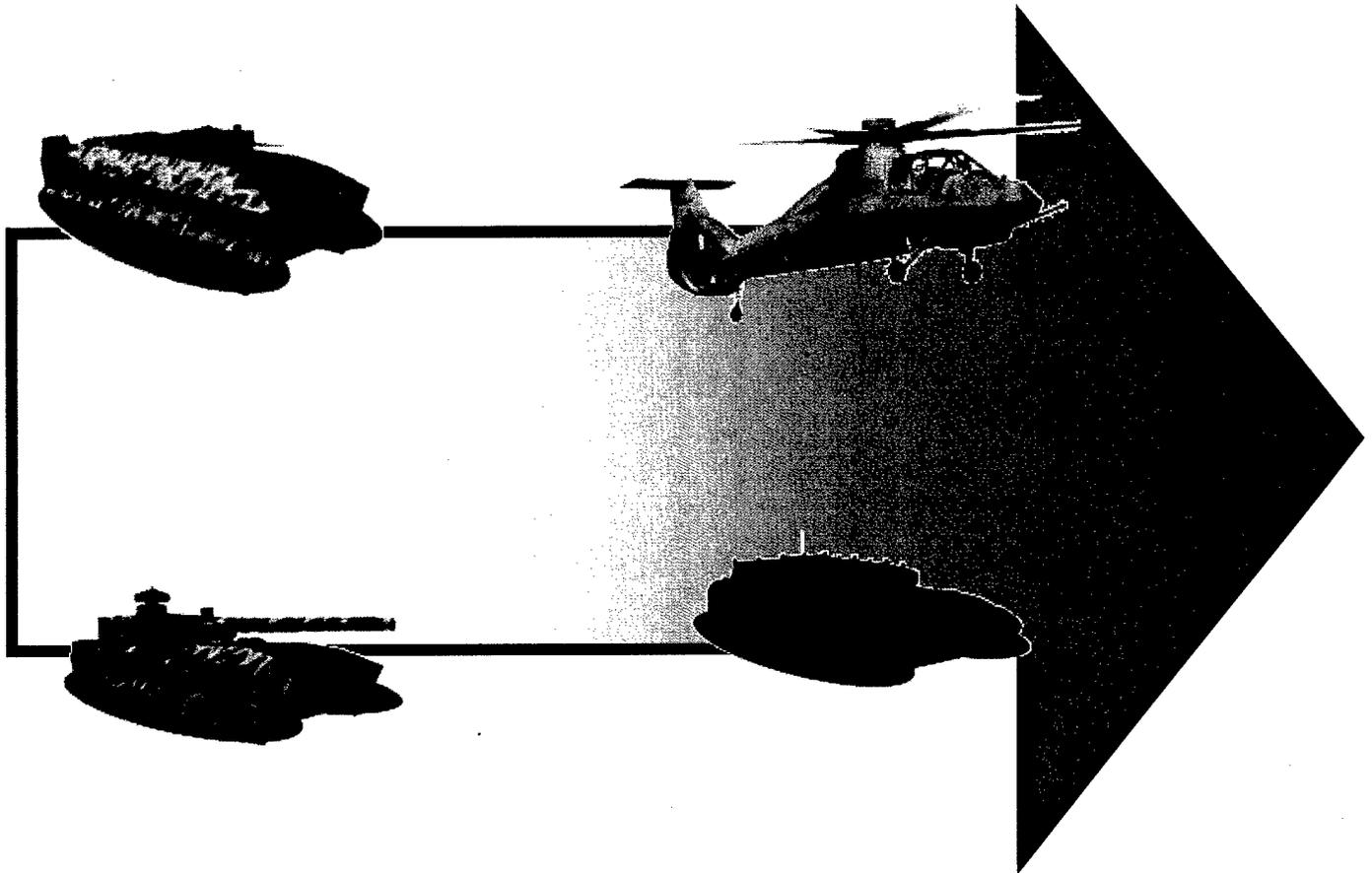


OCTOBER 2002

UNIT OF ACTION JANUS GAMING FINAL REPORT



DEPARTMENT OF THE ARMY

UNIT OF ACTION MANEUVER BATTLE LABORATORY
FORT KNOX, KENTUCKY 40121

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13. ABSTRACT (Maximum 200 words) The Unit of Action Maneuver Battle Laboratory (UAMBL) in conjunction with other TRADOC agencies and schools conducted analysis on the Unit of Action and the Future Combat System in order to finish completion of the Operations and Organization (O&O) document and the Operational Requirements Document (ORD). The UAMBL in conjunction with contractor and other TRADOC personnel conducted the warfighting analysis in the Maneuver Warfare Test Bed (MWTB) during the period 8 July - 16 August 2002. A computer suite consisting of a host and 20 stations running the Janus model was used to simulate combat operations at various echelons on Asian terrain to gain insights into the warfighting capability of the force and various platforms. The objectives of the analysis was to determine the warfighting effectiveness at the platoon, company and battalion echelons of the Unit of Action force; to determine and compare the force effectiveness of the battalion fighting "pure" and task organized companies; to determine and compare the force effectiveness of the battalion fighting during day and night scenarios; and to examine the model output for potential use in the ORD documentation for the Future Combat System.			
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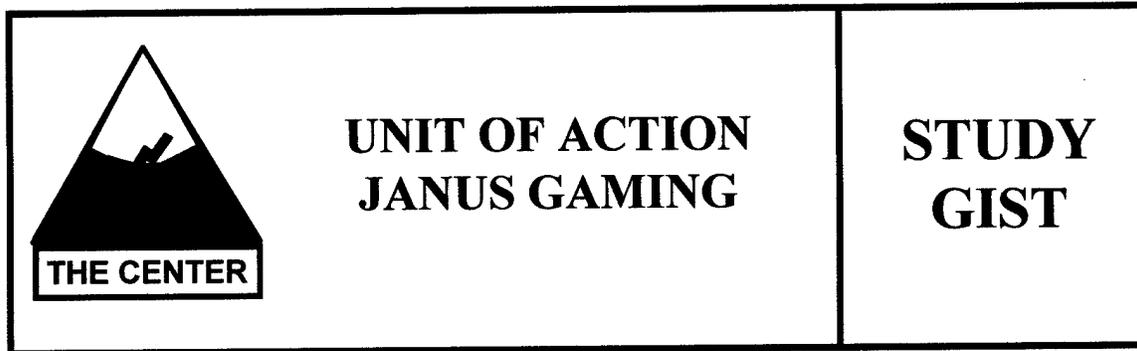
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The findings in this report are not to be construed as an official Department of the Army position, unless so designated by other authorized documents.



THE REASON FOR PERFORMING THE ANALYSIS to evaluate the Unit of Action and the Future Combat System in order to finish completion of the Operations and Organization document and the Operational Requirements Document.

THE PRINCIPAL RESULTS of this analysis are the “pure” LOS/BLOS platoon is not as effective as the combined arms platoon in the offense when confronted by Threat dismounts. The Unit of Action was able to rapidly detect and defeat enemy forces that chose to flee. Unit of Action forces are in most danger when they become involved in a close-in infantry fight.

SCOPE: The analysis focused on platoon, company and battalion level unit of action forces and used a Janus computer suite consisting of a host and 20 stations to gain insights into the warfighting capability of the force and various platforms.

THE STUDY OBJECTIVES were to determine the warfighting effectiveness at the platoon, company and battalion echelons of the Unit of Action force. Also, to determine and compare the force effectiveness of the battalion fighting “pure” and task organized companies. To determine and compare the force effectiveness of the battalion fighting during the day and night scenarios.

THE BASIC APPROACH use to accomplish this evaluation was limited to examination of the operational effectiveness of the echelon within the man-in-the-loop Janus simulation.

THE STUDY PROPONENT/AGENCY was the Unit of Action Maneuver Battle Laboratory.

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ABSTRACT

The Unit of Action Maneuver Battle Laboratory (UAMBL) in conjunction with other TRADOC agencies and schools conducted analysis on the Unit of Action and the Future Combat System in order to finish completion of the Operations and Organization (O&O) document and the Operational Requirements Document (ORD). The UAMBL in conjunction with contractor and other TRADOC personnel conducted the warfighting analysis in the Maneuver Warfare Test Bed (MWTB) during the period 8 July – 16 August 2002. A computer suite consisting of a host and 20 stations running the Janus model was used to simulate combat operations at various echelons on Asian terrain to gain insights into the warfighting capability of the force and various platforms. The objectives of the analysis was to determine the warfighting effectiveness at the platoon, company and battalion echelons of the Unit of Action force; to determine and compare the force effectiveness of the battalion fighting “pure” and task organized companies; to determine and compare the force effectiveness of the battalion fighting during day and night scenarios; and to examine the model output for potential use in the ORD documentation for the Future Combat System.

