What Can We Do To Stay Current With Technology?

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ABSTRACT-We need to focus on the exact cause of failure and perform prognostics during the test and repair cycle. Technology must change for test/diagnosis. With the advent of more robust microcircuits we need to think outside the box when if comes to testing. If we continue to perform diagnostics in the same manner, without considering other testing philosophies, we will continue to waste time and resources.

I. INTRODUCTION

To stay current with technology that can enable us to perform testing more efficiently requires looking at and thinking about technologies not normally employed for testing. The technologies that we are referring to might not be considered for use in testing, in fact these technologies might have a completely different function. We need to review and consider abstract technologies and figure out methods to use these technologies in our applications.

There is always a large group of people that will not accept any new testing techniques. Actually, they will fight against any changes to the so-called normal test environment. Let's face it, to change the way we perform test/diagnosis is an absolute uphill task. We need to always press forward in our pursuit of technology advancements and mediate problems as they occur.

This paper will discuss various technologies and some core instrument discussions to use for testing. Also, the paper will address how to review and consider test technologies to improve the way we do business. We need to share our ideas and techniques and support each other as test technology evolves.

There is a huge difference between working with a new test technology in a lab and actually integrating a new test technology into a real world fielded test system. We need to understand our role as technology integration specialists.

Integrating a new technology into an actual fielded tester is a major engineering task. In fact, you will have a major engineering task to make it work as advertised. You'll need adequate funding. All of the fabrication and integration requirements come into play.

Essentially, you will be going from the theoretical to the actual. You must create a verification plan that will make the technology work with all test programs (we will not change any test programs) by adding options in the test executive (actually this is the only way we can make it work right). If you do it, do it right.

New technology can keep technology evolving, keep you on the lending edge and aid in future workloads and test requirements. Actually, new technology could solve many test/diagnosis problems. New technology, if properly integrated and verified, could have nothing but positive fallout. Also, acceptance testing is formal testing conducted to determine whether or not a system satisfies its acceptance criteria. Acceptance criteria is a defined condition that enables an end user to determine whether or not to accept the system.

II. CORE SYSTEM

Proprietary legacy systems are being replaced by common core test sets using commercial-off-the-shelf (COTS) hardware and open software environments. A Core system is a set of instruments with system software. Automated test equipment (ATE) is computer-controlled equipment that tests electronic devices for functionality and performance. ATE also conducts stress testing with minimal human interaction. ATE includes the control hardware, sensors, and software that collects and analyzes the test results. ATE is considered cost efficient for high-volume testing.

Test automation is the use of software to control the execution of tests and the comparison of actual outcomes to predicted outcomes. Hardware to be used during test execution is computer controlled under the ATE standard. System software is comprised of the Test Executive, the Software Development Environment, and other tools for Test Program Set development. A strong core system is needed to include new technology into an ATE environment.

Mingling both new stimulus and sensor technologies is critical. The core system as shown in figure 1 needs to be very robust and expandable to handle new technologies.

