

VHM Impacts to ATE

Dave Droste

NDIA ATC 9/12/2010

The Task




AUTOMATIC TEST SYSTEMS EXECUTIVE DIRECTORATE

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9 October 2009

From: DoD ATS Executive Directorate
To: Chairman, National Defense Industrial Association Automatic Testing Committee
Subj: Request for Study and Recommendations Relative to the Impact on Automatic Test Equipment of Enterprise Health Management Approaches

1. "Ten years ago many industry pundits were forecasting the disappearance of ATE, to be replaced with redundant, self-repairing systems, smart diagnostics, prognostics and extensive built-in-test. As predicted, all of these technologies have advanced enormously, but survive today as true partners with traditional ATE augmenting its functions, focusing its applications and working in Harmony to achieve the common goal of maximizing prime systems availability." (Mike Ellis, Technical Program Chair AUTOTESTCON 2009)
2. These improvements to the Health Management Enterprise are indeed contributing to weapon system availability. However, they are being interpreted by some DoD Program Managers and senior leadership as an opportunity to eliminate at-system and off-system ATE.
3. It is requested that the NDIA Automatic Testing Committee perform a study to determine (1) where diagnostics, prognostics or any other elements of Enterprise Health Management have been introduced into a complex platform, and (2) the effects of this introduction on weapon system support, including weapon system availability and ownership costs, as well as any impact to the weapon system's ATE over the life cycle.
4. Please direct questions to the undersigned at (301) 757-6907 (e-mail william.ross@navy.mil) or to Jay Romania at (973)724-5832 (email jay.romania@us.army.mil).


W. A. ROSS
Assistant Director

The Task - Continued

- NDIA Automatic Testing Committee perform a study
 - Where diagnostics, prognostics or any other elements of Enterprise Health Management have been introduced into a complex platform
 - The effects of this introduction on weapon system support,
 - including weapon system availability and
 - ownership costs, as well as
 - any impact to the weapon system's ATE over the life cycle

Participants/Interested Parties List

- Anthony Sedberry
- Bill Ross
- Bruce Scott
- Chris Reisig
- Clark Harmon
- David Carey
- David Droste
- Dennis Hecht
- Derek Marston
- Gene Morin
- Grady Johnson
- Greg Simpson
- Howard Savage
- Jaime Olivas
- Jay Romania
- Jeff Olsen
- Jim Westphalen
- Joe Stanco
- John Hutchins
- John Stratton
- Kevin Walters
- Les Orlidge
- Lisa Pollack
- Mark Holtzer
- Mike Heilman
- Mike Stora
- Mukund Modi
- R. (Wade) Lowdermilk
- Rick Freeman
- Ron Newman
- Scott Brown
- Steve Butcher
- Steve Karlovic
- Tim Fountain
- Tom Sarfi
- William Birurakis

Activities to Date

- December '09 Meeting Introduced Task
 - D. Droste Identified as Lead
 - Renamed Task to VHM Instead of EHM Impacts to ATE
- Held Web Meetings
 - 1/20/10 - Provided Survey Form and Requested Comments and Data Input
 - 2/24/10 – Status of Activity

Activities to Date – Cont.

- Held Meeting 3/25/10
 - Presented/Discussed Preliminary Information
- Provided Draft Report (Strawman) 4/29/10
 - Draft/Interim/Incomplete
- Provided 2nd Draft to Entire Report Working Group 8/9/10
 - No Comments Received in 10-day window

Results

- Final Report is Available
 - Incorporates DRS TEM and Agilent Direct Inputs
 - Selected Papers from Past AutoTestCons and Prognostics Conferences (References Cited in Report)
- VHM has Provided Significant Benefit
 - On and At-Platform Diagnostic Labor < 50%
 - Time to Diagnose <30%
 - Ambiguity Size Reduction (Variable, but Exists)
 - Minor Reduction of NEOF on ATS (Not Quantified)

Results

Relationship/Interaction of VHM and Off-Platform Support (ATE)

