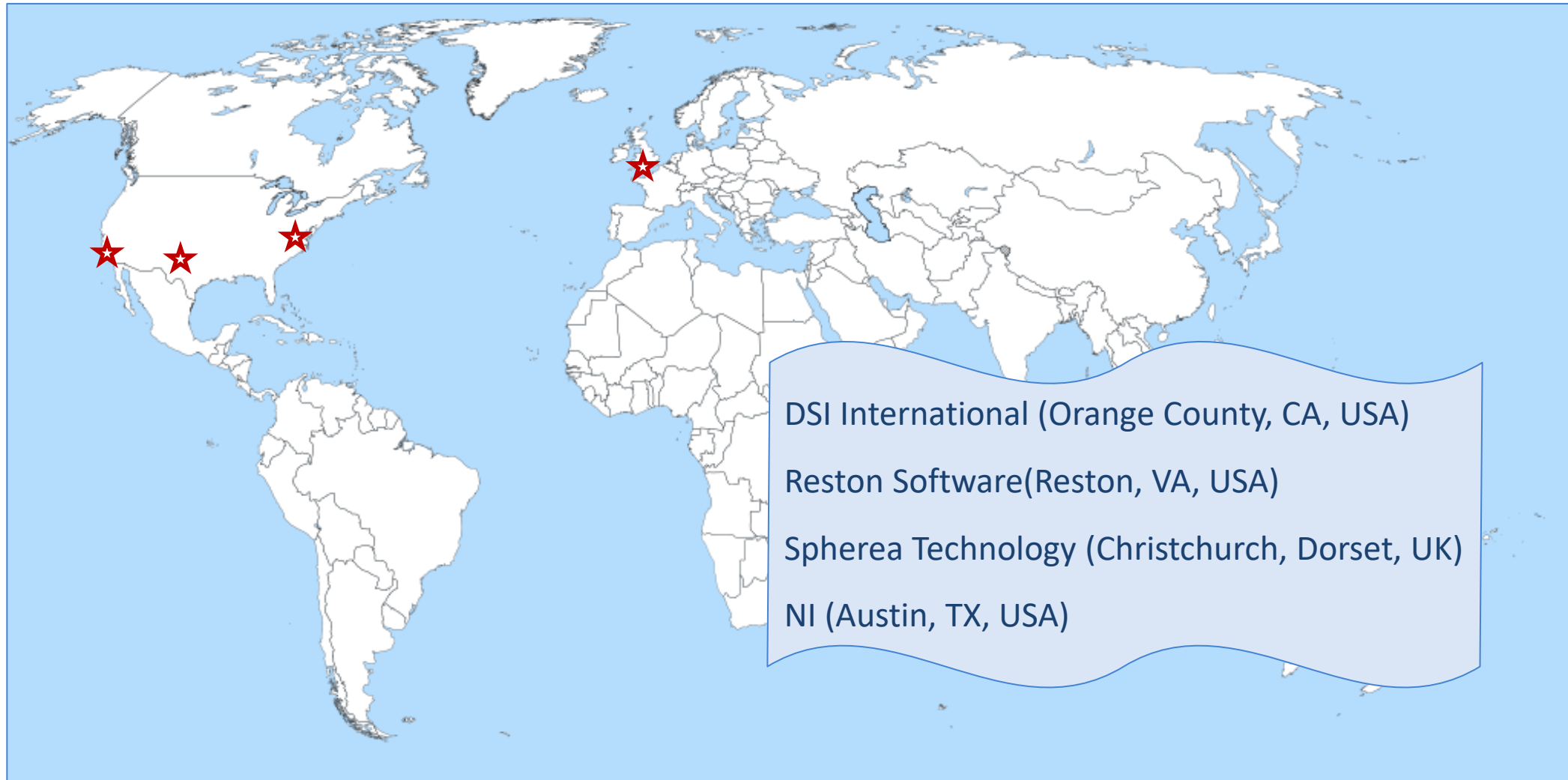


Digital Integration – Design to Sustainment

CATS4D 2021-2 Meeting 2021-11-23, Online

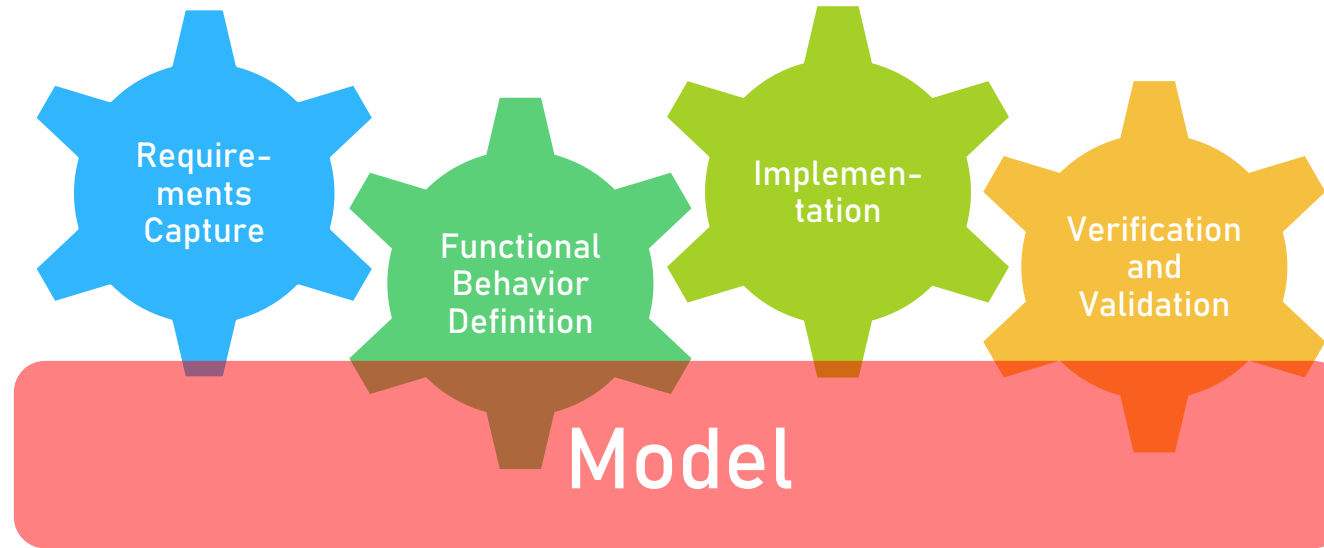
Ion Neag
Software Architect
Reston Software
ion.neag@restonsoftware.com

Demonstration 2021-06-23



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Model-Based Systems Engineering Integration

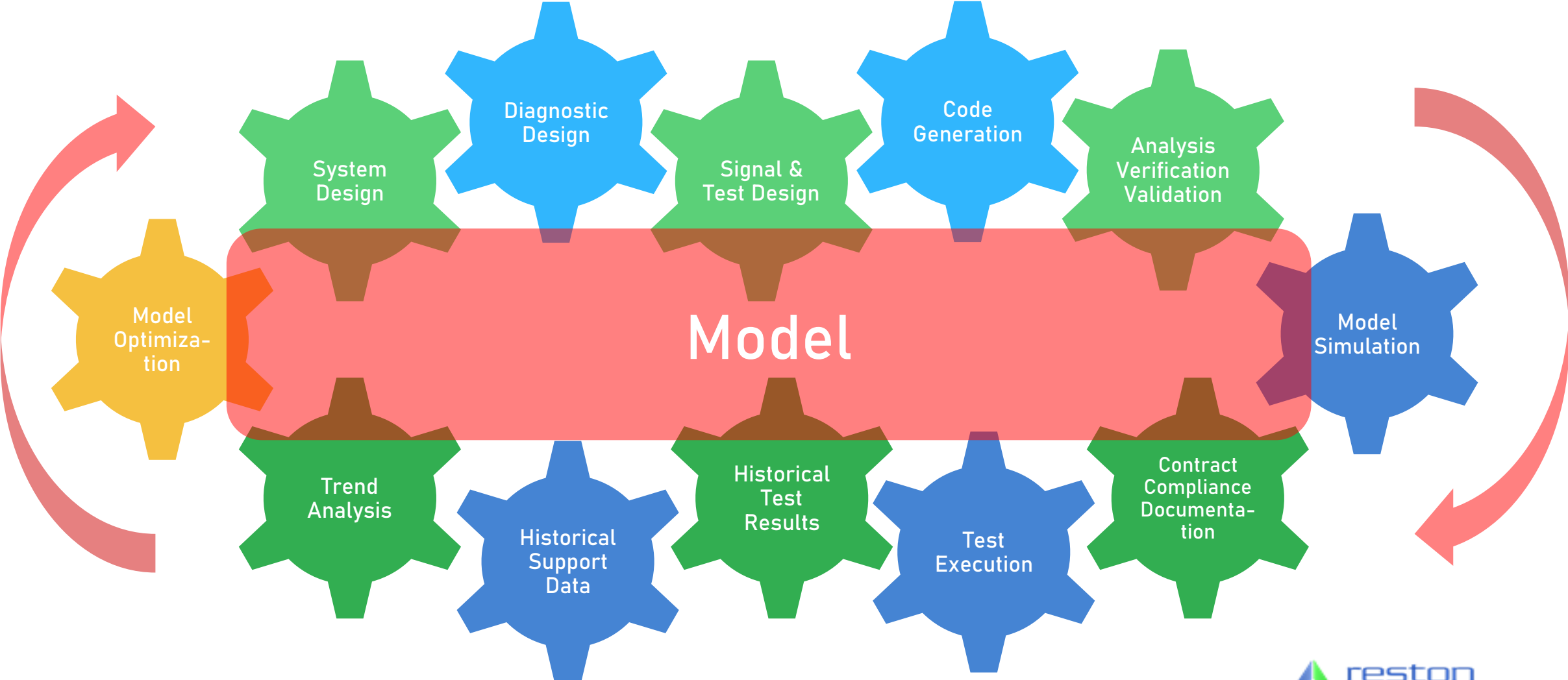


Model-based
<ul style="list-style-type: none">• Model must be precise and complete• Visual design, with multiple views for stakeholders

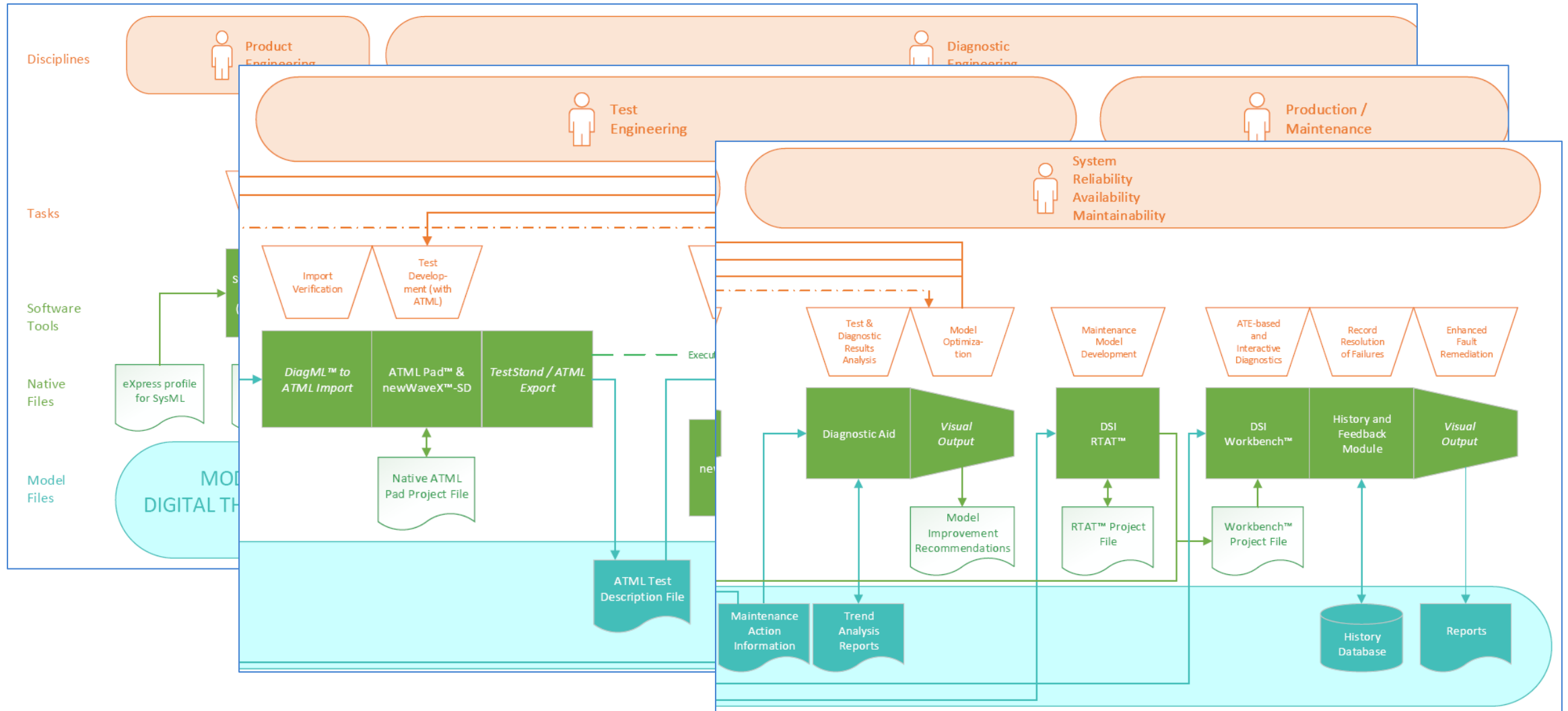
Requirements-driven
<ul style="list-style-type: none">• Full model traceability to user requirements and system requirements