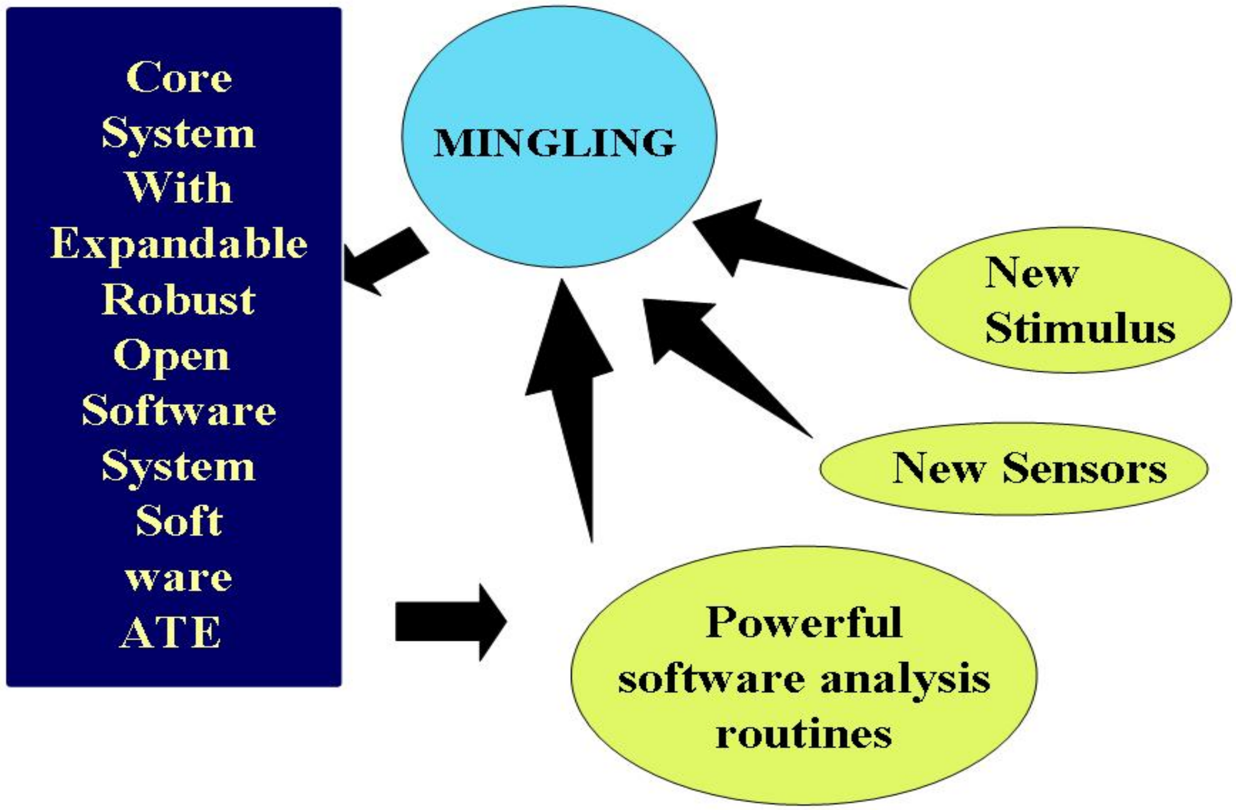

Figure 1. Mingling

III. FINDING NEW TECHNOLOGY

All in all, you must remember a technology tested in a lab especially for test/diagnosis does not necessarily mean it will work as advertised in the actual world of fielded UUTs. You should never mislead a customer; you should be absolutely honest in your business dealings.

Sensors seem to be on the raise. Interesting microsensors coupled with very robust software can achieve amazing results for test/ diagnosis. On-board sensors can add sufficient data to achieve prognostic ATE test domain. A prognostic ATE test domain can significantly improve maintenance trends and aid solving the RTOK problem. Also, system down-time and mean-time-between-failures can be improved. You might say on-board sensors supply little information for electronic test/diagnosis but consider the electrical power monitoring and power electronics control signals supplied from actual systems. As shown in Figure 2, we can expand our sensory information to actual wireless information from fielded systems and cross-correlate our diagnostic analysis. Human observations are another factor that is not utilized to the extent that it should. Reviewing human observations has been a practice for all repair facilities since ATE conception, but actually creating robust software to use this information should be required.

