Raytheon

Customer Success Is Our Mission

Statistical Test Optimization
High Maturity Practices

Raytheon Integrated Defense Systems

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The Statistical Test Optimization Challenge

Raytheon
Integrated Defense Systems

We are being challenged by our customers and by the marketplace to develop and deliver increasingly complex systems with smaller performance margins that meet the user's requirements in the shortest time, with high reliability, open and adaptable, and at the lowest cost.

Given this challenge, there is more pressure than ever on test activities to deliver performance results on time and within budget. The integrated program application of statistical test optimization techniques have proven themselves to be a best practice enabler in overall test optimization efforts.

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.

"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
Chief Executive Officer
Raytheon Company

Organizational Readiness:

- Statistical Test Optimization (STO) is a Core Test Planning Competency
- STO Practitioner and Subject Matter Experts (SMEs) Development Process
- SMEs are external biased; always searching for best practices
- Trainers and coaches are experienced and motivational
- STO Experts and Practitioners are recognized for their results

Organizational Readiness (continued):

- SME network is well led / networked
- Actively promoted and expected by Leadership
- Success stores are propagated throughout the organization
- Celebrate success (“OctoberTest”)
- Overcoming traditional “one factor / requirement at a time” testing mentality

Process & Tools:

- The use of scientific test and analysis techniques is integrated directly into the product development process, procedure and reviews as a part of standard design practice

- Test Readiness Reviews focus on evaluating developed test designs not on whether or not design of experiments was utilized

- Statistical test optimization efforts should be integrated rather than run in parallel with traditional methods

Process & Tools (continued):

- Recognition that process experts tend to underestimate context; domain experts tend to overrate context; truth is in the middle
- Test automation enablement through scripting
- Be wary of tendency for statistical tool infatuation (better to be tool agnostic)
- Leveraging increased opportunity exists for up-front integrated Operational Analysis and Model Based Engineering (MBE), Agile application

Program Integration:

- STO integral to up-front program planning (“Festina Lente”)
- Up-front use of a multi-discipline Test Optimization Workshop
- Implementation driven by Product Teams not by SMEs
- Analysis output linked to Risk & Opportunity register
- STO integral to Test Readiness Review Process

Program Integration (continued)

- Up-front and integral Customer and Supplier involvement
- Focus needs to be on achieving Mission Assurance though “right size” testing and on increasing the knowledge gained from the testing…. cost and cycle time benefits will follow
- Actively considered as an enabler for all forms of testing across all phases of the lifecycle
- Understanding of system requirements and intended operational use is absolutely critical in development of a properly defined parameter design space, interactions of technical interest, and any constraints

Program Integration (continued):

- Up-front Measurement System Analysis (MSA)
- Integrated and contextual understanding of measures of effectiveness (statistical confidence, coverage & power)
- Be wary of statistical tampering of individual test cases / experimental runs by test leads and operators
- Test / DOE language issues (test cases, presentations, objectives, missions, scenarios, factors, parameters, etc.) can slow the process and the technical context understanding