

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

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Rev 3

This demonstration and the underlying integrated solution were developed jointly by the following companies:

- DSI International (eXpress, RTAT, Workbench, STAGE)
- National Instruments (TestStand ATML Toolkit)
- Reston Software (ATML Pad)
- Sphera Technology (newWaveX, Diagnostic Aid)

Note: This diagram represents the process flow of the referenced demonstration. It is not intended to describe the entirety of functional and interfacing capabilities of the software tools. These capabilities support many other process flows. Please contact the tool vendors for detailed information:

- [DSI International Products](#)
- [TestStand ATML Toolkit](#)
- [ATML Pad](#)
- [newWaveX](#)

ATML is the “Automatic Test Markup Language”, standards IEEE 1671 and IEEE 1636.1

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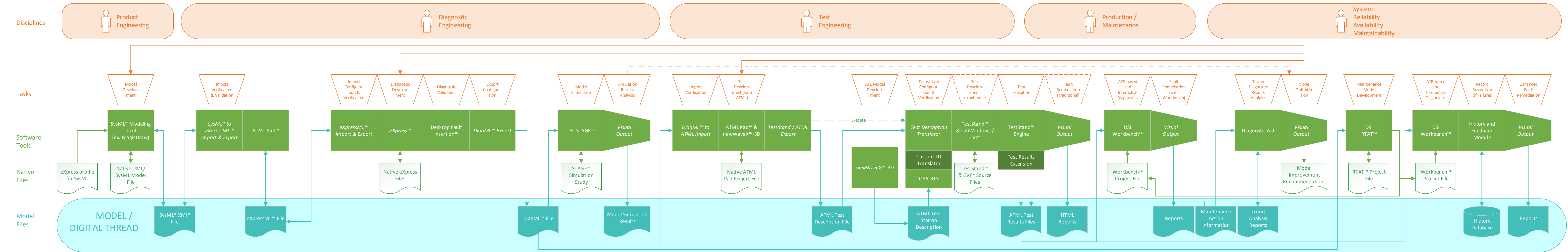
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- Process Notes**
- The SysML design follows a set of rules that ensure compatibility with the eXpress importer.
 - Stereotypes from the eXpress profile are assigned to items that are imported into eXpress (ex. Blocks, Ports, Connectors, States). The properties defined in stereotypes are set.
 - eXpress-specific items are created (ex. “eXpress Output Functions”)
 - The imported model must be precise & complete
 - Manual verification & validation of imported data
 - Automatic validation against the eXpressML schema
 - The imported data contains Components, IO Flags, Nets and States; hierarchical models are supported
 - Missing information can be added during eXpressML import
 - Diagnostic development (after import from SysML) consists of:
 - (1) Specifying failure data for Components
 - (2) Describing Tests
 - (3) Auto-generating a Diagnostic Study
 - (4) Evaluating performance of fault detection & isolation
 - (5) Iterating until requirements are met
 - (6) Validate diagnostic procedures, to ensure suitability for deployment
 - Performs a turnkey sustainment simulation using diagnostic model data from eXpress.
 - Uses a Monte Carlo process based on modeled failure rates and distribution functions.
 - Supports “cocktails” of diagnostics, prognostics & scheduled maintenance.
 - Provides a mechanism for validating model accuracy based on simulated performance
 - 130+ scripted calculations analyze different aspects of sustainment-related behavior over time-including critical failures, false alarms, RAMS-T metrics, prognostic performance, etc.
 - The imported data contains Tests, Test Groups (“fault tree” sequences), Fault / Failure data, and UUT data (Components, Ports)
 - Test development (after import from DiagML) consists of:
 - (1) Describing stimuli, measurements, and limits
 - (2) Describing Test behavior using sequences of Operations
 - (3) Describing preconditions for Tests and Test Groups
 - Signal-based, UUT-oriented models make possible the targeting of different ATE platforms and test languages / executives performance, etc.
 - The default translator creates an initial test program, which is completed manually, following the ATML information imported into code comments
 - The OSA-RTS Custom Translator auto-generates complete, runnable test programs through:
 - (1) Translation of signal-based ATML Operations into calls to a hardware control API (commands, instrument drivers, “Hardware Abstraction Layer”)
 - (2) Resource allocation (automatic, manual, or mixed) – requires signal-oriented models of ATE resources and their capabilities (ATML Test Station Description)
 - (3) Switch path calculation (manual or automatic; static or dynamic)
 - DSI Workbench operates in in “Health Monitoring Mode”, with the “pass/fail” Test Results from the ATML Test Results documents. When any test fails, it displays a red horizontal bar and highlights the suspect items.
 - From this point, the technician can continue with any additional testing as needed to isolate to smaller fault groups or to a single component (depending on diagnostic design)
 - Analysing historic test results allows for the actual reliability and availability of a system to be compared against contractual and predicted performance.
 - Changing our models will adjust past predictions, aligning the new model predictions with current performance will represent a more accurate model of the system.
 - Changes to the model will reflect true performance and can be used to address better designs and updates to meet original or adapted system goals
 - The Workbench models developed in RTAT contain:
 - (1) Diagnostic information
 - (2) System topology diagram
 - (3) Optionally, system images mapped to topology through overlays
 - (4) Messages & callouts
 - (5) Configuration information for mapping to ATML Test Results
 - History database collects diagnoses and the corresponding failure resolution
 - Historical Resolutions from the history database can be displayed in DSI Workbench as an empirical complement to the engineering-based diagnostics developed in eXpress.