



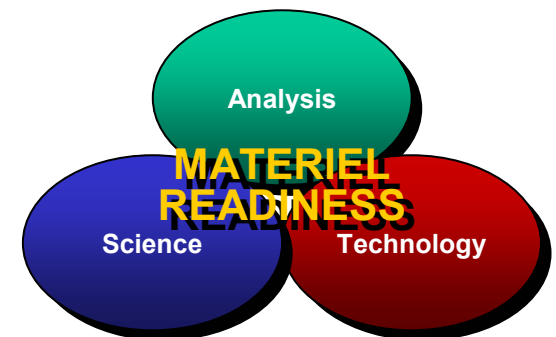
MISSIONS AND MEANS FRAMEWORK (MMF) Demo Status

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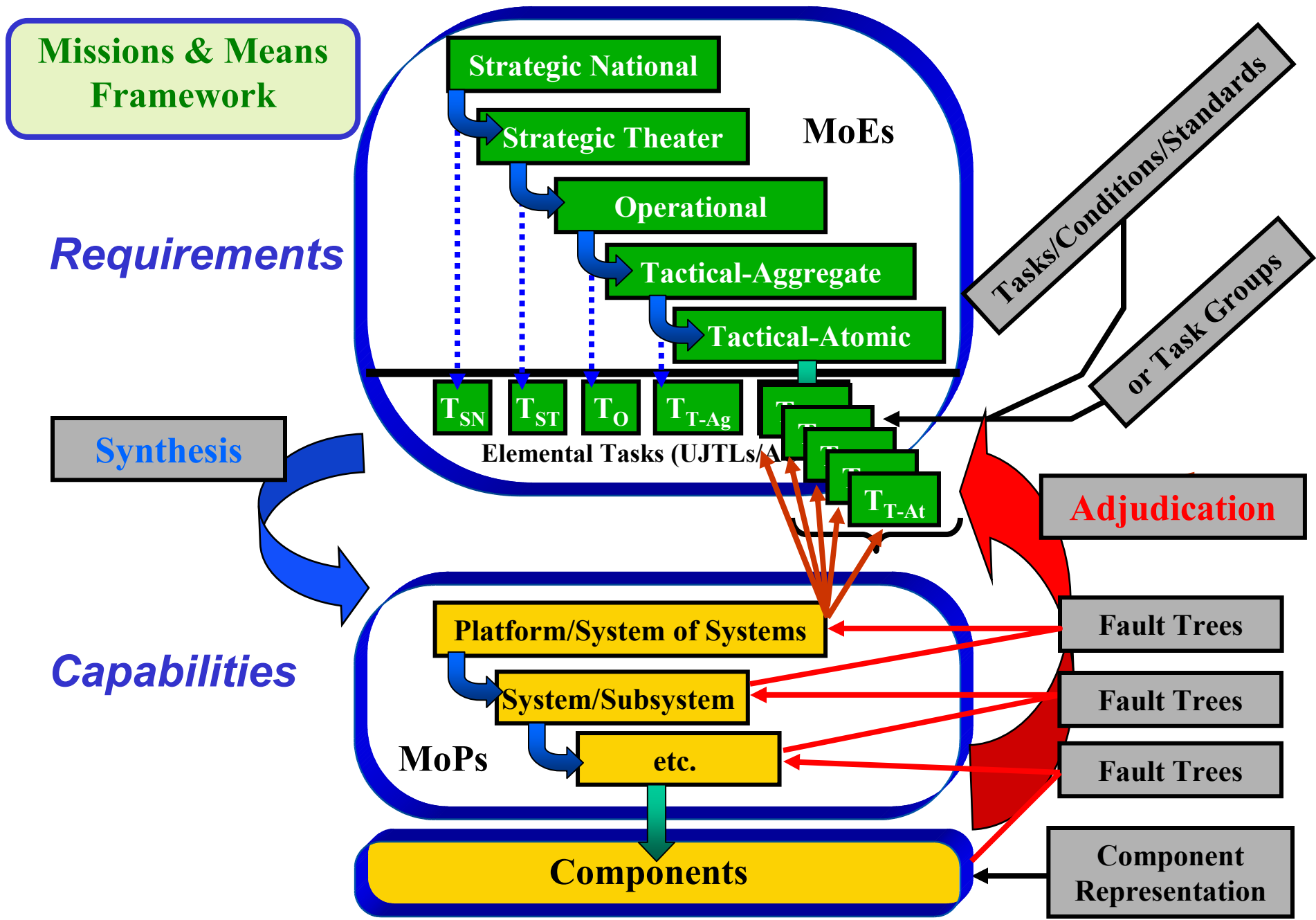
Slide 1