Architecture-centric
<ul style="list-style-type: none">• Ensure structural and functional integrity• Full derivation traceability

Integrated Model-Based Diagnostic, Test, Maintenance and Sustainment Solution

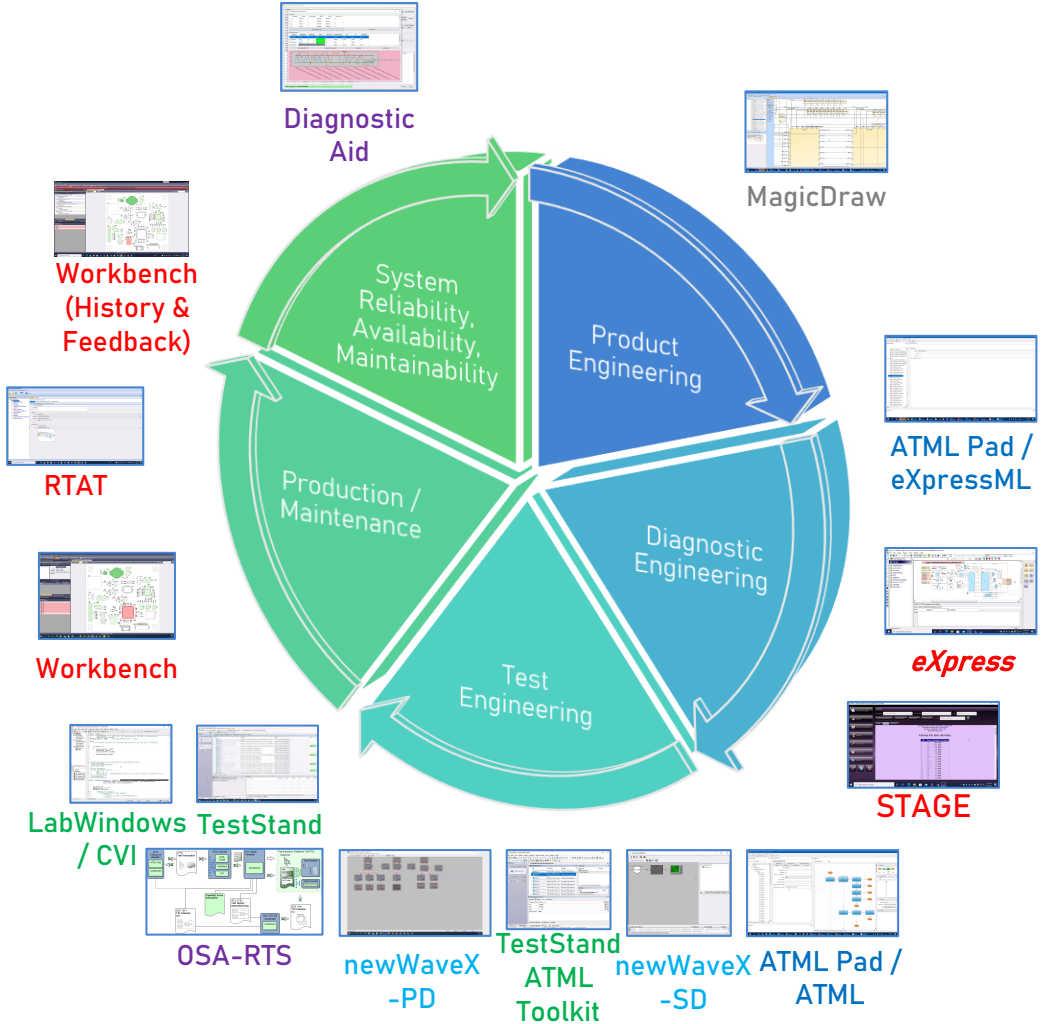


Digital Integration – Design to Sustainment

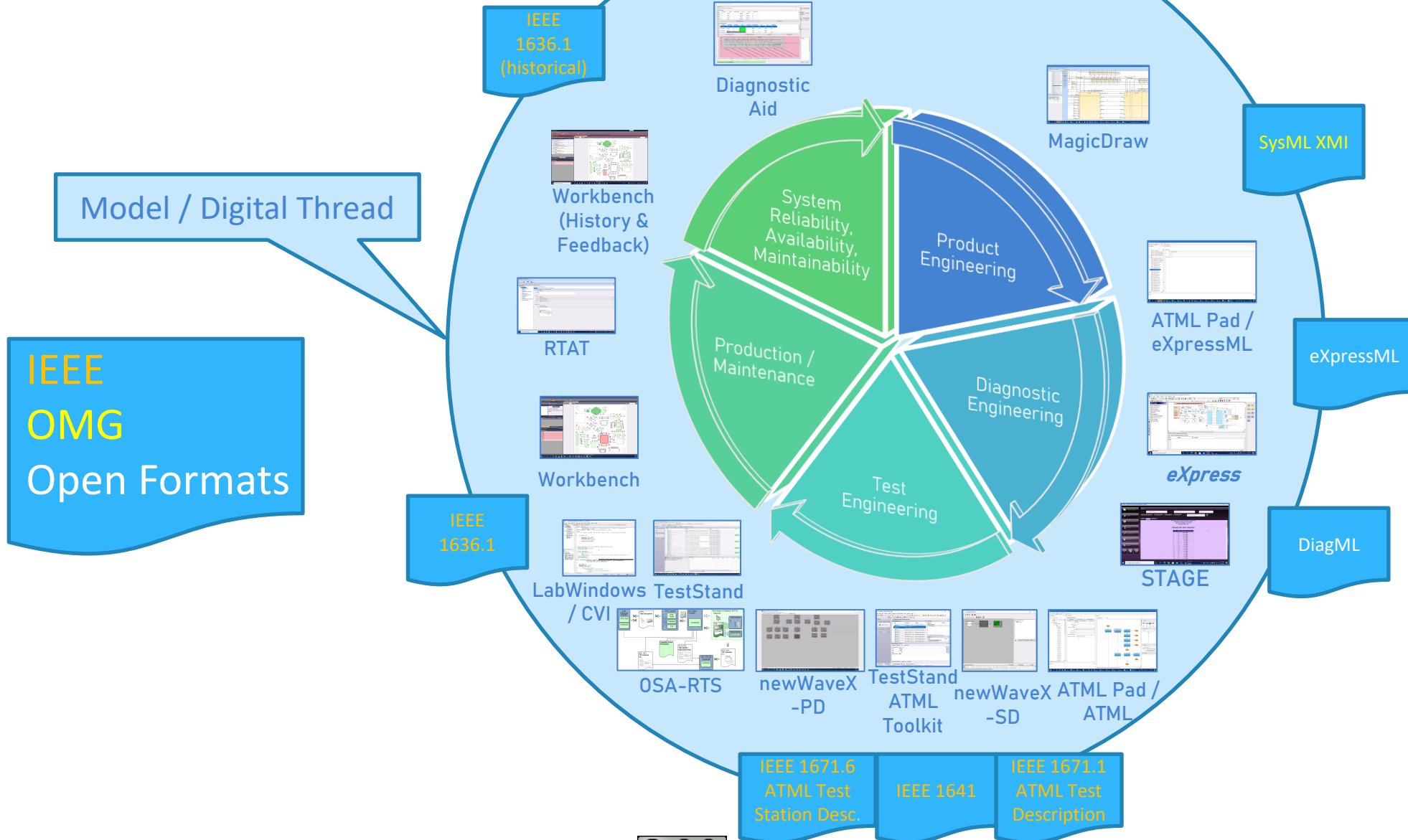


Design to Sustainment : COTS & Open-Source Software

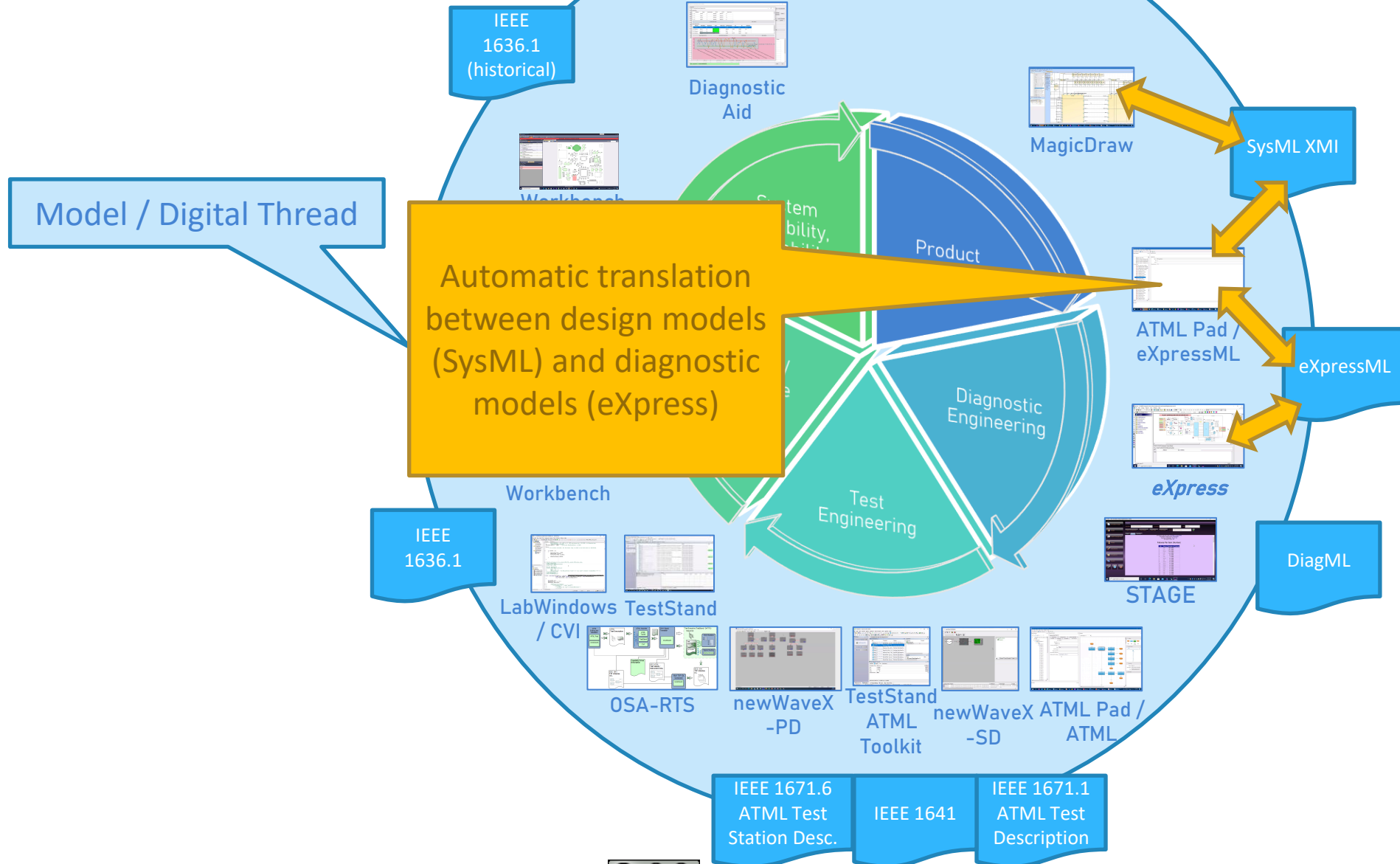
DSI International
 NI
 Reston Software
 Sphera Technology
 UK MOD
 Third Party



