



RDECOM



TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Predicting the Mental Workload of the Infantry Squad: Importance of A Mission Based Approach

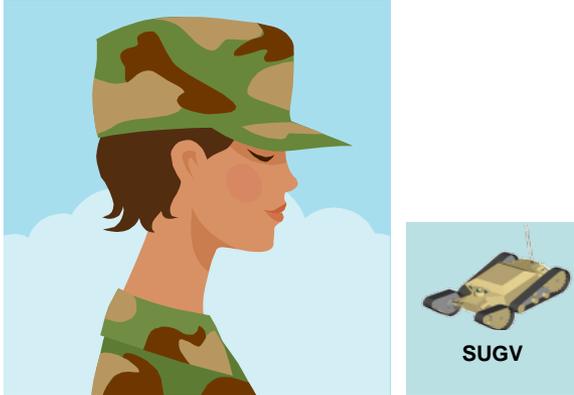
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March 18, 2010 (DRAFT)



- What is the trade-off between workload and performance for an Infantry unit that has been given a small unmanned ground vehicle (SUGV) to complete its mission?





*Soldier controlling
SUGV*

- Mental workload associated with a single function.
 - Typically not overload.
- One Soldier.
 - Soldier part of a unit.
- Task analysis of one function.
 - Soldiers multi-task.
- Performance of one piece of equipment
 - Multiple pieces of equipment used in combat.

Mission-Based Test and Evaluation is a methodology that focuses test, evaluation, and analysis on the mission task capabilities provided to the warfighter.



Understand the mission

1. Define Mission Context
2. Develop Mission Tasks
3. Develop Supporting Tasks
4. Identify and Assign Task Capabilities

Understand the system

1. Determine SoS Components
2. Identify and Assign Component Attributes

Design the Analysis

1. Develop Unconstrained Operational Conditions
2. Develop Evaluation Strategy
3. Develop Evaluation Measures
4. Assign Measures to Data Sources
5. Develop Constrained Operational Conditions
6. Develop Data Source Requirements
7. Develop T&E Databases

Determine the results

1. Conduct Tests and Gather Data
2. Perform Data Analysis
3. Generate Evaluation Results

Report the results

1. Generate the evaluation report.

Source *Mission-Based T&E Strategy Overview, 18 Sep 08, Chris Wilcox, Army Evaluation Center.*

- **“The combat mission of the Infantry rifle company is to close with the enemy by means of fire and maneuver to destroy or capture him, repel his assault by fire, close combat, and counterattack.” TCM IBCT**



Sample Scenario: Enemy insurgents have seized key buildings in the sprawling urban area known as Yorkville. They have a platoon (+) of infantry operating out of a building within the metropolitan area. Their intent is to fight to the death in the urban areas, as they are aware that U.S. and coalition forces must regain control in the areas to take back the political will of the people.

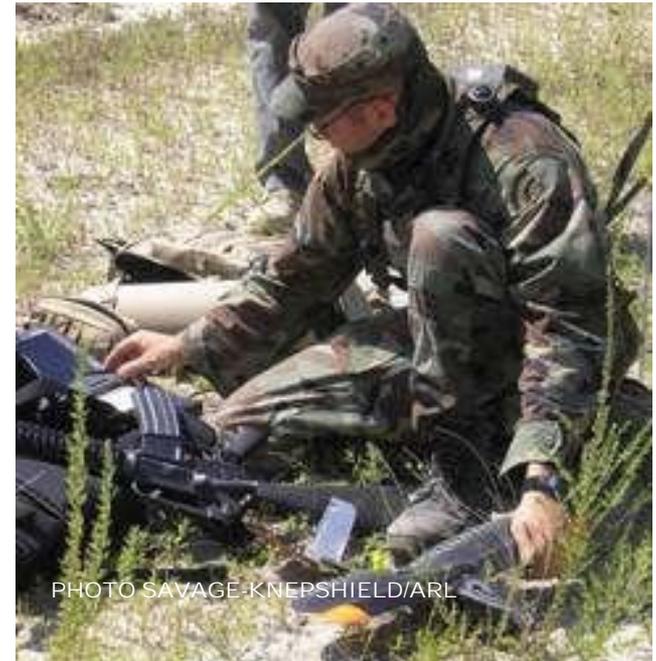
Example: Within an urban area, one infantry squad uses their SUGV to perform reconnaissance of a building. The other two infantry squads wait for the SUGV reconnaissance before clearing the building. Because two squads are waiting for the SUGV squad, speed of SUGV operations is critical.