UNIT OF ACTION JANUS GAMING (U)

1. (U) INTRODUCTION.

a. (U) In June 2002, the U.S. Army Training and Doctrine (TRADOC) Commander directed the Unit of Action Maneuver Battle Laboratory (UAMBL) in conjunction with other TRADOC agencies and schools conduct analysis on the Unit of Action and the Future Combat System (FCS) in order to finish completion of the Operations and Organization (O&O) document and the Operational Requirements Document (ORD).

b. (U) This report details the conduct of the Janus gaming that was performed at Fort Knox in support of this requirement.

c. (U) The UAMBL, in concert with personnel from Raytheon Corporation, AB Technologies Inc., Lockheed Martin Inc., TRADOC Analysis Center personnel and Small Group Instructors (SGI) from the Armor School conducted warfighting analysis in the Mounted Warfare Test Bed (MWTB) during the period 8 July – 16 August 2002. A computer suite consisting of a host and 20 stations running the Janus model was used to simulate combat operations at various echelons on Asian terrain to gain insights into the warfighting capability of the force and various platforms.

2. (U) OBJECTIVES.

a. (U) Determine the warfighting effectiveness at the platoon, company and battalion echelons of the Unit of Action force.

b. (U) Determine and compare the force effectiveness of the battalion fighting “pure” and task organized companies.

c. (U) Determine and compare the force effectiveness of the battalion fighting during day and night scenarios.

d. (U) Examine the model output for potential use in the ORD documentation for the Future Combat System.

3. (U) SCOPE.

a. (U) The analysis examined warfighting on a single piece of Asian terrain. The terrain was in northwestern Azerbaijan and consists of a river valley between two mountains all of which is south of the large Mingacevir reservoir. This valley is a portion of the main East-West corridor through the country.

b. (U) Platoons were employed as individual platoons supported by a proportionate slice of reconnaissance and fires. Platoons executed both offensive and defensive operations. Two platoons performed offensive operations in urban and close terrain. Two platoons' defensive operations took place in open rolling terrain.

c. (U) The company runs were offensive in nature and were terrain oriented. The company objective was to maneuver through enemy held territory and seize an airfield.

d. (U) The battalion runs were offensive in nature and consisted of pursuing the enemy when he was retreating and terrain oriented when the enemy did not retreat. The terrain objective when the enemy didn't retreat was multiple bridge crossing sites in enemy held territory.

e. (U) A limited number of Janus iterations were produced for each echelon due to the limited time available for the analysis.

4. (U) JANUS RUNSTREAM.

a. (U) The methodology used to accomplish this analysis was limited to examination of operational effectiveness of each echelon within the Janus man-in-the-loop simulation at the MWTB.

b. (U) The calendar for conducting the analysis is shown in figure 1.

JULY				
MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
8	9	10	11	12
← JANUS TRAINING BY CONTRACTOR →				
15 PLATOON SETUP	16	17	18	19 PURE PLATOON
← CA PLATOON RUNS →				
22 RUNS →	23	24	25	26
29	30	31		
← COMPANY RUNS →				
AUGUST				
			1 BATTALION SETUP	2 ←
5	6	7	8	9
← TASK ORGANIZED BATTALION NIGHT → TASK ORGANIZED BATTALION DAY →				
12 ← PURE BATTALION DAY →	13	14 ← PURE BATTALION NIGHT →	15	16 EXCURSIONS

Figure 1. (U) JANUS Calendar

b. The number of iterations of each run varied from day to day with a minimum of a single run to a maximum of four platoon runs on any given day. A run matrix is displayed in tables 1 through 3 that show the changes in organization and situational awareness capabilities that were made each run.

DATE	RUN	Force Structure	# UGS	# SUAV	Force Structure/Modifications
16	1	4 CA Platoons	60	No Limit	A
16	2	4 CA Platoons	44	No Limit	A
16	3	4 CA Platoons	30	No Limit	A
17	1	4 CA Platoons	30	No Limit	A
17	2	4 CA Platoons	51	No Limit	Replaced BLOS with Assault ARV
17	3	4 CA Platoons	45	No Limit	Replaced BLOS with Assault ARV
18	1	4 CA Platoons	45	3 @ one time	A
18	2	4 CA Platoons	45	5 @ one time	A
18	3	4 CA Platoons	45	8 @ one time	A
18	4	4 CA Platoons	45	8 @ one time	A
19	1	4 Pure Platoons	45	8 @ one time	B
19	2	4 Pure Platoons	45	8 @ one time	B
22	1	4 Pure Platoons	45	8 @ one time	Swapped battle CPTs
22	2	4 Pure Platoons	45	5 @ one time	B
22	3	4 Pure Platoons	45	3 @ one time	Swapped battle CPTs

Table 1. (U) Platoon Run Matrix

DATE	RUN	Force Structure	# UGS	# SUAV	Force Structure/Modifications
23	1	Design "B" Company	45	No Limit	C
24	1	Design "B" Company	45	No Limit	C
25	1	Design "B" Company	45	No Limit	Tethered ARV/ ARV Recon - OCSW
26	1	Design "B" Company	45	No Limit	3 Comanches added
26	2	Design "B" Company	45	No Limit	"
29	1	Design "B" Company	45	No Limit	"
30	1	Design "B" Company	45	No Limit	"

Table 2. (U) Company Run Matrix

DATE	RUN	Force Structure	# UGS	# SUAV/# TUAV	Force Structure/Modifications
2	1	Battalion TF Night	45	96/2	D
2	2	Battalion TF Night	45	96/2	D
5	1	Battalion TF Night	45	96/2	D
6	1	Battalion TF Night	45	96/2	D
7	1	Battalion TF Night	45	96/2	D
8	1	Battalion TF Day	45	96/2	D
8	2	Battalion TF Day	45	96/2	D
8	3	Battalion TF Day	45	96/2	D
9	1	Battalion TF Day	45	96/2	D
12	1	Battalion Night	45	96/2	E
12	2	Battalion Night	45	96/2	E
13	1	Battalion Night	45	96/2	E
13	2	Battalion Night	45	96/2	E
14	1	Battalion Day	45	96/2	E
14	2	Battalion Day	45	96/2	E
15	1	Battalion Day	45	96/2	E
15	2	Battalion Day	45	96/2	E
16	1	Battalion TF Night	45	96/2	F
16	2	Battalion TF Day	45	96/2	F

Table 3. (U) Battalion Run Matrix

5. (U) PLATOON ANALYSIS.

a. (U) General. The platoon level analysis was performed first to provide insights into the organization and to provide the interactors an opportunity to begin playing Janus with as few icons on the screen as possible. This also allowed the platoon leaders to familiarize themselves with the capabilities of each of the systems in the platoon and its capabilities.

b. (U) Scenario. The individual platoons were each given an area on the map in which they were to conduct operations. The areas were separated enough that the platoons could not mutually support one another and therefore had to conduct their mission independently. The mission for each area was different and the Threat forces within each were also varied. Two of the platoons were to clear and seize the terrain. These two platoons were in objectives A and D on the map. The other two platoons were to defend the line of communication running through their area from being interdicted by the Threat forces. These two platoons were in objectives B and C on the map. The reconnaissance slice allotted to each platoon was to screen forward of the platoon and provide intelligence on the opposing force's activity. The NLOS slice was positioned so that it could provide effects in each of the four areas and thus support all of the platoons in accomplishing their mission. The scenario takes place at night and the weather is clear. Shown in figure 2 are the objective areas for each platoon.

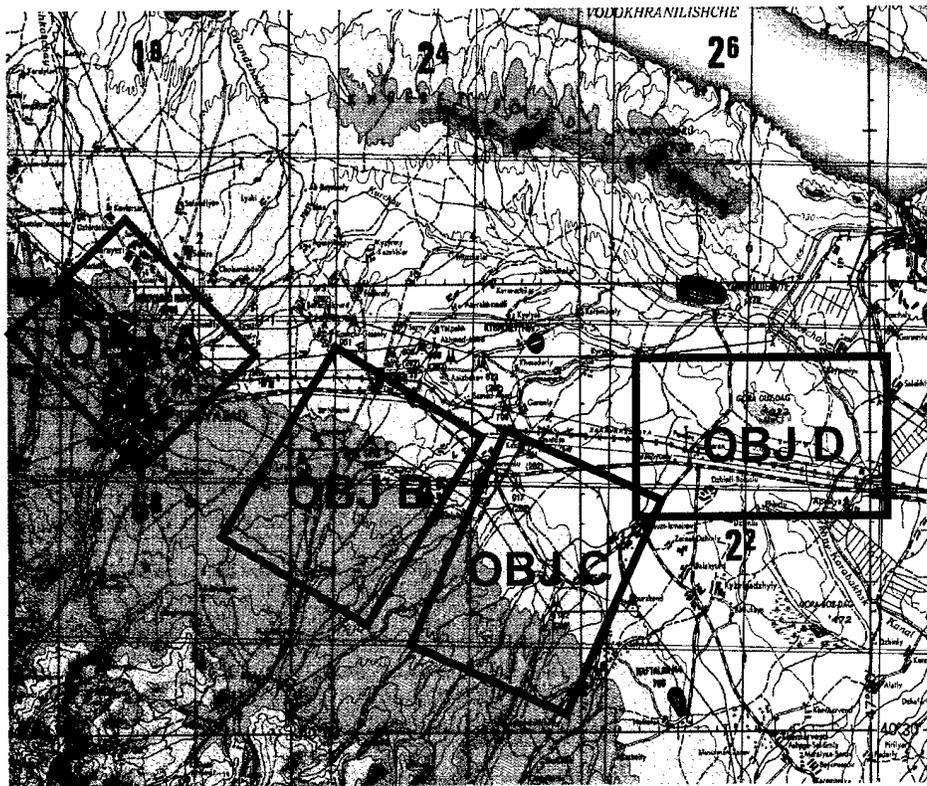


Figure 2. Platoon Mission Areas (U)

