Soldier-centered Analysis from Requirements to Test & Evaluation

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Soldier-centered Analysis

Analyzes system concepts and requirements from the Soldier’s Perspective for example:

Concept document reads:

The remote operations allow the gunner and/or vehicle commander to remain protected from enemy fires...

- Soldier-centered analysis identifies that the vehicle commander is the gunner and analyzes the consequences to mission performance.
Influencing Requirements

Soldier-centered Analysis

The Defense Acquisition Management Framework
Analysis Tool

IMPRINT
Improved Performance Research Integration Tool

http://www.arl.army.mil/IMPRINT

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.
• Set realistic system requirements
• Identify future manpower & personnel constraints
• Evaluate operator & crew workload
• Test alternate system-crew function allocations
• Assess required maintenance manhours
• Assess performance during extreme conditions

• Examine performance as a function of personnel characteristics and training frequency & recency
• Identify areas to focus test and evaluation resources
• Quantify human system integration risks in mission performance terms to support milestone review
• Represent humans in federated simulations

IMPRINT is a trade-off analysis tool
Experimental Design Process

1. Conduct Mission Analysis
2. Identify issues for analysis
3. Identify Soldiers & system design
4. Perform Function Decomposition
5. Develop Experimental Design Matrix
6. Develop Models, Simulations, Field Tests
7. Run Analysis or Experiment
8. Summarize Results
9. Make Recommendations

- Soldier roles
- Baseline and Alternatives
- Not the first step!!!!
- Predict or determine Soldier performance
- Predict or determine mission performance

- Literature Review
- Soldier Interviews
- Mission relevant Key Performance Parameters
- Number per vehicle or unit & equipment
Concept for an advanced Light-weight Utility Vehicle (UVL)
Identify the Mission

- Reviewed program documents, e.g. UVL Capability Development Document and Annex A, B, C and Appendix A with DoD Architectural Framework views (DoDAF)
- Activity diagrams, Operator View from DoDAF
- Reviewed Field Manuals (FM), e.g. FM 55-1, Transportation Operations.
- Reviewed Training Manuals, e.g. Convoy Protection Platform Gunnery, draft training circular, 2010.
- Completed online training, e.g. Convoy Survivability Training, 2008.
- Completed cognitive task interviews with Soldier Subject Matter Experts (SMEs), e.g. Infantry Military Occupational Specialty (MOS).

Conduct Mission Analysis

Logistics Missions
UVL crew delivers supplies by driving securely across forward area of battlefield (FOB). May or may not be within a convoy.
What is the cognitive workload of the operators of the UVL versus the currently fielded vehicle? What is the impact of their cognitive workload on their logistics mission?

(Desired Outcomes)

Performance Parameters

- Evenly distributed, manageable workload
- Secure mobility
- Maintained situation awareness
- Sustained periods of time
- Deliver supplies to destination
M1152A1 is baseline vehicle

Concept
UVL
Function Decomposition

- Drive
- Transport Supplies
- Communications with Headquarters
- Navigate
- Manage Platform Health
- Communications within UVL
- Crew Search
- Exercise Command & Control (C2)
- Communications with lateral units
- Evaluate threats to Mission
- Manage Tactical Information
- Defeat or Mitigate Threats

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.
Outcome Variables can be used for T&E

<table>
<thead>
<tr>
<th>Functions</th>
<th>Single Vehicle</th>
<th>Convoy</th>
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<tbody>
<tr>
<td>Drive</td>
<td>Driver</td>
<td>Driver</td>
</tr>
<tr>
<td>Navigate</td>
<td>Vehicle Commander (VC)</td>
<td>Vehicle Commander (VC)</td>
</tr>
<tr>
<td>Crew Search</td>
<td>Driver &amp; VC</td>
<td>Driver &amp; VC</td>
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<td>Evaluate Threats to Mission</td>
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<td>Defeat or Mitigate Threats</td>
<td>VC</td>
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<tr>
<td>Transport Supplies</td>
<td>Driver</td>
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<td>Manage Platform Health</td>
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<td>Driver</td>
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<tr>
<td>Exercise C2</td>
<td>VC</td>
<td>VC</td>
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<tr>
<td>Crew Communication</td>
<td>Driver &amp; VC</td>
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<td>VC</td>
</tr>
<tr>
<td>Manage Tactical Information</td>
<td>VC</td>
<td>VC</td>
</tr>
</tbody>
</table>
**Scenario**

1. **Build Model(s)**
2. **Travel Time to Destination**
3. **Move Via Checkpoints**
   - IEDS present
4. **Arrive at Destination**
5. **Mission Ends**

**Build Task Network**

**Function Names**

**Task Names**

**Branching Logic**

**Time**

**Operator Function Allocation**

**Workload**

**Interfaces**

**Consequences of Failure**

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**Mission**: UVL C

**Vehicle Commander (Cdr)**

**Driver**
IMproved Performance Research Integration Tool (IMPRINT) selected as tool for implementing mission based analysis approach for predicting cognitive workload and UVL operator performance.

Mission Tasks → Which Brain Resources Involved? → Workload Estimation
High workload causes operator to stop scanning. Threat was present but not identified. Currently fielded vehicle encounters IED. Vehicle is destroyed. Mission fails.
High workload causes operator to stop searching

Threat was present but not identified

UVL is targeted

Mobility capability loss determined

Mission continues but becomes an ambush

Summarize Results Conceptual UVL

Crew Search + Exercise C2 + Manage Tactical Information + Communications

VC Workload & Conceptual UVL System Design
Standard operating procedure for the currently fielded utility vehicle is to pair the utility vehicle with another vehicle such as a gun truck.

Recommend similar SOP for the conceptual UVL or add gunner to the UVL.

Consider this requirement when determining number of vehicles available for each tactical unit.
Soldier-centered analysis

- can be implemented early in the acquisition cycle.
- can analyze conceptual system designs and requirements from the Soldier’s perspective.
- can be implemented with IMPRINT
- can adhere to design of experiments
- can identify combinations of functions and equipment that have potential for high workload
- can provide task combinations for T&E
- can make requirements realistic!!!!!