Example: The 1st Team Leader and rifleman provide security for the infantryman operating the SUGV. The 2nd Infantry Squad Leader provides situation reports to the Team Leaders, 1st Squad Leader, and 1st Platoon Leader. The 2nd Squad Leader determines the room is clear, and 1st Infantry Squad prepares to enter the room for detailed room clear and secure.



Communications	Platoon Leader, Squad Leader, Team Leader, Infantryman
Navigate	Squad Leader, Team Leader, Infantryman
Local Security	Squad Leader, Team Leader
Battle Tracking	Squad Leader, Team Leader
Monitor Squad Movement	Squad Leader
Monitor Team Movement	Team Leader
Unpacks/Assembles SUGV	Infantryman
Control SUGV	Infantryman





SUGV



spare batteries and carrying case



Tool set



Controller



Ground soldier ensemble



Soldier's Load



The ability of the SUGV to provide information to the battle command network is a key capability because it enables tactical leaders to react to changes in the enemy situation.



The controller has direct influence over the SUGV.

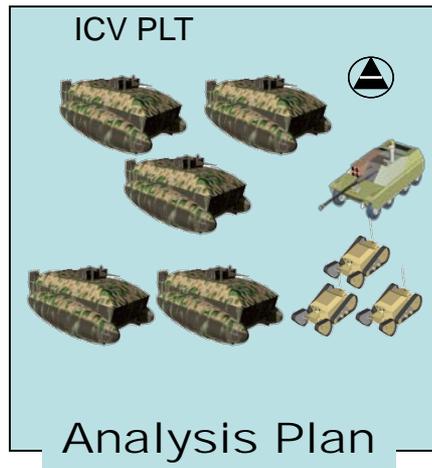


Ground soldier ensemble provides digital information exchange capability for the platoon leader, squad leader, and team leaders but not infantryman controlling SUGV.

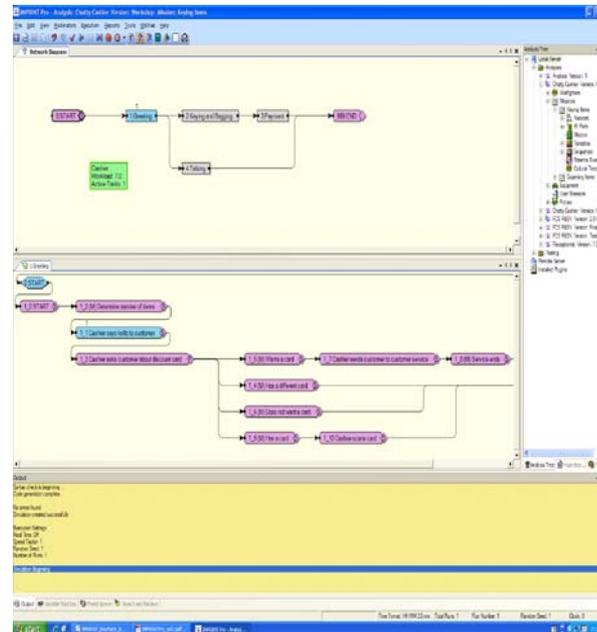


What is the trade-off between workload and performance for an Infantry unit that has been given a small unmanned ground vehicle (SUGV) to complete its mission?