c. (U) Blue Forces. Initially, the platoons were organized in combined arms platoons. These platoons contained infantry, direct fire and indirect fire systems along with organic aerial reconnaissance assets. The elements that made up the combined arms platoons are shown in table 4. After three days of simulation with this force structure a change to “pure” infantry and line-of-sight/beyond line-of-sight (LOS/BLOS) platoons was instituted. The elements that made up the “pure” platoons are shown in table 5. The “pure” infantry platoons operated in objective areas A and B. The “pure” LOS/BLOS platoons operated in objective areas C and D. The reconnaissance slice for each platoon amounted to 15 unmanned ground systems, 8 short range unmanned aerial vehicles (SUAV), a reconnaissance and surveillance vehicle with dismounts, and a reconnaissance version of the robotic vehicle.

COMBINED ARMS PLATOON	
SYSTEM	# of System
Infantry Carrier	4
ARV	2
LOS/BLOS	2
Mortar Carrier	1
OAV (Light)	4

Table 4. (U) Combined Arms Platoon

PURE PLATOON	
INFANTRY PLATOON	
SYSTEM	# of System
Infantry Carrier	3
Assault Robotic Vehicle	4
OAV (Light)	3
LOS/BLOS PLATOON	
SYSTEM	# of System
LOS/BLOS	3
Recon Robotic Vehicle	6
OAV (Light)	3

Table 5. (U) Pure Platoon

d. (U) Threat Forces. The Threat forces that operated in objective areas A and B were primarily 2 squads of dismounts supported by a company of 10 BMP's and a platoon of 3 anti-tank guns and an unmanned aerial vehicle. The Threat forces that operated in objective areas C and D were primarily mounted with a company of 10 BMP's and a platoon of 3 tanks with an unmanned aerial vehicle. These forces were supported by battalion and brigade slices of artillery (cannon and missile rocket launched) and air defense. The artillery amounted to a battery of self-propelled howitzers plus a section of missile rocket launchers. The air defense was a battery from battalion and a section from brigade also.

e. (U) Analysis.

(1) (U) The following measures of effectiveness (MOE) and measures of performance (MOP) were employed in the analysis. Measures of effectiveness were employed to quantify the force effectiveness of each organizational structure. Measures of performance were employed to quantify the performance of each organizational structure.

(2) (U) The MOE that was employed in this analysis to assess force effectiveness is as follows:

$$\text{Fractional Exchange Ratio} = \frac{\text{Number of Threat Systems Killed by U.S. Systems}}{\text{Number of U.S. Systems Killed by Threat Systems}} = \frac{\text{Number of Threat Systems Beginning the Exercise}}{\text{Number of U.S. Systems Beginning the Exercise}}$$

(3) (U) The following MOP was used in the analysis.

(a) (U) Total Red Losses.

(b) (U) Total Blue Losses.

(4) (U) The average fractional exchange ratio (FER) over all trials for the two organizational designs is depicted in figure 3. This measure of effectiveness takes into account the differing numbers in the beginning U.S. systems. The MOE also includes all systems to include dismounts for both the Threat and U.S. Overall, there is not much difference between the combined arms platoon and the “pure” platoon in terms of force effectiveness. The single area where there is a difference (objective area C) can be explained by the platoon leader being content to defend with the “pure” platoon. He was able to take advantage of the LOS/BLOS capability to strike at long range and consequently suffered few losses from either direct or indirect fire from Threat. In objective area D especially the “pure” platoon was unable to clear both the city and the forested area while retaining combat power leading to the much lower FER than the other areas.

PLATOON FER

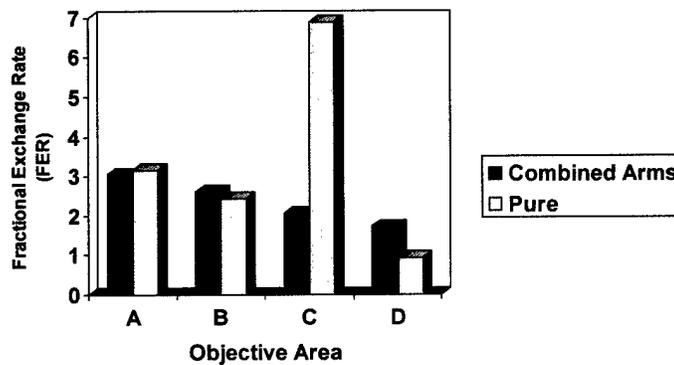


Figure 3. (U) Fractional Exchange Ratio

(5) (U) The losses that the Threat suffered in each area is shown in figure 4. This figure portrays the lethality of the U.S. platoons. Threat losses in areas A and B are roughly the same. In these areas the U.S. force was an infantry platoon. The infantry platoon possessed some dismount capability in both organizational structures this enabled them to counter the Threat dismounts that existed in these areas. In areas C and D where the “pure” U.S. force was a LOS/BLOS platoon and did not possess any dismount capability they were not as lethal. In area C the commander had the luxury of defending against whatever attack the Threat chose to mount. However, in area D the U.S. platoon was given the mission of clearing and seizing the area. Here the platoon leader had to attack which led to numerous instances of Threat dismounts popping up from defilade and ambushing U.S. LOS/BLOS systems.

Red Losses

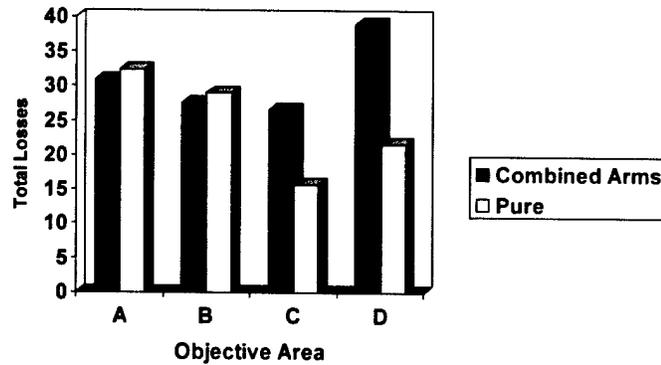


Figure 4. (U) Total Red Losses

(6) (U) Figure 5 depicts the total Blue losses in each platoon area. This figure shows the vulnerability of the U.S. platoon in each area. Again in areas A and B there is very little difference between organizational structures. In area C where the U.S. platoon was defending, the platoon leader when using the “pure” platoon chose to sit and wait on an attack from the Threat. The “pure” platoon, therefore, suffered few losses in the battle. In area D, the platoon leader had to attack. When equipped with the combined arms platoon he was able to attrite Threat forces while suffering the most losses of the U.S. platoons. When equipped with the “pure” platoon he only achieved half as many kills of the Threat while suffering fewer losses. These few losses in the “pure” force structure caused him to be extremely cautious and rarely did he clear or seize the objective area.

Blue Losses

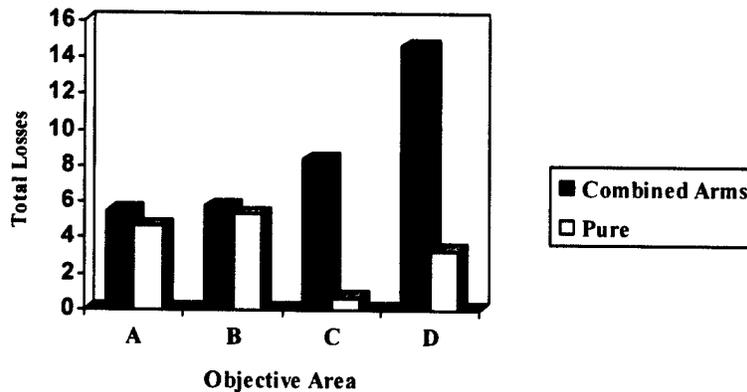


Figure 5. (U) Total Blue Losses

f. (U) Insights. The following list of insights was developed through after action reviews that were held at least daily with the interactors, platoon leaders and SGI's participating in this analysis.

