Urban Terrain Combat Simulation

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ABSTRACT

A commander decides what procedures to use in different situations.[1] His staff and he develop a course of action (COA).[2] The goal of Course of Action Technology Integration project is to provide commanders with quick and varied combat options. The goal of Urban Terrain Combat Simulation project is to develop a scenario that emulates a COA and conduct an experiment to collect data for COA analysis.

I. INTRODUCTION

The commander is very important when planning the flow of the battle. He/she develops a course of action (COA), which details troop and equipment movement and identifies critical battle objectives. “Each COA considered must meet the criteria of suitability … feasibility … acceptability … distinguishability and completeness.”[3] “The commander is in charge of the military decision process and decides what procedures to use in each situation.”[4]

> The commander uses the entire staff during the MDMP[5] to explore the full range of probable and likely enemy and friendly COAs, and to analyze and compare his own organization’s capabilities with the enemy’s. The staff effort has one objective to collectively integrate information with sound doctrine and technical competence to assist the commander in his decisions, leading ultimately to effective plans.[6]

In the past a COA was developed and played out in a field exercise setting. Data was collected to track casualties, expenditure of supplies, and whether the intended mission was completed. The COA was changed as necessary to improve the battle outcome and executed numerous times. However, this method was very expensive and unlimited resources do not exist. The rising cost of field exercises has coincided with an increased amount of military interest in combat simulation. Computerized combat simulations are relatively inexpensive to operate, and COAs can be executed as many times as required.[7] The Army Research Lab (ARL) is currently investigating methods of determining critical battle parameters to assist a commander in his COA. This project is entitled Course of Action Technology Integration (COATI). “A future program goal is to provide commanders with a planning model that enables quick exploration of varied combat options when forced with developing COAs for urban combat.”[8]

The UTCS (Urban Terrain Combat Simulation) project is a part of the COATI research. The goal of the UTCS summer research project was to develop and enhance a scenario that emulates a COA. After the scenario was enhanced, the scenario would be used in an experiment. The scenario would be run 200-300 times, and data collected for each run. This data will be analyzed to determine critical battle parameters. UTCS was developed to help the commander analyze his COA and realize the critical aspects of the battle. This in turn allows the commander to make better decisions which results in fewer friendly casualties. “Advances in the fields of simulation and data mining can provide commanders with relevant battlefield planning sights.”[9]

II. RESEARCH

The UTCS project was two-fold. First, a working urban scenario had to be developed. Second, the scenario had to be run 200- 300 times for data collection. In the spring of 2003 the COATI project ran an urban scenario 75 times for data collection. The first problem found was firer unknown, meaning not knowing who fired what ammunition. The next problems found were friendly movement and threat movement.

The friendly would not always move to their objective and the threat was completely immobile. UTCS addressed the problems with friendly movement and threat movement.

The first part of the project was to develop a new scenario. There were many new discoveries. Vehicles that were placed in different locations sometimes wouldn't execute task the way they should. They also wouldn't move in the right directions. Sometimes they would move but only move halfway to their objective. Sometimes Dismounted Infantry (DI) would move away from their objective or would not move with their armored entities. Armored vehicles would not stay with each other when they should have. Armored vehicles included US M1A1 tanks and US M2s (Bradley Fighting Vehicles).

In order to get the scenario to the point where simulations could be completed many things had to be done. Armored vehicles and DI had to be placed on different locations of the terrain, so they would enter the town at the same time. The DI and the armored vehicles behavior had to be monitored and checked to make sure it was desirable. After placing the DI and armored vehicles, trial runs had to be done to check the changes. That process was repeated over 25 times in order for the scenario to be the way it is now. The UTCS project provided a good working scenario that could be used for the experiment. Two of threat vehicles were tasked to move in the urban environment. That allowed the threat units to better protect the city. (Please see Figure 1 for the improved lay down of the forces.) The time and effort placed in perfecting the scenario freed up ARL researchers to work on other projects, and to correct the firer unknown problem.