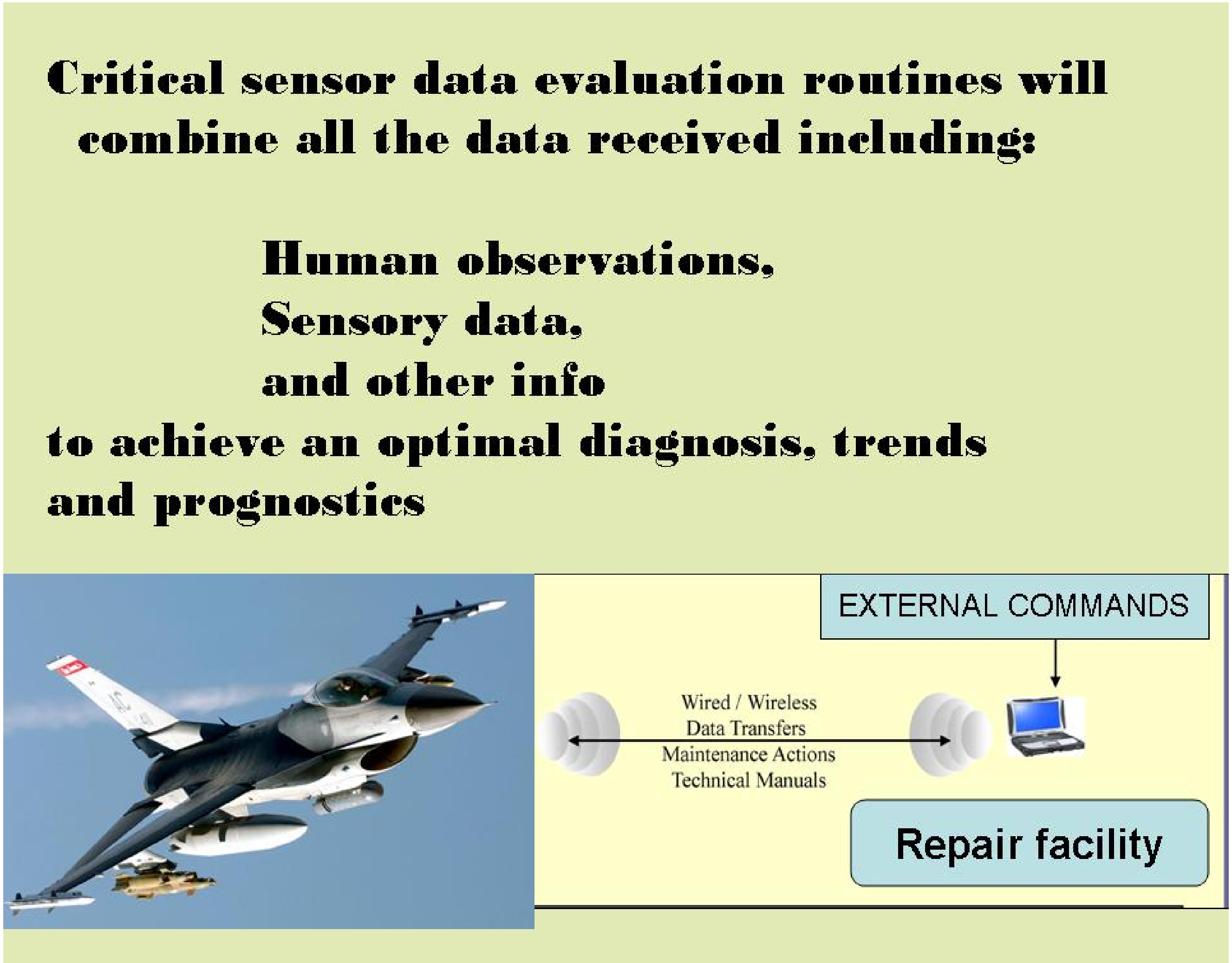

Figure 2. Human observations

If you come to believe a technology that is normally used for another application, has the potential to improve test/diagnosis you need to do adequate research and perform a detailed analysis prior to a recommendation. There are many things to consider in your detailed analysis, see table 1.

You should never have a MAJOR failure in things to consider SIGNIFICANCE.

IV. CORE INSTRUMENT CONSIDERATIONS

At the core of the defense industry's most advanced test systems[1] you'll find essential instruments. Core instrument selection is critical to adequately utilize new technology. If stimulus or measurement signals are questionable then adequate correlation can't be accomplished.

It is interesting to note how a gutless system (core instrumentation) can't perform. Instrumentation that simply can not perform an adequate test is absolutely useless. Tests performed by inadequate instrumentation are of questionable quality and pose a risk. It is senseless to perform tests/diagnosis with meager instruments.

V. INTEGRATION FACTORS

Integrating a new technology requires planning. Space in your existing system is only one factor to consider. Other factors are shown in Table 2. If you have adequate space available is your system for the new technology.

