WSTAT

Whole System Trades Analysis Tool

Highlights

What does WSTAT Enable?
- Decision support for system designs
- Exploration and evaluation of the complex trade space that exists between component-level design decisions and system-level stakeholder value areas (e.g. performance, investment cost, schedule risk, growth potential, operating cost)

Why is WSTAT important?
- Provides analytical rigor and a robust systems engineering approach to tradeoff analysis.
- Provides a repeatable way of assessing system design solutions to determine major cost and capability drivers.
- Is capable of solving highly complex optimization problems for system design choices covering various technology areas and performance requirements while balancing other areas of stakeholder value (cost, risk, etc.)

Key to Success
- Collaboration with analytical community
- Validated data sources (cost & performance)
- Senior leadership engagement and involvement

Example Applications
- Inform Requirements:
  - ➢ Evaluate the ability of optimum system configurations to meet performance requirements
  - ➢ Assess the tradeoffs among opposing requirements
  - ➢ Evaluate the impacts of meeting certain requirements (on cost, other requirements, or system characteristics)

WSTAT Overview

WSTAT is a decision support tool that integrates subsystem models into a holistic system view, mapping critical design choices to consequences relevant to stakeholders. It is capable of solving highly complex optimization problems covering various technology areas and performance requirements while balancing costs, risk, and growth – in sufficiently short timeframes to support the various stages of a system's modernization process. WSTAT was developed and applied in partnership with the US Army Program Executive Office for Ground Combat Systems to provide unprecedented analytical capability and application of systems engineering in system design.
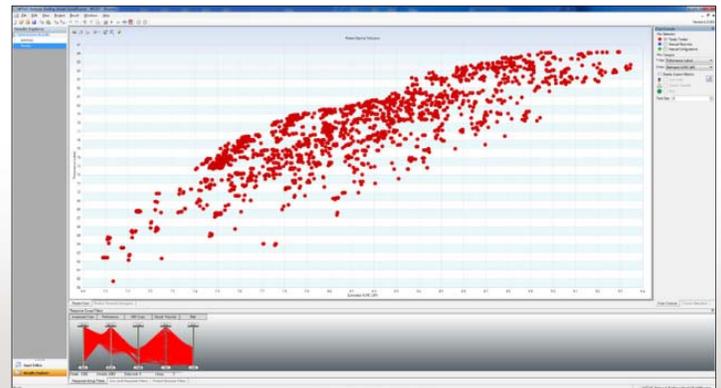
Multi-Dimensional Pareto Solution Set
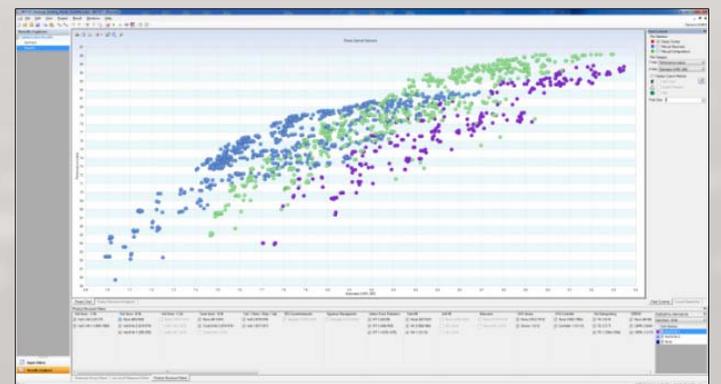
Technology Trends

WSAT
Whole System Trades Analysis Tool

Key Features

Optimization Features

- Rapidly identifies a Pareto frontier sampling that outlines the efficient tradeoffs between multiple system objectives
- Identifies major cost and capability drivers in the trade space of optimum system designs
- Captures physical and programmatic system design constraints:
  - ➤ Necessitation and obviation relationships between technology areas
  - ➤ Performance requirements are explicitly modeled, so that tradeoffs can occur among them
  - ➤ Different types of system costs (procurement, O&S) are modeled

Input Features

- Data architecture makes it easy to define the inputs despite high complexity of the problem
- Enforces consistency between inputs and provides the analyst with extensive data validation checks
- Allows definition of components, sub-systems, technology and system dependencies, function priorities, and requirements
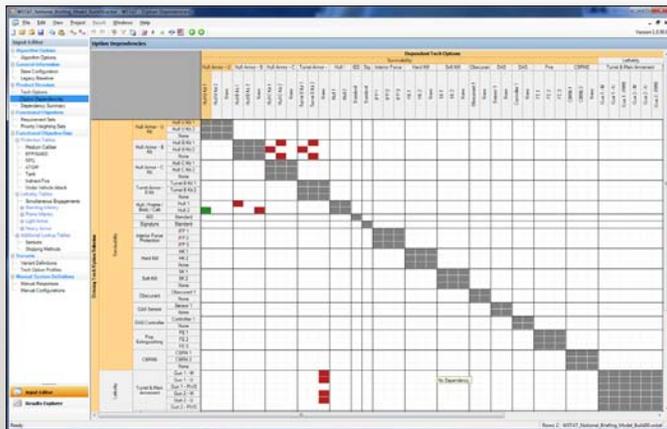
Technology Option Dependencies

Output Features

- Pareto frontier solutions can be plotted on different axes for comparison purposes
- Filtering capabilities to explore trade space
- View multiple dimensions on one chart
- Detailed output views: subsystem selections, functional area performance, and system-level metrics

Key Benefits

High Performance and Capability

- Makes component and subsystem technology selections to balance multiple system-level stakeholder value areas
- Uses a genetic algorithm to solve a Multi-Objective Combinatorial Optimization problem
  - ➤ Runs on standard PC/laptop hardware
  - ➤ Takes advantage of high-performance multicore computing capabilities
  - ➤ Can be quickly re-run with updated assumptions and constraints

Clean, Intuitive User Interface

- Streamlines data entry/model building process
- Effective data visualization
  - ➤ Enhances communication between stakeholders, analysts, and SMEs
  - ➤ Provides tools to assist analyst with data verification and validation
- Simplifies specification of different analysis cases
- Provides insightful results tables and charts
- Easy integration with Excel

Product Structure Histograms

Comparison Charts
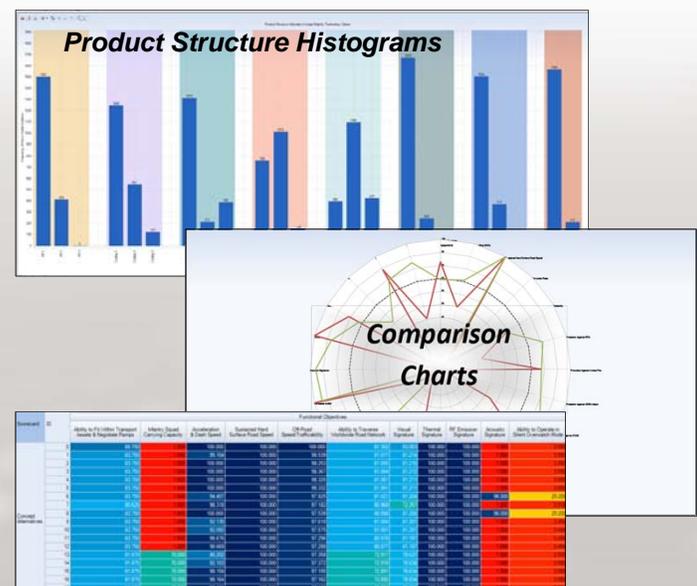
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