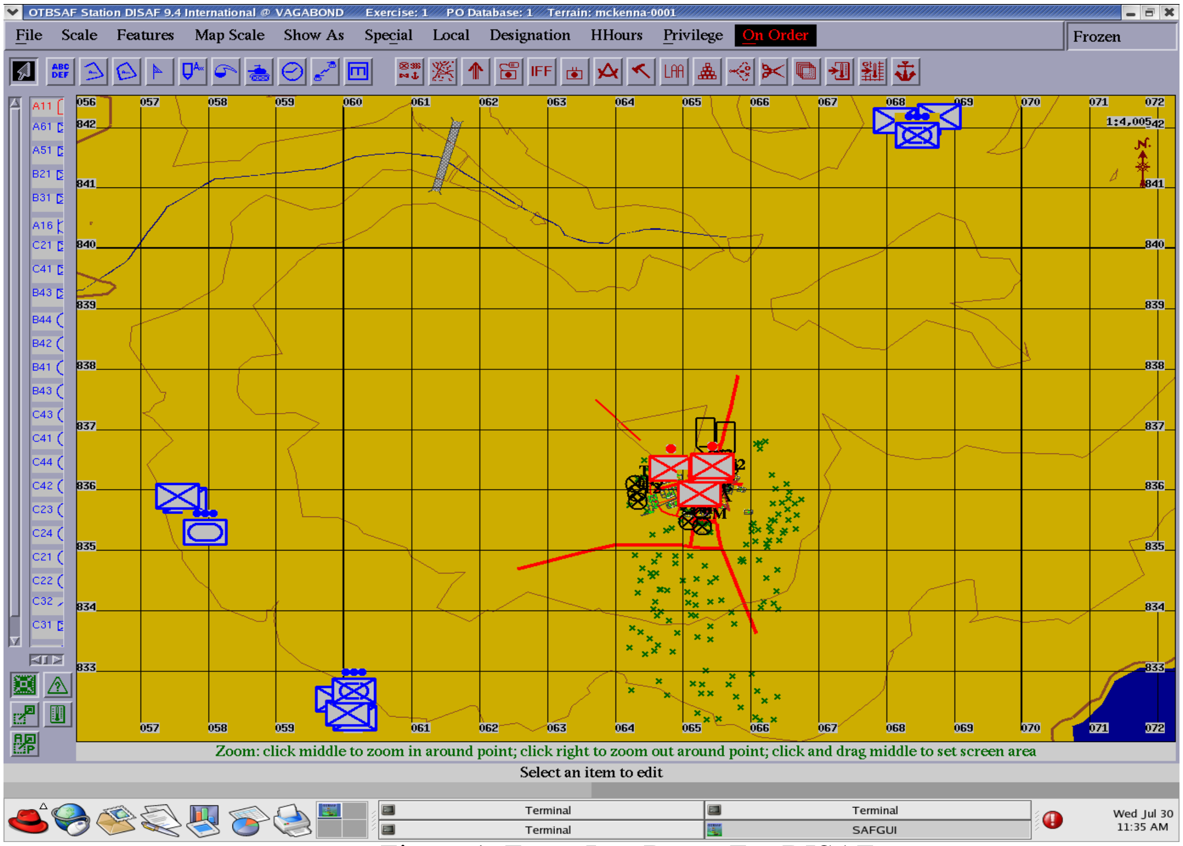

Figure 1: Force Lay Down For DISAF

The second part of the UTCS project was to execute the scenario 200 - 300 times and collect the data for future analysis. To run the scenario the simulation Dismounted Infantry Semi-Automated Forces (DISAF) is executed. DISAF is running under the LINUX operating system. The following steps must be completed in order to bring up the simulation and supporting windows:

1. Open two terminal windows.
2. In one of the terminal windows change directories (cd) into the home directory of DISAF.
3. In the same window enter the following command: "./run.mckenna." (This brings up the simulation.)

4. The run.mckenna command will bring up a separate simulation window. Once this window is up the following steps are taken:
    a. Click on the icon for the point editor then select abort (This brings up the spacing for unit status.)
    b. Go to the "File" menu and then select "Load Scenario" (This brings up another window, and select moutex.71. A message will appear asking to resume or freeze the simulation, always select freeze.)
    c. Zoom in on the map so you can see the DI, vehicles, and buildings, select a vehicle by clicking on it, select "Status Selections," then select "Unit Status." (This allows data to be collected to a file.)
    d. Go to the "File" menu and select "Resume Exercise." (Record the start time from the upper right hand corner of the simulation window.)
    e. Then at the top menu bar select "On Order," then select "Authorize All." (this starts the simulation)
5. In the second terminal window cd into the home directory of DISAF
6. In the same window enter the following command:
   "cd DATACOLL" then enter "ls –lat | more" once each run is started the command "ls –lat |more" must be re-entered (This command shows the name of the data collection file and allows you to get the time stamp which must be recorded.)
7. Go to the LINUX main menu and select "Accessories."
8. Then select "Text Editor" and the following steps are taken:
    a. Select "File" and "Open."

b. Advance through the directories until the DISAF home directory is selected.

c. Look for the MOUTEX file on the right and select it then and click ok. This brings up the table for data entry. (Please see Appendix A for a sample of the MOUTEX file.)

