Framework for Assessing Cost and Technology Project (FACT)

Project Overview & Metadata Standardization

Marine Corps Systems Command
Systems Engineering, Interoperability
Architectures, and Technology

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FACT Overview – Why FACT

• Problem: Marine Corps needs a capability to enable rapid exploration of trade space and alternatives analysis
  – trial and error least efficient
  – high cost
  – many one-off solutions & limited life cycle extensibility (these have been useful but no reuse)
  – M&S allows ability (adaptable) to start with lower fidelity and develop higher fidelity within the acq cycle
  – allows generation of an exhaustive number of alternatives

• Approach: A M&S Systems Engineering framework
  – model agnostic
  – common language for data interchange
  – collaborative
  – integrates analysis and cost models to support vehicles throughout the vehicle lifecycle – promotes reuse – builds on prior efforts
Standard Acquisition Process

Design Team
- Req Docs
- RFP

End To End
- Archive
- Decision Makers

Test
- Analysis Team

Prototype
- Marine Corps T&E
- Joint T&E

Analysis Report

Decision Makers

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Moving from Sequential to Concurrent Design Trades

Diagram showing the relationships between Mobility, Survivability, Maintainability, Reliability, Lethality, Transportability, and Affordability.
FACT Process

- Complements the Systems Engineering process and provides a decision support tool set that enables rapid trade space and alternatives analysis...unique

- Apply this process to the elements of traditional weapon system acquisition
  - Performance
  - Cost (design linked)
  - Reliability, Availability, & Maintainability
  - Logistics Support
FACT Applied Across A Platform Lifecycle

**Should cost**
- Concept Refinement
- Requirements Rationalization with Cost

**Will cost**
- Tech Development
- Analysis of Alternatives

**Does cost** (Acquisition)
- Source Selection

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**Analysis of Alternatives**
Rigorous systems engineering process applied to identify alternatives and modeling and simulation to analyze them

**Requirements Definition**
Conduct requirements feasibility analysis and identify key tradeoffs during material solution analysis phase

**Source Selection**
Toolset may be used to assist source selection planning

**Tech. Roadmap**
Technologies evaluated against functional architecture Requirements during technology development phase

**Inform Acquisition Decisions**
Modify tools to verify candidate system performance and technologies through M&S enabling contractor oversight

**Tech. Readiness Assessment**
Determine if Critical Technology Elements exist and impact system maturity

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**Sustainment Support**
Addition of reliability, logistical, and life cycle cost modeling to support deployment
FACT Implementation for an Individual Vehicle Development/Upgrade

Bracket the Problem – Then Refine
FACT Data/Information Traceability – Expanding to Test and Evaluation

Key Milestones

Formal Testing

Current FACT

Development
- Feasibility
- Alternatives
- Design

Specify
- DoD Artifacts
- Plan
- Test Plan
- Training
- TEMP

Measure
- COIs
- MOEs
- MOPs
- Metrics
- UJTLs

Evaluate
- Analyze
- Report
- Present

Test
- Virtual
- Constructive
- Live

Design of Experiments

FACT Test Design

Archive

More Joint

Improve
- Redesign
- Refine
- Train

FACT Test Support

Specify

• DoD Artifacts
• Plan
• Test Plan
• Training
• TEMP

Measure

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FACT Test Support
Shareable and Discoverable Data - A Key Enabler to Data/Information Traceability Across Lifecycle Phases

**Discovery Metadata Process**

- **EMBR Tool**
  - ACV Cost Model
  - ACV Performance Model
  - FACT Framework

- **Metadata Standard**
  - Id (…)
  - Taxonomy
  - Title
  - Type
  - Description
  - Dates
  - Version
  - Rights
  - Releasability
  - Security
  - Associations
  - POCs
  - Keywords
  - Usages
  - Media
  - Image
  - Taxonomies Cited
  - Extensions
  - Other

- **DoD M&S Catalog**

**System Metadata Process**

- **SysML Specification & Fact Authoritative Documents**
- **SysML Parser / Code Generator**
- **System Data/Metadata BSON (MongoDB documents)**
- **FACT Model Repo**
- **FACT Web Dashboard**

- **Associated Parametric Models** (executable code)
- **Model Wrappers** (as necessary)

- **Parameter Values and Results**
- **WBS and Attributes**

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FACT Trade Space Technical Approach

Objectives

Drive Cycle

Product Benchmarking

Requirements Tradespace

Initial Architecture Selection

Baseline Models

Simulation

Energy Balance

Market Outreach

Technology Market Survey

Define

Characterize

Analyze

Design of Experiments

Surrogate Model Development

Technology Selection Tool

Design Space Exploration

Pareto Frontiers

Final Architecture Selection

Balance System Requirements

Technology Selection

Concept Design

Prototype Verification & Validation

Verify
Summary

• FACT is an M&S Systems Engineering Framework
  – model agnostic
  – common language for data interchange
  – collaborative
  – integrates performance and cost models to support vehicles throughout the vehicle lifecycle – promotes reuse – builds on prior efforts

• FACT current focus is integration of models supporting trade space analysis during system concept development and guiding technology development phases of precededent and unprecedented systems

• FACT is expanding towards a standardized workflow and model/data driven approach

• FACT supports Design of Experiments for Test and Evaluation

• FACT shaping strategy offers
  – Leverages disparate models and databases in a federation built using open standards
  – Facilitates exploration of the design trade-space for insight into system performance weighed against both procurement and lifecycle cost
  – Identifies program risks for cost, schedule, and performance early in system development when mitigation measures are simpler and less expensive i.e. we don’t “bend metal” until we understand the system design and manage risks
Questions?