US ARMY RDECOM

U.S. Army Research, Development and Engineering Command

Soldier-centered Analysis from Requirements to Test & Evaluation

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Diane Kuhl Mitchell, March 13, 2012

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

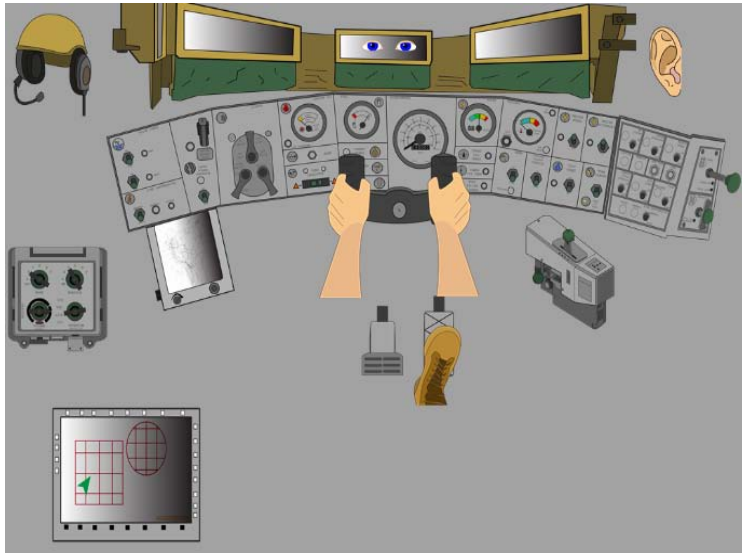
Soldier-centered Analysis

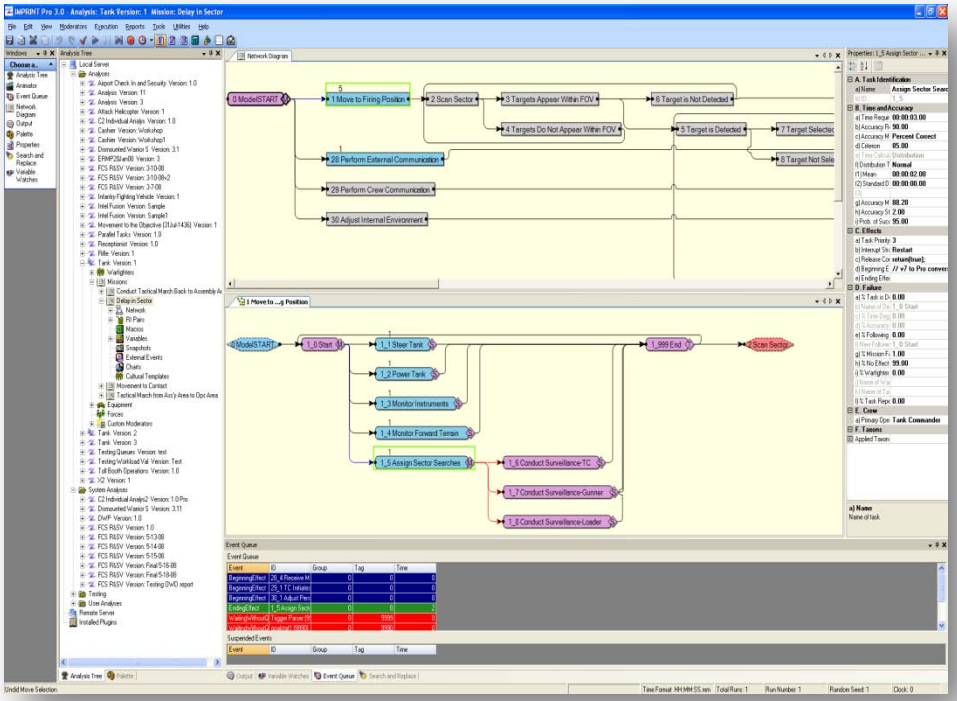
The Defense Acquisition Management Framework