After, the simulation has started the run needs to be supervised. If the "Unit Status" says that there are no men undamaged you must click on another entity that is not undamaged. If the Unit Status is selected on a damaged vehicle, data is lost and that run is no longer useful. A run usually takes between twelve to twenty minutes. Meanwhile, the buildings should be zoomed in on. They should be checked to see how many friendly DI are alive. This has to be recorded on the data sheet that was developed. (Please see Figure 2 for a sample of the data table.)

Run #		N	C2	
Timestamp			C3	
Start Time			C4	
Stop Time		SW	B2	
OBJ Taken			B3	
B1 Taken			B4	
B2 Taken		W	A5	
B3 Taken			A6	
B4 Taken				
Num DI Alive w/ FP				
MOUTSCORE				

Figure 2: Data Collection Table

To check the buildings to see if the blue DI have taken over, the buildings must be zoomed in on enough to see the movement inside. There are four buildings and one objective that must be checked. After twelve minutes it would be a good idea to check the buildings every two minutes. If there are threat DI in the building they must be damaged or there must be twice as many blue men in that building for the blue DI to have taken it. If they take the building it is marked on the data sheet as a one, if they do not take the building it is marked on the data sheet as a zero. If they take the buildings one through four they get one point for each building they take. If they do not take the building they do not get any points. If they secure the objective building, it is worth four points. (Please see Figure 3 for a view of the objective after being secured by the friendly force.) Then you add all of your points together. When the run is finished you count the total friendly DI alive. If the total number of DI alive adds up to twelve or under the score from the buildings is divided in half. After the score is calculated then it is recorded on a data chart. This chart includes the time stamp, the start and end time, the DI alive from each platoon, what buildings were taken, the mount score and the system used.