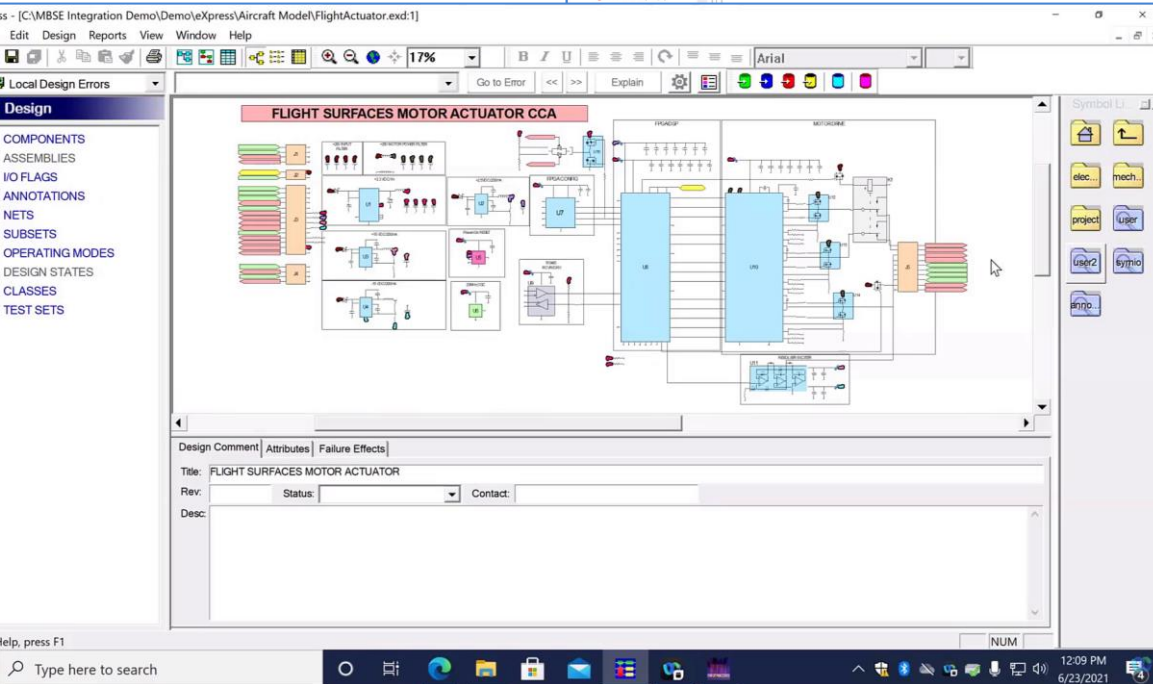
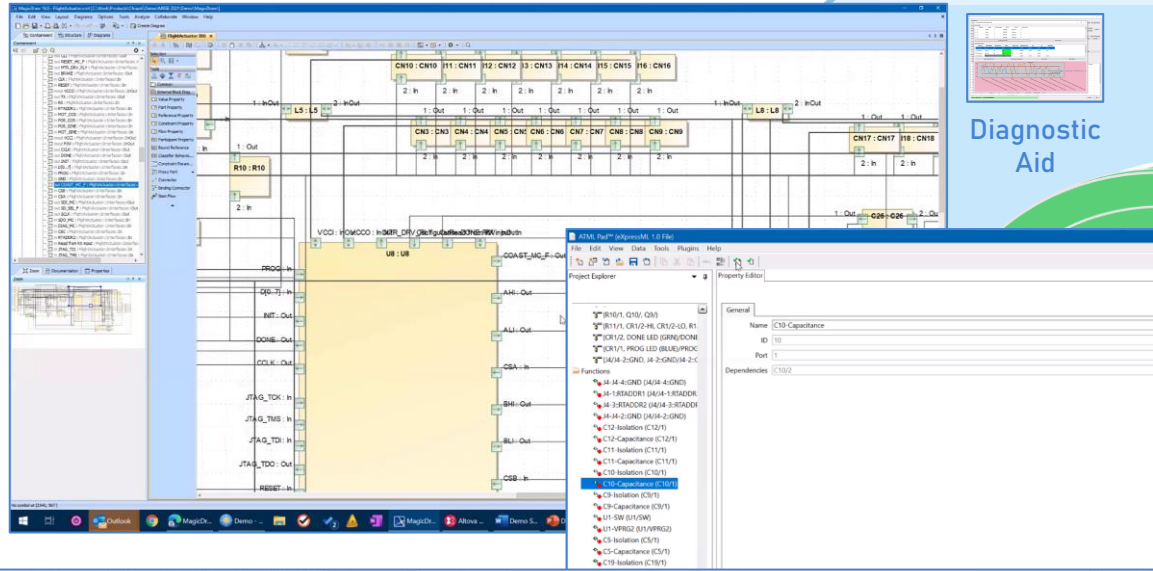
Design to Sustainment : Standard and Open Data Formats



Design to Sustainment : Model-Based Development



Design to Sustainment : Model-Based Development



Diagnostic Aid

MagicDraw

SysML XMI

ATML Pad / eXpressML

eXpressML

eXpress

DiagML

STAGE

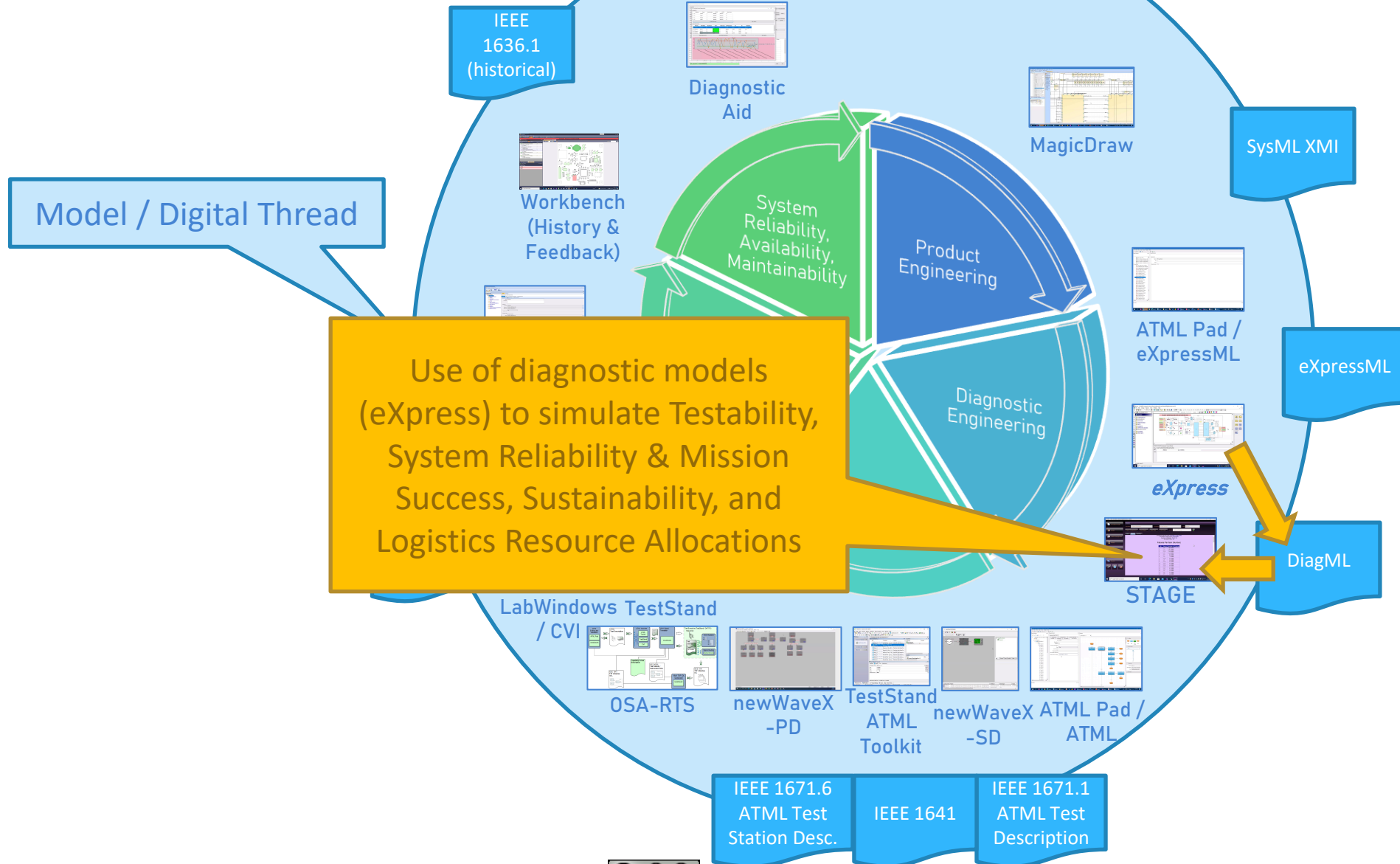
TestStand
ATML
Toolkit

newWaveX
-SD

ATML Pad /
ATML

IEEE 1641
IEEE 1671.1
ATML Test
Description

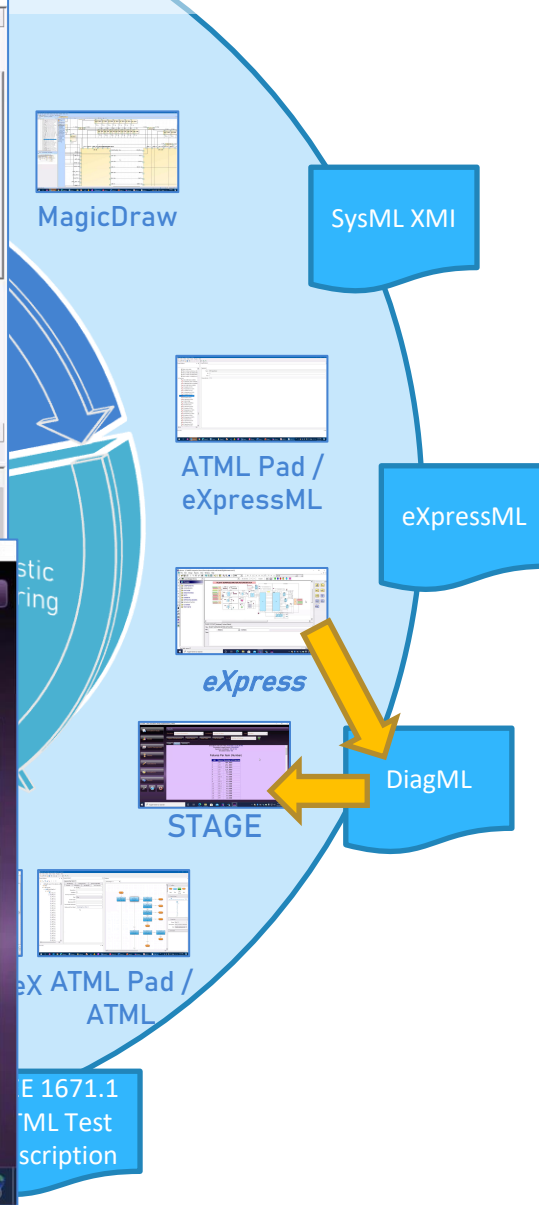
Design to Sustainment : Model-Based Development



-Based Development

The screenshot shows the eXpress software interface. The top window displays a 'Diagnostic Study' with a list of tests and fault groups on the left, and a schematic diagram of a system on the right. The bottom window shows a 'Simulation Study' with a table of 'Failures Per Item (Number)'.

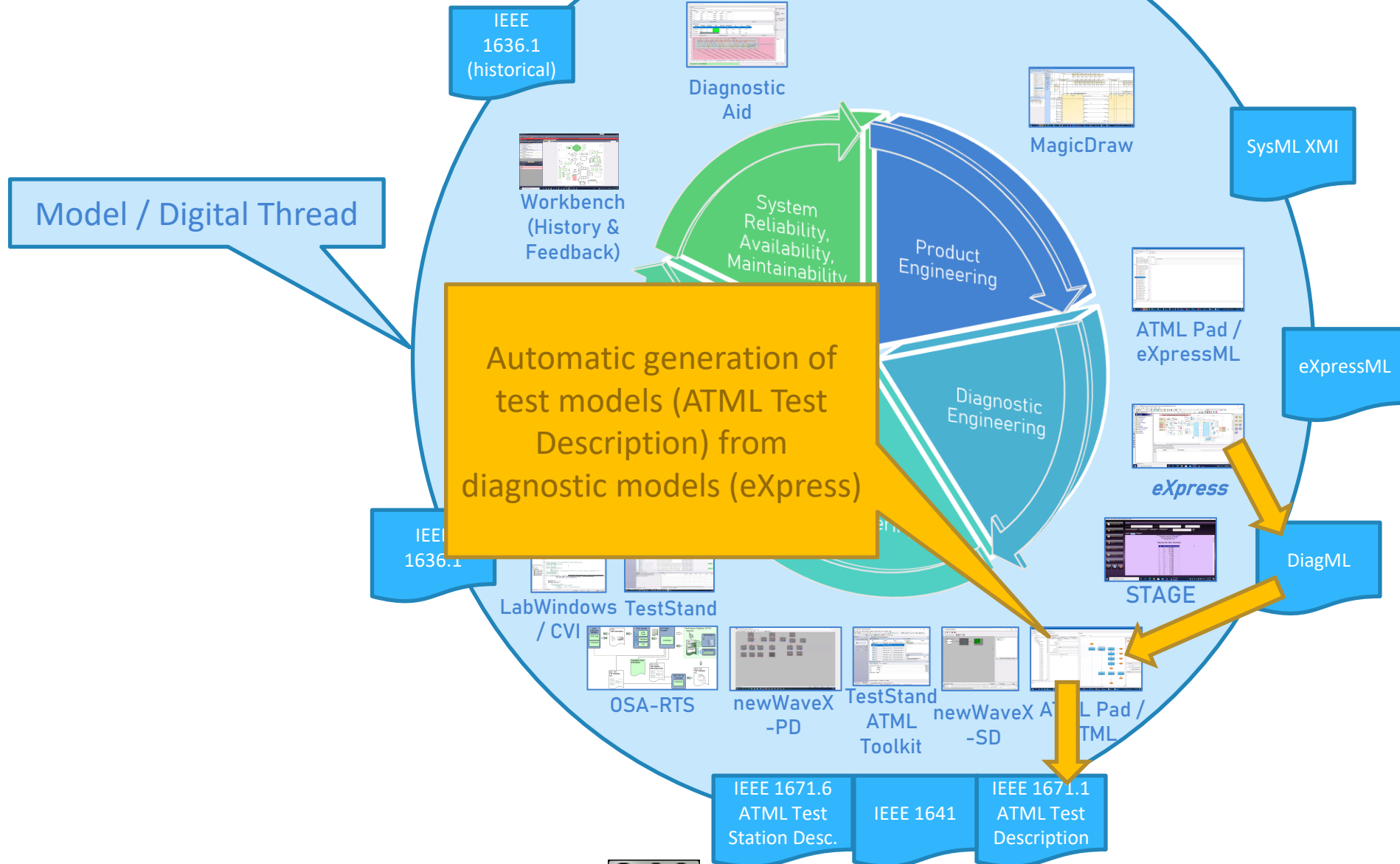
##	Items	Number of Failures
1	U8	49.000
2	J3	21.000
3	U10	19.000
4	J5	13.000
5	U7	8.000
6	J4	7.000
7	U14	6.000
8	J1	6.000
9	U12	6.000
10	U13	6.000
11	U16	6.000
12	U15	6.000
13	U11	5.000
14	U2	5.000
15	U4	5.000
16	U9	4.000