Analysis Tool

IMPRINT
Improved Performance Research Integration Tool

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



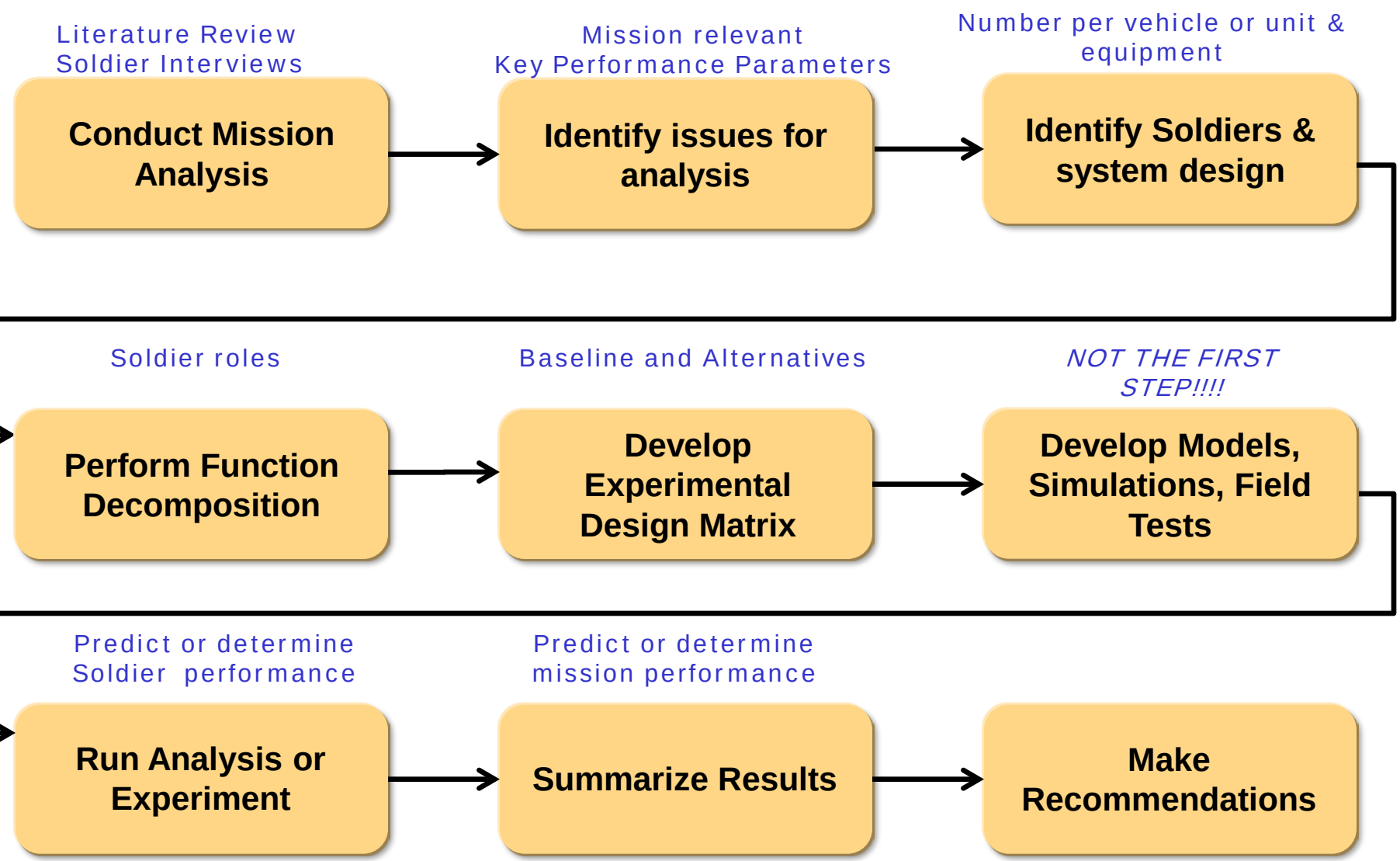


IMPRINT Capabilities

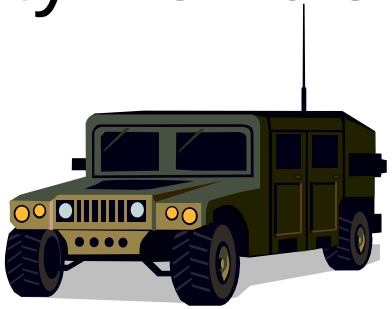
- Set realistic system requirements
- Identify future manpower & personnel constraints
- Evaluate operator & crew workload
- Test alternate system-crew function allocations
- Assess required maintenance manhours
- Assess performance during extreme conditions
- Examine performance as a function of personnel 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



Concept for an advanced Light-weight Utility Vehicle (UVL)



Identify the Mission

Logistics Missions
