Framework for Assessing Cost and Technology

*Integrating M&S into the Acquisition process*

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Framework for Assessing Cost and Technology (FACT)
Integration with HSI
Roadmap FY16-FY17

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The Framework for Assessing Cost and Technology (FACT)

- **Winner of the 2014 Secretary of the Navy Innovation Excellence Acquisition Team of the Year Award**, introduced a new systems engineering tool into the MCSC.
- FACT enables **rapid trade space and alternatives analysis** in support of United States Marine Corps (USMC).
- It is capable of conducting trade space analysis from Pre-Milestone “A” analysis of alternatives to system disposal.

![Image of award ceremony](image_url)
FACT Capability Overview

**Framework for Assessing Cost and Technology**

- **Capture Knowledge**
  - Conceptualizing the System
  - Conceptualizing the Needs
  - Defining Part Interdependencies

- **Execute Models**
  - Monte Carlo Simulation
  - Automatic System Assembly
  - Concurrent Execution

- **Collaborate**
  - Near Real-Time Feedback
  - Specific User Control & Permissions
  - Archived Changes & User Communication

- **Visualize Data**
  - Dynamic Data-Driven Displays
  - Intuitive Interactive Interfaces
  - Statistical & Visual Analytics

- **Agnostic Model Interface**

- **Extensible Data Interface**

* There can be multiple models within these generic categories, e.g., cost models for both the life cycle and acquisition, each being its own “peg”
† Requires integrated models to be executable in near real-time

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Web Browser Interface
# M&S/SE Tools Applied Across the Vehicle Lifecycle

<table>
<thead>
<tr>
<th>Should cost</th>
<th>Will cost</th>
<th>Does cost (Acquisition)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milestone A</td>
<td>Milestone B</td>
<td>Milestone C</td>
</tr>
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- **Previous:** focus on concept refinement using one-off custom tools
- **Introducing Cost and RM&A and extending through life cycle through web-based, evolving tools**

### 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

### Sustainment Support

- Addition of reliability, logistical, and life cycle cost modeling to support deployment
Human Systems Engineering Analysis Tool (HEAT)

- Developed under the SBIR Program by Harmonia Holdings Group, LLC, a company with a history building of HSI/Human Computer Interface (HCI) design tools that informed the design of HEAT.
- HEAT, is an optional software module installed into FACT for HSI impact detection, analysis, prediction, comparison, and reporting.
- HEAT also catalogs HSI artifacts (e.g. risks, user feedback, etc.) through a program’s lifecycle in a repository to support evidence for final certification and reuse of lessons learned.
- HEAT’s support of HSI is not limited to any platform and works for any hardware or software system which supports human habitation or provides a human interface (e.g., knobs/buttons, wearable computers, instrument panels in vehicles).
A Naval Engineer is working on the design of a habitable space (e.g. cockpit, workstation, etc.) and wants HEAT to help him check if there are any impacts on an operator in that space.

- The user will load the system’s CAD file into CAD JS and click the HEAT button.
- The user will be presented with a mock interface to step him through the rest of the process:

1. HEAT adds icons in the parts tree that are human-related;
2. User selects a part (e.g. console) of interest;
3. HEAT adds a human reservation to the 3D model in the form of a 3D rectangle roughly the size of a 95th percentile male to the part;
4. HEAT centers 3D model on the part with the human rectangle positioned appropriately;
5. User clicks ‘Run collision detection’;
6. User receives visual results.
FACT 2.1
Smart Antenna
HMMWV
3D MODEL & SYSML
JACK
JACK Acquisition

PHASE ONE
GFI
FACT C4I 1.7
FACT 2.1
Smart Antenna
HMMWV 3D MODEL & SYSML
JACK

PHASE TWO
FACT-HEAT Module
FACT 2.1.X
Smart Antenna
Add HFE Trade Space
JACK

SBIR Phase I & Option I
SBIR Phase II

Proof of Concept

Software Integration and Build Continuum

REV(2)
Nov 12, 2015
Day 1 to 5
- 15 January
Developer to provide 3D CAD model HMWVV (HMWVV CAD and Step File)

Day 1 to 30
- 19 February
Demonstration and Roadmap
- March
Phase I ends

Day 6 to 100
- Vendor to migrate FACT 1.7 to FACT 2.1.X
- Develop and document USE Case (FACT with an external model and surrogate modeling)
  - FACT from Concept->WBS->SYSML->CAD->STEP FILE->Python->AngularJS->Mongo
  - Documentation details concept vehicle being introduced into the FACT framework
  - Methodology of decomposing a concept to be integrated into a model such as FACT 2.1.X
  - Developer how to connect to the CM CodeBeamer from IDE Eclipse
  - Use the Vagrant scripts to build up the version of FACT to the designated version required (CentOS baseline to FACT 2.1.X)
  - How to make changes to Python in FACT 2.1.X
  - How to make changes to Angular JS in FACT 2.1.X
  - How to make changes to MongoDB in FACT 2.1.X
  - How to manipulate the FACT API to make a data call to the external webservices
  - How to build a surrogate model into FACT 2.1.X

March
SIAT M&S Division IPR

March
SIAT M&S Division IPR

- How to migrate a CAD design into FACT
- How to map step file data from CAD to the different SYSML and WBS attributes
- How to aggregate multiple step file to a designated WBS
- How to conduct testing of the product in FACT 2.1.X
Considerations for a FACT Module Integration in general

- Identify New Participant(s)
- Cross-Module Participation
- Maintaining FACT Module Consistency
- User-feedback Integration

FACT Module Requirements Design

- FACT User & Developer Accounts
- FACT Development Documentation & CM
- Users for Usability Testing (Throughout)
- Requirements From Domain SMEs
**FACT**

**HEAT FY16-FY17**

- Training Material
- Integrate HEAT into FACT (Alpha Release for Pilot)
- HEAT Usability Testing (Throughout)

**Baseline**

- FY16 QRTs 1-2
- FY16 QRT 3 - FY17 QRT 2
- FY17 QRTs 2-4

**Functional**

- HSI Requirements Analysis/ Management
- Alerts Management
- Human Modeling Support

**Extended**

- User-testing
- Reporting Support
- HSI Evaluation

**Phase I Option**

**Phase II Option**

TBD Module

TBD Module
• **Select** the type of safety analysis you want to run
• **HEAT to find** what issues it can on its own and utilize an HMT for more precise analysis and for dynamic properties such as movement or fatigue over time
• **Review** the issues found textually and in the model
• Issues would be **logged** in the HEAT repository for lessons-learned

Note: We show multiple choices to illustrate additional types of analysis we COULD investigate for support, but currently the Human Modeling Tool (Jack) provides only collision analysis, though additional manual analysis can be done using some of their dynamic and advanced modules