Insights

- **Under new “pure” force structure the Infantry Company lacks organic indirect fire assets. Units had insufficient infantry killing weapons when it encountered dismounts (OBJ A & B).**
- **The fights in restricted (OBJ A and D) terrain boxes required dismounted infantry which the “pure” LOS/ BLOS unit doesn't possess**
- **In the urban fight (OBJ A) the platoon needed an indirect fire weapon in order to be effective.**
- **Platoon leaders required 8 small unmanned aerial vehicles (SUAV) flying to maintain sufficient situational awareness. Coverage by a minimum of two SUAV's per company objective was deemed necessary to prevent excessive losses.**
- **When the number of UGS and SUAV was reduced, there were more direct fire fights due to the resulting lack of situational awareness.**
- **When the ARV (Recon) was equipped only with Common Missile, they were vulnerable after firing missiles since they had no other weapons (19 & 22 July runs)**
- **Combined Arms Platoon organization was preferred over the “pure” Platoon organization.**
 - **Battle CPTs wanted more responsive indirect fire**
 - **Common Missile equipped ARV could not assist fight**
- **When SUAV coverage was reduced, the OAV could not make-up the difference due to range and time of flight shortfalls.**
- **Indirect fires consumed a large quantity of ammunition in the shaping and standoff phases. An increase in probability of kill given a shot would reduce the amount of ammunition required.**

g. (U) Conclusions. The primary conclusions to be drawn from this platoon analysis are as follows.

Conclusions

- **At the platoon level there is very little difference in force effectiveness between the combined arms and “pure” infantry platoon force structure.**
- **The combined arms platoon and the “pure” infantry platoon achieve equal force effectiveness in the offense and the defense.**
- **The “pure” LOS/BLOS platoon is not as effective as the combined arms platoon in the offense when confronted by Threat dismounts.**

6. (U) COMPANY ANALYSIS.

a. (U) General. The company portion of the analysis was run next to provide better coordination between the units especially the reconnaissance and fires support to the company. The intent was to examine the interactions between the four companies operating together on a common mission. It also permitted the addition of brigade slice of air to be added to the exercise. This level of exercise generated the need for the platoon leaders to talk and interact with the reconnaissance and fires commanders.

b. (U) Scenario. The company was given the mission to attack in zone and seize and clear Objective Dodge and secure the airfield. On order the company was to attack and seize Objective Ford. The company consisted of two infantry platoons and two LOS/BLOS platoons. They were supported by a reconnaissance platoon and a NLOS platoon (+). The scenario takes place at night and weather is clear. The company graphics are displayed in figure 6.

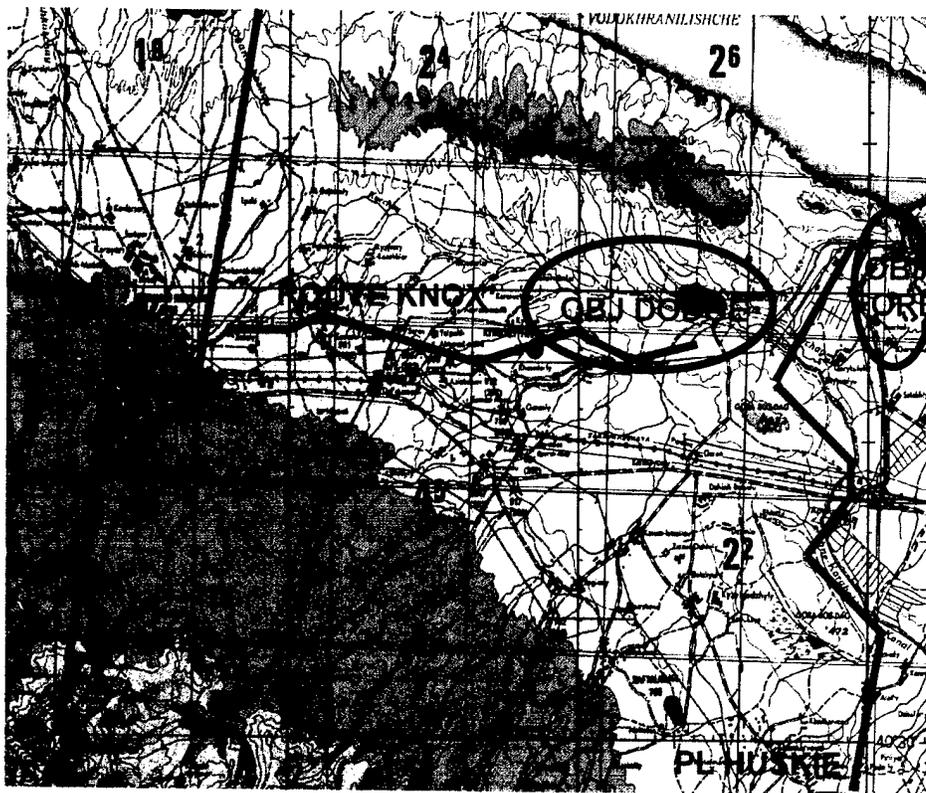


Figure 6. Company Mission Area

c. (U) Blue Forces. The company was organized in two infantry and two LOS/BLOS platoons. These platoons were not task organized but fought "pure". The elements that made up these companies are shown in table 5. The reconnaissance platoon that performed reconnaissance for this company consisted of the following systems. The reconnaissance platoon consisted of three reconnaissance and surveillance vehicles (R&SV), a reconnaissance version robotic vehicle, three lightweight unmanned aerial vehicles (OAV), a carrier for short range unmanned aerial vehicles (SUAV), 32 SUAV, and 45 unmanned ground systems (UGS). Additionally, the company was supported by four UAV's that could not be killed to provide the continuous situational awareness throughout the Janus iteration. These UAV's along with the

short range unmanned aerial vehicles controlled by the reconnaissance platoon and the unmanned ground systems provided a level of situational awareness that was extremely complete. In the last four runs three RAH-66 helicopters were added to the reconnaissance capabilities of the company. Of these only one was allowed to fly in support of the effort at a time. The company was also supported by the following fires systems. The fires support consisted of four missiles-in-a-box (MIB) platforms, four non-line-of-sight (NLOS) cannon systems, eight mortars, a counter-battery radar, and an air defense system. Additionally, the four UAV's that couldn't be killed were supported by two HIMARS multiple rocket launchers that played the shaping fight for the unit of employment (UE) in these Janus iterations.

d. (U) Threat Forces. The Threat Forces that operated in the area is depicted in table 6. These forces are the same as those used in the platoon analysis but now they are grouped under a centralized command.

THREAT SYSTEMS

SYSTEM	# of System
Infantry	251
Manpad	61
APC	45
ATG	6
Tank	6
MTLB	6
Truck	38
Mortar	4
ADA	14
Howitzer	12
MRL	4
UAV	6

Table 6. (U) Threat Systems

e. (U) Analysis. Due to technical problems all of the data for the company level runs were lost and are irretrievable. Therefore, no analysis can be performed.

f. (U) Insights. The following list of insights was developed through after action reviews that were held with the interactors, platoon leaders, company commander, and SGI's participating in the analysis.

Insights

- **Force success was very dependent upon the effectiveness of precision guided munitions and the amount of munitions available.**
- **Precision guided munitions must be capable of finding and killing moving targets to ensure success.**
- **Battle damage assessment (BDA) was necessary but difficult in restricted (wooded and urban) terrain.**
- **The OAV's use was extremely limited in open/rolling terrain. OAV needs the capability to see farther than the vehicle's weapon sensor.**
- **The OAV's short flight range from the vehicle and sensor capabilities does not provide the ability to see farther than the vehicle's weapon sensor.**
- **The control of the robotic vehicles (ARV) requires close examination. The loss of a single control vehicle should not mean the total loss of the robotic vehicle capability.**
- **The proliferation of Threat MANPADS prevented the RAH-66 from performing the reconnaissance role without suffering undue losses.**

g. (U) Conclusions. The total lack of data means there are no conclusions that can be stated with surety. The insights remain valid and are the only summary statements that can be drawn for this portion of the analysis.

7. (U) BATTALION ANALYSIS.

a. (U) General. The battalion level analysis was performed to determine the capabilities of the battalion organization. The battalion commander was allowed to task organize the battalion into company teams initially. Later he was required to fight the companies "pure". We also ran these organizations in the day as well as night. Two excursions were run to examine the battalion without allowing the RAH-66 helicopters to fly.

b. (U) Scenario. The battalion was given the mission of pursuit of the enemy forces. If the enemy forces were not displacing, the battalion was to envelop the enemy and prevent the Threat from crossing the Kur River at the bridge sites over the river. The intent was to close rapidly and destroy as many Threat forces as possible. This was to deny the enemy the capability to set up defenses further to the East. There were civilian non-combatants in the area of operation that would pass information to the Threat but were not to be engaged by the U.S. forces.

