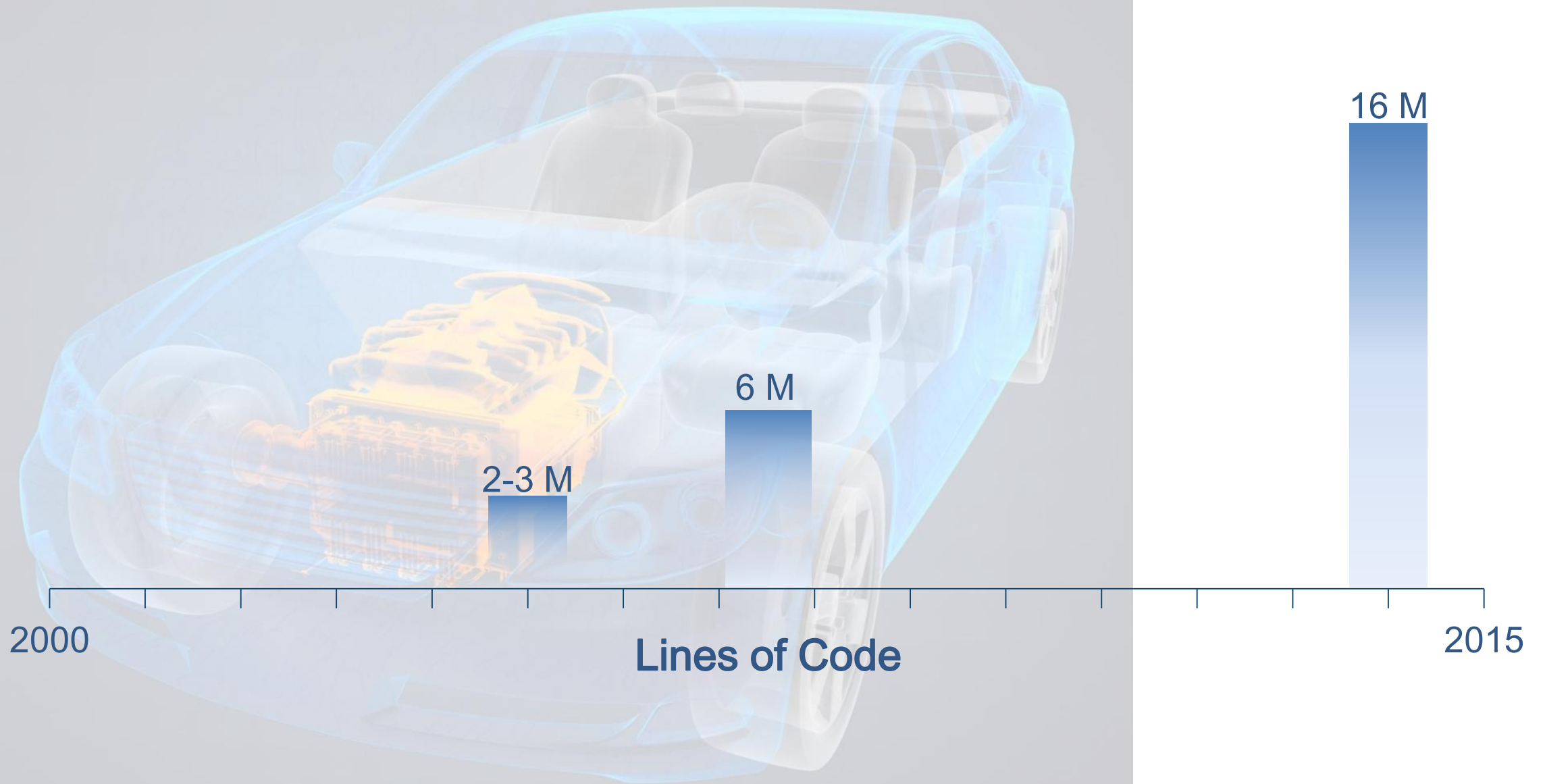
Transmission

Engine

Body Control

Entertainment

Driver Assist



Siemens, ["Ford Motor Company Case Study,"](#) Siemens PLM Software, 2014

McKendrick, J. ["Cars become 'datacenters on wheels', carmakers become software companies,"](#) ZDJNet, 2013