ITEM	*ARGUMENT*	*DRAWBACKS*	*SIGNIFICANCE MAJOR / WORKABLE*
Cost	Within about 20% of overall test equipment cost	Budget	MAJOR
Ease of use	User-friendly is critical, additional test time and high training requirements is counter-productive	Operator will not use if not user friendly	WORKABLE
Hardware	Can the hardware be purchased or does it need to be fabricated. Is the hardware marketable	Not available	MAJOR
Software	Open system software – source code availability	Closed system - user friendliness – source code - supportable	WORKABLE
Compatibility	Must be compatible with existing hardware and software	Non- compatibility is a NOGO	MAJOR
Open System	Becoming an industry standard – plug and play is critical	Closed systems have become obsolete	WORKABLE
Return on investment	Does the technology provide adequate cost savings to justify	Little advancements in test/diagnosis	MAJOR
Performance	Must be fast and friendly	Slow, not repetitive results are not useful	MAJOR
Safe to use	Does the technology has any hazards to humans or do human need to wear additional protective clothing or protective devices?	Hazards of any kind must be mitigated without additional human clothing or protective devices	WORKABLE
Outputs	Are the displays or testing responses in a usable format.	Evaluating display data or detailed information.	WORKABLE
Test time	Is the test time reasonable for the ROI	Excessive test time can be very awful	WORKABLE
Size	Can it fit without the desired test space	Huge systems that are not portable	MAJOR
Portable	Can the system be moved easily- is it small and workable	Weight and outsized measurements	WORKABLE
Reasonable	Does it make sense	Is it totally impractical	MAJOR
Integration characteristics	Does it require a major modification to the test system	Changes to the test system might change the test systems performance.	MAJOR

Table 1. Things to consider

Verifying technology into an actual fielded tester includes at least the following actions:

1. Utilizing the ITA hardware on a government furnished ITA.
2. Perform actual testing using a government furnished ITA(s) and UUT(s).
    a. Use an actual UUT test program running on the fielded ATE.
    b. Interact with government personnel for feedback, training, and user requests.
3. Develop all the documentation in the proper format.
4. Design, develop and code any change requests from government personnel.
5. To optimize this effort will require testing a digital, analog and hybrid UUT.

FACTOR	*CONSIDERATIONS*	*QUESTIONS TO ASK*
Cabinet Space	Wiring Portability Dual Screens Functionality	Does the new technology require it's own computer?
Power	What power is available to existing system	Does the new technology require unique power?
Computer	Another computer	Can the existing computer handle the computing needs?
Monitor	How big, how robust Confusing information	What type (touch-screen)? Different displays than normal TPS?
Connections	Comparable UUT connections	Do you unique connection technology?
Alterations	What requirements exist	Do you need to make alterations?
Interaction	Operator requirements	Is there confusing interaction between the test systems?
Hardware	Proximity, size, uniqueness	Do you need to alter existing test hardware for UUTs?
TPS	Add addition options to the TPS	Can universal TPS changes be made?
Diagnostics	Add comparable diagnostics	Can the diagnostics be compared? Are the diagnostics compatible?
Size	Cabinet space might be over utilized	Is the size prohibited?

Table 2: Factor

This verification effort will involve using actual fielded aircraft circuit boards on an actual fielded tester. It is critical to make this technology almost transparent to the user and make the usage very user friendly. This effort is vital to producing a fielded and usable product.

VI. CONCLUSION

Integrating a new technology into the test/diagnosis realm poses many risk factors. Often, a useful technology is over sold and tends to fail miserably when fielded. Certainly, new technology can be employed if it is used in a manner that functions well.

Test/diagnosis experience shows major weaknesses still exist in test/diagnosis. Weaknesses could include things like:

- Overall Life-cycle costs
- Maintainability
- Prognostics
- Real-life trends
- Technology insertion
- Time to repair
- Diagnostics
- Inter-operability
- Core systems (what is a real supportable system)
- Verification
- Flexibility
- Cross-referencing
- Logical reasoning software
- Sensor fusion
- New Sensor integration
- Experience gathering
- Data sharing
- Data analysis
- Integration techniques
- User friendliness
- Transparency
- Non-intrusive
- Acceptance

REFERENCES

[1] TERADYNE, Defense and Aerospace Test Solutions, Core System Instrumentation CSI

[2] WesTest Engineering,, WesTest.com