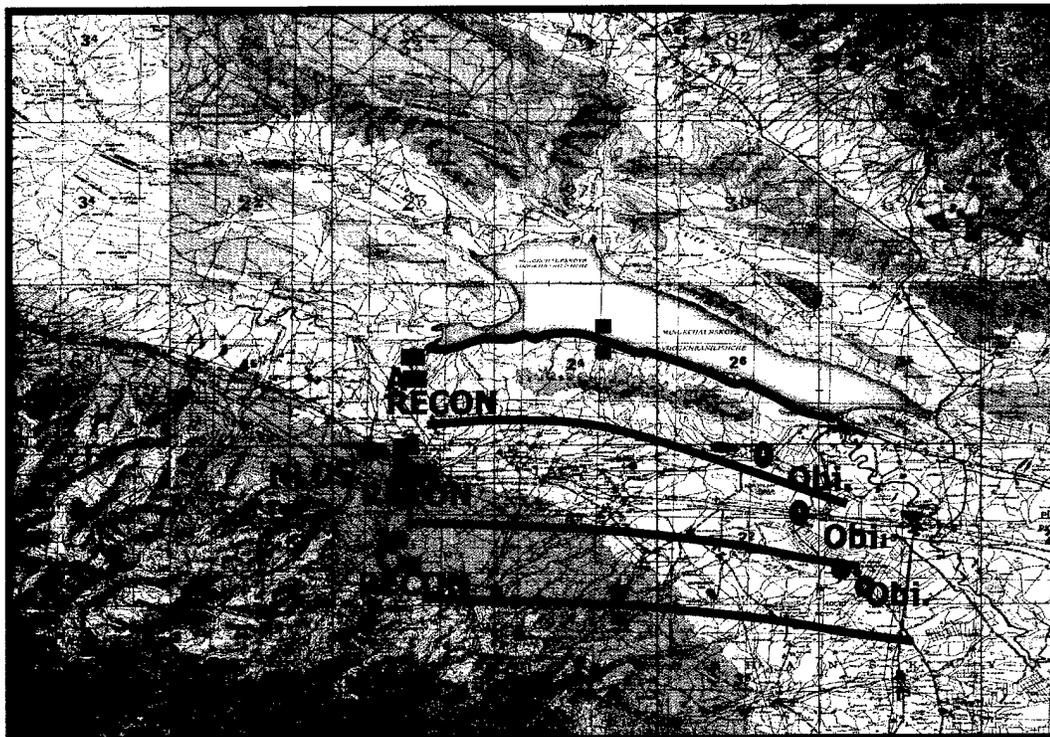


Figure 7. (U) Battalion Mission Area

c. (U) Blue Forces. The composition of the battalion is depicted in table 7. Regardless of whether it was task organized or “pure”, these were the assets that were available to the battalion commander. In the “pure” organization, the forces were as deployed and moved as the units in table 7 below. The task organization of the battalion was directed by the battalion commander and is shown in table 8. In addition to these forces, the always alive UAV’s (4) were flown to represent the situational awareness capabilities of Unit of Employment (UE) and higher feeds to the UA. Also, 6 RAH-66 and a battery of HIMARS were assigned to kill deep targets found by the UAV’s. These UE or higher assets were attributed to be available from outside the UA for shaping of the battlefield simultaneously with employment of the UA.

UNIT OF ACTION	
SYSTEM	# of Systems
LOS/BLOS Co	
LOS/BLOS	9
OAV	3
Infantry Co	
Infantry Carrier	9
Control Vehicle	3
Assault Robotic Veh.	3
OAV	9
Rifleman	69
Machine Gunner	6
Javelin Gunner	6
Recon Det.	
Recon & Surv. Veh.	9
Soldier BOT	9
SUAV Carrier	3
OAV	3
SUAV	96
Recon Robotic Veh.	3
Rifleman	27
NLOS	
MIB Carrier	9
NLOS Cannon	6
Mortar Carrier	8
UGS	45
Counter Btry Radar	1
Aviation Det	
RAH-66	6
TUAV	2
Rearm Truck	1
Refuel Truck	1

TABLE 7. (U) Battalion Forces

UNIT OF ACTION			
SYSTEM	# of Systems	SYSTEM	# of Systems
Recon Plt X 3			
LOS/BLOS	1		
Recon & Surv. Veh.	3		
Soldier BOT	1		
OAV	1		
Recon Robotic Veh	1		
Rifleman	9		
SUAV Carrier	1		
SUAV	32		
TM LOS/BLOS #1		TM INF #1	
Infantry Carrier	3	Infantry Carrier	6
LOS/BLOS	6	LOS/BLOS	3
Control Vehicle	1	Control Vehicle	2
Assault Robotic Veh.	1	Assault Robotic Veh.	2
OAV	9	OAV	3
Rifleman	23	Rifleman	46
Machine Gunner	2	Machine Gunner	4
Javelin Gunner	2	Javelin Gunner	4
		Mortar Carrier	4
TM LOS/BLOS #2		TM INF #2	
Infantry Carrier	3	Infantry Carrier	6
LOS/BLOS	6	Control Vehicle	2
Control Vehicle	1	Assault Robotic Veh.	2
Assault Robotic Veh.	1	OAV	2
OAV	9	Rifleman	46
Rifleman	23	Machine Gunner	4
Machine Gunner	2	Javelin Gunner	4
Javelin Gunner	2	Mortar Carrier	4
		Aviation Det	
NLOS		RAH-66	6
MIB Carrier	9	TUAV	2
NLOS Cannon	6	Rearm Truck	1
UGS	45	Refuel Truck	1
Counter Btry Radar	1		

TABLE 8. (U) Task Organized Battalion Forces

d. (U) Threat Forces. The Threat forces that operated in the area of operations were brigade (+) in size. The force was primarily infantry. The Threat force composition is shown in table 9. The numbers depicted in table 9 reflect the attrition of Threat vehicles of approximately 20 percent that took place before this scenario was played. The intent of the Threat forces was to disrupt the mobility of the blue force while preserving its strength. Threat forces sought to

conduct ambushes, use obstacles, and shield their force with civilians. They also wanted to avoid decisive combat and attempt to inflict maximum casualties on U.S. forces.

THREAT SYSTEMS

SYSTEM	# of System
Infantry	1046
Manpad	141
APC	102
ATG	94
Tank	32
MTLB	3
Truck	61
Mortar	13
ADA	32
Howitzer	39
MRL	6
UAV	6

Table 9. (U) Threat Force Composition

e. (U) Analysis. The following areas were investigated during this analysis: target acquisition, target standoff, lethality, survivability, sustainability and force effectiveness.

(1) (U) Target Acquisition.

(a) (U) Target acquisition is directly related to the sensors mounted on their respective vehicles and as such is not affected by whether the vehicles are employed "pure" or task organized. Target acquisition can be affected by whether it is day or night. Therefore, this analysis will only examine the difference in target acquisition between the day and the night. This will be preceded by an examination of the percentage of total targets detected by UA systems and average target acquisition range of these systems.

(b) (U) The UE and higher echelon systems (JSTARS, invincible UAV's and helicopters accounted for more than 60% of the total systems detected by all U.S. systems on the battlefield. This indicates the UA commander should have a very good situational picture of the battlefield before he commits his forces. The UA flying assets (helicopters, tactical UAV (TUAV) and short range UAV (SUAV)) accounted for an additional 33% of the total systems detected by all U.S. systems on the battlefield. This means that ground maneuver systems and soldiers accounted for less than 7% of the total systems detected. The implications of this target acquisition breakdown are twofold. The first implication is the UA is dependent upon higher echelon forces to provide a great deal of situational awareness of the battlefield before it is employed. The second is the almost total dependence of the UA on aerial reconnaissance assets to provide the situational awareness. This reliance on aerial assets could have major ramifications dependent upon the weather conditions and the all weather operational capability of the aerial assets.

(c) (U) Shown in figure 8 are the average target acquisition ranges for the major UA ground systems. As can be seen the indirect fire systems (MIB, Mortar and NLOS cannon) do not have long target acquisition ranges as they depend on other systems to find the targets that they will fire upon. The ground systems with the best sensors were limited to average target acquisition ranges in the neighborhood of 3 kilometers. This limitation was attributed to the terrain over which these battles were fought. The LOS/BLOS system had a direct fire capability of 8 kilometers and fired a number of rounds at near maximum range. However, the terrain limited the average target acquisition range to 3.3 kilometers as shown in figure 8.