UVL crew delivers supplies by driving securely across forward area of battlefield (FOB).
May or may not be within a convoy.

- 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 (FMs), 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).

Potential for High Workload

Identify Analysis Issues

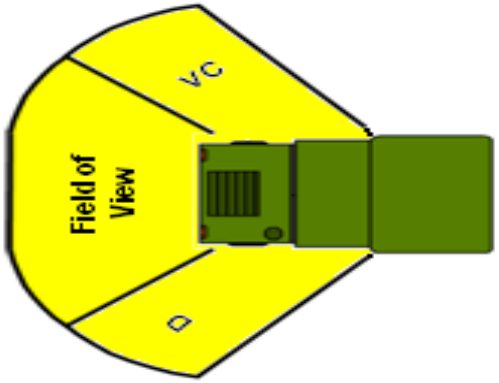
What is the cognitive workload of the operators of the UVL versus the currently fielded vehicle? What is the impact of their cognitive workload on their logistics mission?

(Desired Outcomes)

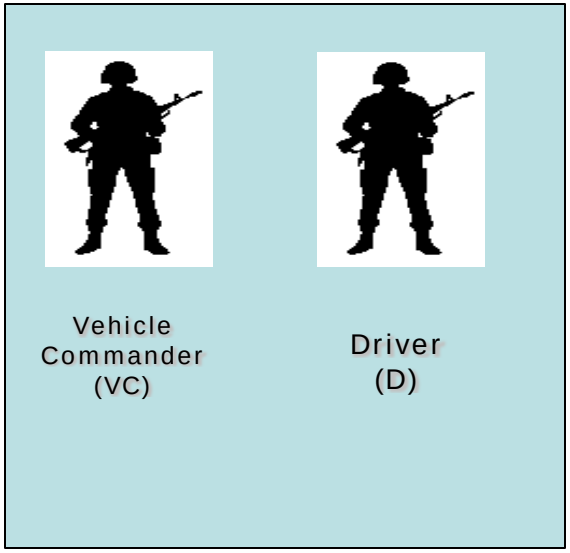
Performance Parameters

- Evenly distributed, manageable workload
- *Secure mobility*
- Maintained situation awareness
- Sustained periods of time
- Deliver supplies to destination

