DSI international, inc.

eXpress™ Newsletter

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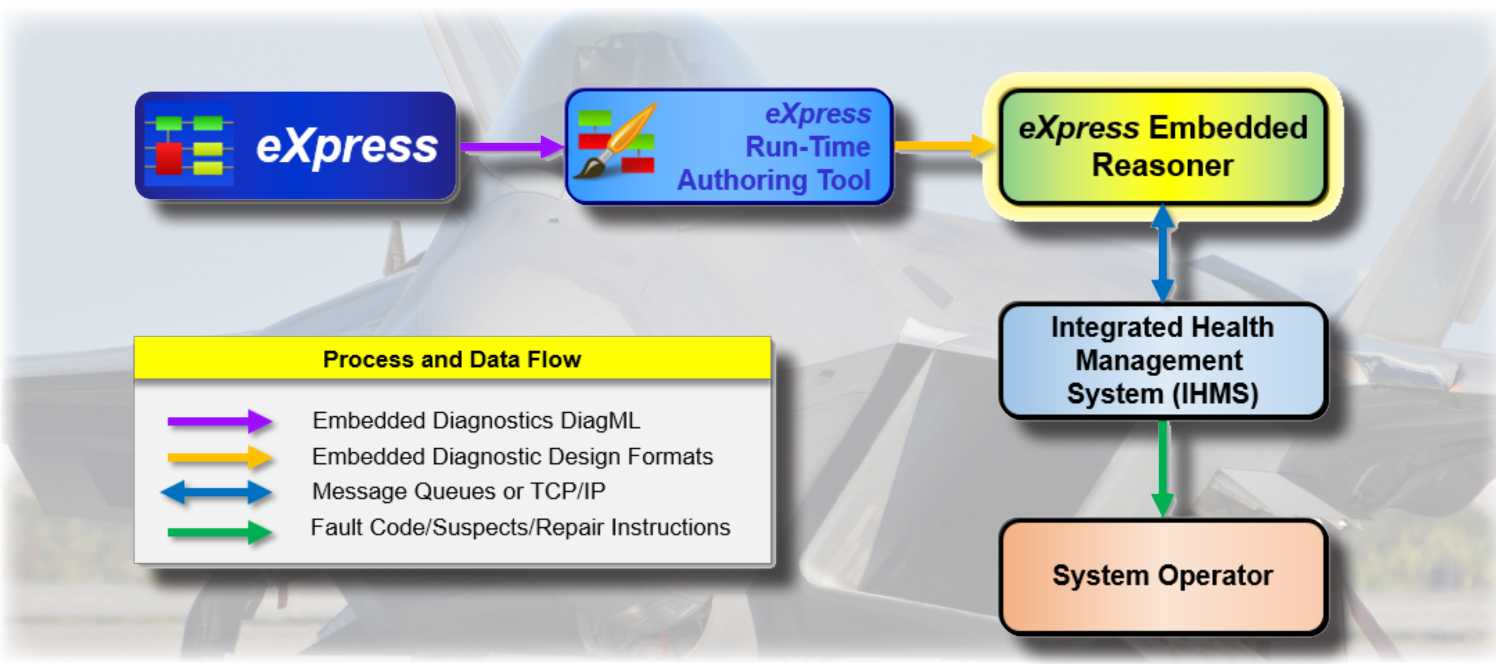
Embedded Reasoning goes "Platinum"

There is a new "platinum" capability in DSI's Integrated System Diagnostic Design (ISDD) Tool Suite that provides a direct path between your model in ***eXpress*** and the diagnostics on your embedded system. This diagnostic "digital thread" between Design Development and Operational & Support / Sustainment has never been so integrated and seamless.

As the benefits of Model-Based Systems Engineering (MBSE) are increasingly recognized, those who have already been relying on the expert knowledge captured in ***eXpress's*** high-end diagnostic models are finding themselves instantly ahead of the curve. Effective model-based sustainment must start during Design Development. Those who exploit model-based diagnostic design as a core interdisciplinary design competency will see all their projects go platinum!
The portion of the ISDD process dedicated to Embedded Reasoning is illustrated below.



Platinum Tracks:

1. Embedded diagnostics are developed by creating a functional dependency model and diagnostics in ***eXpress***.
2. The model is then exported to the Run-Time Authoring Tool (RTAT) and converted into a compact format, used by the Embedded Reasoner in the Integrated Health Management System (IHMS).
3. The on-board Diagnostic Reasoning capability, which is exhaustive compared to traditional methods (which simply report "failed" test results from BIT), is fully transferrable to aircraft, vehicle, ship-deck, depot, ground or any other testing platform. This provides unprecedented integration of diagnostic expertise during all stages of design and sustainment.
4. Refer to the "Diagnostic Reasoners" topic on the DSI website for more hit tracks.