Road to Complexity



Road to Complexity



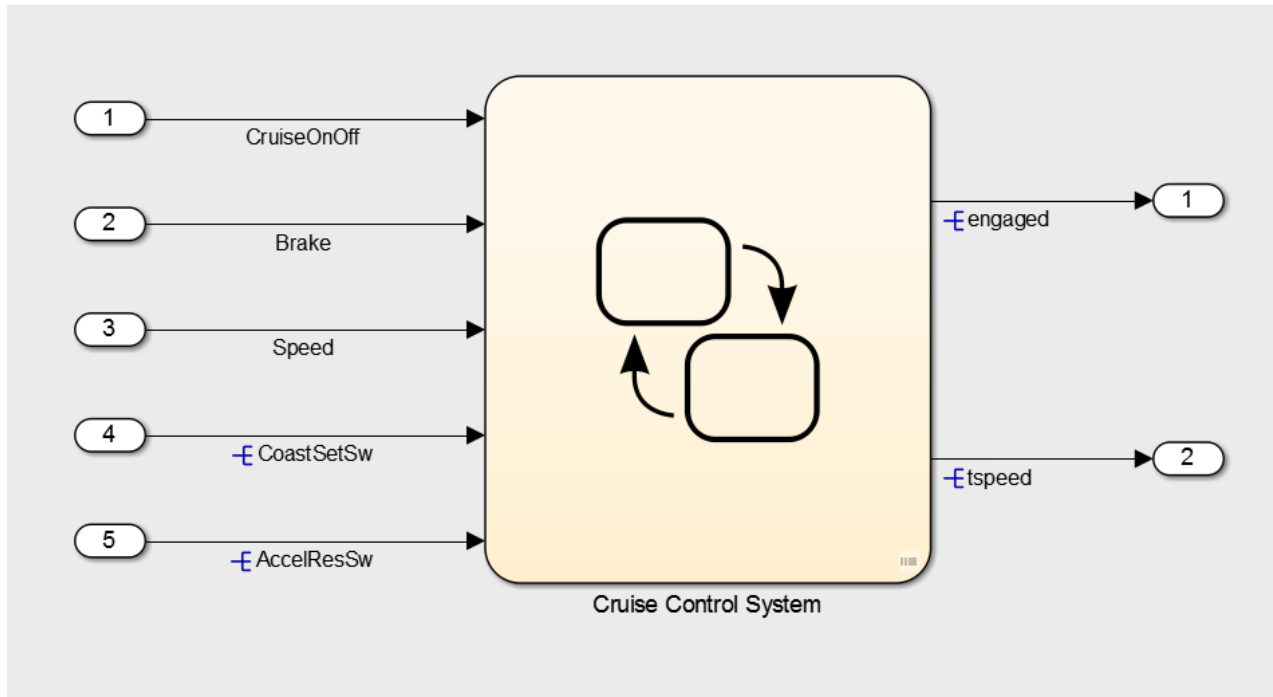
Software Related Recalls

NHTSA Office of Defect Investigation, Recalls [[Data file](#)], 2014
Thomas, J et al., "An Integrated Approach to Requirements Development and Hazard Analysis," SAE World Congress 2015

50

**Percentage of
warranty costs
attributed to
electronics
and embedded
software**

Simulation Testing: Verification & Validation



Is the model behaving as intended?

Is the code behaving as intended?

Is it the right behavior?