Identify Soldiers & equipment

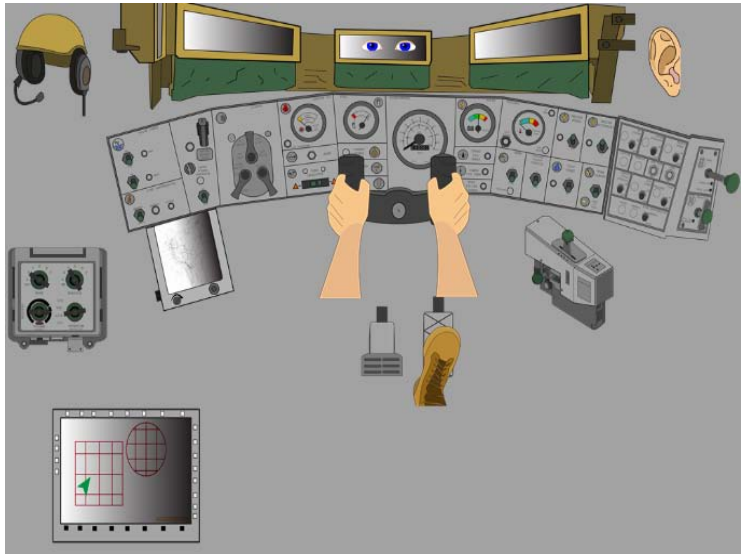


M1152A1 is baseline vehicle



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

Experimental Design Matrix for UVL

Develop Experimental Design Matrix –

Outcome Variables can be used for T&E

Workload Measures

High Workload Task Combinations
Overall Workload Value
Number of Concurrent Tasks

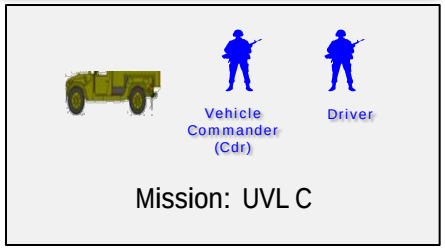
Mission Performance

Time to Destination
Number Targets Detected
Number of Targets Missed
Number of Messages Missed
Mission Success & Failures

Functions	Utility Vehicle & Currently Fielded Function Allocation	
	Single Vehicle	Convoy
Drive	Driver	Driver
Navigate	Vehicle Commander (VC)	Vehicle Commander (VC)
Crew Search	Driver & VC	Driver & VC
Evaluate Threats to Mission	VC	VC
Defeat or Mitigate Threats	VC	Gun Truck Crew
Transport Supplies	Driver	Driver
Manage Platform Health	Driver	Driver
Exercise C2	VC	VC
Crew Communication	Driver & VC	Driver & VC
Headquarters Communication	VC	VC
Between Vehicle Communication	VC	VC
Manage Tactical Information	VC	VC

IMPRINT Model

Build Model (s)

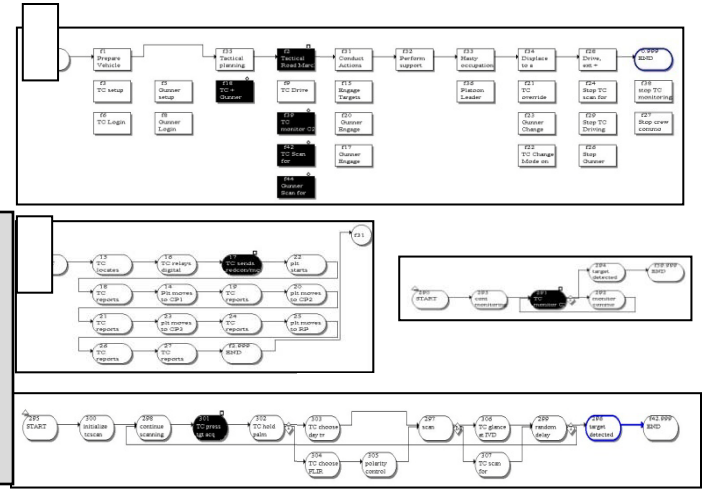


Scenario

Travel Time to Destination → Move Via Checkpoints IEDS present → Arrive at Destination → Mission Ends

Build Task Network → Function Names, Task Names, Branching Logic

Enter Task Data → Time, Operator Function Allocation, Workload, Interfaces, Consequences of Failure