E 1671.1
ML Test
description



Design to Sustainment : Model-Based Development



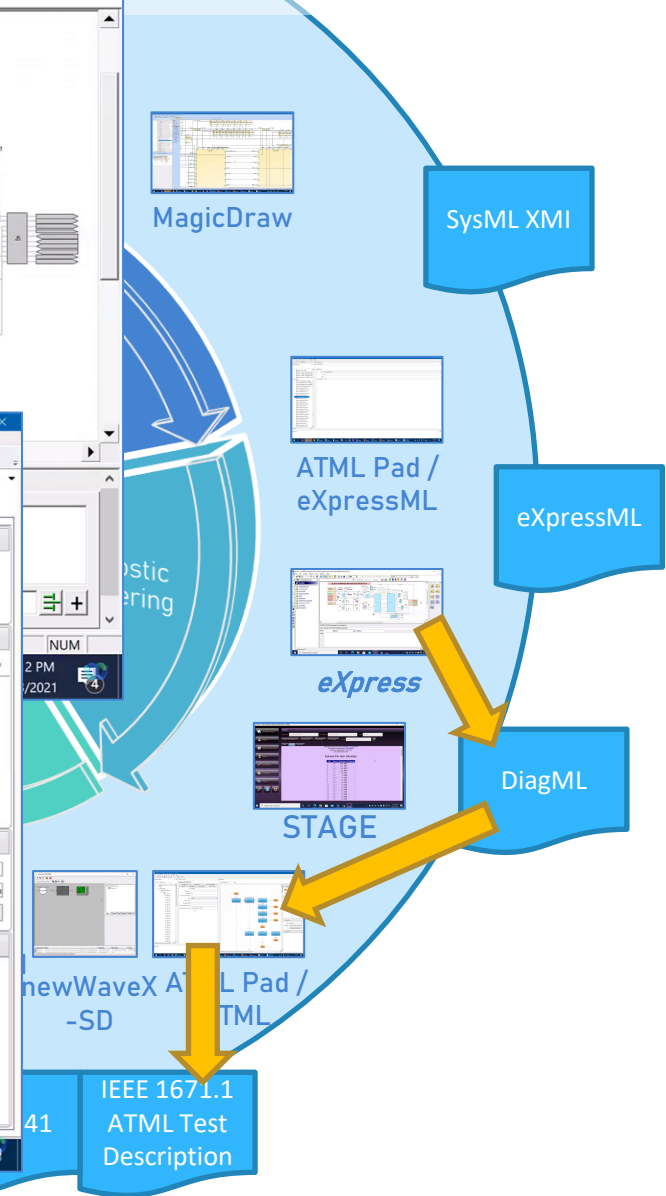
Model / Digital Thread

Automatic generation of test models (ATML Test Description) from diagnostic models (eXpress)

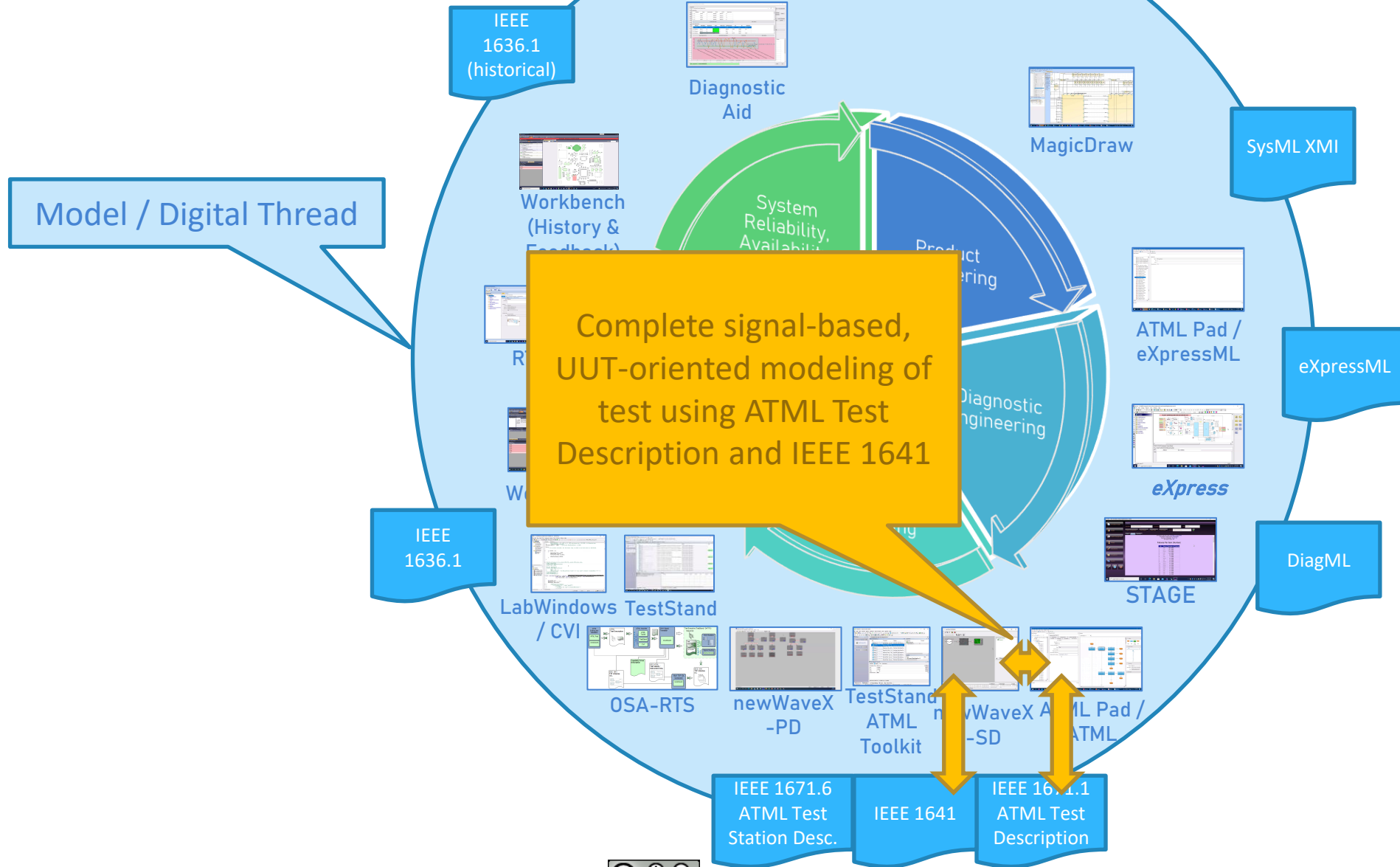


-Based Development

The image displays two software windows. The top window is 'eXpress - [NewDiagnosticsDoc1:1]' showing a diagnostic study with a list of tests (Test 1-6 to Test 2-4) and a central schematic diagram of a circuit board. The bottom window is 'ATML Pad™ (ATML Test Description 2017 / Project)' showing a sequence step 'Test_1-1' with a flowchart of test steps and a properties editor.

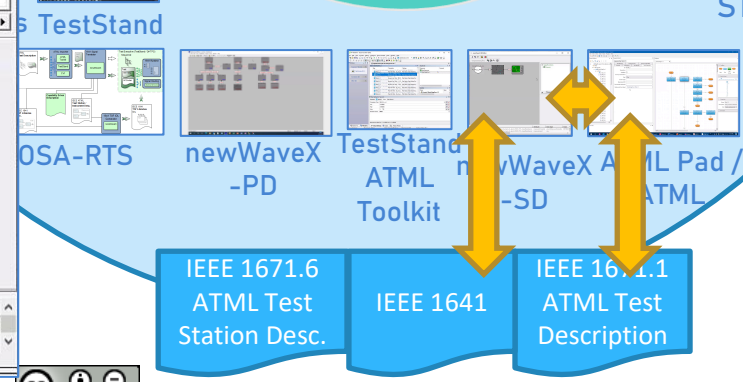
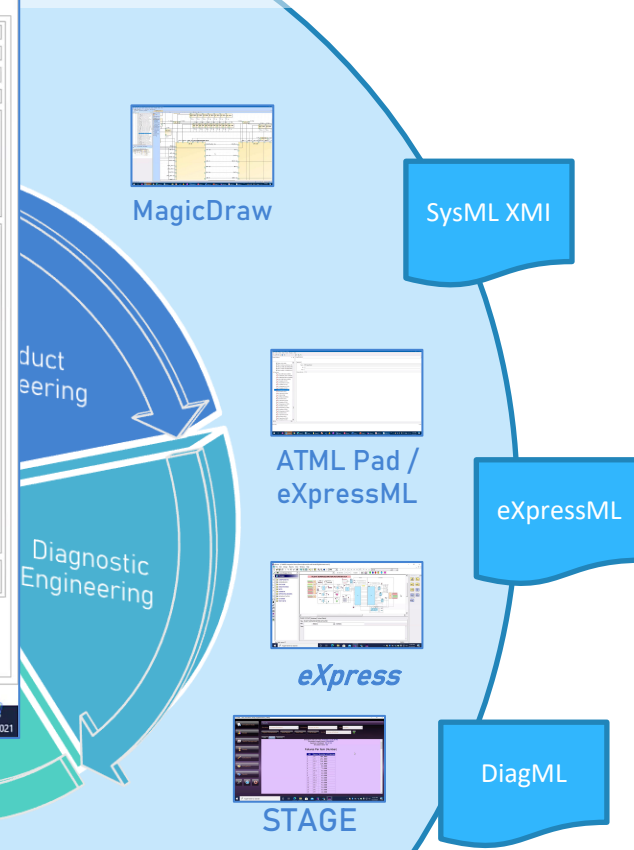


