Engineered Resilient Systems

Influencing Acquisition Innovation

20th Annual NDIA Systems Engineering Conference
October 26, 2017

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ERS Program Manager
US Army Engineer Research and Development Center (ERDC)

ERS Platform: Innovation & Acquisition Reform

ENGINEERED RESILIENT SYSTEMS
DEPARTMENT OF DEFENSE

DoD current goals of acquisition reform and innovation are supported in six major thrusts within ERS

Non-linear Engineering
Promotes Model-based Engineering

Data-driven Analytics and Machine Learning Data Analytics
Deeper insights into decisions

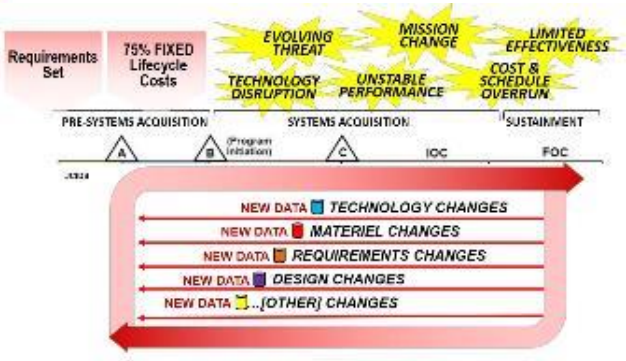
Physics-based Modeling
Enables design accuracy earlier in the process.

Big Data Visualization
Enhances communication and understanding in decision-making

Workflow Solutions
Breaks down barriers to HPC use

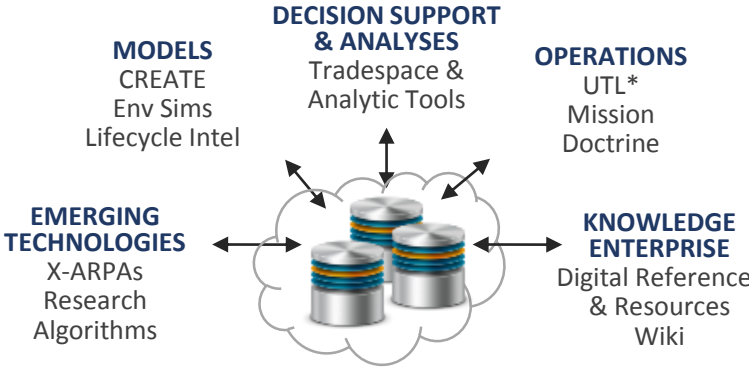
Govt-Industry Collaboration
Amplifies communication with common understanding and goals

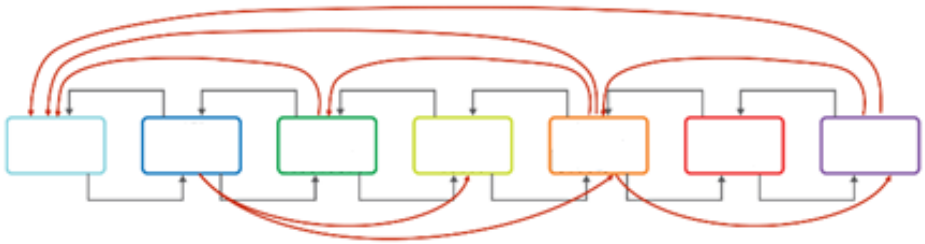
Non-linear, Model-based Engineering



Linear Engineering does not support today's complex system engineering and analytics