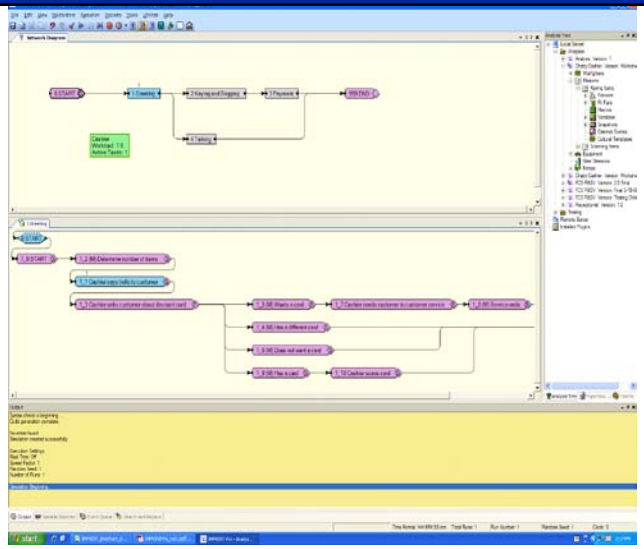


Run the Analysis

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**

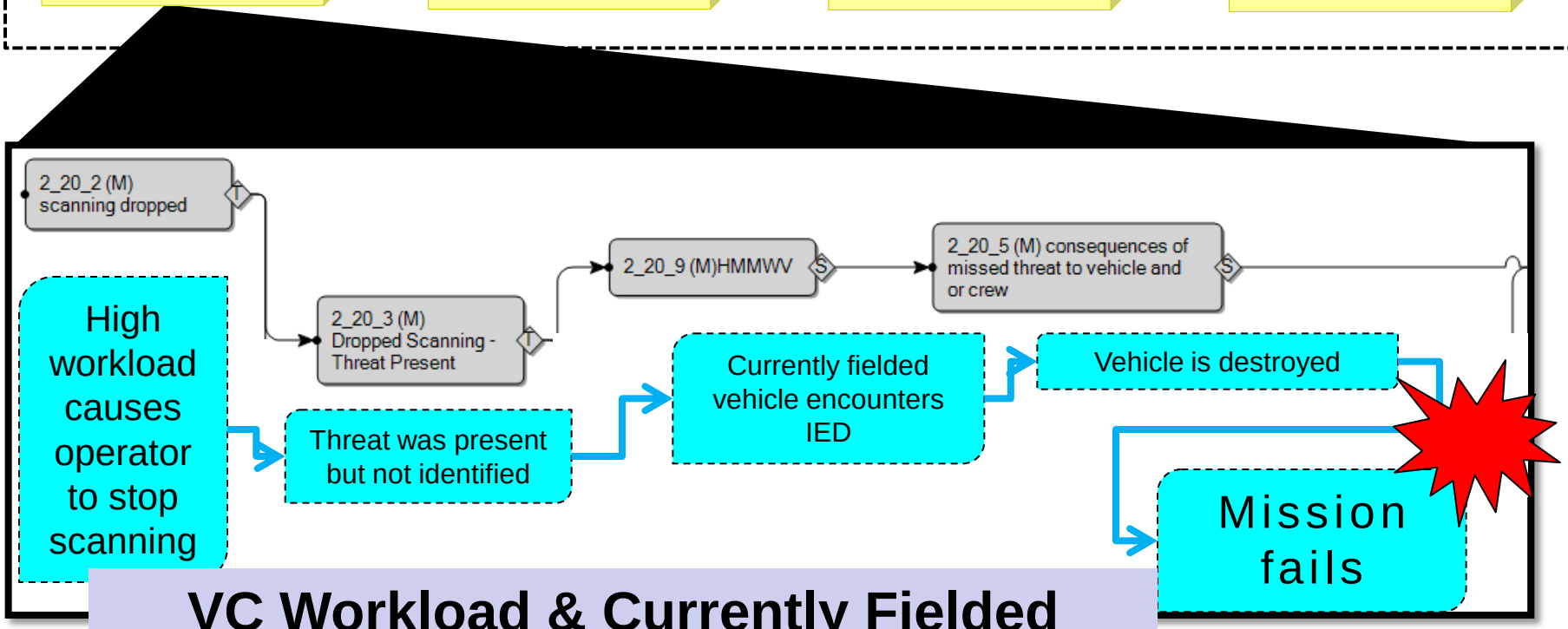
IMPRINT
Improved Performance Research Integration Tool



Summarize the results

Summarize Results Currently Fielded

Crew Search + **Exercise C2** + **Manage Tactical Information** + **Communications**