Design to Sustainment : Model-Based Development

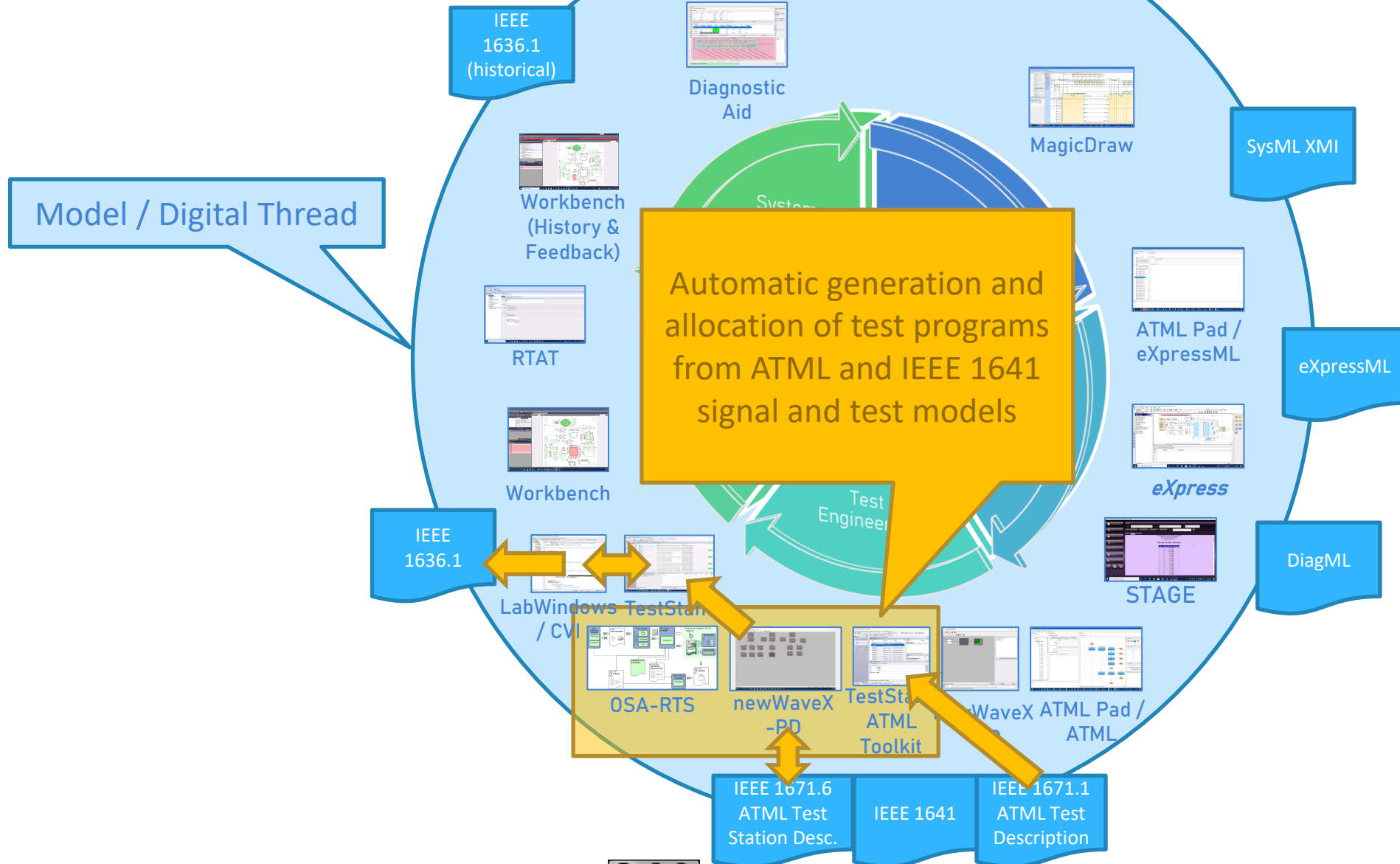


el-Based Development

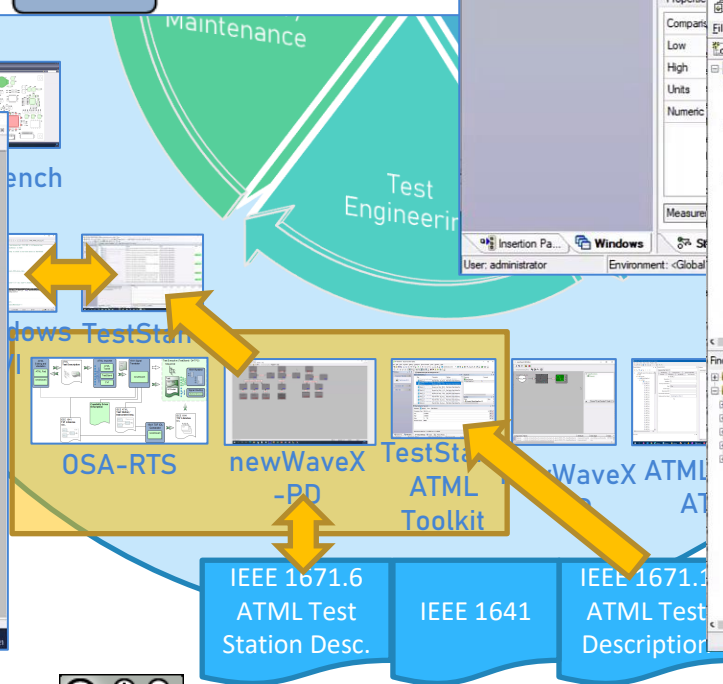
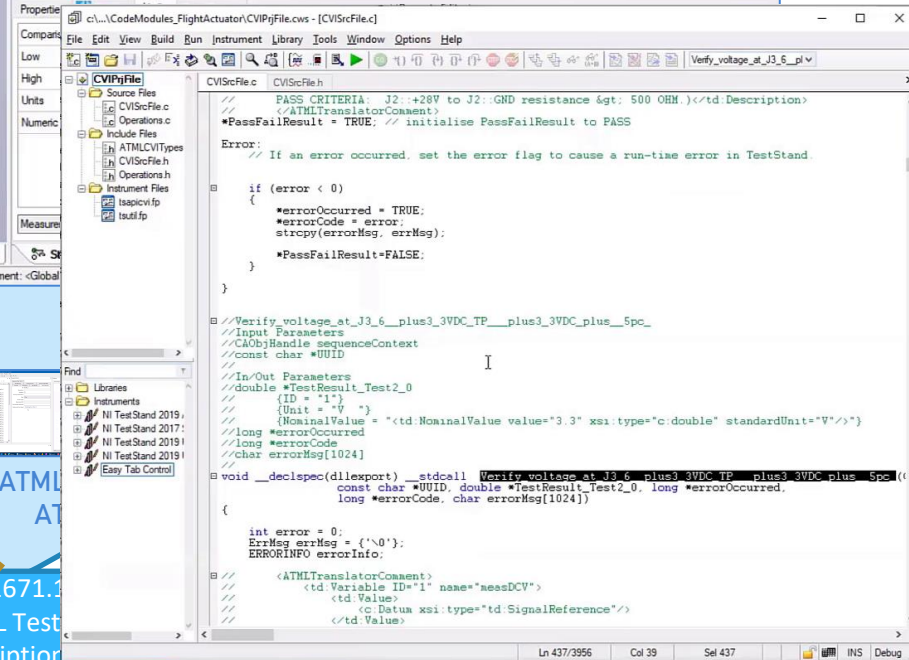
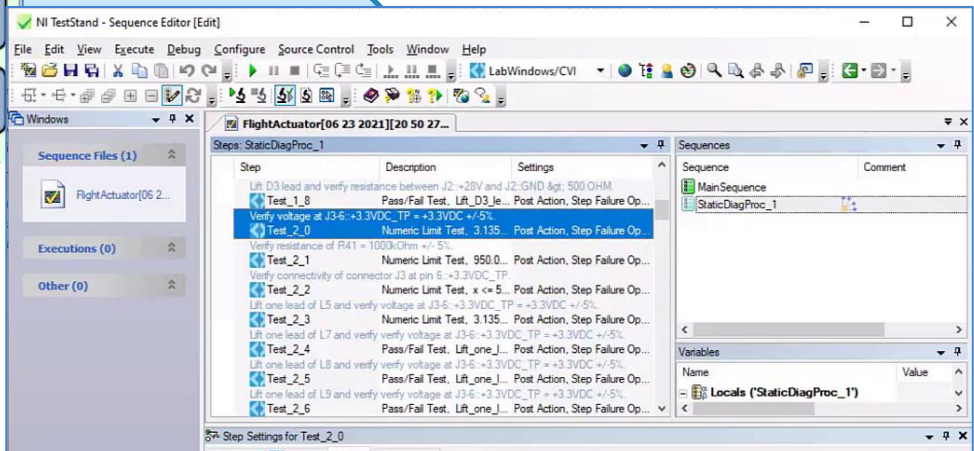
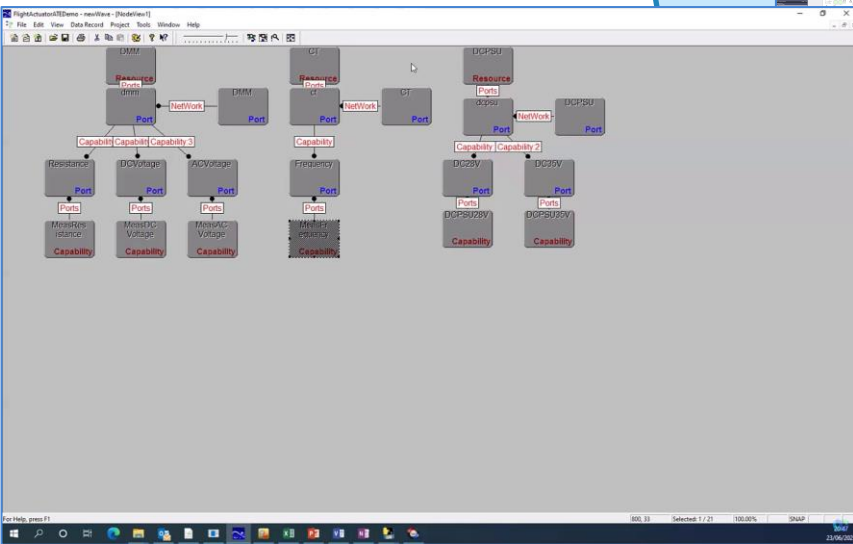
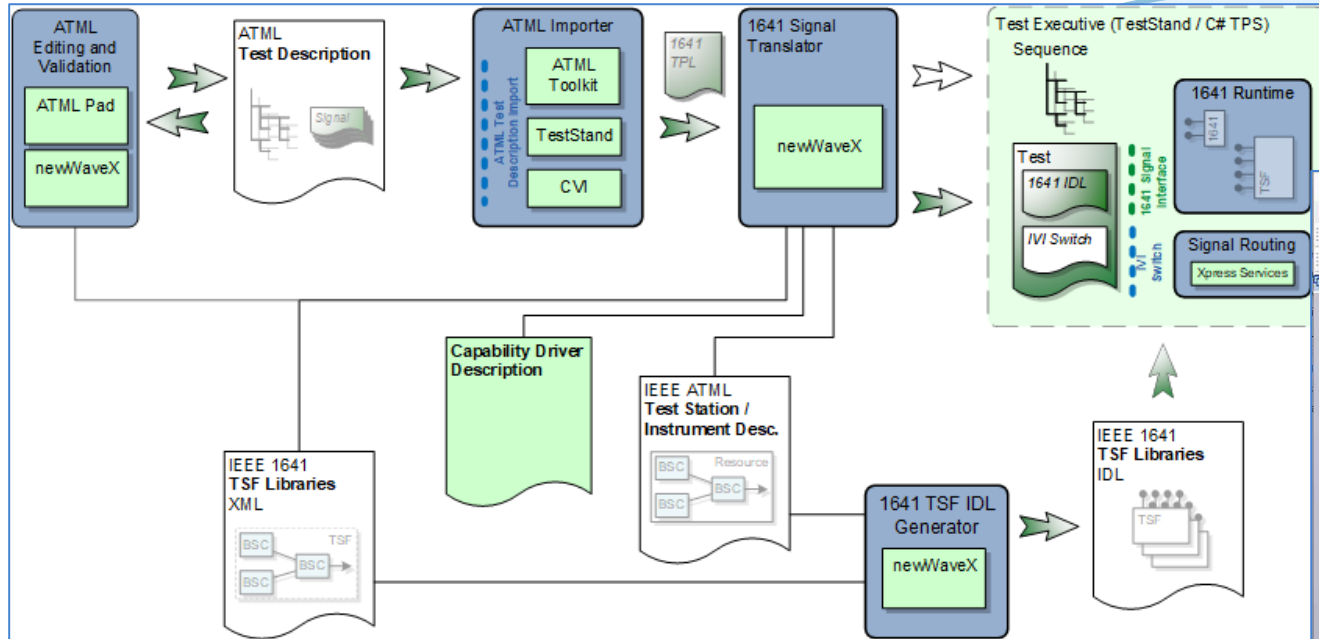
The screenshot shows the ATML Pad interface with a Project Explorer on the left listing various tests, a Property Editor in the center for configuring a test case (Test2_0), and a newWaveX-SD Editor at the bottom showing a circuit diagram and a signal function viewer.