Maximize the use of data and models for large scale analytics





Facilitates non-linear engineering processes

* Universal Task List

Relevant ERS NDIA Talks

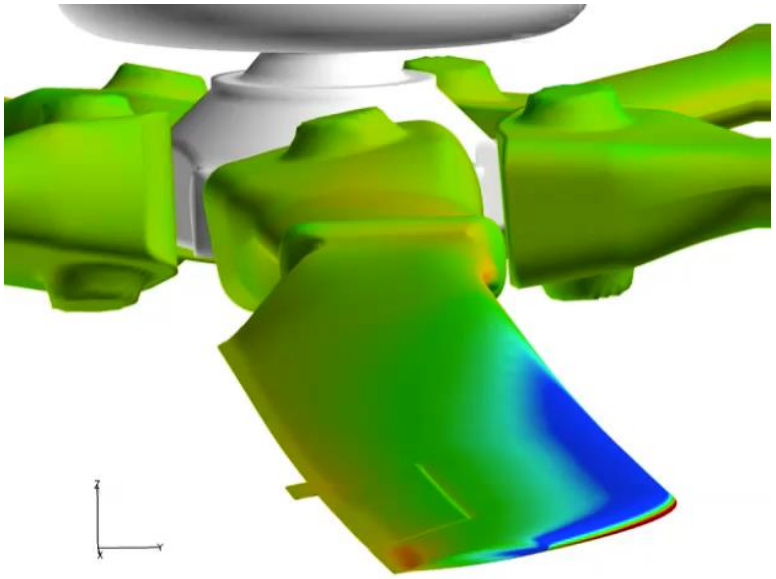
11:05 - Introducing Lifecycle Cost to Early Conceptual Tradespace Exploration
Alex Baylot - ERDC

1:00 - The Language of Complexity: Ontology in Systems Design & Engineering
Abe Wu - Raytheon Missile Systems

4:30 – ERS & MBE: Opportunities, Risks and Best Practices
Mark Halpern- Gartner

Physics-based Modeling

Provides confidence in performance and viability assessments early in the process



- **Realistic Insights:**
  - **Effectiveness (performance) and efficiency (time & cost) are critical measurements in the concept design phase**
- **Test/Eval Confidence:**
  - **Makes supporting virtual flight certification processes for new or modified platforms achievable**

Relevant ERS NDIA Talks

1:20 - Physics and model based aerodynamic design and analysis at GA *Pritesh Mody - General Atomics*	2:15 - Application of CREATE Tools for High Fidelity Design Space Exploration *Antonio De La Garza III - Lockheed Martin*	3:15 - Clustering Analysis in ERS Tools for Enhanced Trade Space Exploration of GVs *Andrew Pokoyoway - TARDEC*

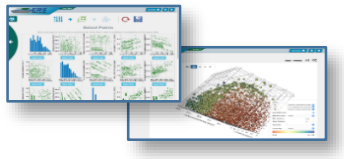
Workflow Solutions for Computational Environments

New workflow solutions lower the barriers to working in high-performance environments

