DSI international, inc.

eXpress™ Newsletter

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Drawing From Both Sides of the Force: Empowering Engineers by Crossing Disciplinary Boundaries

Model Based Systems Engineering (MBSE) and Product Lifecycle Management (PLM) technologies are opening up exciting new avenues for collaboration between design disciplines that have traditionally worked in relative isolation. As users of ***eXpress*** are well aware, Diagnostic Engineering and Reliability are two disciplines that work, for the most part, in parallel. Reliability engineers may supply diagnostic engineers with failure modes and failure rates; beyond that, however, the two disciplines typically share very little.

eXpress changed the landscape a little bit with the introduction of its integrated FMECA capability in 2001 and its Fault Tree Analysis (FTA) module in 2015. These features allowed FMECAs and FTAs to be linked to actual diagnostic data, rather than being filled in with Reliability engineers' speculations about what diagnostics *should* be able to accomplish. Moreover, the ***eXpress*** FTA broke new ground by offering—for the first time ever—the ability to quantify and evaluate the risk of having less-than-perfect diagnostics. Analyses like these that draw from both Reliability and Diagnostic Engineering efforts will no doubt become more prevalent as MBSE and PLM become the norm.

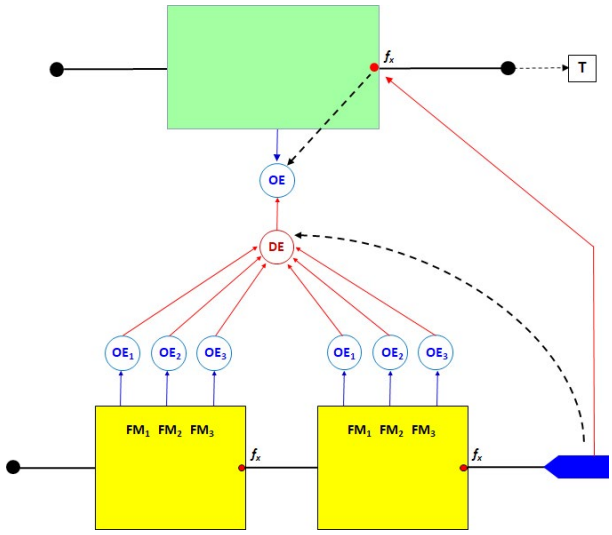
As groundbreaking as these opportunities for collaboration may be in terms of providing new and better insights into the effectiveness of a design, they've not really changed the product procurement landscape. The reason for this is quite simple—to be blunt, they've not saved *developers* any money. Both Reliability and Diagnostic engineers continue to do pretty much the same tasks they have all along, with independent requirements and independent budgets. The very idea that there are new analytical techniques that can help engineers improve their designs to promote better sustainment has fallen largely upon deaf ears.

As collaborative practices like MBSE and PLM gain bigger footholds within the engineering world, however, new opportunities for joint development will no doubt arise—opportunities that ***will*** affect the bottom line. Diagnostic engineers will greatly reduce their efforts by piggybacking on the work of Reliability departments. Likewise, Reliability engineers will streamline some of their most time-consuming tasks by standing on the shoulders of the diagnostic engineers.

Naturally, this will not happen without incentive. It is unlikely that leaders within the different disciplines will voluntarily relinquish their pieces of the budget, their badges of distinction, their positions of power. It will be incumbent upon higher management to recognize the technological and financial advantages of genuine cooperation and make it so.

eXpress sits on the cusp of multiple disciplines and is thus uniquely positioned to encourage collaborative engineering. This is particularly evident in a pair of recently-added features that can save hundreds of hours by allowing Diagnostic and Reliability engineers to incorporate each other's work into their own.

DSI is not only a tool vender, but a service provider as well. This means that we do real work using our own tools. Because, like you, we have a vested interest in accomplishing tasks with a minimum of overhead, we are constantly coming up with ways to streamline the modeling process. Over the last several years, we have often been contracted to develop both run-time diagnostics and a FMECA as part of the same project. Unlike efforts where the customer supplies us with a FMECA or with test definitions, DSI had to derive all of this information for our customers from scratch. It quickly became clear that we could save a huge amount of time and money if we could reduce diagnostic development time by tapping into efforts spent developing the FMECA, or reduce FMECA development time by co-purposing work done developing the diagnostics.