OVERVIEW



- *The Missions and Means Framework (MMF) is used to establish required tasks for an FCS mission.*
- *Mathematical Fault Trees are used to model the capabilities of the surviving FCS SoS.*
- *ARL-SLAD will compare residual SoS capability against required tasks to assess mission accomplishment.*
- *A future demonstration will show how this approach may be applied to examine materiel solutions for accomplishing FCS missions.*



Mission Decomposition:

"First the synthesis, now the execution"

MISSION: *On order, attack to defeat Rebel forces and secure urban stronghold northeast of OBJ CAMEL.*

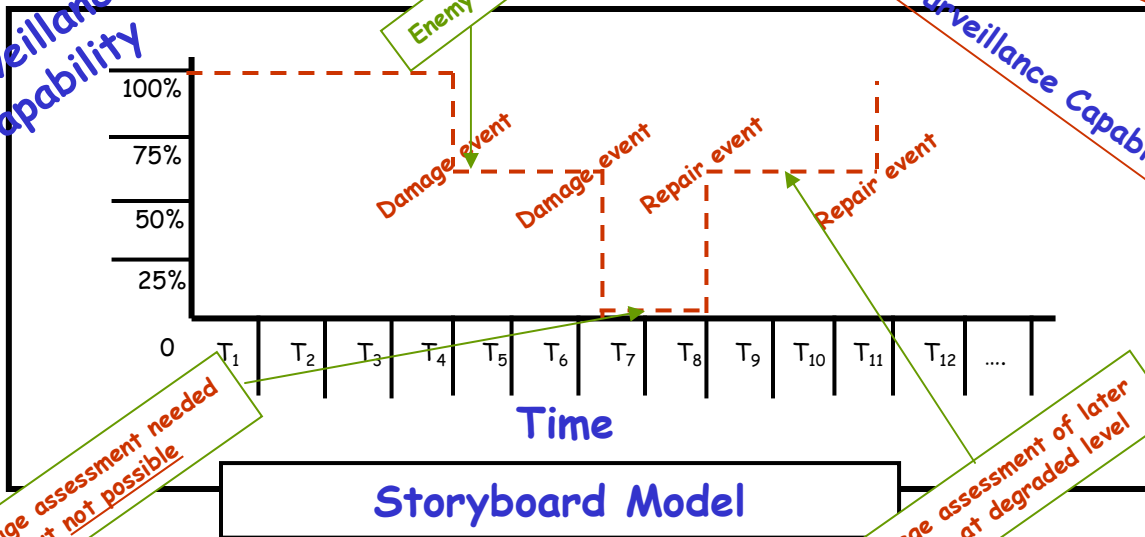
COMMANDER'S INTENT: *Control ingress/egress of city by enemy.*

TIMED SEQUENCE OF EVENTS/TASKS:

1. Move into position
 - a. Reconnaissance Surveillance Vehicle (RSV) observe Target Areas of Interest
 - b. Mounted Combat System (MCS) to target range area
2. **Maintain surveillance. (sensor capability)**
3. Acquisition Report to C2V.
4. Clearance of fires (Situational Awareness).
5. Call for fire from C2V to shooters (Adjusted Fire).
6. Update target location
7. Fire munitions (Fire For Effect).
8. Munitions arrive on target.
9. Assess damage to enemy.

example →

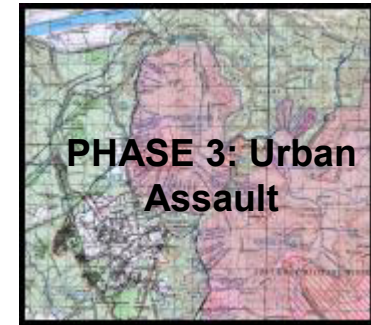
Surveillance Capability



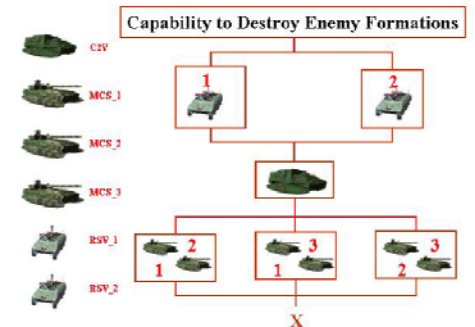
Damage assessment needed but not possible