Inside this Issue...

Did You Know?

New HELP on its Way!

We all realize that ***eXpress*** is a robust "full-feature" Diagnostic Engineering Tool. Many large, complex or critical designs exploit an array of different features, menus and utilities in ***eXpress*** that typically expand in a variety of directions and depth of capability that is demanded by any specific project. As such, we are continuing to expand the ***eXpress*** HELP steadily over time.

Model-based Diagnostics:

Design-based vs. Empirical-based

The label "Model-based Diagnostics" is used to describe widely divergent diagnostic approaches. MBD can refer to diagnostics derived directly from engineering data ("Design-based") or to diagnostics developed over time by recording the resolution of failures in a deployed or operational system ("Empirical-based").

Through the accumulation of symptomatic knowledge from fielded systems, Empirical-based diagnostics are theoretically able to get "smarter" over time. The allure of a diagnostic model that can learn to overcome its initial deficiencies is so strong that it can cause those who fall under its spell to cast pragmatism to the wind (much like the "prognostic delusion" of not so long ago). The fact that Empirical-based diagnostics have a learning curve is embraced as an unequivocal asset. An entire mythology is constructed upon the dream that reasoning from one system might be used to eliminate the learning curve in another.

The diagnostic integrity of an operational asset, however, is constrained not only by the design itself, but also by how much attention is given to diagnostic engineering while the design is still in the definition phase. If Design-based diagnostic knowledge is not carried over and integrated with the Empirical-based diagnostics, a "Diagnostic Gap" forms. This issue is illustrated in Figure 1. These two separate / non-integrated diagnostic approaches have differing objectives, capabilities & effectiveness as shown in the bulleted blue and orange lists below.

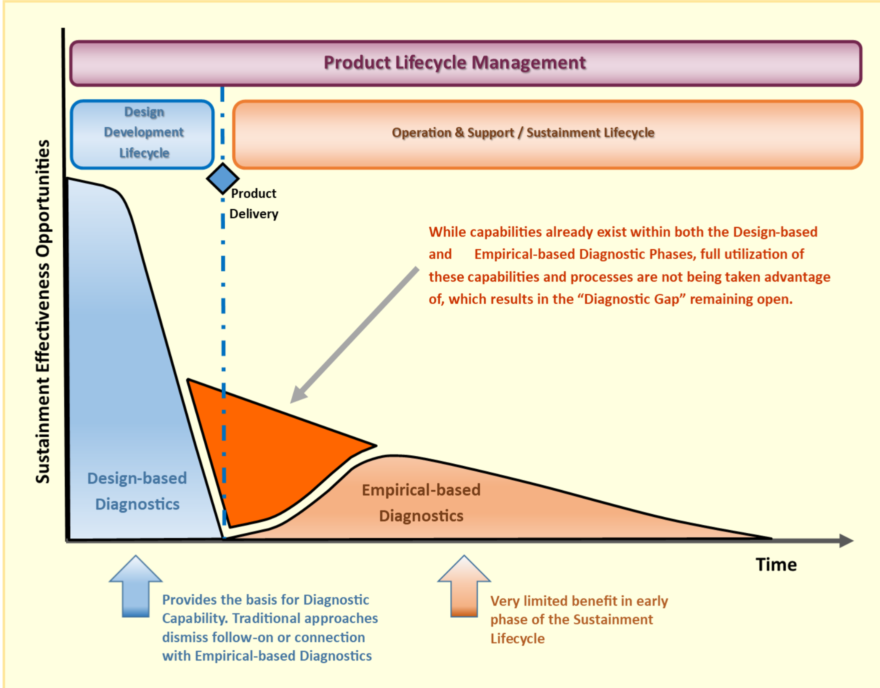


Figure 1 - Current Practice

Note: The Blue box (Design-based Diagnostics), is only shown to provide assistance in pointing out any discrepancies

