

Added Value & Cost Avoidance in “Both”

Development & Sustainment

Discovering Inefficiencies in Efficiencies

Most large organizations find it increasingly difficult to leverage its investments in the collective “data producing” activities in significantly new and profitable ways. Over time, processes become broken into specialized independent “focused” activities that strive to be efficient in attaining increasingly independent objectives. The maturing of independent efficiencies within an organization often counteracts the opportunity for discovery of pools of incredible new value that can be leveraged from within the constraints owned by related, but parallel independent activities. Let’s take a closer look at how this could be changed to work in favor of an aggregate solution.



First, let’s examine the specific disciplines of Reliability, Maintainability, Testability and Test Engineering Groups and their concern for the producing of their respective data products. Beginning with Product Design, each discipline has degenerated to focus more narrowly on their internally-owned limited efficiencies in the generation of data as needed for independent contract deliverables – as they know it.

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Rolling the Dice with PHM:

“Money Plays”

Significant effort has been placed into the defining of metrics for Prognostics Health Management (PHM). The problem is that most of this effort has focused on the concept of unattainable Systems Prognostics performance. Attention to the importance of true Integrated Systems Health Management (ISHM) has been masked by the focus on single failure mode physics of failure analysis with no understanding of how to observe the prognostics results as integrated with the Systems Diagnostics.

The critical metrics derived from Integrated Systems Diagnostics Design (ISDD) have mostly been ignored. These critical metrics include Reliability, Safety, Testability, and System Maintainability & Sustainment, as well as the impact of Prognostics performance on Systems Diagnostics. The ISHM development process must determine the best balance for the Health Management design. The ability of eXpress to identify the impact and effectiveness of Prognostics as integrated with the ISDD process provides true value to performance and cost avoidance.

Prognostic Candidates

| # | Failure Mode | Item | Maximum Severity |
|---|-----------------------|-----------|------------------|
| 1 | Pedal Linkage Failure | Brk Pedal | Loss of Life |
| 2 | Pump Motor Shorted | R Pump | Loss of Life |
| 3 | Pump Motor Open | R Pump | Loss of Life |

Ranked only on severity in this example

Industry must move away from the stand-alone fashionable technology trends that are conceived in academia and then promoted for gains unrelated to system performance improvement. Dr. Alan Sokal, Professor of Physics at NYU, is well known for his Sokal Hoax that exposed the technology community to what he calls “Fashionable Nonsense”.

A good example of this fashionable trend is the concept of full systems prognostics on the F-35 joint Strike Fighter. Even after attempts to show the need for an integrated diagnostics solution, untold millions of dollars were thrown into a prognostics solution, at the expense of diagnostics, that had no chance to succeed. In the meantime, the F-35 is lacking much of the needed diagnostics-based health management.

Just recently, the F-35 was grounded for the third time in the past year due to power system failure. Remarkably, despite the occurrences of these groundings, PHM Program agendas continue to promote the mastery of Failure Prevention through prognostics as the solitary solution. If the F-35 System Health management would have been designed around the proven technology in model-based Diagnostics using eXpress, the failure mode causing the system power failures

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The concern for utilization of data already generated in other activities “seem” to be used in limited form within the current processes of the organization. As each specialized activity becomes concerned about working within its own “efficiency parameters” from within the organization, the collective organizational processes lack the benefit of automatically merging data outputs from each activity into new “hybrid-like” data products that together, can not only be immensely revealing, but incredibly valuable for the organization or program.

What is more typical however, is that each activity in the organization ultimately works towards creating its own independent value and is essentially in competition with other related departments in the same organization. While this calls out a practice that is typically regarded as just the organization’s way of doing business, it underscores how organizations are blissfully unaware of the frivolous and unnecessary tossing of funds away, and repeating this cycle over and over again - Falling into a spiral of maturing “Inefficiencies in Efficiencies”.

The “GOOD NEWS” is that “GOLD” is there anxiously waiting to be discovered by “inadvertently” integrating the data products generated in these parallel processes. It can be realized in a grander and grander scale, as these related independent activities cooperate and function in an interdependent manner. In fact, these independent activities can participate in data leveraging value-added methods while virtually remaining independent! Let’s examine this a bit closer:

| Diagnostic Coverage | | | | |
|---------------------|-------------------|------------------------------------|------------------|-------------------------------------|
| Failure Detected | Fault Isolation | | | |
| | Uniquely Isolated | Number of Root FMs in Fault Groups | Fault Groups | Fault Group Sizes (Number of Items) |
| Yes | No | 10 | Fault Group # 84 | 2 |
| Yes | No | 10 | Fault Group # 84 | 2 |
| Yes | No | 20 | Fault Group # 4 | 7 |
| Yes | No | 4 | Fault Group # 89 | 2 |
| Yes | No | 10 | Fault Group # 84 | 2 |
| Yes | No | 9 | Fault Group # 91 | 1 |
| No | N/A | N/A | N/A | N/A |
| Yes | No | 10 | Fault Group # 84 | 2 |