*Model-based design **and testing** enables the development of complex systems*

Current Testing Practices

Pain Points:

No/Limited Testing

Limited Model Testing
Vehicle Testing

- ❖ Troubleshooting
- ❖ Rework
- ❖ Consistency

Extensive Testing

Regression Testing
Unit Testing
Integration Testing
Code Testing
Vehicle Testing

- ❖ Investment
- ❖ Customization
- ❖ Sustainability

Customer Feedback

Need to improve V&V in the model and generated code

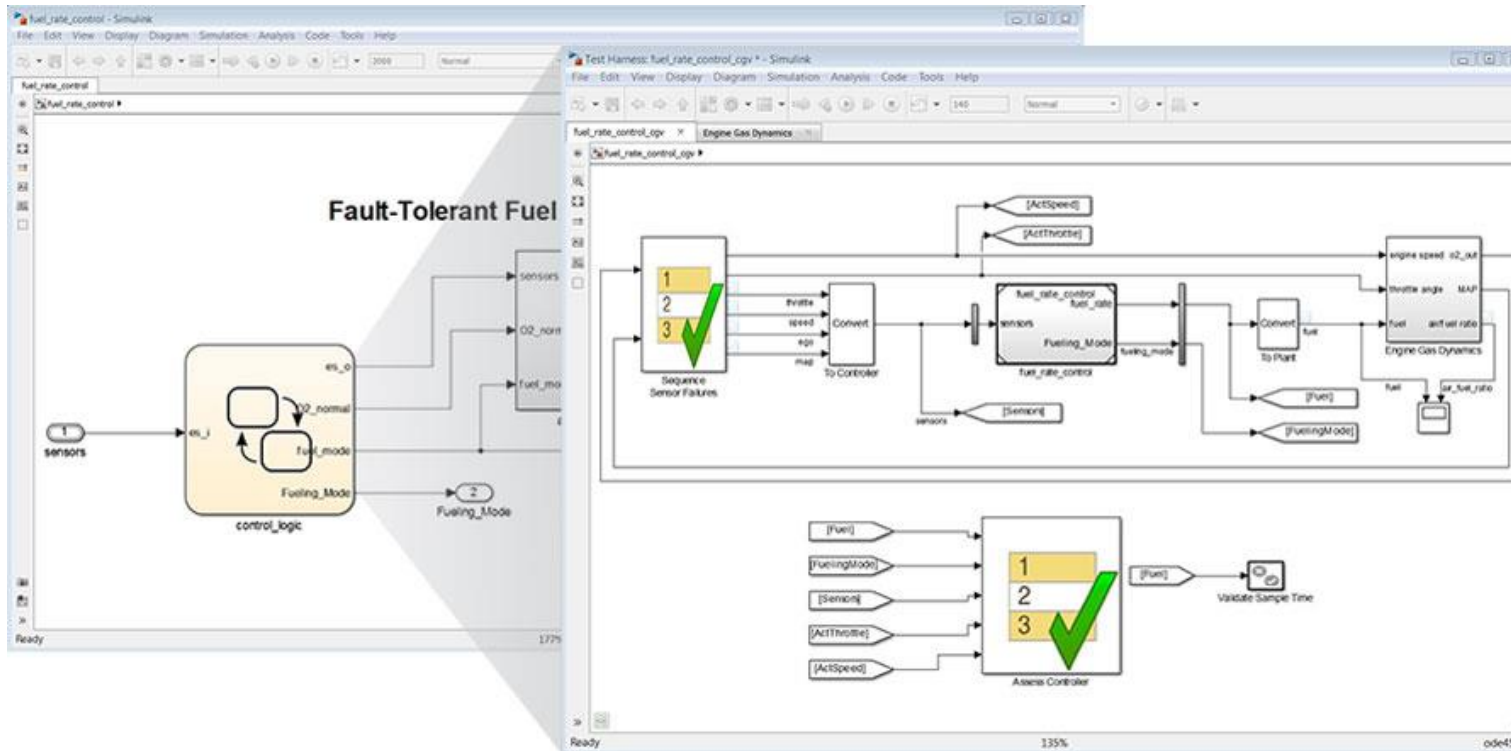
Seamless integration of V&V into the design workflows