Damage assessment of later rounds at degraded level

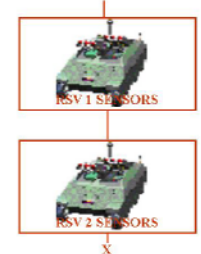
Maximum Surveillance Capability
Reduced Surveillance Capability



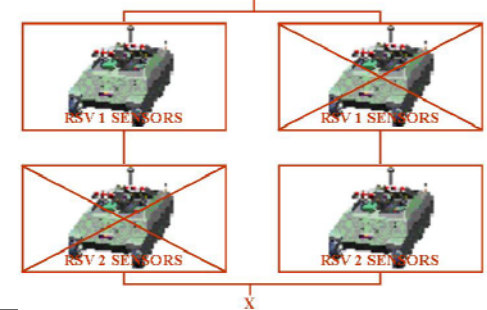
Top Level Fault Tree at T₀



Z0-Maximum Surveillance



Z1-Loss of One Surveillance Subsystem





Expected Products



Storyboard Model

- ✓ Executes a simple vignette of short duration
- ✓ Required tasks vary with phase of vignette
- ✓ Available capabilities vary during vignette as SoS takes damage, suffers failures, and is repaired
- ✓ Capabilities are compared to required tasks to determine mission accomplishment.



BACKUP





Mounted Combat System (MCS)*



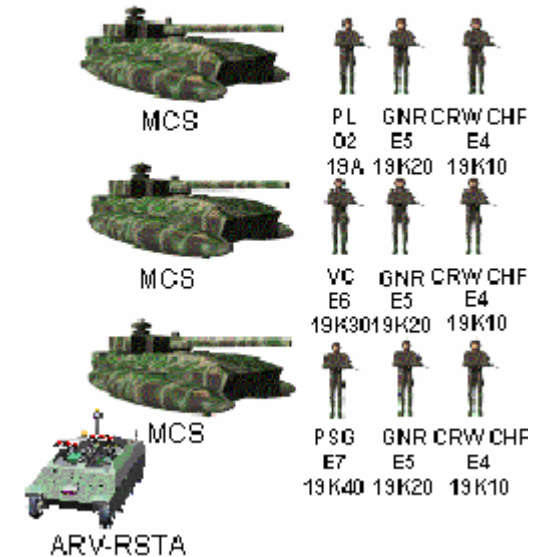
MCS Company mission.

To close with and destroy enemy forces, using fire and maneuver and tactical assault. Optimized for extended LOS and BLOS fires and employs chemical energy (CE) and kinetic energy (KE) munitions to engage at standoff as well as provide rapid gun fires required for actions on contact or during tactical assaults. Attacks or defends under hostile fire and during limited visibility conditions. This unit is optimized for high-speed mobile operations and has required lethality to kill main battle tanks (MBT) with enhanced reactive armor and active protective systems. Each MCS is operated with a 3-man crew with the ability to transport a fourth soldier.

MCS Company Tasks:

- Execute fire and maneuver before contact, in contact, and during tactical assault to close with and destroy the enemy.
- Provide mutual support in overwatch and cooperative engagements.
- Conduct offensive, defensive, stability and support operations in all terrain and weather.
- Conduct reconnaissance and surveillance operations (zone, area, route).
- Conduct security operations (counter-reconnaissance).
- Fire munitions that will accurately destroy low and slow moving enemy aircraft and UAVs.