Design-based Diagnostics

- Knowledge Capture & Design Influence
- MBSE compatible
- Product "Lifecycle" Management – Optimization
- First Failure Accountability
- Model & Data Interoperability/Reusability
- Requirements Traceability
- Multidisciplinary Collaboration
- Iterative Design Assessment & Cross-Validation
- SysML, ATML, NGATS & ATS compatibility
- Diagnostic (Failure-to-Test) & BIT Validation
- Reliability/Supportability/Safety Constraints
- PdM vs. RCM vs. Corrective Maintenance Effectiveness
- RAMS-to-Diagnostic Constraints Time-based Simulations
- Test Paradigm independence
- Sustainment Technology Uniformity and Scalability
- Fully Integrated Health Management
- Proactive approach
- Diagnostic Reasoning
- Diagnostic Certainty
- "Digital Twin" / "Digital Thread" Readied

Design-based diagnostic techniques are widely used both to improve a system's diagnostic design and to assess the ability of diagnostics to meet contract requirements. Inexplicably, many projects discard all "Design-based" diagnostic models entirely when developing run-time diagnostics.

Empirical-based Diagnostics

Mostly deficient when not coupled with Design-based Diagnostics

- Trending Analyses
- Diagnostic sequence biasing enrichment
- Not able to Influence the design's diagnostic integrity
- Test Methods/Tools Restricted
- Limited Data Reusability
- Restricted Data Interoperability
- First Failure Uncertainty
- Variables Restrict Achievement of High Level Certainty
- Reactive approach
- Diagnostic Correlation
- Diagnostic Uncertainty

Empirical-based diagnostics are particularly poor when confronted with a failure—even an expected failure—for the first time. This is precisely the situation, however, where Design-based diagnostics shine. The fact that diagnostic models that already exist can be of immediate benefit should be sufficient for their use as a foundation for fielded diagnostics. On the other hand, situations where Design-based diagnostics fall short, such as when a system fails in an "unexpected" way (due to manufacturing defects, truncated engineering efforts, or environmental idiosyncrasies) are precisely where Empirical-based diagnostics, over time, prove their worth. When the two approaches are viewed not as competitors, but rather as a diagnostic tag-team, integrated diagnostics will begin to fulfill its destiny as a consistent presence during all phases of the product lifecycle (as shown in Figure 2 on page 3).

Balancing both Design-based and Empirical-based diagnostics is the key for an optimized lifecycle solution with the Design-based diagnostics forming the Foundation without which the Empirical-based diagnostics is only marginally effective.

If one exploits every aspect of design-based diagnostics with a balanced empirical-based diagnostic approach - there is much to be gained:

Balanced Approach to Design-Based & Empirical-Based Diagnostics

- Design & Empirical Knowledge Capture & Reuse
- MBSE compatible
- Product "Lifecycle" Management – Optimization
- First Failure Accountability
- Data Analytics & Maturation
- Model & Data-Interoperability
- Requirements Traceability
- SysML, ATML, NGATS & ATS compatibility
- Diagnostic (Failure-to-Test) & BIT Validation
- Reliability/Supportability/Safety Constraints
- PdM vs. RCM vs. Corrective Maintenance Effectiveness
- RAMS-to-Diagnostic Constraints Time-based Simulation
- Test Paradigm independence
- Sustainment Technology Uniformity and Scalability
- Fully Integrated Health Management
- Full Reusability
- Multidisciplinary Collaboration
- Diagnostic Certainty
- Trending Analyses
- Diagnostic Sequence Optimization
- Test Methods/Tools Integrated
- "Digital Twin" / "Digital Thread" Readied