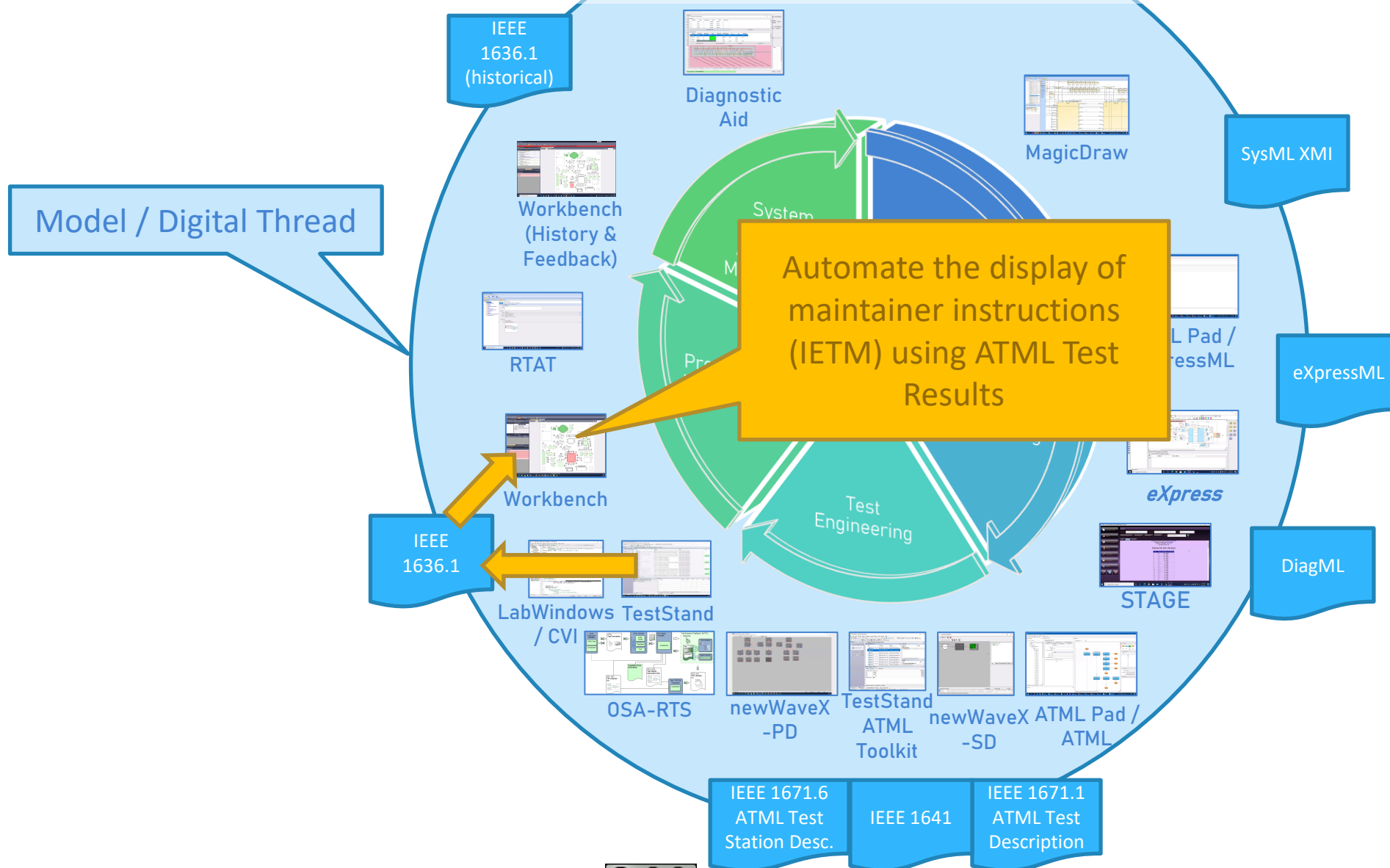
Design to Sustainment : Model-Based Development



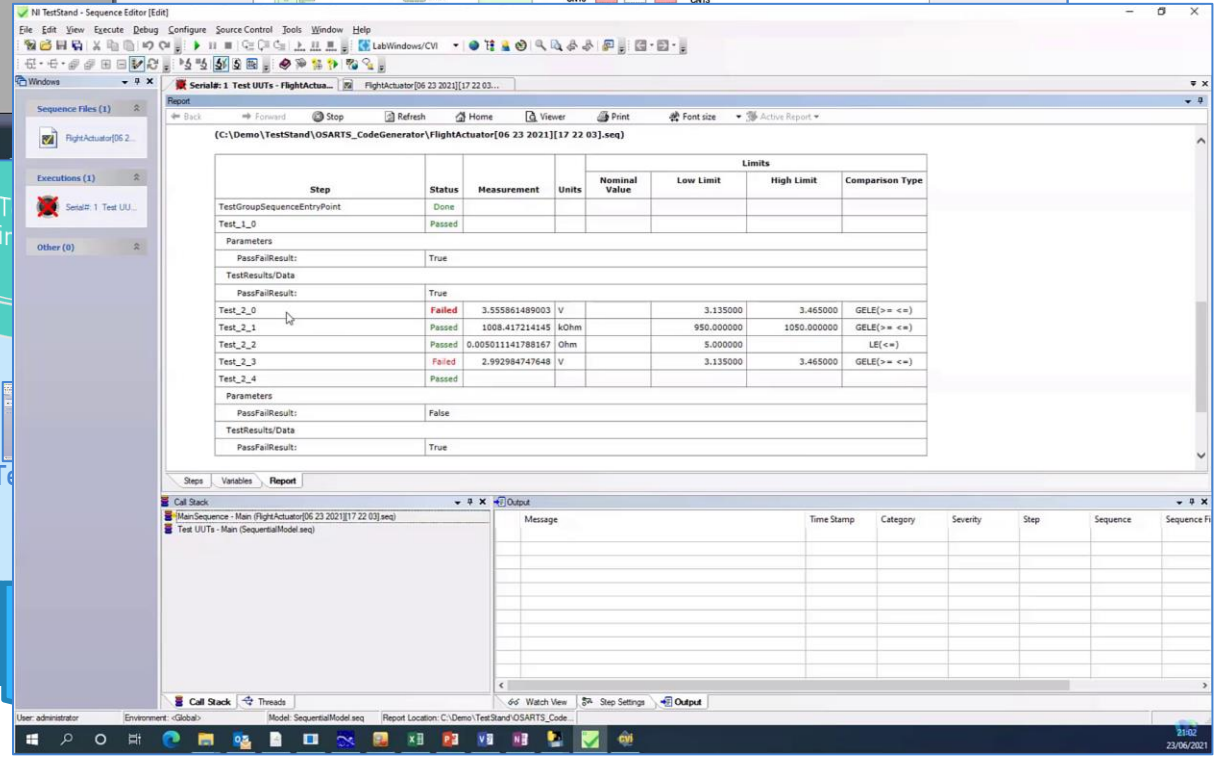
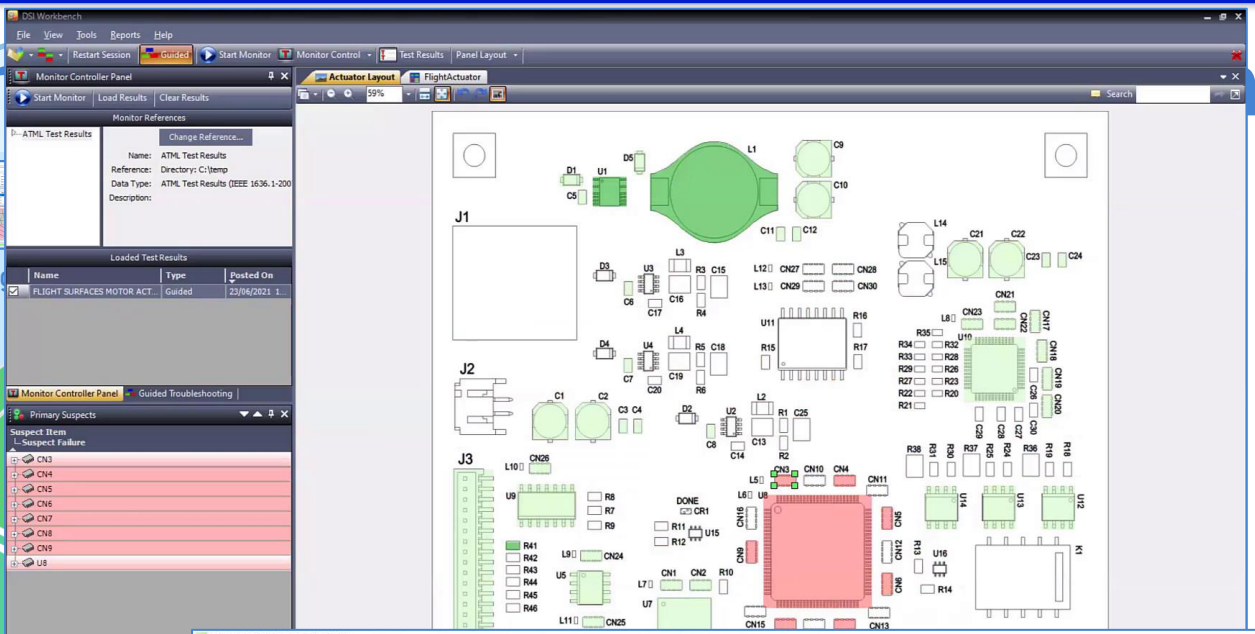
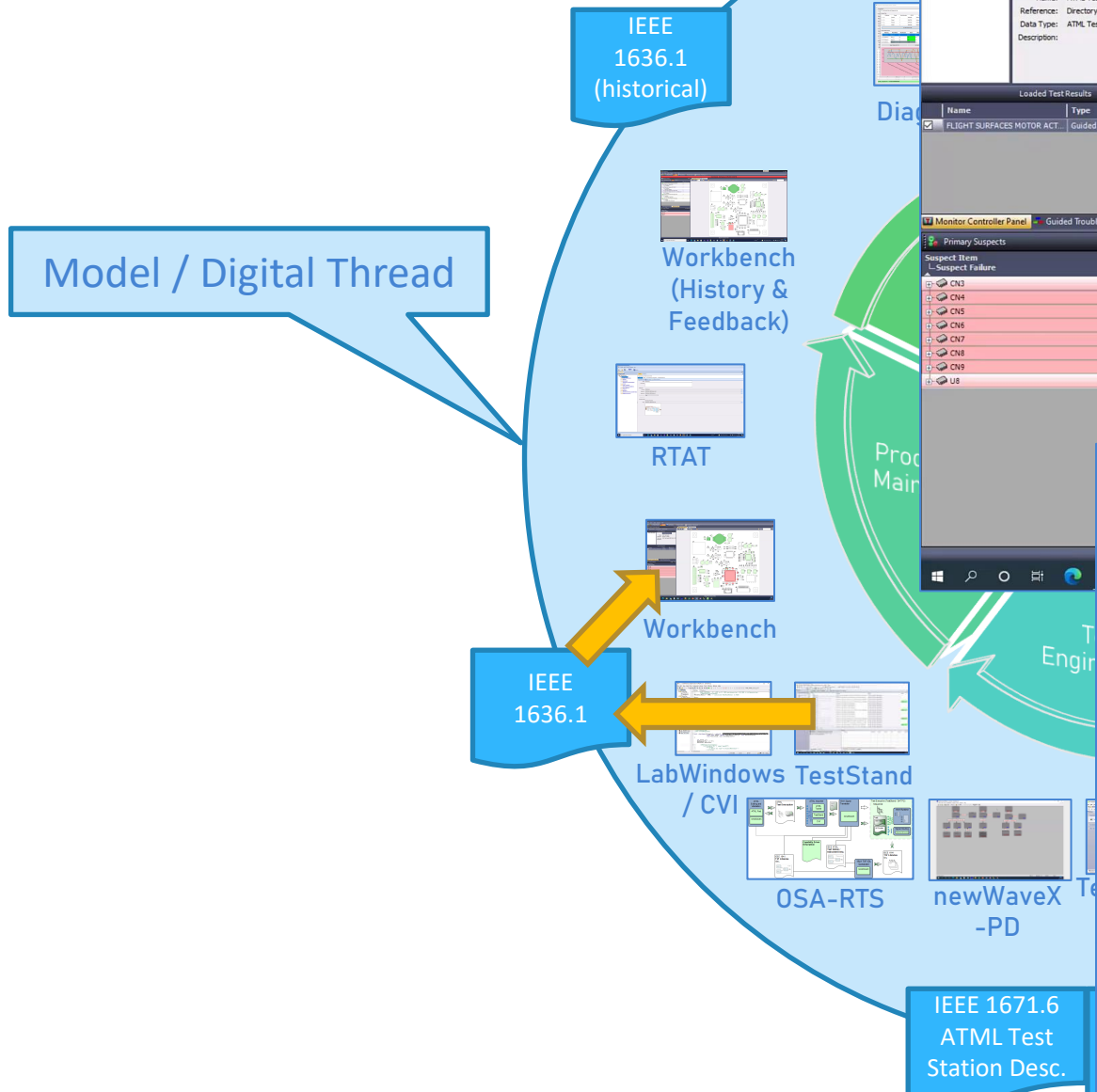
Model-Based Development