Off-Platform Test/Support Effects	VHM Evidence Factors												
	Time Stamp (Correlation of environmental events)	System Power (stability)	Power of LRU/SRU (when it doesn't correlate with System Power)	Bit Error (Recording of BIT Failure indications)	BIT Thresholds (static related to BIT design)	LRU Analog Inputs (to VHM System manager – really the LRU/SRU I/O)	Temperature of LRU/SRU	Vibration of LRU/SRU	LRU/SRU Reliability (Initial analysis expectations updated with historical reality)	LRU/SRU Life History (failure and repair history)			
Establishment/update of Test Ranges/Limits	Y	Y	Y	Y	G	G	R	R	R	R			
Reduction of NEOFs Through Test strategy/techniques	G	Y	G	G	G	G	G	R	R	G			
Run Time reduction Through Directed Test Segment	Y	G	G	G	Y	G	R	R	G	G			
Repair/Scrap decisions	Y	G	R	R	R	R	G	G	G	G			
LRU/SRU Update/redesign decisions	G	G	G	G	G	R	G	G	G	G			

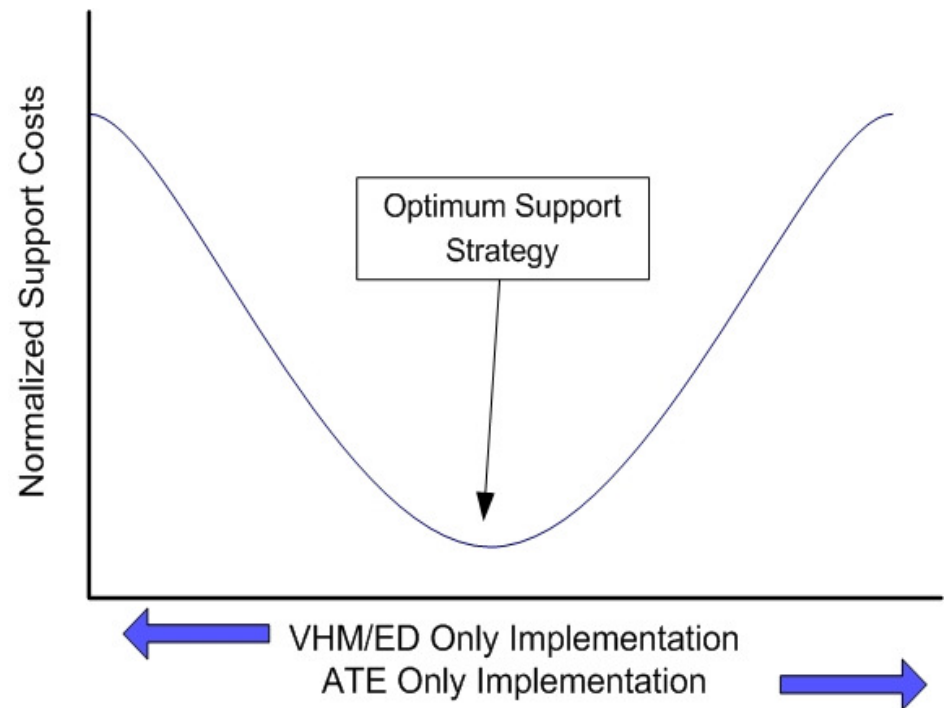
Green = VHM characteristic has positive impact on Off-Platform (ATE) support (maybe ATE Reduction)
 Yellow = VHM has moderate (neutral) benefit or effect on Off-Platform (ATE) support
 Red = VHM has no identified benefit or effect on Off-Platform (ATE) support

Results

- ATS Still Required
 - Verify Failures and/or Repairs
 - Avoid Using the Weapon Systems as a “Hot Mockup” to Verify Repair or VHM Results
 - Some Testing Not Practical On-Platform due to Accessibility and Size/Weight/Power (SWAP)
 - ED/VHM Performance in Presence of Battle Damage an Issue
- ED/VHM may Result is Slightly Reduced ATS Workload (Variable)
 - Not Really Quantifiable Due to Diversity of Factors

Results

- The Use of VHM and At-Platform & Off Platform ATS needs to take a Balanced Approach
- The Optimum Balance Depends on a Number of Variables
 - Design of the Platform and Effectiveness of VHM
 - Deployed Location and ATS Availability
 - Design Complexity/Technology of Platform
 - Etc.



Summary

- With Current Technology/Capability ED/VHM Requires Repairs to be Verified Off-Platform
- ED/VHM Not able to Perform Effectively 100% of Time With Battle Damage
- Indication that Costs to Eliminate Off-Platform ATE and a Totally Comprehensive VHM Would
 - Add Prohibitive Size, Weight and Power (SWAP) to Platforms
 - Ultimately Be Unsuccessful Due to Accessibility of Signals While (LRU and SRU) Installed on Platform
 - Advanced Architectures (LRMs) May Change This Picture
- A Mix of ED/VHM and ATE is Still the Answer with Current Technology