A schematic representation of the modeling automation that supports Effect-based Test Coverage on Assemblies. This sophisticated mechanism is mostly hidden from the analyst, greatly simplifying the test definition process.

Inside this Issue...

Keep In the Know

- New Feature: Automated FMECAs from Tests
- Interoperability: DASH On-Vehicle Diagnostics
- Under development: Sneak Circuit Analysis
- Coming up: GUI Upgrades (dual monitor/ 4K)

Latest Software Versions

• ***eXpress***	7.2.1	11/19
• Run-Time Authoring Tool	5.5.6	10/19
• DSI Workbench	4.10.3	10/19
• STAGE	Act II. Scene 3	10/16

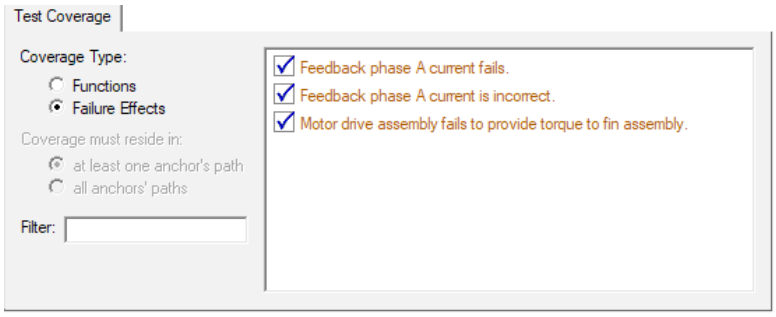
From page 1

Effect-Based Test Coverage on Assemblies

Test definition is typically one of the most time-consuming tasks in diagnostic modeling—especially for large, hierarchical systems when test coverage must be constrained to specific failure modes in multiple lower-level models. In ***eXpress*** 7.2.0, DSI introduced the ability to use failure effects—borrowed from the FMECA or automatically generated specifically for this purpose—to control lower-level coverage on upper-level tests.

The first step is for ***eXpress*** to identify which failure effects on an assembly are associated with the coverage of a given test. This requires that the software traverse both the functional dependency model (typically used when defining tests for diagnostics) and the failure propagation model (used for FMECA and FTA development) across all levels of the ***eXpress*** design hierarchy. This sophisticated process (depicted on the front page of this newsletter) is performed in the background as designs are saved so that the information is ready-to-use during test definition.

On each assembly with functions in the coverage of the upper-level test, the analyst simply de-selects those failure effects whose lowest-level failure mode causes are to be removed from the test's coverage.



On the Test Coverage panel, the analyst is presented with a list of all failure effects whose root failures at the lowest level of the design are related to functions covered by the upper-level test. By deselecting these effects, lower-level failure modes are removed from the upper-level test's coverage.

Most of the calculation is automated; the engineer need only identify the effects that need to be disabled. For engineers with not only a good working knowledge of ***eXpress***, but also an adequate understanding of their design, this feature can save hundreds of hours when defining tests in large, hierarchical systems. We know, we've already reaped the benefits on some of our own contract work.

Testing For Effects

eXpress also lets you create tests whose entire coverage is derived from a failure effect. Although this feature is not new (it was introduced seven years ago in ***eXpress*** 6.0), it is worth mentioning here because it too allows engineers to take advantage of Reliability analysis when defining tests for diagnostics.