Mounted Supported by Dismount			Urban/Mout			Defensive Operations		
Tactical Move	Attack	Hasty Defense	Tactical Move	Attack	Hasty Defense	Tactical Move	Defend	Counterattack



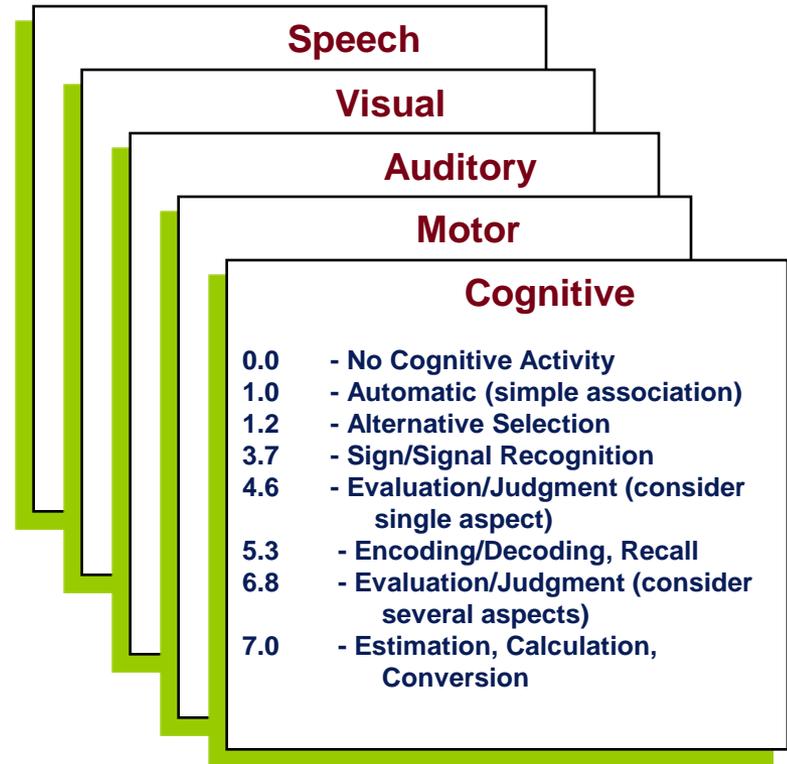
Both approaches converge here but mission-based approach superior analytical foundation



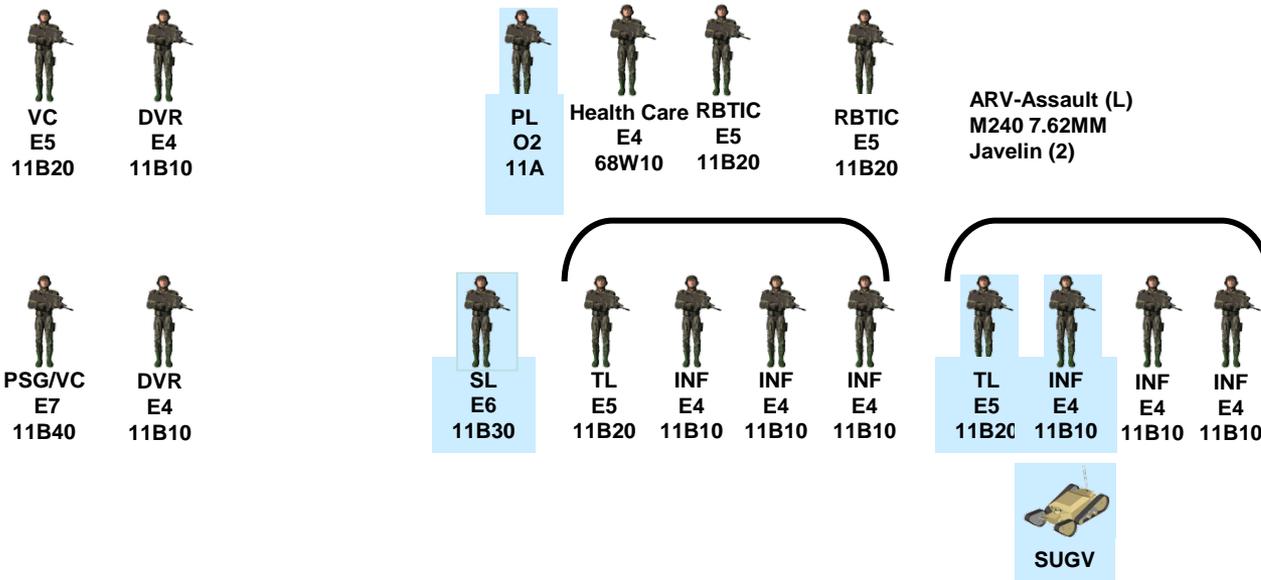
Evaluation Measures for Infantry Squad Members Modeled