AVERAGE TARGET ACQUISITION RANGE

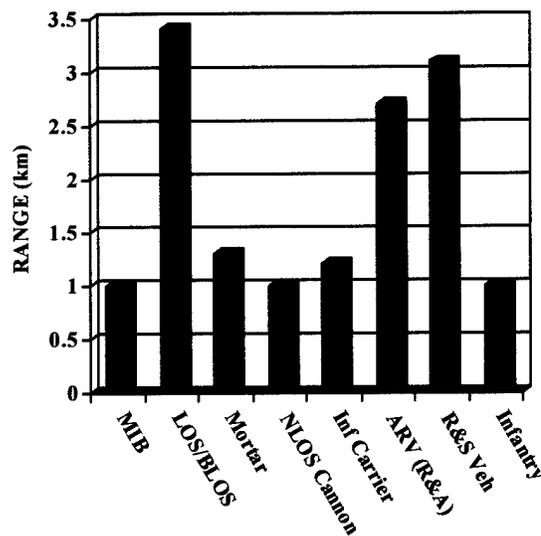


Figure 8. (U) Ground System Target Acquisition Range

(d) (U) In comparing night scenario versus the day, the following comments are applicable. The percentages of detections by each system remain about the same with no more than a 2% variance between any of the systems compared. The average target acquisition range remains about the same for all of the systems except the “invincible UAV’s”. This system saw a significant drop in average target acquisition for the night scenario. This drop is attributed to the average range at which this UAV detected Threat infantry. Shown in figure 9 is a comparison of the ground system average target acquisition range for both day and night. Notice that most of these systems had a slightly longer detection range at night. This is attributed to the use of thermal sensors by the UA ground systems and their slightly increased capability at night. The only systems that don’t display this slight increase in range are NLOS systems that depend on other sensors to locate the targets they will fire upon.

AVERAGE TARGET ACQUISITION RANGE

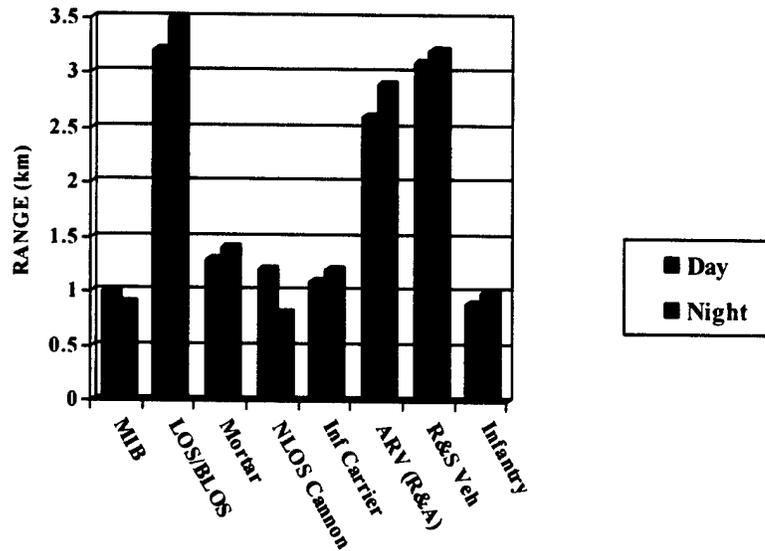


Figure 9. (U) Average Target Acquisition Range Comparison

(2) (U) Target Standoff.

(a) (U) For exactly the same reason as stated in target acquisition, this analysis will only examine target standoff for day and night and not consider the “pure” and task organized breakout. The examination of target standoff range will focus on Threat armored personnel carriers (APC) against the U.S. reconnaissance and surveillance vehicles (R&SV), infantry carrier vehicles (ICV), and the mounted combat system (MCS). These systems are the ground systems that would be pitted against each other as they maneuver. Figure 10 displays the average range at which the Threat and UA systems acquired each other and the delta between the acquisition ranges. It should be noted that the UA R&SV and MCS enjoy a substantial (nearly 1 kilometer) standoff from the Threat APC. The UA ICV, however, does not possess a standoff. This is primarily due to the usage of the ICV as a battlefield carrier that is not employed to seek out the enemy but used to transport dismounted troops exclusively. The employment of the ICV does not require it to have the sensor capability built into the R&SV and MCS which must acquire the enemy as far away as possible in order to decide where and when to engage the enemy. Because of its requirement to transport infantry the ICV will likely have a larger profile and be more susceptible to being acquired than the R&SV and MCS.

AVERAGE DETECTION RANGES OF THREAT APC SYSTEMS

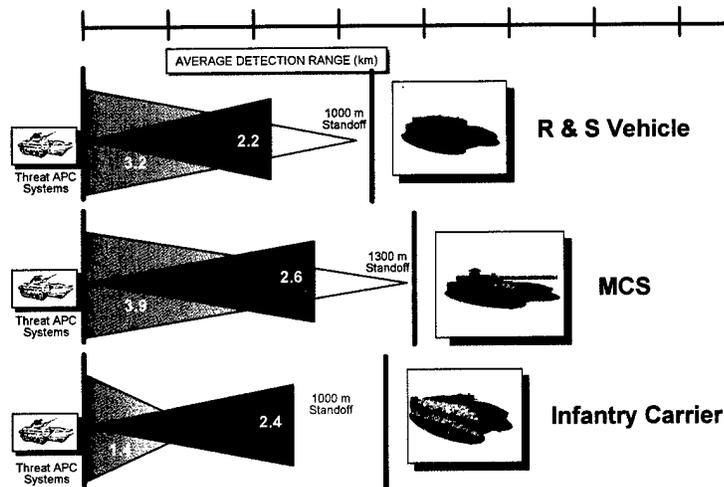


Figure 10. (U) Target Standoff Comparison

(3) (U) Lethality.

(a) (U) General. Unit of action lethality is difficult to analyze because so much of it is dependent upon a set of sensors locating targets for non-line-of-sight systems to fire upon. The derivation of the number of Threat systems that died is easy. The difficulty lies in determining the underlying cause and effect. This analysis will examine the lethality of the UA in the overall context and then compare the night versus the day and the "pure" versus the task organized force.

(b) (U) Overall. Unit of action system kills of Threat systems is displayed in figure 11. A glance at this figure shows the three primary killing systems to be Comanche, missiles in a box, and LOS/BLOS. It should be noted that half of the Comanche kills should be attributed to the helicopters allotted to the UE. These primary killing systems are followed by a second tier that includes mortar, NLOS cannon, robotic vehicle and the reconnaissance and surveillance system. The latter is surprising since the mission of the reconnaissance and surveillance vehicle is to acquire targets for other systems and not become engaged. These two tiers of lethality are what would be expected for this UA force. The tactics of this force, if followed, would dictate the missiles in a box and LOS/BLOS as primary killers due to their capabilities to attack moving and stationary Threat vehicles from a distance. These should be the primary killing systems of the UA force. The other systems would naturally follow due to their innate capabilities and method of employment within UA.

AVERAGE RED SYSTEMS KILLED

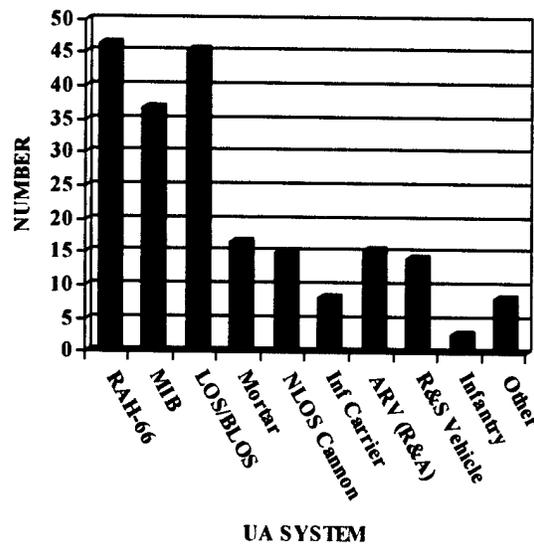


Figure 11. (U) Overall Lethality

(c) (U) Organization. The comparison in system lethality for the UA force is shown in figure 12. The trend depicted in the overall lethality chart remains for both the task organized and the “pure” force. The only anomalies displayed in figure 12 are the decreased number of kills for the missiles in a box and reconnaissance and surveillance vehicle when played in the task organized force. The decline in R&SV kills when task organized can be explained by the task organization of a LOS/BLOS system with each of the reconnaissance platoons. The LOS/BLOS system was employed to kill either through direct or indirect fire targets that the R&SV found. Note that the number of kills by LOS/BLOS is up slightly when task organized. In fact it is the number one killing system on the battlefield for the task organized runs. The difference in missiles in a box kills of Threat systems is not as easily explained. It should be pointed out that missiles in a box fired nearly two and a half times more rounds (190 versus 78) on average in the “pure” organization. Firing of more missiles obviously results in a greater number of kills. It is unknown why such a significant increase in the number of missiles fired was accomplished in the “pure” organization. Equally unknown is why this dramatic increase in rounds fired did not achieve a greater difference in the Threat kills achieved.