MathWorks V&V Product Portfolio

Product	Capabilities
New in 15a Simulink Test	Author, execute, and manage simulation-based tests for models and generated code
Simulink Verification & Validation	Trace to requirements, check model standards, perform coverage analysis
Simulink Design Verifier	Identify design errors, automatically generate test vectors, verify designs against requirements
Polyspace Bug Finder	Find software bugs and check compliance to MISRA
Polyspace Code Prover	Prove the absence of run-time errors in software

Isolate and Test

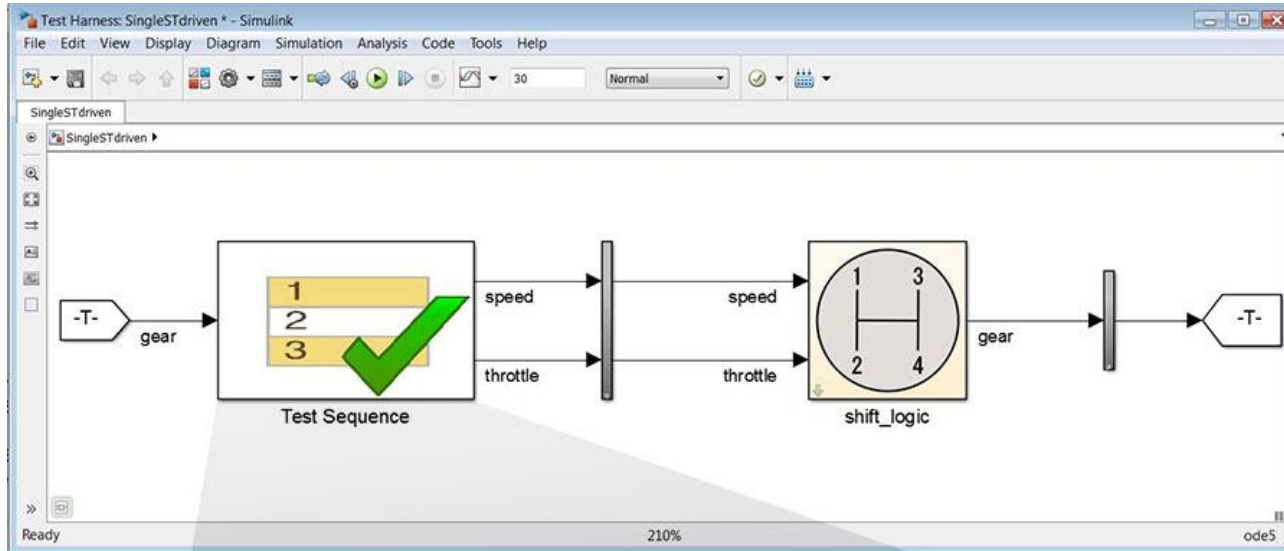
New Test Harness provides a synchronized simulation environment



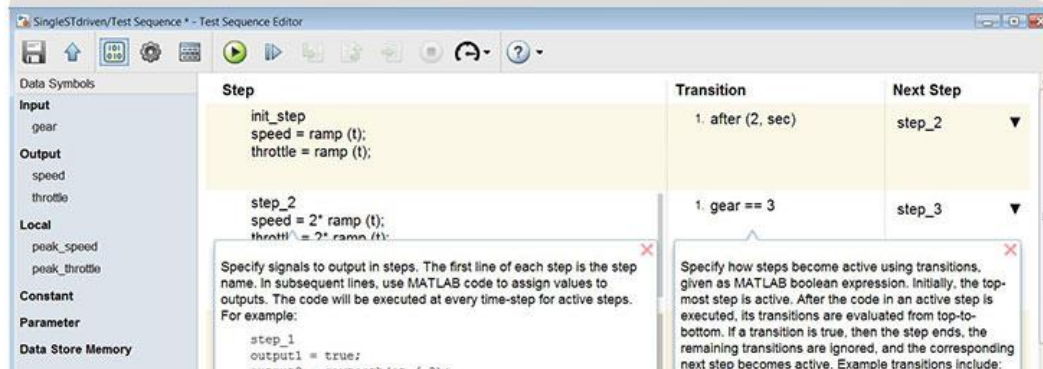
- Isolate Component of Interest
- House Testing Related Artifacts
- Enable Adhoc Testing