Requirements & Systems Modeling

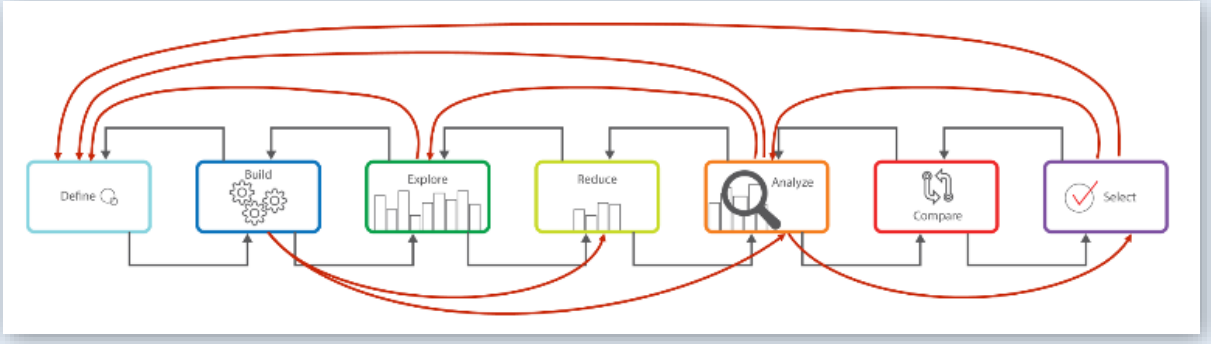
Tradespace Creation

Tradespace Analysis



INTEGRATION AUTOMATION COLLABORATION

INDUSTRY
Develop & integrate tools to support complex system design processes



GOVERNMENT
Invest in future computing environments; communicate needs

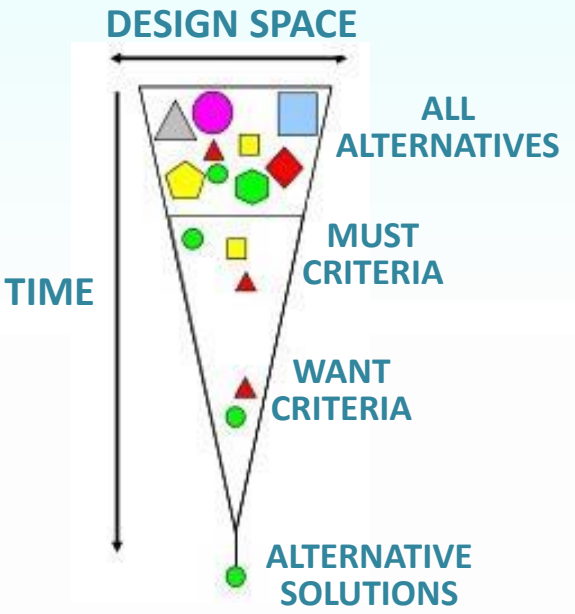
Relevant ERS NDIA Talks

1:50 - Automation and Integration for Complex System Design
Scott Radon - Phoenix Integration

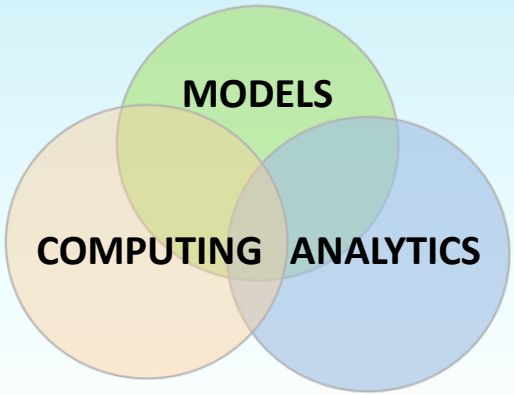
Data-driven Analytics
Machine Learning Data Analytics

Data-driven, tradespace analytics – provides greater insights earlier in the design process, e.g., cost vs risk

DATA-RICH ASSESSMENTS



INTEGRATED TOOLS & RESOURCES



MACHINE LEARNING TECHNIQUES

Humans - 10s of Options

Excel - 100s of Options

Data Analysis Tools - 1000s of Options

Hyper-dimensional space - Millions of Options

Relevant ERS NDIA Talks

8:50 - Scaling Data Analytics for Engineered Resilient Systems
David Stuart – ERDC

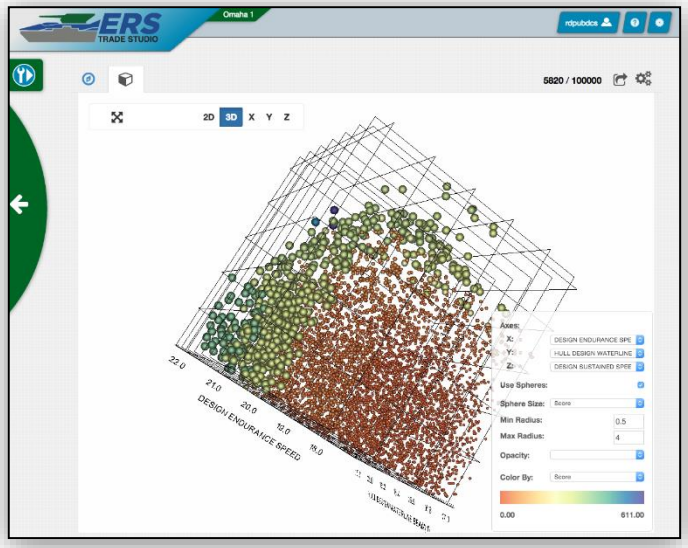
10:15 - Tradespace: Informed Decision-making for Acquisition
Timothy Garton - ERDC