- Percentage of Time in Overload
- Maximum Overall Workload Value
- Maximum Workload -Visual, Auditory, Cognitive, Psychomotor
- Instances in Overload
- High Workload Task Combinations

Task Demands



IMPRINT Analysis



Mission Based approach makes interview questions more relevant and focused.
More awareness of potential data sources.

Cognitive Task Interviews:
TCM Representatives
Current Force Talon & Packbot operators
UML Use Cases, Sequence Diagrams,
Mission Threads
Controller Design Concepts and Requirements
GSE concepts
Goal Directed Task Analyses
Infantry Roles

Project Folder on Vision Digital Library (VDLS)

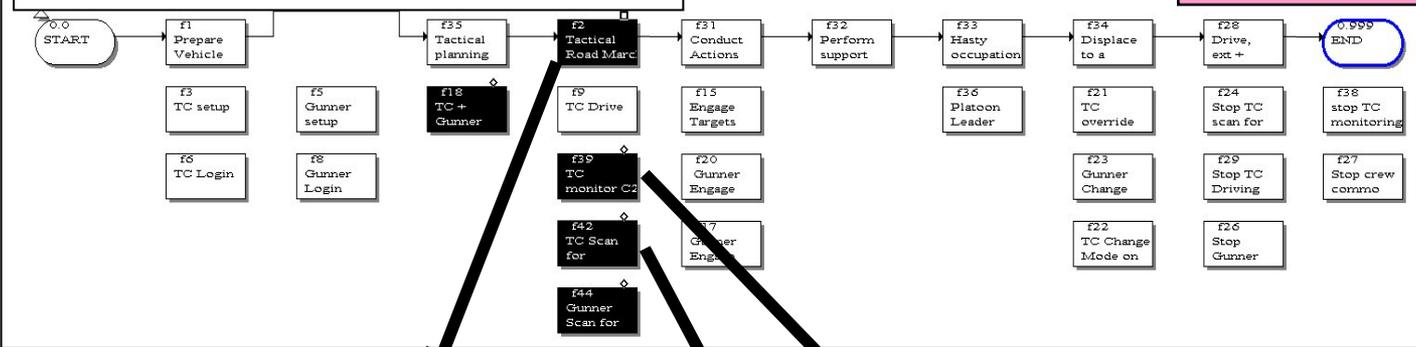


IMPRINT inputs

- Task times
- Task demands
- Task assignments
- Task interfaces



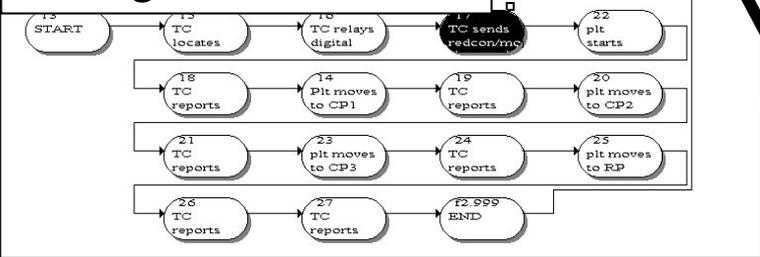
Mission at run time 705.71



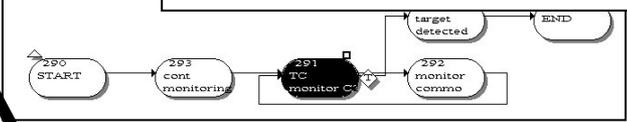
View Reports

Time Performance
Accuracy Performance
Operator Workload

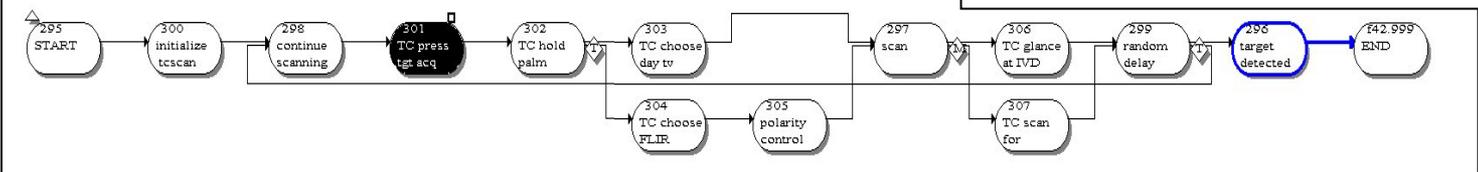
Navigate - function



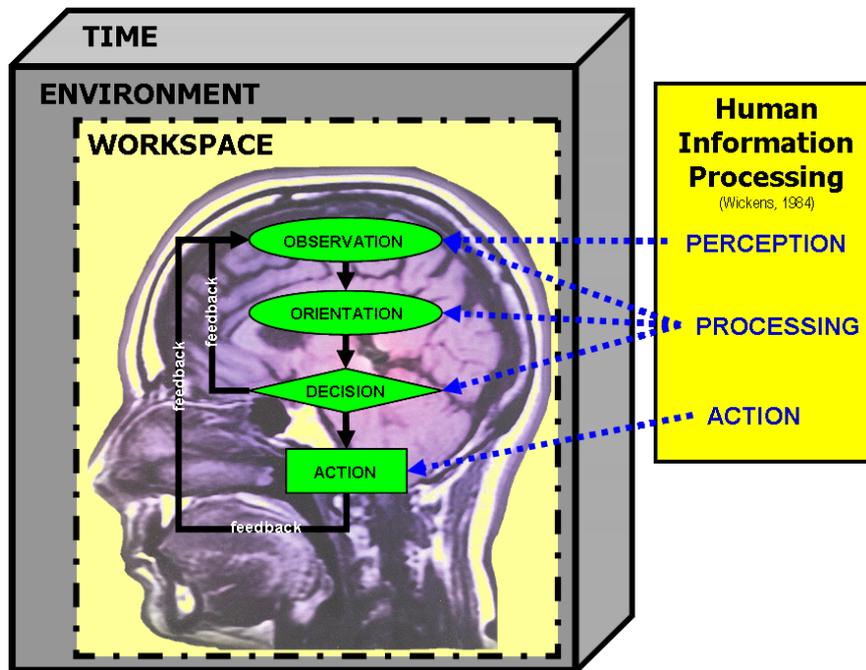
Commo - function



Battletracking- function



Multiple Resource Theory

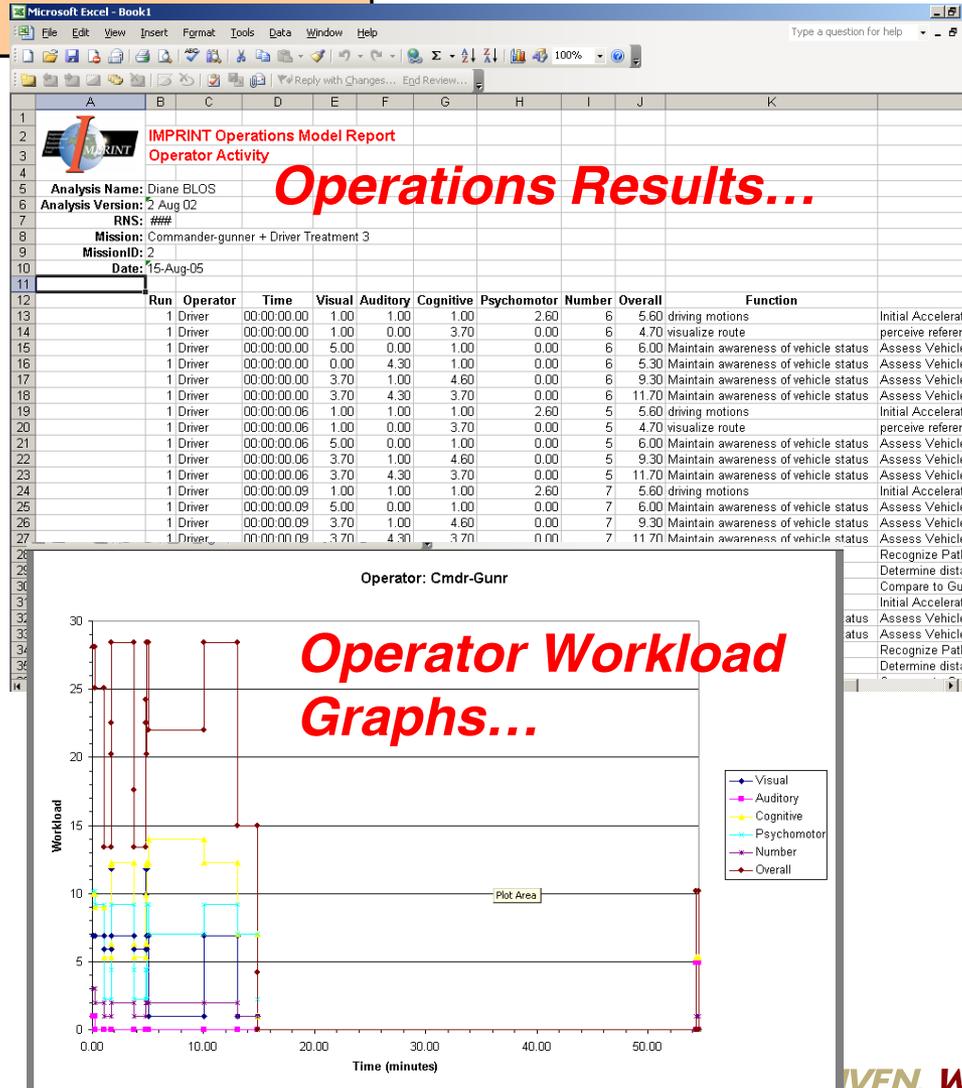


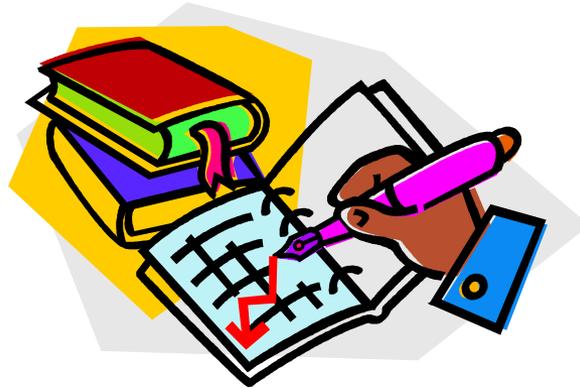
Task time and accuracy

Operator workload level

Impact on System Performance

IMPRINT Output Reports





Infantry Squad Using the Common Controller for Small Unmanned Ground Vehicle Control: Soldier Workload Analysis ARL-TR-5003

Analysis Conclusions & Recommendations

- Included multi-tasking, e.g. need to make SUGV control more compatible with voice communications tasks
- Included multiple systems, e.g. GSE data needs to be integrated with SUGV outputs
- Included unit performance, e.g. squad workload increased by need to protect SUGV operator who does no local security

- Identifying human operators not unique step
- Recommend including steps that identify specific operators and characteristics

Thanks for Opportunity to Present!