Reliability efforts, for example, lack the interest to take advantage of the value that diagnostics engineering has available – specifically such value that can be gleaned from borrowing the “concept of fault groups and isolation to contracted LRU levels”. The result is that Reliability FMECAs effectively, “terminate” at detection. Until now, everyone seemed to feel that quantifying design detection capability into a naked declaration of “yes” or “no” within a column on a spreadsheet was totally sufficient and usual practice. While this may have been efficient contractually in the past, the cost of “terminating” at that naked declaration has not previously been considered to be expensive and inefficient. From now on, let’s take profound responsibility in knowing that this is a “gimme” inefficiency from which the organization can choose to realize further utility of the investment in the data production.

FMECA Plus in *eXpress* exploits this “terminating with detection declaration” barrier simply and effortlessly by automatically correlating this data with data from multiple disciplines, to produce entirely new and powerful data products. Immediately, detection declaration is correlated to Fault Group constituency, test and isolation details, available in parallel Diagnostic Engineering activities, into selectable columns to fit any extended health management or sustainment objectives.

Systems Engineering processes that formulate divergent data product development objectives will produce outputs that can only fulfill independent, and sometimes, competing objectives. The avoidance of insightful data sharing (in just the FMECA, in this example) directly causes immediate loss in a host of Development and Production Test activities.

As a result, these losses, which are shamefully considered, “our normal way of performing contract requirements”, continue to escalate in virtually every related Product Sustainment activity as well. These costs are not simply limited to the current program - these losses are extended and burdened forward – burdened by future awards, contractor, customer, operator, maintainer and taxpayer alike. The losses reach beyond the sustainment of the current program, and on to each similarly successive program(s) from that moment forward.

Being the most advanced and industry-trusted Model-Based Diagnostic Engineering Tool, one of the most powerful advantages of using *eXpress*, is that it affords you the opportunity to reuse the Design Models in Development and Sustainment – time and time again, and in a forum for painless Development process integration that quickly embraces any changes to the design or support parameters.

Funds are no longer lost in a process that ignores the ability to capture that data (expert design capture knowledge) in a form that is instantaneously merged and leveraged to create extended value. Costs are avoided when design components (models) are reusable across the design team disciplines, and in a form that can be extended for any number of variations of the design. Furthermore, development and sustainment costs are avoided on the production of similar designs with modifications, enhancements, or different configurations.

With *eXpress* at the core of the Integrated Systems Diagnostic Design (ISDD) process, you have the affordable control to position your designs so that any part of it can be extracted and remobilized for any and all support on that design – in the current system – and towards any further use of that design, in whole or in part, in any future use or application.

Institutionalizing a process that avoids “normally assumed” costs in both Development and Support of the design, is already an incredible option - but to enrich such cost avoidance advantages by enabling these processes to virtually integrate painlessly as data is leveraged throughout the design team, is smashingly ground-breaking. But for the process to provide a “bonus advantage” of bridging these enriched data components into future designs so we can be fully engaged in the “Never Start Over Again” design mentality, brings home the ultimate cost avoidance paradigm that is an unsurpassable competitive edge for many design opportunities beginning today !

*Be Ready - Fall of 2012...
Better – Stronger – Faster !*



True Value with eXpress 5.12

If you haven't downloaded the newly released **eXpress 5.12** yet, you'll want to make a point to do so NOW !

It offers a number of productivity enhancements in speed, usability and interoperability to benefit the many advanced **eXpress** users, and also flattens the learning curve for the new users as well !

Big Time Reducer

Now with the push of a button, there are many guided help features including an "Assist" selection. Error free models can now be produced with lightning speed. This assist capability is now presented in the new Design Wizard, See Figure 1. for the Design wizard screen in **eXpress 5.12**. The new **eXpress** Design Wizard enhances the previous powerful Error Checker by providing intelligent guidance through the discovery and correction of any modeling mistake the user might make. This will greatly reduce the time to build a good Diagnostics Model and ensures that the real power of the **eXpress** Diagnostics Analysis can be performed with confidence.