Create Input Vectors and Assessments

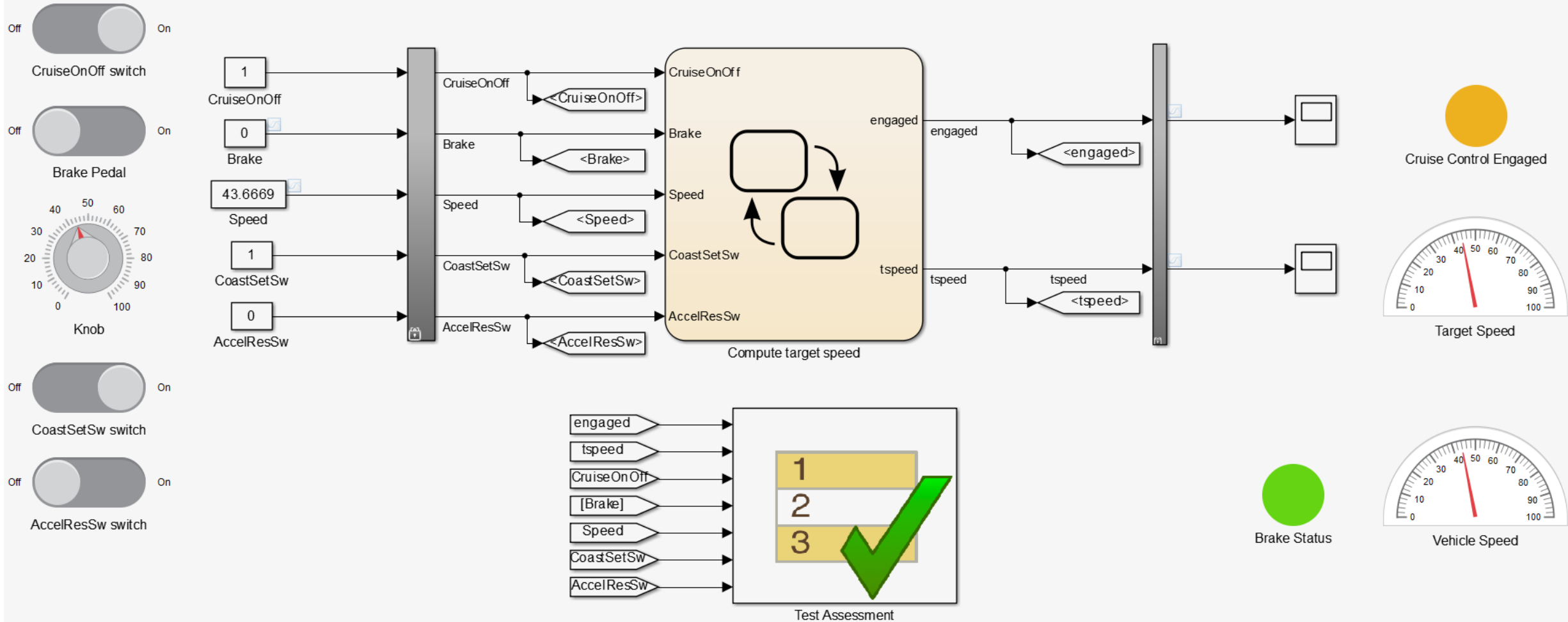
Test Sequence Block Compliments Time Series Data