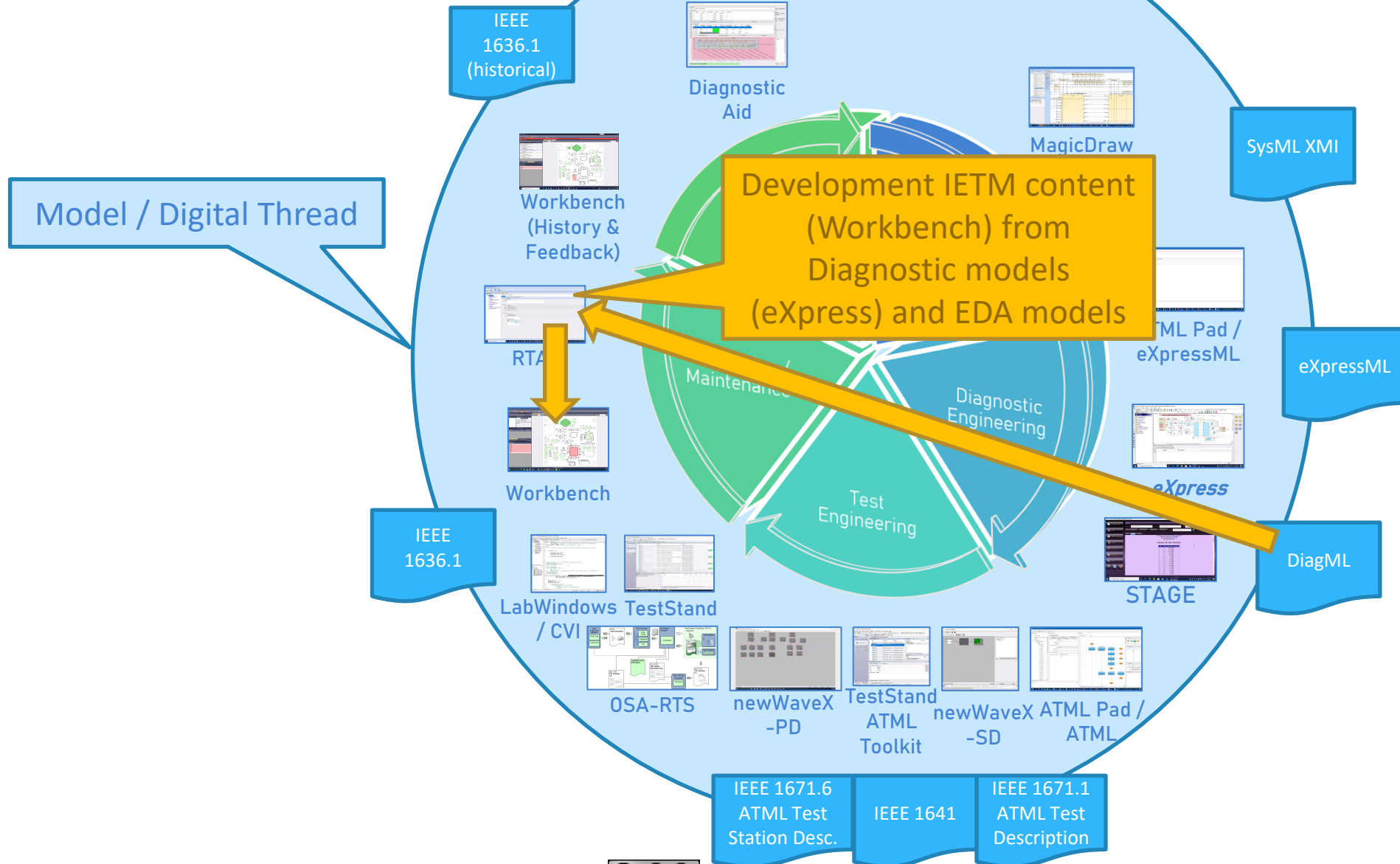
Design to Sustainment : Model-Based Development