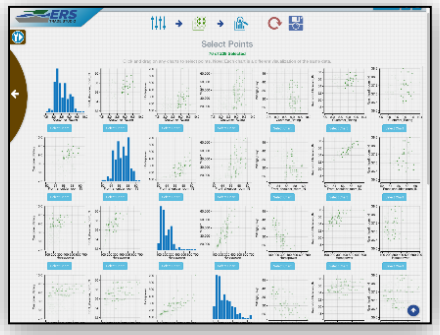
Big Data Visualization

Data Visualization builds accurate representations for the human mind

ERS Visualization of multi-dimensional data enables:

- Deeper comprehension (required for use of big data analytics)
- Higher level interpretation of multi-dimensional data representations for human consumption
- Critical communication in decision-making





ERS TradeAnalyzer provides automatic insights into design decisions for the user.*

***Beta Release completed Sep 2017**

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Andrew Pokoyoway - TARDEC

Govt-Industry Collaboration Infrastructure

Synthesizes community-wide goals with common data sources, analyses, assessments, and improved understanding.

Relevant ERS NDIA Talks

11:30 - Overcoming the Government-Industry Collaboration Hurdle
Patrick Martin, PhD - BAE

1:25 - Physics and model based aerodynamic design and analysis at GA
Pritesh Mody - General Atomics

2:15 - Application of CREATE Tools for High Fidelity Design Space Exploration
Antonio De La Garza III - Lockheed Martin

ERS in DoD Acquisition Context

DESIGN ENGINEERING ANALYTICAL ENVIRONMENT
Conceptual Design
Analysis of Alternatives
Value Engineering

HIGH-FIDELITY COMPUTATIONAL ENVIRONMENT
Prototyping
Test & Evaluation
Operational Analysis

PLATFORM DOMINANCE
Leverage domain expertise across DoD

USER-BASE STAKE HOLDERS

- SENIOR DECISION MAKERS
- PEOs, PMs
- ACQUISITION ENGINEERS
- SMEs
- ANALYSTS

WEB INTERFACE

ALTERNATIVES

DECISIONS

INDUSTRY Cloud Services

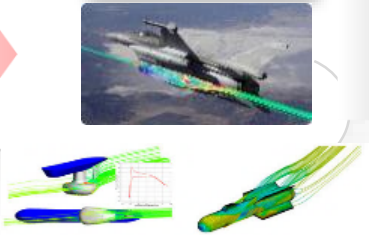
IP PROTECTED

RMF COMPLIANT

- CAPABILITIES GENERATION
- TRADESPACE ANALYSIS
- MISSION ENGINEERING
- ENGINEERING ANALYSES
- COST ANALYSIS
- WORKFLOW PRODUCTIVITY