Create input vectors & assessments based on time or logical conditions

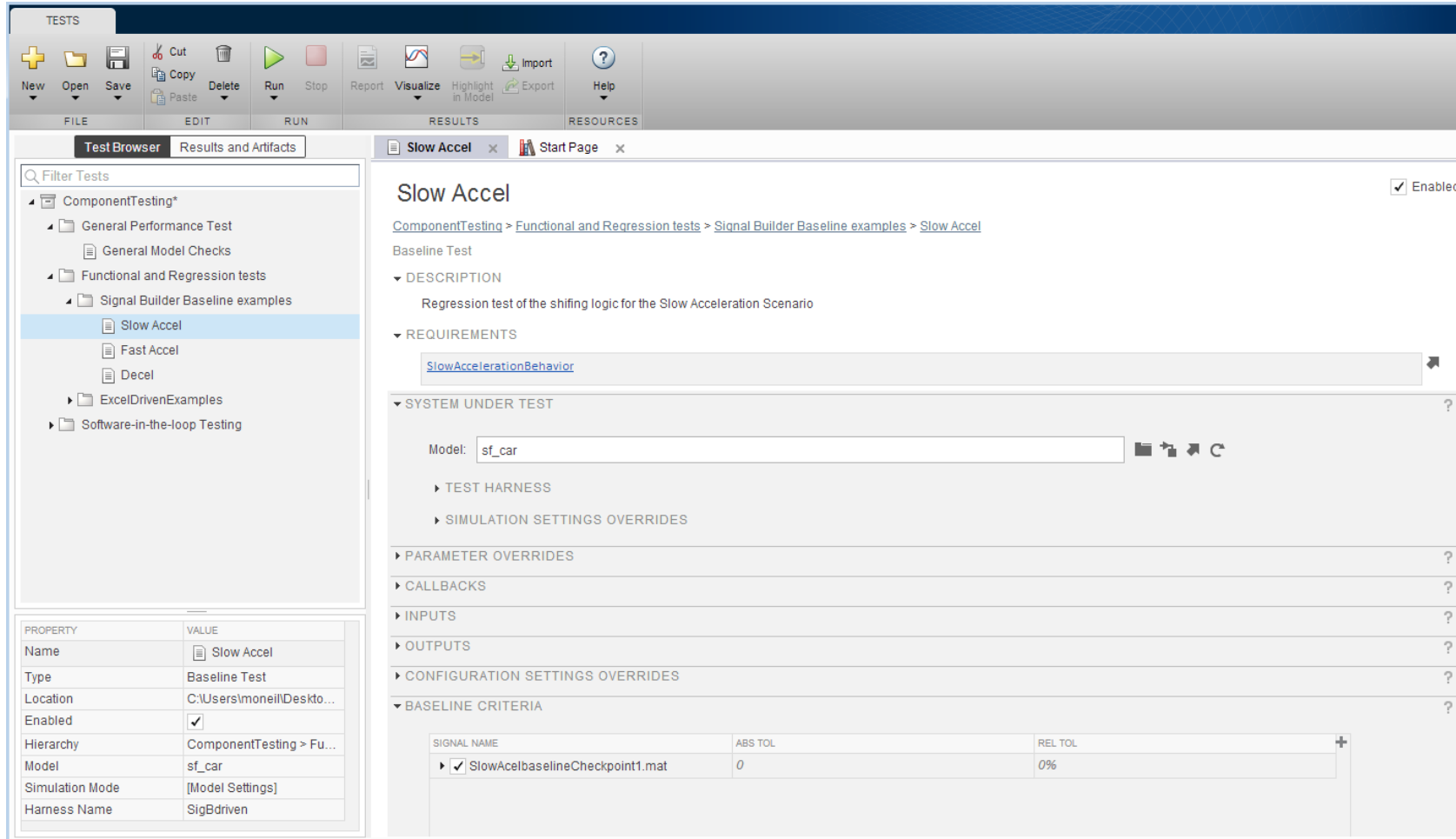


Interactive Testing & Reusable Assets



Test Automation

Test Manager for authoring, executing, and organizing test cases and results



The screenshot displays the Test Manager interface. At the top is a ribbon with tabs for TESTS, FILE, EDIT, RUN, RESULTS, and RESOURCES. Below the ribbon are two main panes. The left pane, titled 'Test Browser', shows a tree view of test cases under 'ComponentTesting*', with 'Slow Accel' selected. The right pane, titled 'Slow Accel', shows the configuration for this test case. It includes a 'DESCRIPTION' section with the text 'Regression test of the shifting logic for the Slow Acceleration Scenario', a 'REQUIREMENTS' section with a link to 'SlowAccelerationBehavior', and a 'SYSTEM UNDER TEST' section with a 'Model' field set to 'sf_car'. Below these are sections for 'TEST HARNESS', 'SIMULATION SETTINGS OVERRIDES', 'PARAMETER OVERRIDES', 'CALLBACKS', 'INPUTS', 'OUTPUTS', 'CONFIGURATION SETTINGS OVERRIDES', and 'BASELINE CRITERIA'. The 'BASELINE CRITERIA' section contains a table with columns for 'SIGNAL NAME', 'ABS TOL', and 'REL TOL'.