Design to Sustainment

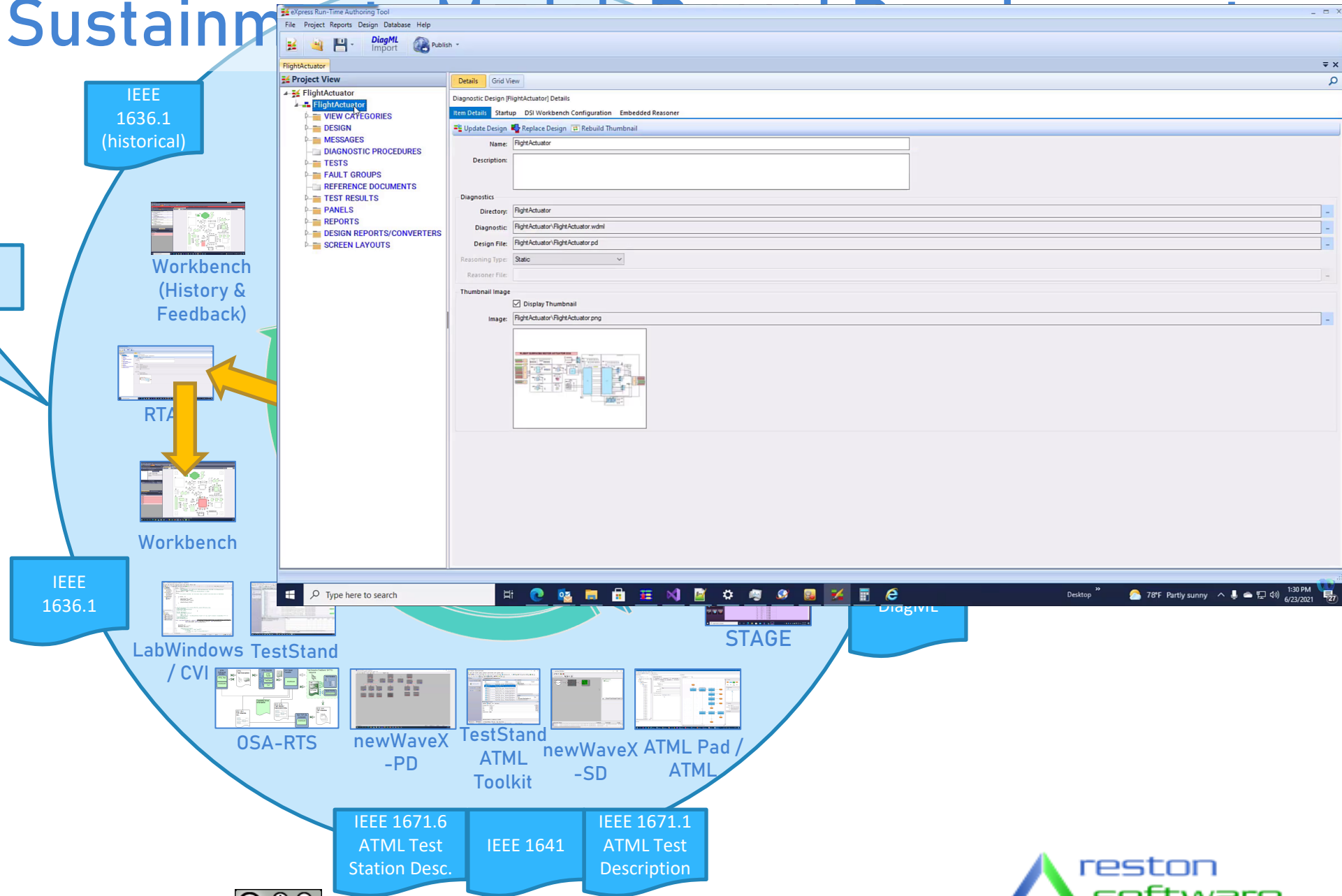


Design to Sustainment : Model-Based Development

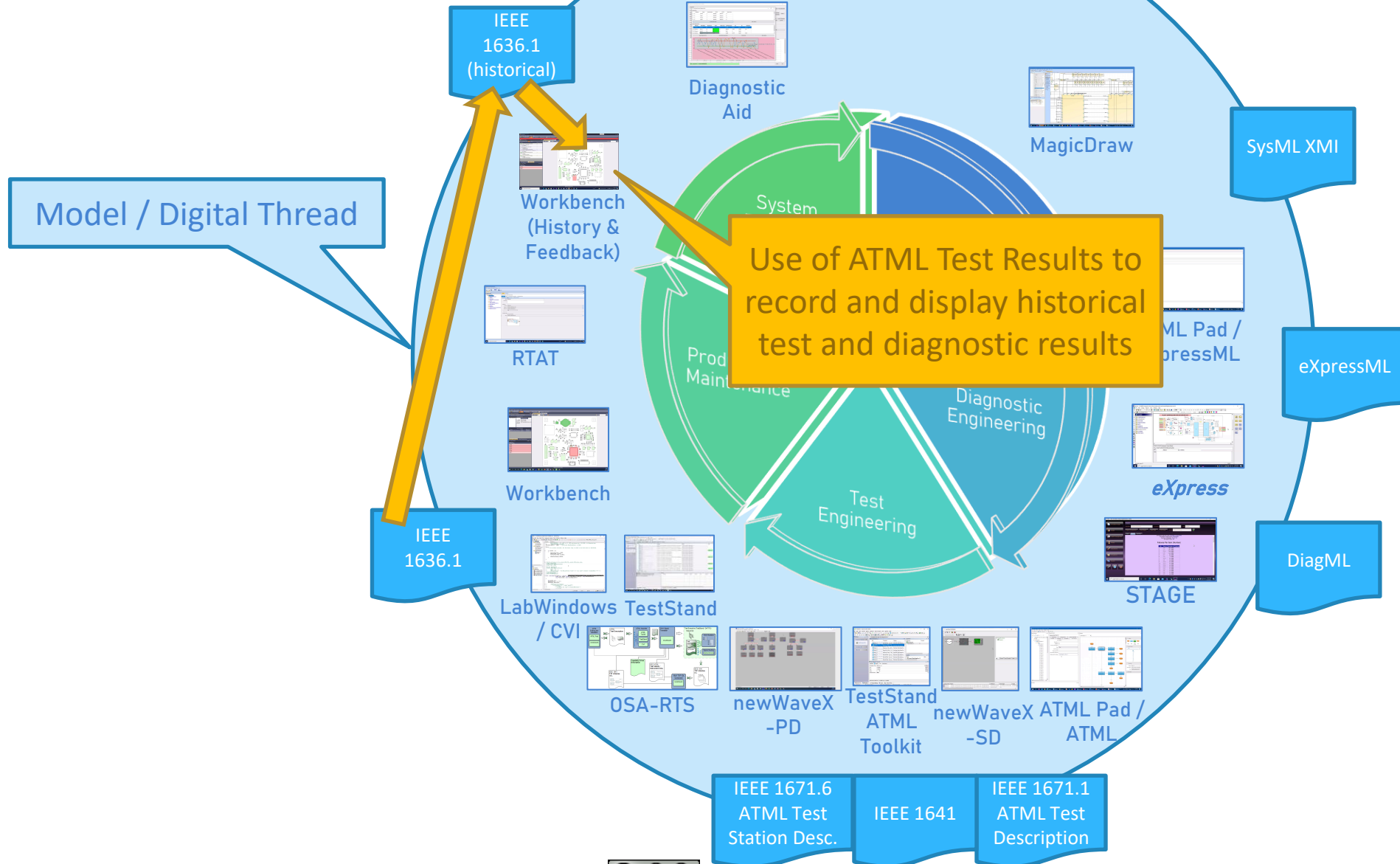


Design to Sustainm

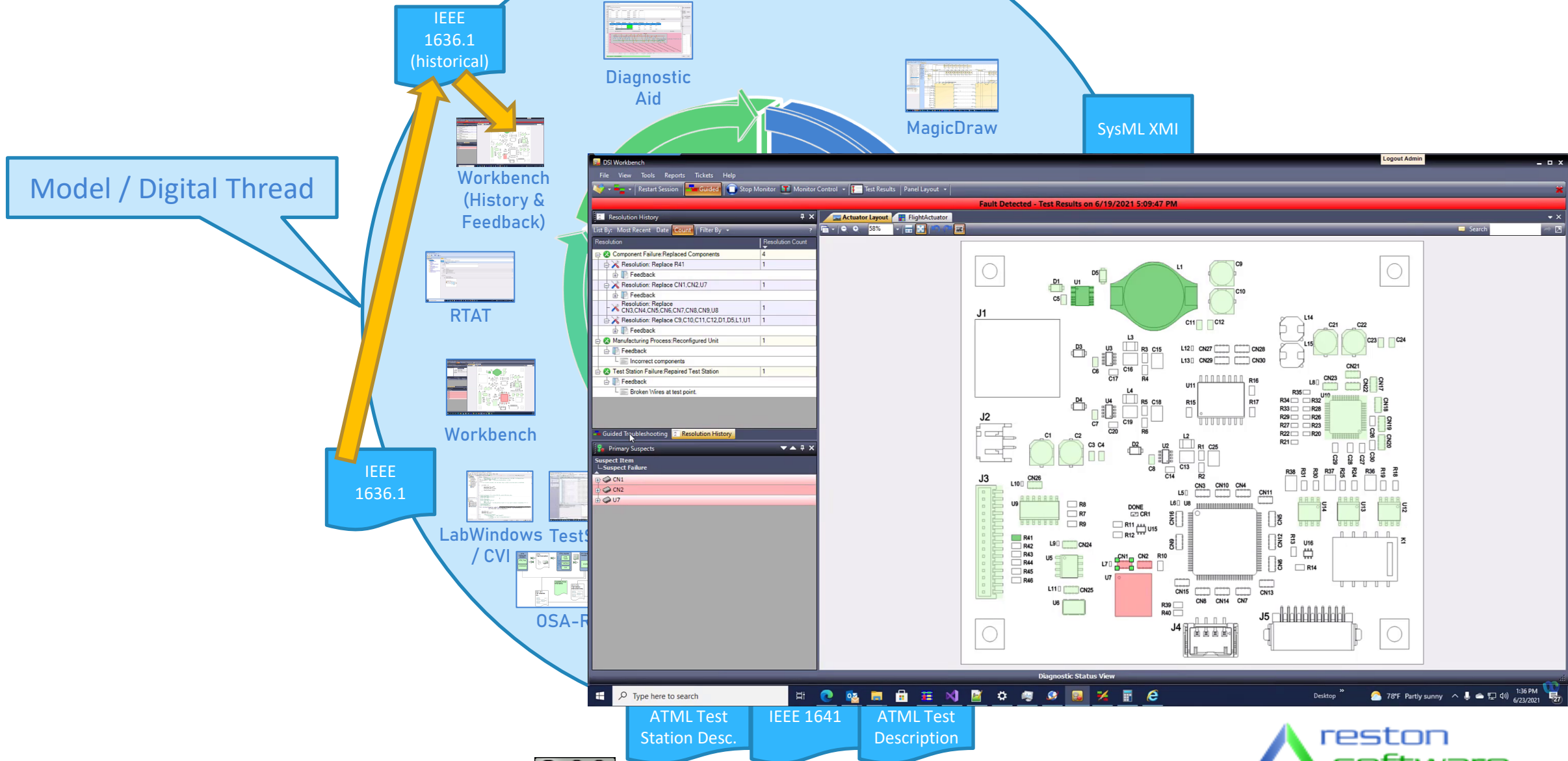
Model / Digital Thread



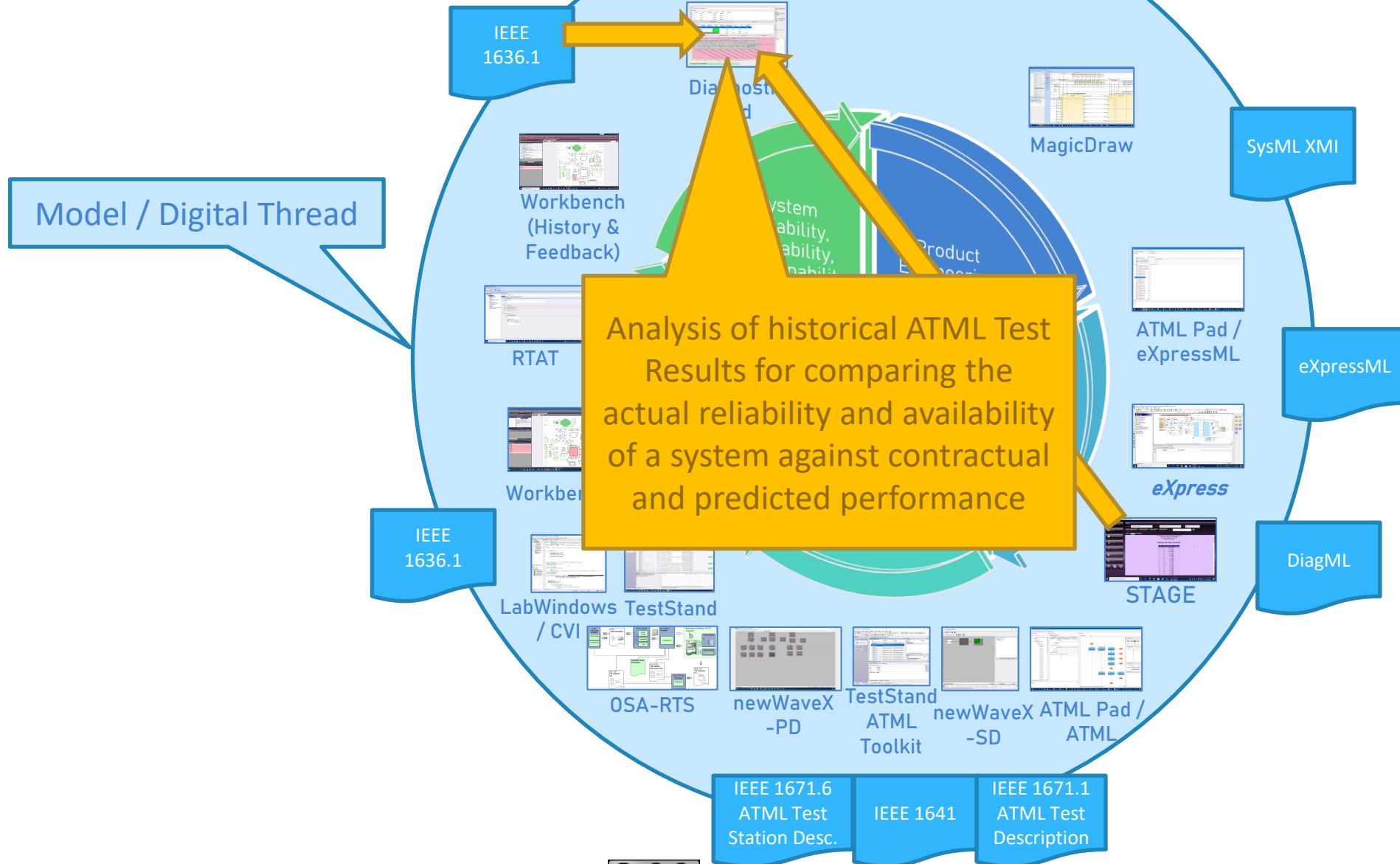
Design to Sustainment : Model-Based Development



Design to Sustainment : Model-Based Development



Design to Sustainment : Model-Based Development



Design to Sustainment : Model-Based Development

IEEE 1636.1

Model / Digital Thread

Workbench (History Feedback)

RTAT

Workbench

LabWindow / CVI

IEEE 1636.1

Diagnostic Aid

Diagnostic Aid Prototype Version 1.12 Beta

Diagnostic Set

Test Results Data for Diagnostic Set

Selected Files	FileName	Result	Serial Number	ATS ID	UUT ID	Node Count
1	C:...	Passed	1	SPH7393	Unknown	17
2	C:...	Failed	1	SPH7393	Unknown	6
3	C:...	Passed	1	SPH7393	Unknown	17
4	C:...	Failed	1	SPH7393	Unknown	6

Unique Measurements

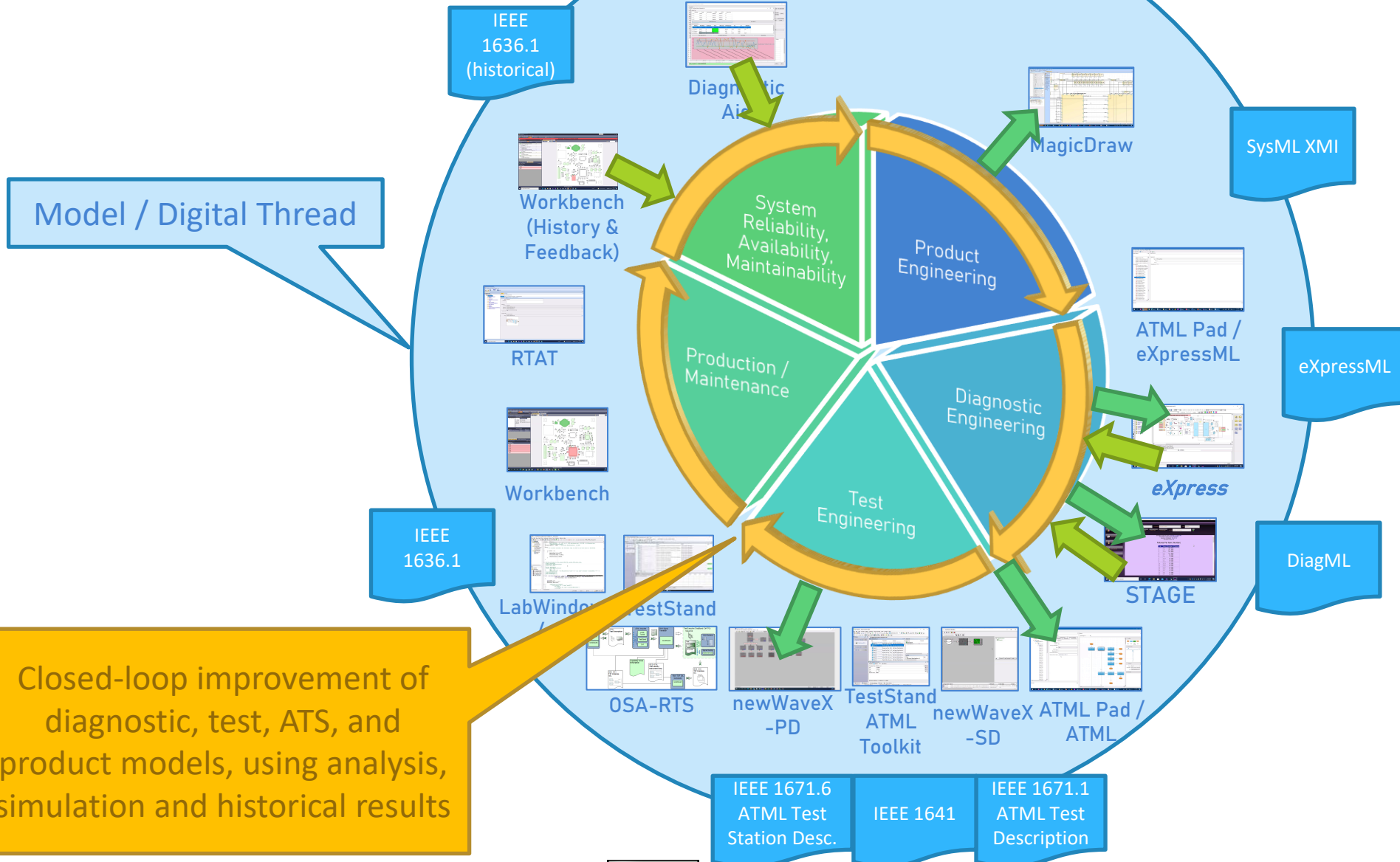
Heirachy	Node Name	ResultCount	Pass %	Meas Count	Mean Measureme	SD	CV	SD/Limit %
1 [C:\Demo\...	Test_2_0	65	49.23	65	3.3159	0.2022	0.061	61.26
2 [C:\Demo\...	Test_2_1	33	100	33	999.976	5.7875	0.0058	5.79
3 [C:\Demo\...	Test_2_2	33	100	33	0.005	0	0.0053	
4 [C:\Demo\...	Test_2_3	33	54.55	33	3.3028	0.1775	0.0537	53.78

Test_2_0

FlightActuator[06 23 2021][17 22 03]_Report[1][17 56 48][23 06 2021], 3.152

Ready - Elapsed time = : 0.8624264000000039

Design to Sustainment : Model-Based Development



Summary

- COTS tools from different vendors and open-source software from UK MOD
 - *Visual design* for system, diagnostic, and test model data
 - Integrated through *industry-standard data formats*
 - Configuration files and adapter modules provide the “glue”
- Model-based design
 - Built-in checks ensure that model is *precise* and *complete*
 - *Traceability* of model data ensures that fielded applications are based on the same information used for contract compliance
 - Enables *closed-loop* model maturation based on field data - model reflects real-life system behavior
- Digital thread
 - Through-life support solution
 - Integrates engineering disciplines across design and sustainment processes
 - “Authoritative Source of Truth” accelerates redesign lifecycle

Observations

- This demonstration stores Model data in *separate XML files* stored in a common, shared directory. Data are maintained consistent by the tools and the process flow.
 - Applications can store all data in a single repository. This could be a database, a data store accessed through a Web Services interface, etc.
- This demonstration showcases *one possible* process flow.
 - The capabilities and open interfaces of the software tools support many variations of this process flow.
 - Please contact the tool vendors for inquiries:
 - [DSI International Products](#)
 - [TestStand ATML Toolkit](#)
 - [ATML Pad](#)
 - [newWaveX](#)

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- ATML is the “Automatic Test Markup Language”, standards IEEE1671 and IEEE 1636.1
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Glossary & Abbreviations

- **UUT = Unit Under Test:** The entity to be tested. It may range from a simple component to a complete system
- **Test program:** A program specifically intended for the testing of a **UUT**
- **TPS = Test Program Set:** The complete set of hardware, software, and documentation needed to evaluate a **UUT** on a given test system
- **ATE = Automatic Test Equipment:** a system providing a test capability for the automatic testing of one or more **UUTs**. The ATE system consists of a controller, test resource devices, and peripherals. The controller directs the testing process and interprets the results. The test resource devices provide stimuli, measurements, and physical interconnections.
- **ATS = Automatic Test System:** Includes the **ATE** as well as all support equipment, software, **test programs**, and adapters.
- **ATML = Automatic Test Markup Language:** a family of standards specified in IEEE 1671, IEEE 1636.1, and IEEE 1641

Thank you!



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