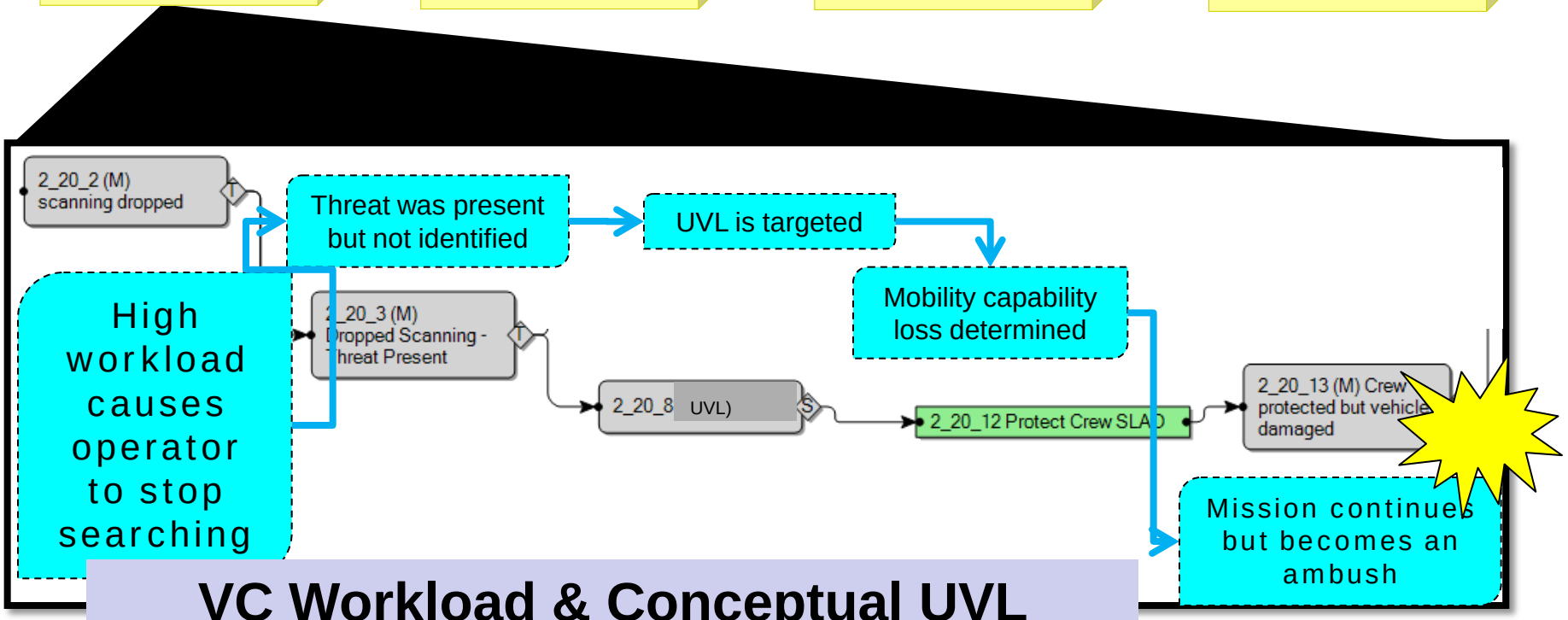


VC Workload & Currently Fielded System Design

Summarize the results (cont.)

Summarize Results Conceptual UVL

Crew Search + **Exercise C2** + **Manage Tactical Information** + **Communications**



VC Workload & Conceptual UVL System Design

Recommendations

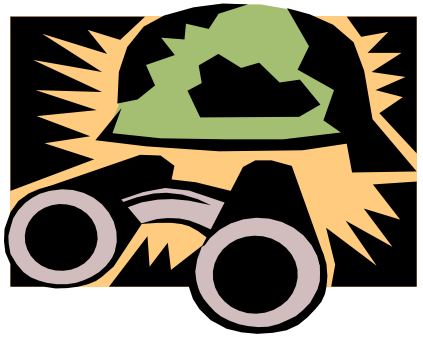
Make Recommendations

- 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.

Summary

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!!!!!




THANK
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