MCS Platoon (3)



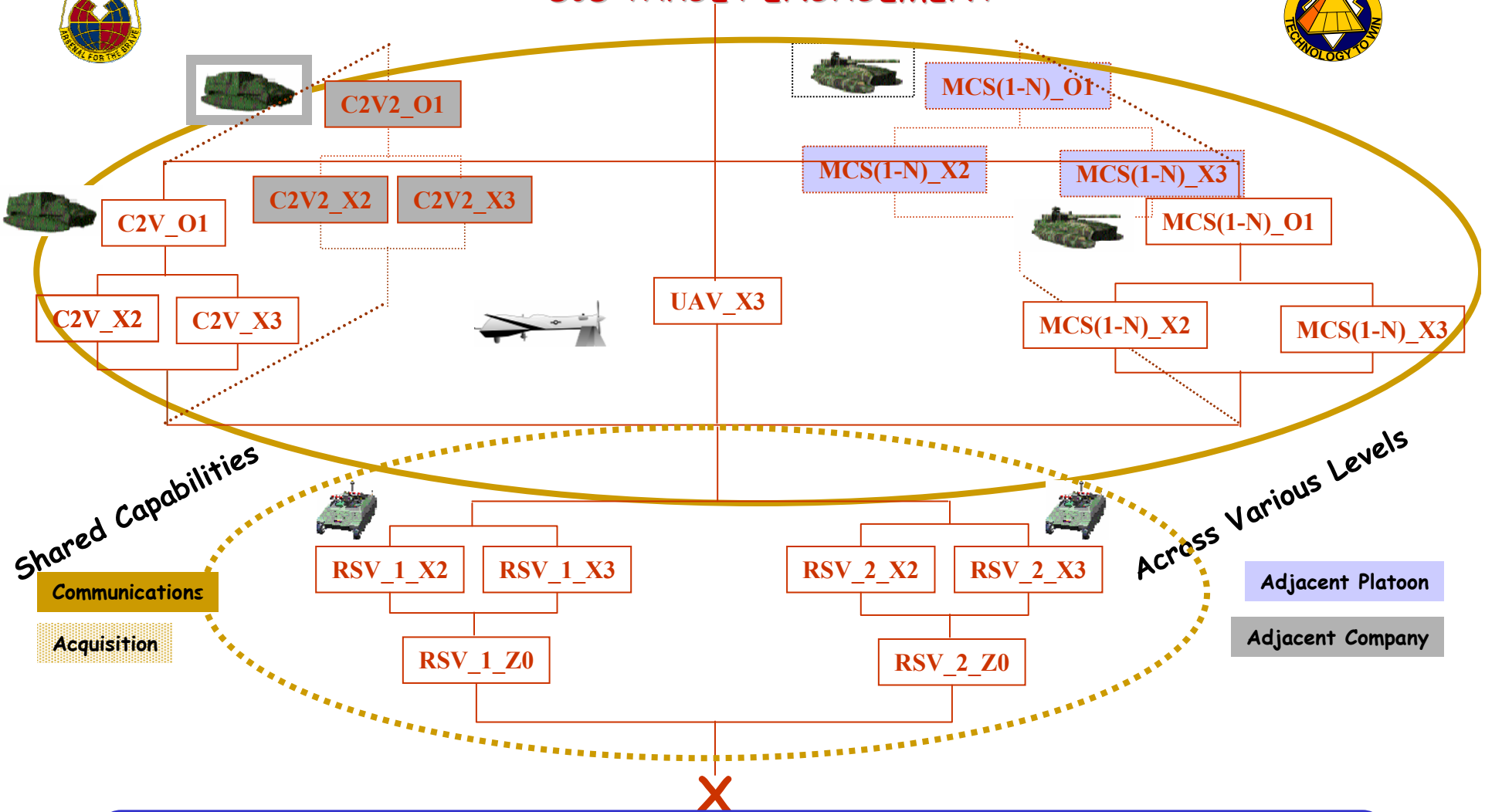
Company HQ Section





System-of-System Representation

SoS TARGET ENGAGEMENT



System-of-System capabilities required are communications and situational awareness.



MCS Company Attack*



Mission: (U) MCS Company Attack (164 task(s))
Mission Task: ART 2.0 The Maneuver Battlefield Operating System
Command-Linked Task: MTP 17-2-0219.17-00DT ATTACK BY FIRE

Supporting Task: MTP 17-2-0219.17-00DT ATTACK BY FIRE

Description: While conducting tactical operations, the troop has made contact with a moving or stationary enemy. The troop conducts an attack by fire IAW the OPORD/FRAGO or its higher unit commander. Additional maneuver and CS assets (e.g., air, engineer and intelligence) may be available to the troop. Your unit may be digitally equipped. The troop maneuvers to and occupies an attack-by-fire (ABF) position. It places effective direct fires and (if applicable) indirect fires on the enemy, destroying it or causing it to withdraw. If digital equipment is available, the troop uses it as necessary or as directed to accomplish the mission. No friendly unit suffers casualties or equipment damage as a result to fratricide. (OPERATIONS)

Standards

| M# | Criterion | Scale | Measure |
|----|-----------|---------|---|
| | (U) | Meters | (U) Accuracy of indirect fires |
| | (U) | Minutes | (U) Response time from target identification and location |
| | (U) | Number | (U) Friendly casualties sustained |
| | (U) | Minutes | (U) Time to move into attack fire position |



Storyboard Model



Purpose: demonstrating mission/task success/failure as a function of low-level component state.