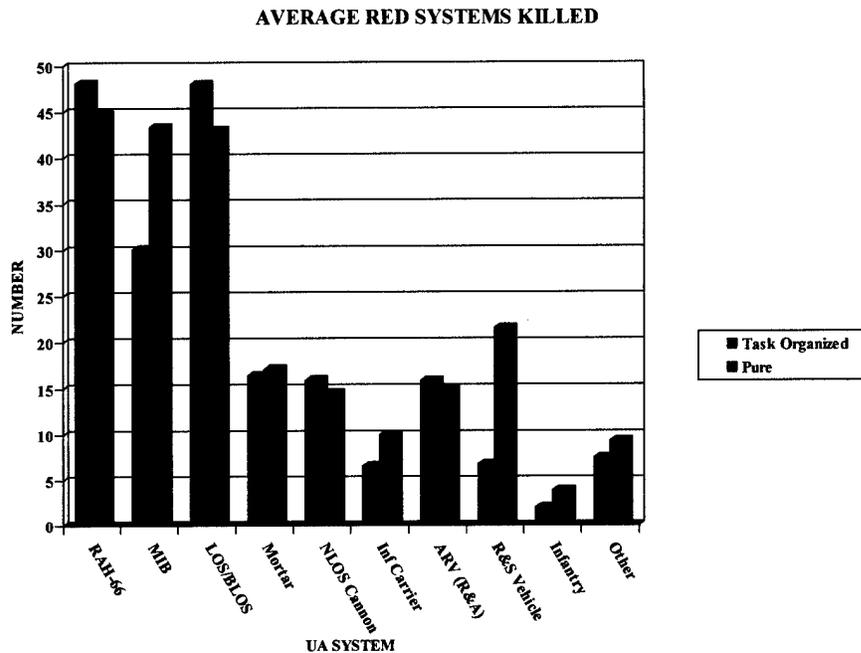


Figure 12. (U) Lethality Comparison UA Force Organization:

(d) (U) Day and Night. The comparison of UA system lethality between day and night is portrayed in figure 13 below. The important things to note from this figure are the following. There is very little difference in lethality for the UA systems during the day or night. This is primarily due to the night sensor capability of the UA systems. The lethality of all but two systems is lower in the day than at night. This is primarily due to the Threat systems increased capability in daylight. The Threat acquires the UA systems better during the day and thus is capable of inflicting increased kills on the UA. This limits the UA systems time to kill and lowers the number of Threat systems they kill on average. The two systems that do not display this trend are indirect fire systems (mortar and NLOS cannon). These systems are used out of direct fire range of Threat systems and thus survive longer and achieve more Threat kills. What is puzzling is the fact that the MIB, also an indirect fire system, did not also follow this trend.

AVERAGE RED SYSTEMS KILLED

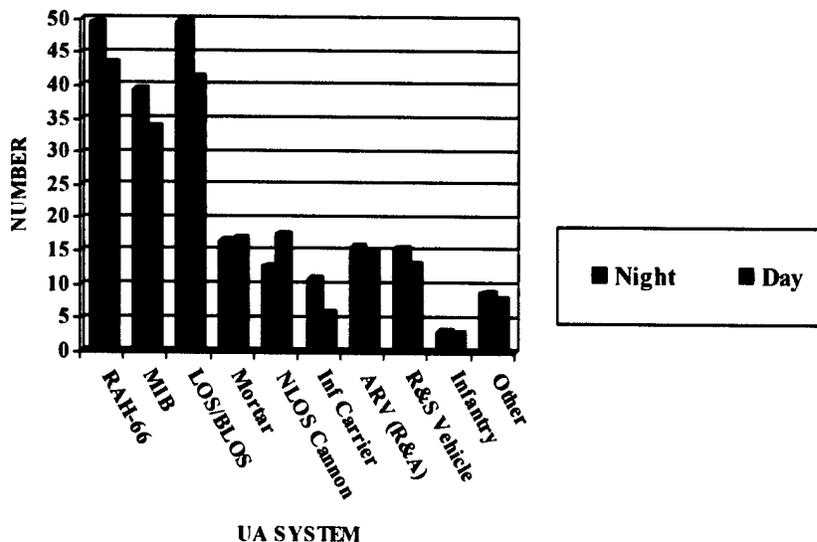


Figure 13. (U) Day Versus Night Lethality Comparison

(4) (U) Survivability.

(a) (U) General. In this portion of the analysis examination of the survivability of UA systems will follow the same framework as the lethality section above. Survivability will be analyzed by looking at the losses of UA systems. The timing of when the losses occurred was examined and the only significant point to be made was the distribution of losses over time was bimodal. This follows in the tradition of past simulations and nothing of significance was noted. Therefore, there will be no reporting of losses over time.

(b) (U) Overall. Shown in figure 14 is the average number of losses of UA systems for an iteration of the Janus battalion scenario. Losses of UA systems were relatively small. Most UA systems recorded less than six losses per scenario. The largest number of losses occurred in infantrymen (61.8) which amounted to approximately one-third of the dismountable soldiers. The largest portion of the other category was SUAV missiles lost to Threat ADA systems (23.5).

AVERAGE UA SYSTEMS KILLED

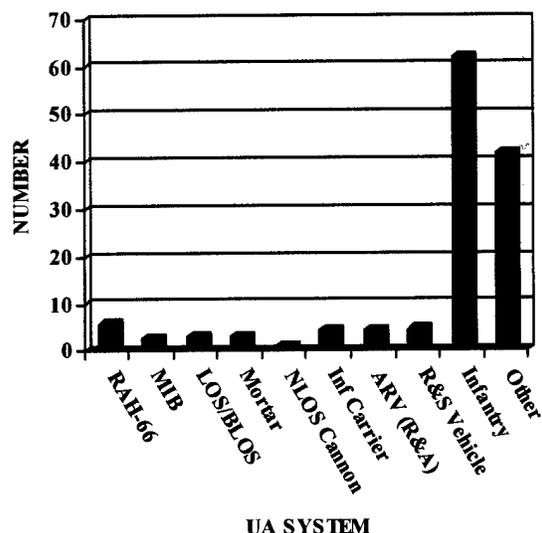


Figure 14. (U) UA System Survivability

(c) (U) Organization. The comparison between task organized and “pure” UA battalions is displayed in figure 15. The overall look of the chart shows the same sort of shape as the overall survivability. Again the bulk of UA systems show very few losses when employed in the task organized and “pure” organization. The comparison does show an overall decrease in survivability when the UA is employed “pure”. The dismountable infantry and scout survivability decreases by 230 percent when the force is employed “pure”. This dangerous situation is created by the lack of an effective direct fire system in the infantry company with the exception of the assault robotic vehicle. The reconnaissance detachment suffers the same fate and is slightly worse off since the robotic vehicle in the detachment doesn’t have a direct fire capability greater than the objective crew served weapon (OCSW). The infantry carrier or R&SV when surprised by hidden Threat vehicles and dismounts has very little chance of surviving the engagement. All but two UA systems show a lack of survivability in the “pure” case when compared to the task organized. In those two cases (RAH-66 and LOS/BLOS) the change in survivability is miniscule.

AVERAGE UA SYSTEMS KILLED

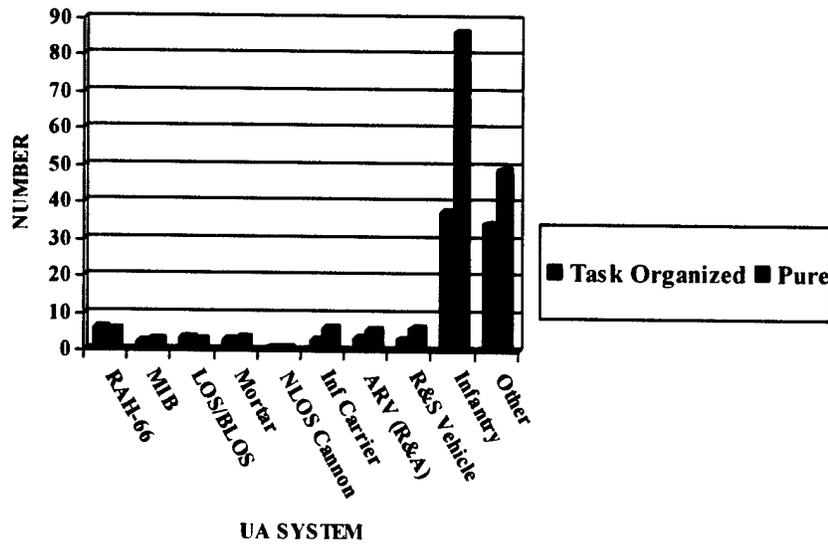


Figure 15. (U) Organization Comparison Survivability

(d) (U) Day and Night. Depicted in figure 16 is a comparison between day and night survivability for UA systems. Again, the comparison shows a remarkable likeness to the overall average survivability. There is no clear cut winner in this comparison. Of the ten UA systems displayed six show decreased survivability in day scenarios. That leaves four systems with decreased survivability in night scenarios. The only category that can be said to show a difference between day and night is the other category. This difference is primarily attributed to the difference in loss of the SUAV missiles. At night the SUAV losses averaged 15.3 while in the day the losses amounted to 31.8 per scenario. The majority of this increase is due to the capability of Threat manpad systems. During the day the SUAV was acquired more by these dismounted individuals and they accounted for an increased kill of 13.5 systems.