Domain-specific Design and Engineering Support

MAKE PROTOTYPING COMPUTATIONAL



ENTERPRISE DATA AND KNOWLEDGE ENVIRONMENT

DIGITAL THREAD – DIGITAL TWIN

DOCUMENTATION **SEARCH** **STORAGE** **DISTRIBUTION** **RETRIEVAL** **TUTORIAL**

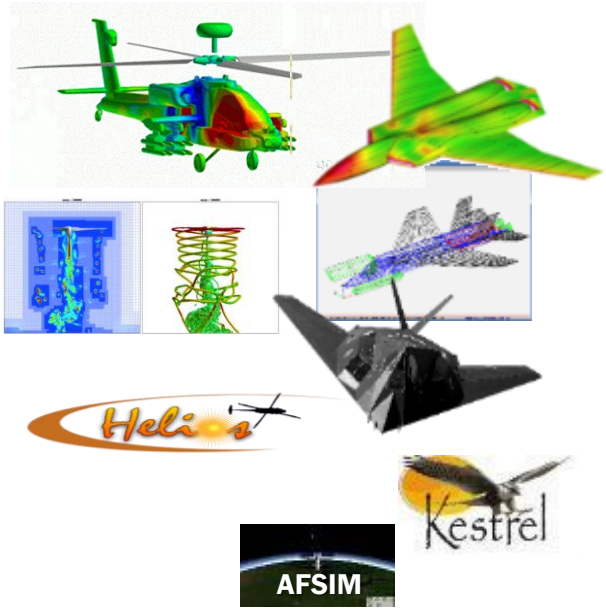
ENGINEERING A RESILIENT SYSTEM

ERS: Developing Domain-specific Design Environments

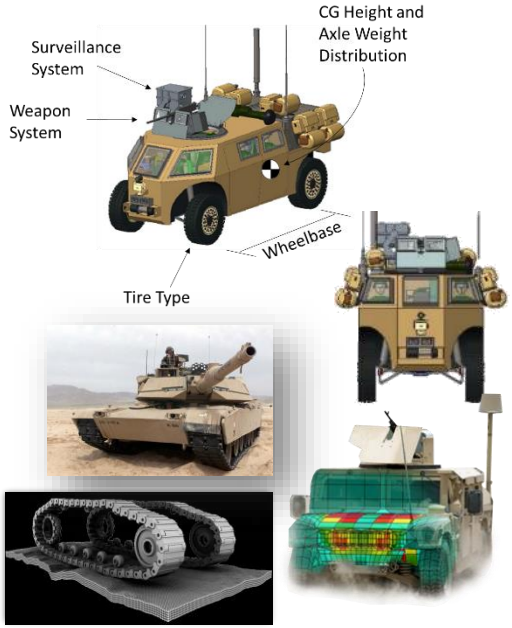
Each domain has unique processes and toolsets

Air

Rotorcraft – Fixed Wing



Land

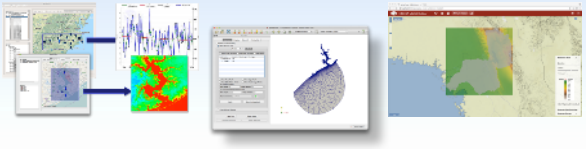


Sea

TOOLS AND PROCESSES **HPC** **ENVIRONMENTAL SIMULATOR**

TradeStudio

CREATE



SUPPORT BY COMMON, INTEGRATED RESOURCES

ERS Industry Participation

Industry partners are working with the Government in the ERS environment development and implementation

BAE SYSTEMS

11:30 - Overcoming the Government-Industry Collaboration Hurdle
Patrick Martin, PhD - BAE

Raytheon

1:00 - The Language of Complexity: Ontology in Systems Design & Engineering
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GENERAL ATOMICS AERONAUTICAL

1:25 - Physics and model based aerodynamic design and analysis at GA
Pritesh Mody - General Atomics

PHOENIX INTEGRATION

1:50 - Automation and Integration for Complex System Design
Scott Radon - Phoenix Integration

LOCKHEED MARTIN

2:15 - Application of CREATE Tools for High Fidelity Design Space Exploration
Antonio De La Garza III - Lockheed Martin

Senate Arms Services Committee Statement on Pentagon Acquisition System Report

"…Without ongoing reform and innovation, the Department of Defense cannot hope to maintain the technological advantages that underpin our nation's military superiority."

Senator John McCain
Majority Chairman, SASC
August 2017

Questions

ERS NDIA
FUELING INNOVATION & COLLABORATION