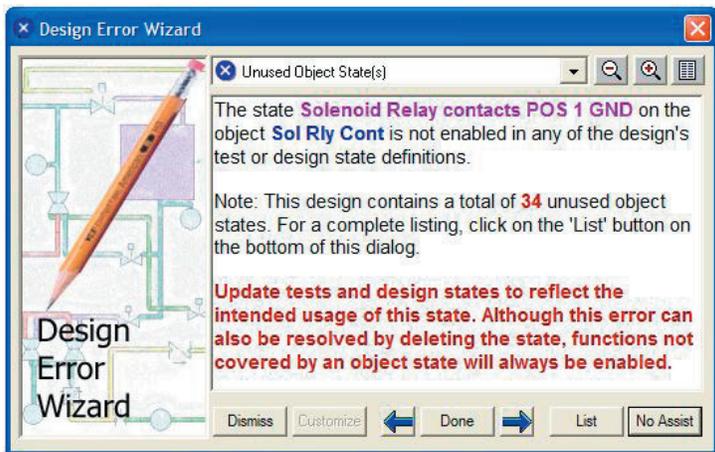


Figure 1, Design Wizard Screen

For Those Special Operating Conditions - CLASSES!

While **eXpress** has delivered exceptional value with its comprehensive mastery of many automated Object and Design State utilities for many years, it now delivers another unprecedented capability with its introduction of Classes!

Classes are the most revolutionary feature added to **eXpress 5.12** - revolutionary in that they will likely change the way that many analysts create their designs. Classes provide a mechanism for categorizing functional or failure entities of a design in such a way that operational states and tests can be automatically represented and analyzed independently or collectively, throughout the design.

The analyst can now create a class for each major characteristic of the signal (figure 2, shows the example of temperature, pressure and flow). These classes are then assigned to the various output functions that impact them, using the tool to split up each original function into multiple functions based on the assigned attributes. The value gained from this new feature in **eXpress 5.12** can be virtually unlimited!!

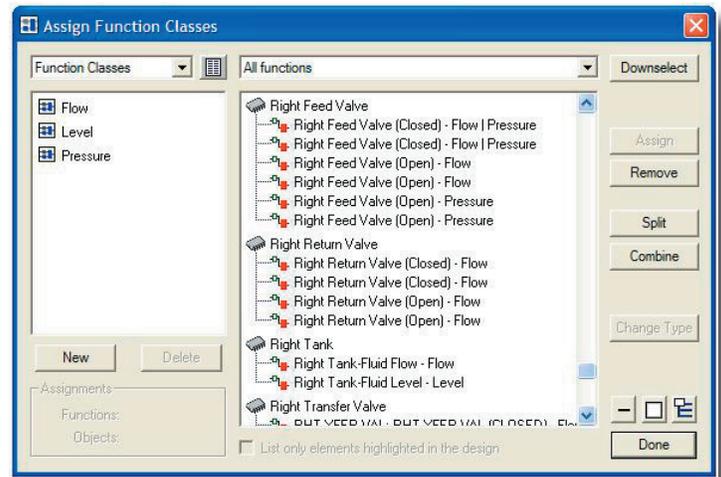


Figure 2, Function Classes Assignment Screen

The use of Classes provides more realistic results from the Diagnostics Design Analysis, and now better represents the true operational conditions for the Health Management System – The major power of the **eXpress 5.12** Diagnostics Design process.

The new **eXpress 5.12** supports several other features that will make you Diagnostics Analysis task perform as needed – a true Integrated Systems Engineering process tool to provide the confidence that your Health Management system will meet all Operation and Support Needs!



Rolling the Dice with PHM - from page 1

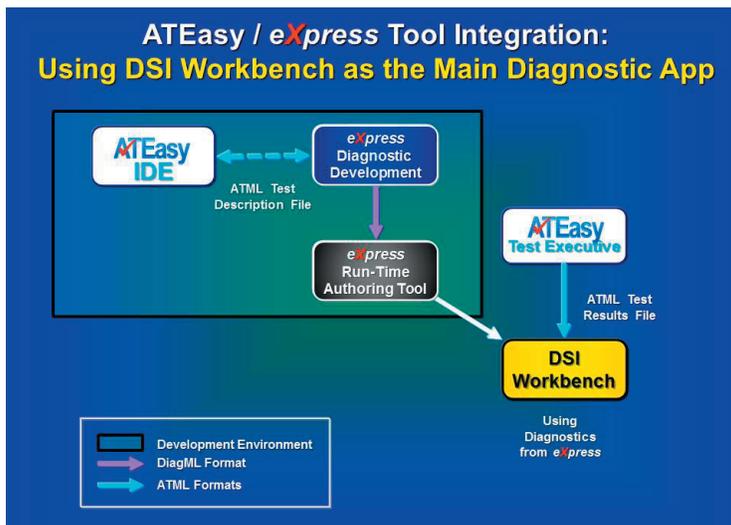
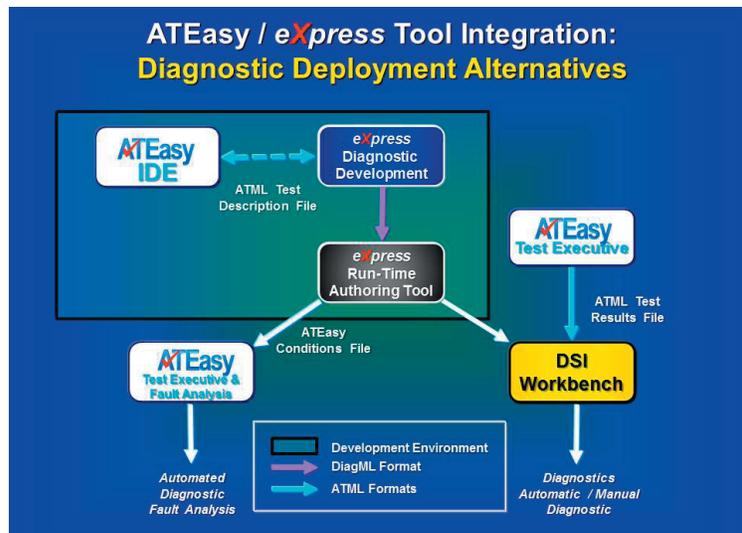
would have been conspicuously identified in an **eXpress** problem listing and corrected during the design phase.