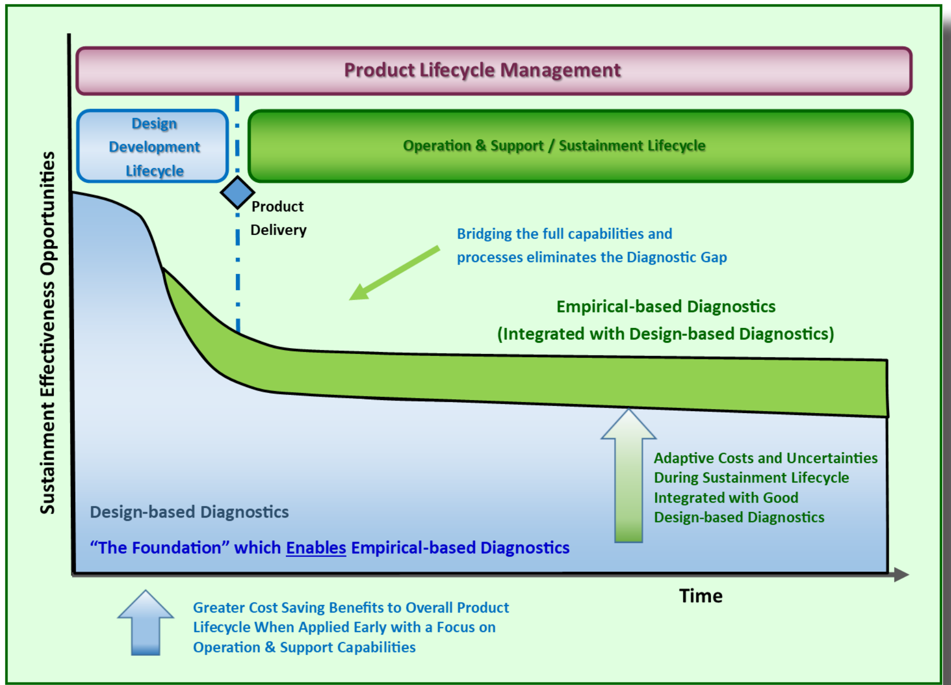
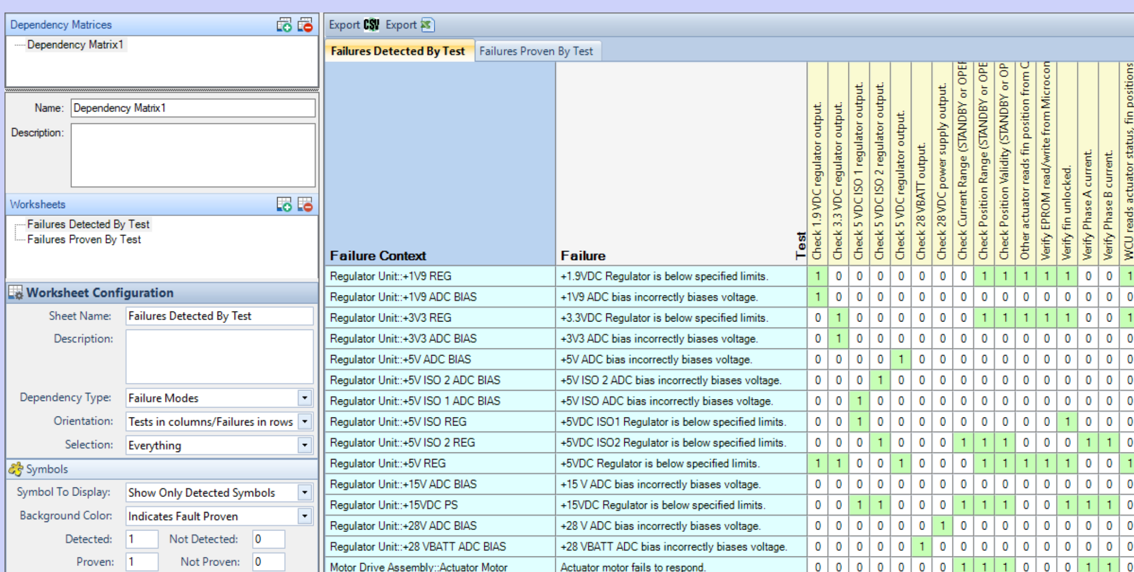


Figure 2 - Optimal Diagnostic Solution

D-Matrix Added to Support Legacy Methodologies

While moving forward, DSI continues to develop utilities that address weaknesses in legacy diagnostic practices—weaknesses that are often framed by narrow sustainment requirements or technologies. DSI's Run-Time Authoring Tool (RTAT) now features an output that accommodates traditional applications that utilize a Dependency Matrix ("D-Matrix"), sometimes referred to as a Test or Fault Truth Table. For some organizations, this capability will extend the interoperability and "multi-purposing" of their ***eXpress*** diagnostic models. While there are undoubtedly some programs and organizations that still adhere to this approach, DSI understands the inherent limitations of the D-Matrix and can provide alternative means that often result in substantial improvements over matrix-based diagnostics. At right, the D-Matrix is shown with one of many customizable views.