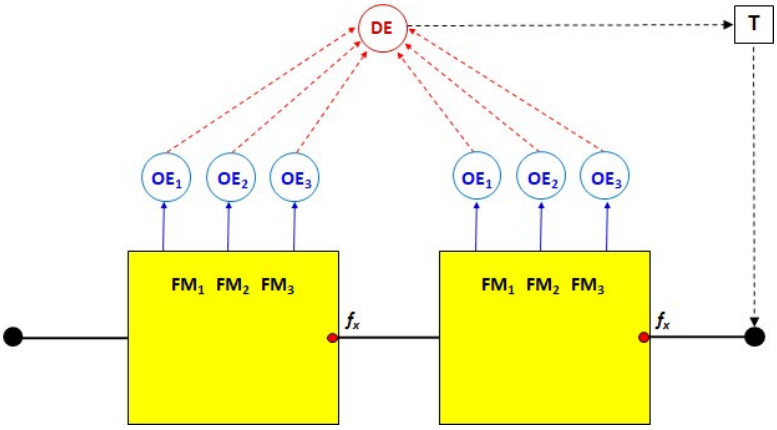
The engineer simply selects a failure effect when defining a test (or creates a batch of tests for a set of selected failure effects). The resulting tests will be linked to those effects, with their test coverage set to the lowest-level failure modes that represent the root causes of each effect.

Because, like the *Effect-Based Test Coverage on Assemblies* feature, this allows analysts to control lower-level coverage on top-level tests, this presents another opportunity to reduce test definition time. The savings can be substantial for large, hierarchical systems that include symptomatic testing.

Failure Effects with Dynamic Causes

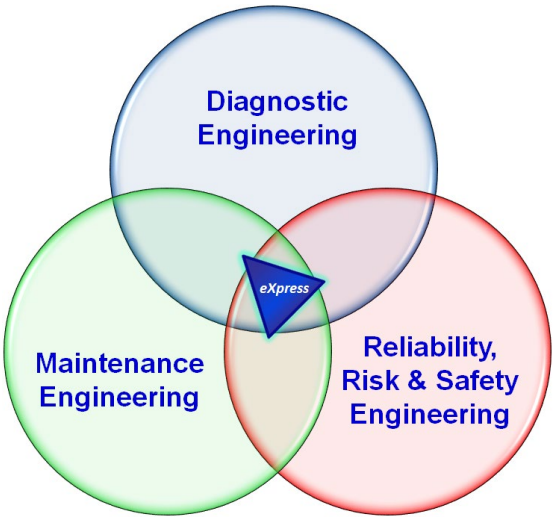
The previous two features allow diagnostic engineers to reduce test definition efforts by utilizing data that has either been developed by Reliability engineers or automatically generated in ***eXpress*** using areas of the tool that are normally associated with FMECA & FTA production. Another feature—*Failure Effects with Dynamic Causes*—offers the opposite benefit. It allows engineers to reduce the time spent defining failure effects (the lion's share of FMECA development) using tests that have been either developed for diagnostics or defined specifically to accelerate Reliability analysis.

A failure effect with dynamic causes is an effect whose causes are derived from the coverage of a specified test. The engineer simply selects the test to which an effect is linked (or creates a batch of failure effects for a set of selected tests). ***eXpress*** then uses the coverage of the selected test to calculate the causes of the dynamic effect.