It is fairly well understood that prognostics can play an important role in ISHM and should not be determined by purely "rolling the dice" on seemingly logical intuition. Instead, the payoff can be consistently realized in a manner that maximizes cost avoidance with technical suitability. This, of course, only occurs when specific prognostics candidates are selected during the Systems Diagnostics Analysis as an integral activity during the ISDD process.

From Design to Test - REALLY!

Integrating eXpress Diagnostics with Geotest's ATEasy Test Executive

DSI and Geotest have come together to provide a powerful integration capability! Those of you that can benefit from reducing production costs through rapid “smart” repair of a UUT can now use your eXpress models to push your diagnostic strategies into Geotest's ATEasy Development Environment Test Executive. This provides the certainty that your diagnostics (calculated testability performance characteristics) are being “executed” in an integrated production test and maintenance troubleshooting solution.



Now, you can simply “deploy” the analysis that you deliver to meet Testability requirements and effortlessly bypass the effort and time involved in creating separate diagnostic instructions.

This integration also demonstrates how ATML is being used to transfer the test data between Geotest's ATEasy and DSI Workbench. ATML is an XML-based data exchange format serving to facilitate interoperability between test assets, and is being led by Naval Air Systems Command and ATE Industry members.

Two videos have been produced that show the integration of the eXpress Diagnostics between ATEasy Test Executive and DSI Workbench:

Viewing ATEasy Test Results in DSI Workbench

Video one demonstrates how diagnostic sessions within DSI Workbench (based on diagnostic strategies developed in eXpress) can be automated using test results from ATEasy Test Executive.

Populating ATEasy Fault Analysis with eXpress Diagnostics

Video two shows how Condition definitions in the ATEasy Fault Analysis module can be populated with diagnostic conclusions developed in eXpress, creating the maintenance messages for specific sets of test results.

If you are interested in streamlining your production process to reduce Unit Production Cost, you can request this video set or talk with our specialists by contacting either Geotest or DSI International.

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World Wide Representatives



EADS Test Engineering Services (UK) Ltd.
29-31 Cobham Road
Ferndown Industrial Estate
Wimborne Dorset BH21 7PF
United Kingdom

EADS TEST & SERVICES /EL/S
MetaPole; 1 Boulevard Jean Moulin
CS 40001 - 78996
ELANCOURT CEDEX

Tel: +44 1202 872800
Contact: Penri Jones (Gen Mgr)
Fax: +44 1202 870810
E-Mail: penri.jones@eads-ts.co.uk
www.eads-ts.com

Tel: +33 (0) 6 88 61 33 91
Contact: Michel Schieber
Fax: +33 1 61 38 58 34
E-Mail: michel.schieber@cassidian.com
www.eads.com



Y-MAX Inc.
2-16 Tsurumaki 5-chome
Setagaya-ku, Tokyo
Japan
154-0016

Tel: 81-3-5451-0085
Fax: 81-3-3429-0089
E-Mail: ate@y-max.co.jp
www.y-max.com



MTCS Systems Engineering Co Ltd.
Room 1905 Block C1
Yi Cheng Plaza
No. 11 Chang Chun Qiao Road
Haidian District
Beijing 100089 China

Tel: 86-10-5881-6565
Fax: 86-10-5881-6566
E-Mail: sales@mtcs.com.cn
www.mtcs.com.cn



DSI International, Inc.
1574 N. Batavia St., Bldg. 3
Orange, California 92867
Phone: (714) 637-9325
Fax: (714) 637-0584
E-mail: info@dsiintl.com

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