What it IS:

- * A minimal model to demonstrate that
 1. Low-level component damage can be mapped to platform capabilities,
 2. platform capabilities can be mapped to SoS ability to perform tasks,
 3. the completion or failure of the constituent tasks determines the success or failure of the mission.
- * The term “Storyboard” is an analogy to movie making; set the scene and play it out, focusing on the “star actors” but don’t worry about the off stage details.

What it ISN’T:

- * Not a two-sided combat simulation or war game.
- * Very low resolution in most aspects.

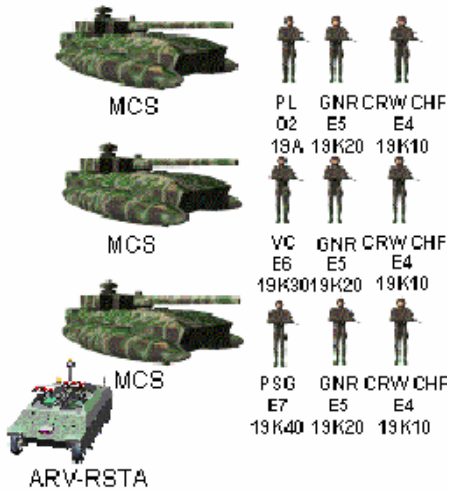


Level 2-3 data

Background Definitions: Degraded Capability State



MCS Platoon



Mobility

- M0 No Mobility Degradation
- M1 Reduced Maximum Speed
- M2 Reduced Maneuverability
- M3 Stop After Time t
- M4 Total Immobilization

Firepower

- F0 No Firepower Degradation
- F1 Reduced Delivery Accuracy While Moving
- F2 Reduced Delivery Accuracy of Main Armament
- F3 Reduced Initial Rate of Fire of Main Armament
- F4 Reduced Subsequent Rate of Fire of Main Armament
- F5 Loss of Main Armament
- F6 Reduced Delivery Accuracy of Secondary Armament
- F7 Reduced Initial Rate of Fire of Secondary Armament
- F8 Reduced Subsequent Rate of Fire of Secondary Armament
- F9 Loss of Secondary Armament
- F10 Loss of Tertiary Armament
- F11 Loss of Fourth Armament

Target Acquisition

- A0 No Acquisition Degradation
- A1 Loss of Acquisition System 1
- A2 Loss of Acquisition System 2
- A3 Loss of Acquisition System 3
- A4 Loss of Acquisition System 4

Surveillance

- Z0 No Surveillance Degradation
- Z1 Loss of Surveillance System 1
- Z2 Loss of Surveillance System 2

Communication

- X0 No Communication Degradation
- X1 Reduced Range of External Communication
- X2 Loss of External Voice
- X3 Loss of External Data
- X4 Loss of Internal Communication

Survivability

- S0 No Survivability Degradation
- S1 Loss of Survivability System 1
- S2 Loss of Survivability System 2
- S3 Loss of Survivability System 3
- S4 Loss of Survivability System 4
- S5 Loss of Survivability System 5
- S6 Loss of Survivability System 6

Crew

- C0 No Crewmember Incapacitated
- C1 Commander Incapacitated
- C2 Gunner Incapacitated
- C3 Driver Incapacitated
- C4 Loader Incapacitated
- C5 Equipment Operator Incapacitated

Passengers

- P0 No Passengers Incapacitated
- P1 Passengers Incapacitated

Other

- O1 Situational Awareness

Catastrophic Loss

- K0 No Catastrophic Loss
- K1 Catastrophic Loss



Planned Storyboard Outputs



- Probability of SoS available capability and task completion.
- Average number of components/subsystems killed before capability level falls below requirement.
- Key elements driving failure.
- Insights to force-level data analysis techniques.