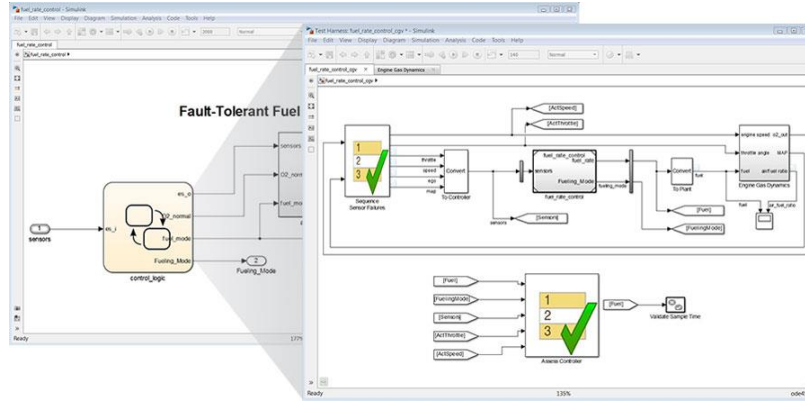
PROPERTY	VALUE
Name	Slow Accel
Type	Baseline Test
Location	C:\Users\lmonell\Desktop\...
Enabled	<input checked="" type="checkbox"/>
Hierarchy	ComponentTesting > Fu...
Model	sf_car
Simulation Mode	[Model Settings]
Harness Name	SigBdriven

SIGNAL NAME	ABS TOL	REL TOL
<input checked="" type="checkbox"/> SlowAccelbaselineCheckpoint1.mat	0	0%

- Create test cases from templates
- Customize set up & clean up scripts
- View, share, report results

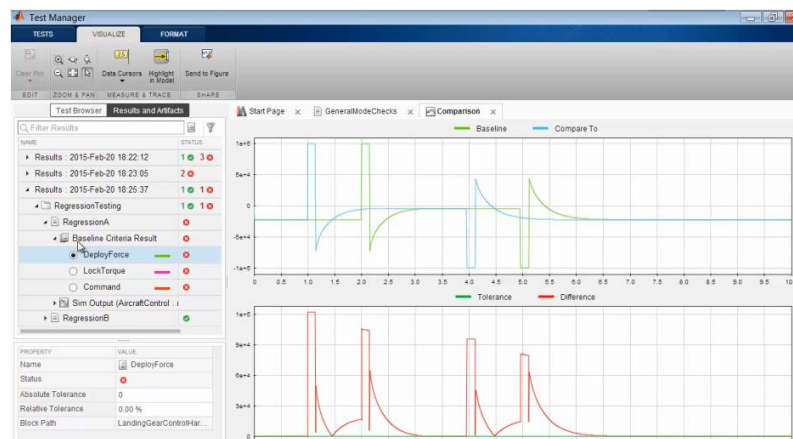
Expanding Portfolio: Simulink Test New Product R2015a

Isolate



Exercise

Analyze



Reuse

- ComponentTesting
 - General Performance Test
 - General Model Checks
 - Functional and Regression tests
 - Signal Builder Baseline examples
 - ExcelDrivenExamples
 - Software-in-the-loop Testing
 - SILtest

Robust Simulation Testing

We will continue to develop capabilities to aid the design & test of increasingly complex systems

Quality

Development Cost

Time to Market