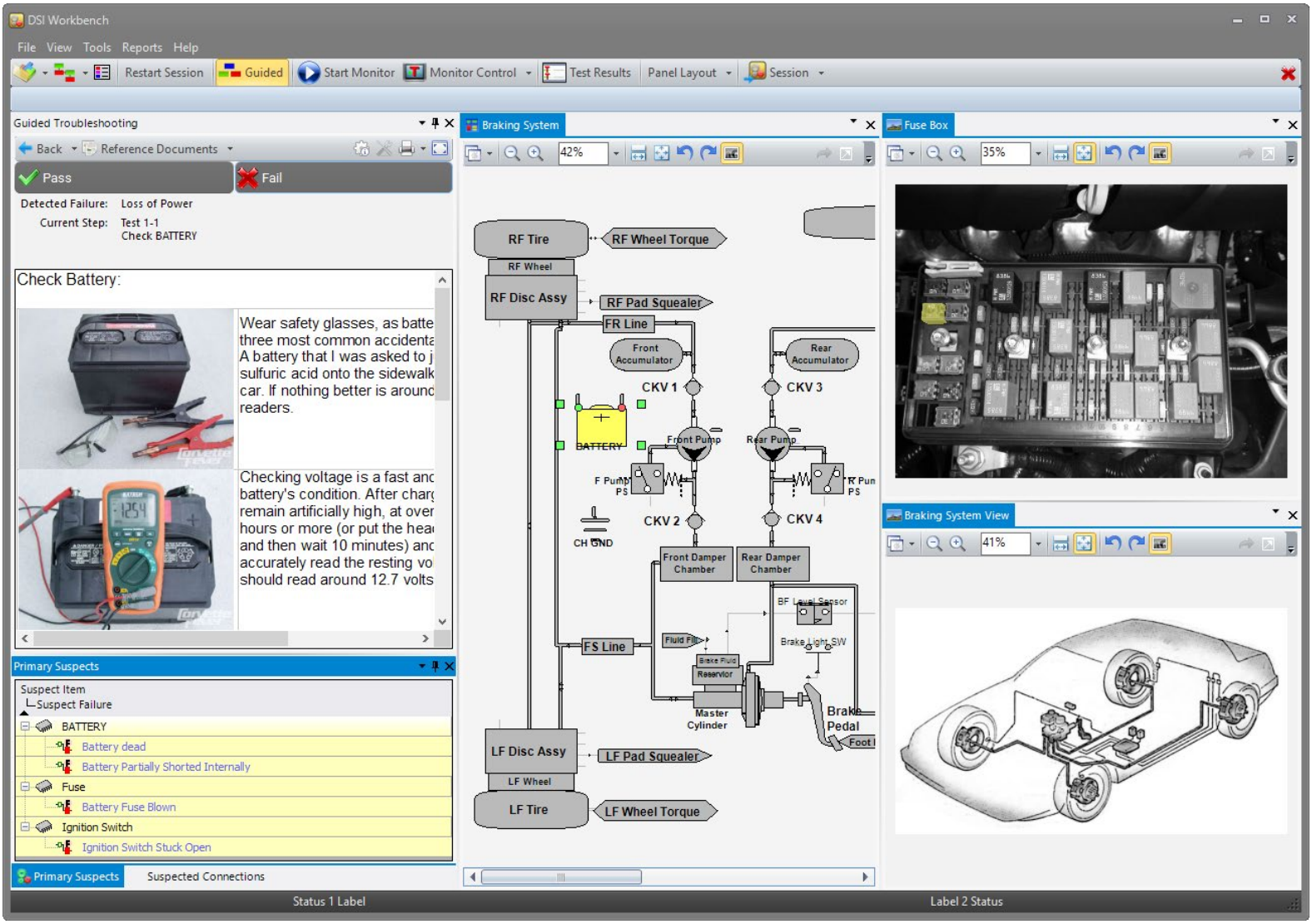
A schematic representation of the process used to calculate causes for Effects with Dynamic Causes.

Once again, the calculation is automated—that is, it is based entirely upon efforts already performed during test development. ***eXpress*** offers a wide array of techniques for creating and modifying test coverage. When they have dynamic causes, failure effects benefit from this same range of techniques. Moreover, when the engineer changes the model in a way that impacts the coverage of one or more tests—whether it be changes to the model topology, settings or constraints on the tests themselves—the causes of any failure effects linked to those tests will be updated automatically to reflect the changes.



*The **eXpress** software empowers engineers to share across disciplinary boundaries, drawing strength from each other's efforts.*

New for Spring 2020 – DSI Workbench 5.0



DSI Workbench is getting a brand new GUI — That's right, the User Interface for DSI Workbench is being overhauled with a new look and better support for the latest run-time platforms (including computers with those pesky high-resolution 4K displays). When you upgrade to WB 5.0, you'll get not only the new GUI, but also all features that have been added to Workbench 5.10.x to date. Here is a partial list of new, recent and optional features that will be available with DSI Workbench 5.0:

New in Version 5.0

- Support for high-res (4K) displays
- Ability to enter measurement values (rather than Pass/Fail) during manual troubleshooting
- Control of WB using TCP/IP commands
- More modern "look and feel"

Recent Changes from 4.10.x

- "Skip All and Diagnose" feature
- Suspected Connections now calculated during Dynamic Reasoning
- Hierarchical context provided for Suspected Connections
- Effectivity Chart

Optional Features

- History and Feedback Module
- DSI Dynamic Reasoner
- ATML & PDEL Import Modules
- Workbench API

RTAT and DSI Workbench Software Maintenance Available for 2020

You asked for it—we heard you! Beginning in 2020, DSI will offer optional Software Maintenance Plans for its primary Run-Time Tools. These new Software Maintenance products will allow you to download software updates for the ***eXpress*** Run-Time Authoring Tool (RTAT), DSI Workbench and licensed companion modules at your convenience, as well as provide the opportunity to acquire upgrades or new products from DSI at a reduced rate.