AVERAGE UA SYSTEMS KILLED

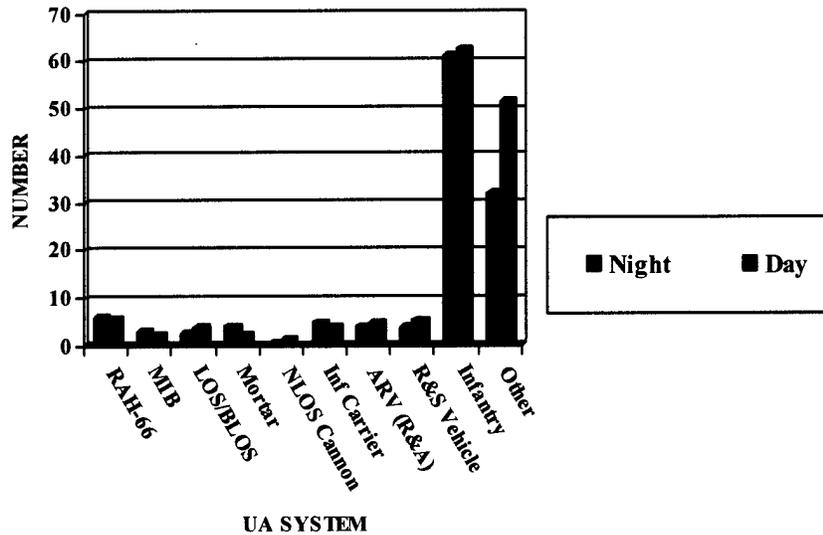


Figure 16. UA System Survivability Comparison Day vs. Night

(5) (U) Sustainability. The level of sustainability for the UA forces is examined using the percentage of initial load of rounds fired by the respective system on average. This battalion scenario was usually between 2 to 4 hours in length. If a UA system fired a large percentage of its initial load of ammunition the consequences are the UA must contain the capability to reload in order for the UA to fight for 72 hours as dictated in the O&O. A quick examination of the average amount of ammunition fired during this scenario shows only a few systems of note. This discussion will, therefore, concentrate on these systems. As you might expect the systems that fired the greatest number of rounds were the primary killing systems of the UA. Shown in figure 17 are the initial load and the number of rounds fired of these systems. This clearly depicts systems firing from 22 to 98% of the initial load out during the scenario. The impacts of this much firing are the necessity of ammunition resupply during the 72 hours and the large number of rounds required by certain systems if numerous battles of this type are fought during this time period. This strongly suggests that especially ammunition resupply is a topic requiring thought and consideration both in the O&O and the operational requirements document for the UA systems.

**PERCENTAGE OF INITIAL AMMUNITION LOAD
FIRED**

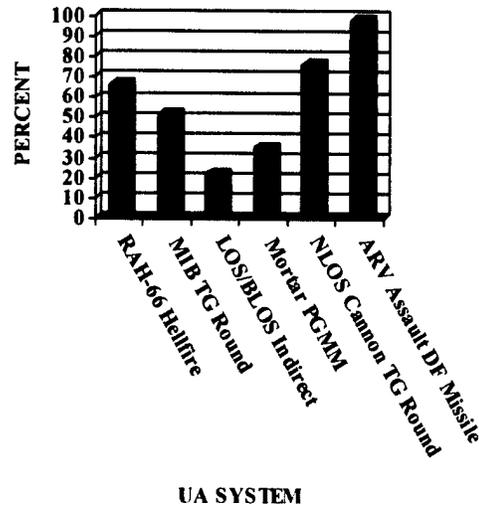


Figure 17. (U) Ammunition Fired

(6) (U) Force Effectiveness. Force effectiveness is included in the analysis to make it complete. The mission of the UA in the scenario did not require the destruction of the Threat force. As such force effectiveness as measured by the traditional MOE of Fractional Exchange Ratio (FER) has very little meaning. The lack of a base case to compare the organization to also limits the utility of the FER measure. The UA is not designed to win attrition battles but to selectively fight the enemy and gain control of enemy centers of gravity in order to defeat the Threat. The FER will be compared between the task organized and “pure” forces and also between the day and night. The FER comparison between the former is displayed in figure 18. The latter comparison is shown in figure 19. The figures clearly show the preference for the task organized force and the night as the better FER. No attempt was made to determine whether the difference is statistically significant due to the small number of iterations of each alternative.

FRACTIONAL EXCHANGE RATIO

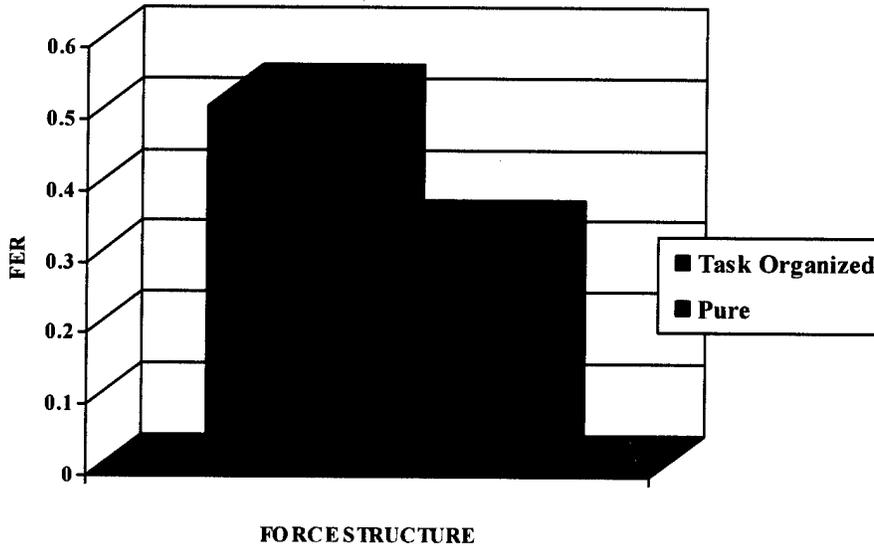


Figure 18. (U) Force Structure FER Comparison

FRACTIONAL EXCHANGE RATIO

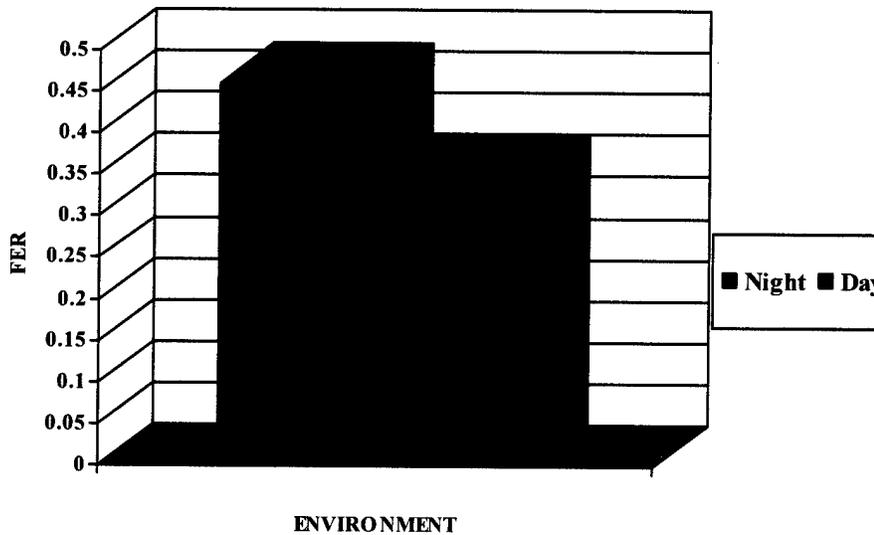


Figure 19. (U) Environment FER Comparison

f. (U) Insights. The following list of insights was developed through after action reviews that were held at least daily with the interactors, platoon leaders and SGI's participating in this analysis. None of the platoon and company insights were contradicted or negated by the battalion scenario. Therefore, the insights listed on page 9 and 12 would also apply to the

battalion scenario. Additionally the following insights were derived from the battalion echelon simulations.

Insights

- **UA was able to rapidly detect and defeat enemy forces that chose to flee.**
- **UA intelligence, surveillance and reconnaissance assets feeding a common operating picture allows maneuver with minimal indirect and direct fire contact between forces.**
- **Threat forces in hide or sanctuary positions saw few UA systems and were not threatened enough to flee or reposition voluntarily.**
- **UA forces are in most danger when they become involved in a close-in infantry fight.**
- **Solutions for the UA force in the close-in fight were:**
 - **More indirect fire**
 - **Suppression of enemy**
 - **Better anti-personnel rounds**
- **Comanche was exclusively a quick reaction force because of Threat MANPADS proliferation.**
- **UA force is not a very resilient force during close combat.**
- **No noticeable difference in situational awareness with Comanche not flying.**

g. (U) Conclusions. The primary conclusions to be drawn from the battalion analysis are as follows.

Conclusions

- **The R&SV and MCS enjoy at least a 1 kilometer standoff in detection compared to the Threat light armored vehicles.**
- **The task organized UA enjoyed a slight increase in overall lethality and a substantial increase in survivability when compared to the "pure".**
- **During the night the UA enjoyed an increase in overall lethality and survivability when compared to day.**