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NDIA SE Statistical Test Optimization Synthesis Panel: Key Findings & Recommendations

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NDIA SE Statistical Test Optimization
Synthesis Panel: Key Findings & Recommendations

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Discussion Topics / Flow:

- Synthesis Panel Background
- High Level Current State Assessment
- “Turning up the Gain” Key Result Areas
- One Organization’s Developing Statistical Test Optimization Maturity: Raytheon IDS

NDIA SE Statistical Test Optimization Synthesis Panel Background

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- The NDIA DT&E Committee identified Statistical Test Optimization using Design of Experiments as a key priority area.

- Accordingly, a Statistical Test Optimization Conference thread was developed for last year's NDIA Systems Engineering Conference. The conference thread consisting of two tutorials, four case study presentations, and a synthesis panel with inter-active audience discussion, was well received.

- The material that resulted became the starting point for a knowledge sharing and white paper development effort involving conference synthesis panel members and interested participants to improve upon our program implementation effectiveness.

NDIA SE Statistical Test Optimization Synthesis Panel Key Contributors

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- Clint Cole, Raytheon
- Laura Freeman PhD, IDA
- Karl Glaeser, AVW Technologies
- Larry Leiby, DUSA(TE)
- Gregory Hutto, 96 Test Wing, USAF
- Mark Kiemele, PhD, Air Academy Associates
- Neal A Mackertich PhD, Raytheon
- Joe Manas, Raytheon
- Allan T Mense, PhD, Raytheon
- Kedar Phadke, Phadke Associates
- Eric Rolfe, Raytheon
- Alethea Rucker, AF/TE
- Tom Russell, DDL Omni Engineering
- Stephen Scukanec, Northrop Grumman
- James Simpson, PhD, 53d Wing, USAF
- Elizabeth J Wilson, PhD, Raytheon
- James Wisnowski, PhD, Adsurgo LLC
- David Wright, LtCol, USAF 96 Ops Group

NDIA SE Statistical Test Optimization
High Level Assessment of Current State

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- Executive Leadership is actively leading the charge and driving for results.
- Pockets of excellence exist and the tools needed are readily available to enable our success.
- Achieved business results from integrated program implementations make the business case for increased deployment
- Our best practice approach needs to become standard practice. In short, it is time for us to be **"Turning up the Gain"** and reaping the benefits associated with across the board integrated deployment.
- Our Synthesis Panel decided to focus our efforts on the integrated use of Design of Experiments in Test & Evaluation because it lays a foundation for all analyses, and in combination with other STAT tools, provides defensible test and analysis.

NDIA SE Statistical Test Optimization
Identified "Turning up the Gain" Key Result Areas

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- Transition from a subject matter expert (SME) based model to a practitioner based model with the SME in the role as teacher, coach, mentor and consultant.
- Focus on achieving Mission Assurance through "right size" testing. Cost and cycle time benefits will follow.
- Integrate the use of scientific test and analysis techniques directly into the product development process and reviews as a part of standard design practice.
- Focus reviews on evaluating developed test designs not on whether or not design of experiments was utilized. Use right measures to drive right behavior (power, confidence and coverage).
- Enable team ownership and accountability through SOWs, procedures, policies, TEMPs, service instructions, memos, etc.

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"Turning up the Gain" Key Result Areas Continued...

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- Be wary of using a cookbook or template based approach, context is of critical important.
- Share case study applications as a mechanism for enabling increased understanding of context across the product lifecycle and various domains. (Note: Toward this end, our white paper includes 16 case study summaries.)
- Create overall organizational awareness and team / role levels of learning as needed. Train to the application need and look for on-the-job training opportunities.
- Leverage existing Centers of Excellence (STAT, et al.) in test requirements / budgetary planning and for subject matter expertise / resources.
- Continually reinforce that statistical test optimization methods enable test optimization and complement but in no way replace domain expertise.

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Raytheon IDS Statistical Test Optimization Maturity

Initial

Organizational Readiness

- Awareness based on personal contact with SME and courses taken
- Classical DOE / statistical performance modeling orientation and training

Enabling Process & Tools

- Classical DOE / statistical analysis toolset
- Limited IPDS process integration

Program Integration

- Ad hoc
- Tool based
- SME driven
- Focused on Risk Mitigation

Current

Organizational Readiness

- Customer / Leadership Driven
- Emerging organizational knowledge and demand
- Classical + DOE for Test Optimization training and application

Enabling Process & Tools

- Classical + DOE for test optimization toolset
- Integrated IPDS Thread & SEMP / TEMP inclusion
- Test design statistical assessment capability
- Programs have to defend need to tailor in

Program Integration

- Enabling the Plan
- Need based
- Program SME driven
- Focused on Risk Identification and Mitigation

Vision

Organizational Readiness

- Top down and bottoms up driven
- Basic skills are a test core competency
- Integrated DOE / statistical performance modeling & test optimization capabilities

Enabling Process & Tools

- Integrated DOE performance modeling & test optimization toolset
- Integrated IPDS Thread & SEMP / TEMP inclusion
- Test design statistical assessment an integral part of test reviews
- Programs have to defend need to tailor out
- Proposal Win Discriminator

Program Integration

- Increased up-front Customer engagement
- Integral to the Plan
- Value based
- IPT / Practitioner driven
- Focused on Risk & Opportunity Identification and Mitigation / Capture

Raytheon IDS Statistical Test Optimization Deployment Baseline Comparison Summary

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Test	Original Test Plan	Optimized Test Plan
Subsystem Testing	28 Tests	8 Tests (71% reduction)
Systems Mission Testing	25 Missions	18 Missions (28% reduction)
Subsystem Simulation	100 Runs	40 Runs (60% reduction)
Near Field Range Testing	1036 Tests	632 Tests (39% reduction)
Software Subsystem Testing	90 Tests	63 Tests (30% reduction)
System Range Testing	826 Tests	473 Tests (42% reduction)
System Modeling & Simulation	26 Scenarios	22 Scenarios (15% reduction)
Subcontractor Testing	90 Tests	49 Tests (45% reduction)
System Testing	332 Tests	238 Tests (28% reduction)

In each case, the reduction in number of test cases was achieved while maintaining or improving upon existing statistical test coverage, confidence and power.

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Leading Change & Driving for Business Results

"There is no way around it - we have to find ways to do more with less. The integrated program use of statistical techniques such as Design of Experiments, have proven themselves to be powerful enablers in our test optimization efforts to reduce cost and cycle time while providing our customers with confidence that our systems will perform."

Dr. Tom Kennedy

Executive Vice President & Chief Operating Officer.

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Biography / Contact Information

- Dr. Neal Mackertich is a Principal Engineering Fellow and member of the IDS System Architecture, Design & Integration Directorate Technical Staff. During his twenty-eight years at Raytheon, Neal has held positions of increasing responsibility within both Engineering and Program Management including that of Systems Integration, Verification & Validation Lead and Director of the Raytheon Six Sigma Institute. Neal is presently responsible for the Systems Engineering enablement of Mission Assurance through product & process optimization strategies within Raytheon's Integrated Defense Systems business. Neal holds a BS in Chemical Engineering, a MS in Engineering Management and Ph.D. in Engineering Operations Research from the University of Massachusetts at Amherst.

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