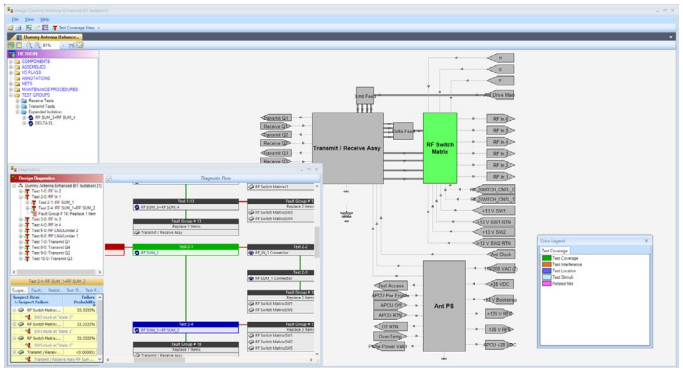
When existing customers are sent quotes to renew their Software Maintenance for ***eXpress***, they will now also be extended the opportunity to acquire Software Maintenance for the Run-Time Tools that they have licensed.

Of course, DSI will continue to support older versions of these Run-Time Tools, correcting software errors at no additional cost. Check the DSI Website for the current releases of both the 32- and 64-bit versions of these applications.

Please contact DSI for pricing information.

Your One-Way Ticket to Consensus: The *eXpress* Design Viewer

The ***eXpress*** Design Viewer is a freeware software tool that permits ***eXpress*** model data to be viewed (and reviewed) on computers that do not have the ***eXpress*** software installed. By allowing team members to visualize and verify the data that comprises an ***eXpress*** diagnostic model, this viewer provides an essential service for any diagnostic engineering project that uses ***eXpress***.



In fact, when we ourselves do contract work here at DSI, we include Design Viewer files not only with our final delivery, but also with every interim or milestone delivery of ***eXpress*** models or statistics. We ask *our* customers to review topology and test definitions within the Design Viewer. This not only helps the customer verify that we've completed the work that we've been contracted to perform; it also helps those who are new to the ***eXpress*** world to better understand what it is we do and why.

Moreover, by allowing team members to participate in all phases of the diagnostic engineering process, the ***eXpress*** Design Viewer provides a means of verifying & validating diagnostic engineering models. As Model-Based Systems Engineering and Product Lifecycle Management practices become the norm, one of the touted benefits will be a significant reduction in redundant efforts. *Validation through the comparison of independent analyses* will inevitably be replaced with *validation through examination by multiple eyes*. By allowing diagnostic engineering efforts to be widely disseminated, reviewed and evaluated, the ***eXpress*** Design Viewer is ready for this change.

Training Course Schedule

Course Number	Pre-requisite	Course Description	Dates	Location	POC
T-200	T-120	Advanced Model Development and Analysis	Dec 9-10, 2019	Orange, CA	info@dsiintl.com
T-205	T-200	Advanced Test Development and Importing	Dec 11-12, 2019	Orange, CA	info@dsiintl.com
T-100		System Diagnostics Concepts and Applications	Jan 20, 2020	Orange, CA	info@dsiintl.com
T-110	T-100	Basic Modeling & Introduction to Testing	Jan 20-22, 2020	Orange, CA	info@dsiintl.com
T-120	T-110	Introduction to Testing & Analysis	Jan 23-24, 2020	Orange, CA	info@dsiintl.com
T-100		System Diagnostics Concepts and Applications	Mar 23, 2020	Orange, CA	info@dsiintl.com
T-110	T-100	Basic Modeling & Introduction to Testing	Mar 23-25, 2020	Orange, CA	info@dsiintl.com
T-120	T-110	Introduction to Testing & Analysis	Mar 26-27, 2020	Orange, CA	info@dsiintl.com

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