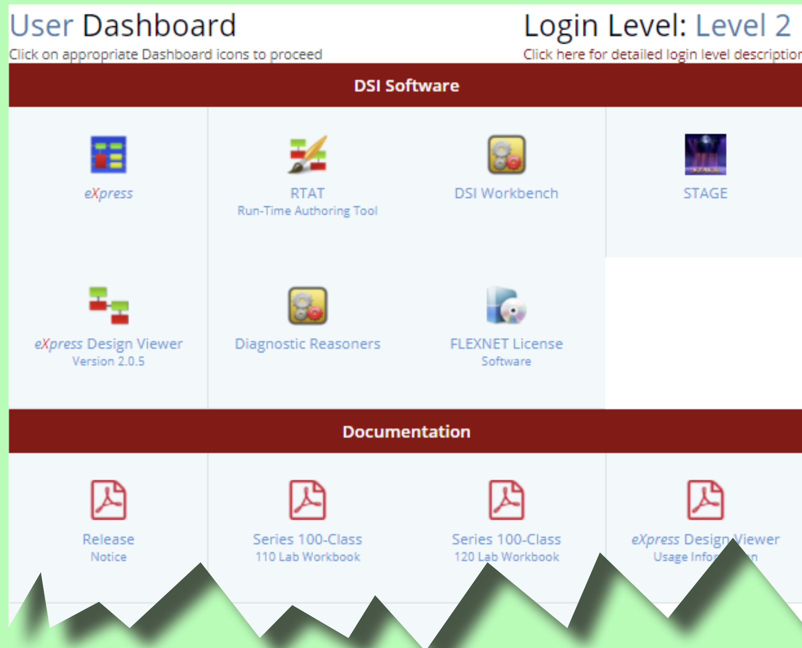
eXpressML Import / Export Module - Coming Very Soon!

Creating ***eXpress*** models is about to become both easier and quicker with the release of the ***eXpress*ML** Import/Export Module. The initial release date is May 3rd, with additional capabilities and features to be added shortly thereafter. This new import has been designed so that you can focus on data acquisition, rather than on modeling. Used in conjunction with Reston Software's ATML Pad (which will allow ***eXpress*ML** to be generated from a variety of industry formats), this feature will be a key piece in establishing diagnostic design data from ***eXpress*** in your company's digital stream. More information on this exciting new capability is available from DSI. **Visit our website at: www.dsiintl.com**

Establish Your User DashBoard

While DSI has published an unprecedented amount of education detail for robust diagnostic engineering on its website, you can gain additional insights, knowledge and skills with more videos and applications of diagnostic engineering activities by establishing your own "User Dashboard"!

After you go to the DSI website, "Register" and apply for the Website Access Level that addresses your needs. "Basic Level" will be auto-activated just by Registering on the DSI website. Then you can immediately access your User Dashboard to begin exploring more information. From there, you can also Register for "Level 1" and "Level 2" Access where, once granted, you can download additional software products or peruse an expanded array of documentation and access over 100 video tutorials.



Register Today!

	Features available in Basic level	Features available in Login Level 1	Features available in Login Level 2
DSI Software	*eXpress* Design Viewer, FLEXNET License software	*eXpress*, *eXpress* Design Viewer, FLEXNET License software	*eXpress*, RTAT Run-Time Authoring Tool, DSI Workbench, STAGE, *eXpress* Design Viewer, FLEXNET License Software
Documentation		DSI Software Release	*eXpress* Quick Start Guide, *eXpress Online Help*, *eXpress*Diagnostics, DSI Software Release, Release
Licensing and Maintainance		Activating the License, DSI Software License, Installing *eXpress*	Activating the License, DSI Software License, Installing *eXpress*
Standards, Schemas & Interfaces	DiagML Schema Documentation, Hardware Requirements	DiagML Schema Documentation, Hardware Requirements	*eXpress* COM Interface, DiagML Schema Documentation, Hardware Requirements

Training Course Schedule

Course Number	Pre-requisite	Course Description	Dates	Location	POC
T-200	T-120	Advanced Model Development and Analysis	Apr 23-24, 2018	Orange, CA	info@dsiintl.com
T-205	T-200	Advanced Test Development and Importing	Apr 25-27, 2018	Orange, CA	info@dsiintl.com
T-100		System Diagnostics Concepts and Applications	May 14, 2018	Orange, CA	info@dsiintl.com
T-110	T-100	Basic Modeling & Introduction to Testing	May 14-16, 2018	Orange, CA	info@dsiintl.com
T-120	T-110	Introduction to Testing & Analysis	May 16-18, 2018	Orange, CA	info@dsiintl.com
T-240	T-205	FMECA and FTA Development and Assessment	May 21-22, 2018	Orange, CA	info@dsiintl.com
T-250	T-205	STAGE Time-Based Assessments and Principles	May 23, 2018	Orange, CA	info@dsiintl.com
T-260	T-205	RTAT and DSI Workbench Theory and Application	May 24-25, 2018	Orange, CA	info@dsiintl.com

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