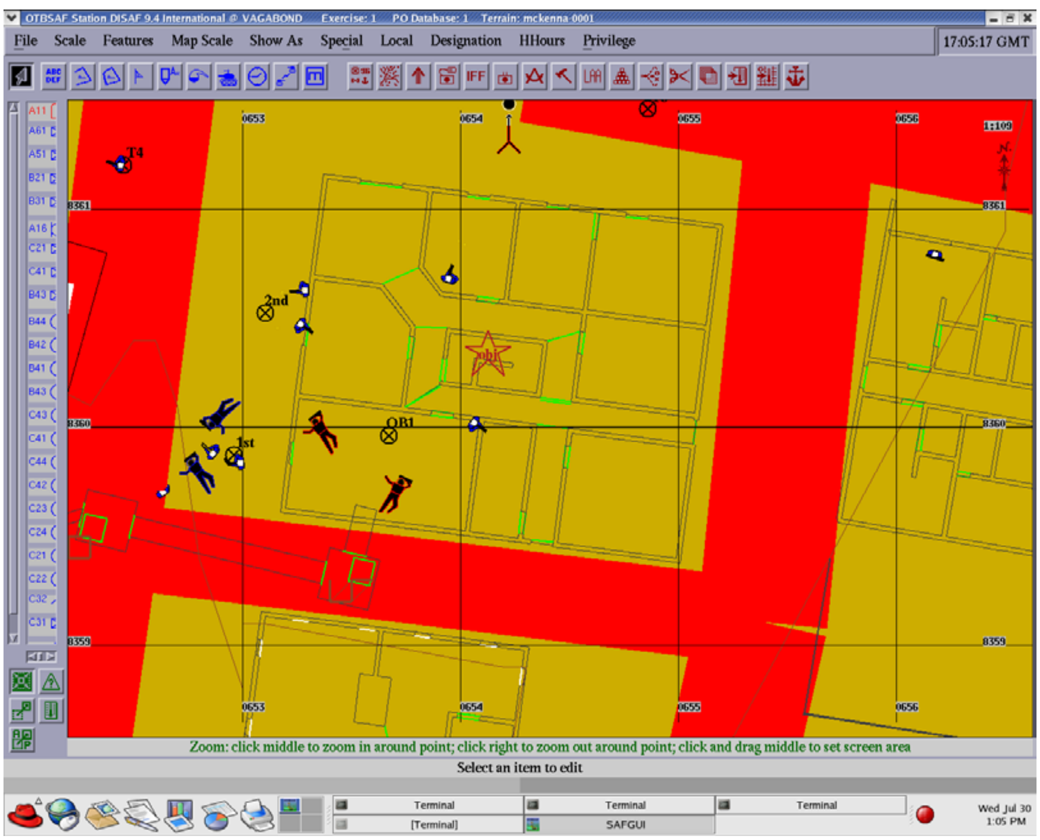

Figure 3: Objective successfully secured by friendly force.

A variety of equipment was used in this project such as computers running LINUX, the program DISAF and the editor. The LINUX computer is the computer that was used to run the program DISAF. The program DISAF was used to run the scenario. The editor was used to develop the data sheet used for this project. Familiarity with all of the equipment was necessary to successfully complete the project.

III. CONCLUSION

All of the data that was collected in the UTCS project will be used for future statistical analysis. The project included developing several different scenarios and having trial runs to test the actions of the vehicles and DI. After developing the scenarios and finding one that was acceptable for the research the actual simulation runs were started. The data was recorded as the runs were being completed. Hopefully the results will enhance the capability of the commander to develop a good COA.

REFERENCES

[1] Norman M. Wade, *The Battle Staff SMARTbook* (Lakeland, FL; The Lightning Press, 1999), 1-3.

[2] Norman M. Wade, *The Battle Staff SMARTbook* (Lakeland, FL; The Lightning Press, 1999), 1-31.

[3] Ibid.

[4] Norman M. Wade, *The Battle Staff SMARTbook* (Lakeland, FL; The Lightning Press, 1999), 1-3.

[5] Military Decision Making Process

[6] Wade, 1-3.

[7] Janet O'May and others, "OneSAF Killer/Victim Scoreboard Capability For C2 Experimentation," in *The Command and Control Research and Technology Symposium Held in Monterey, CA 11-13 June 2002,* by The Command and Control Research Program, 1.

[8] Janet O'May, Eric Heliman, and Barry Bodt, "Data Mining Techniques Applied to Urban Terrain Command and Control Experiment," in *The 8th International Command and Control Research and Technology Symposium Held in Washington, ,DC 17-19 June 2003,* by The Command and Control Research Program, 2.

[9] Ibid., 1.

APPENDIX A

Run	Timestamp	Start	Stop	#B-DI	OBJ	B1	B2	B3	B4	MOUTSCORE	SYSTEM
1	1058272715	12:42:45	13:01:55	16	1	0	1	1	1	7.0	replan
2	1058274282	13:05:16	13:19:12	15	1	1	1	1	0	7.0	replan
3	1058275342	13:24:20	13:40:45	23	1	1	1	1	1	8.0	replan
4	1058276635	13:44:25	14:03:48	17	1	1	1	1	1	8.0	replan
5	1058278181	14:15:51	14:29:29	24	1	1	0	1	1	7.0	replan
6	1058280392	14:47:46	15:00:30	17	0	0	0	1	0	1.0	replan
7	1058281391	15:04:57	15:21:21	17	0	1	0	1	0	2.0	replan
8	1058287420	16:44:28	17:05:33	15	1	0	0	1	0	5.0	replan
9	1058288877	17:08:40	17:26:48	14	0	0	1	1	1	3.0	replan
10	1058296041	19:09:49	19:22:00	24	1	1	0	1	1	7.0	replan
11	1058297178	19:27:21	19:40:04	7	1	1	1	1	0	3.5	replan
12	1058298366	19:47:35	19:47:38	17	0	1	1	1	0	3.0	replan
13	1058354601	11:24:38	11:40:59	18	0	1	1	1	1	4.0	replan
14	1058358516	12:29:57	12:46:14	20	1	1	0	1	0	6.0	replan
15	1058376832	17:34:25	17:50:15	13	1	0	1	1	0	6.0	replan
16	1058378037	17:55:16	18:09:27	22	1	1	1	1	1	8.0	replan
17	1058379183	18:13:51	18:28:25	25	1	1	1	1	0	7.0	replan
18	1058380269	18:32:20	18:46:43	24	1	1	0	1	0	6.0	replan
19	1058381351	19:05:07	19:49:52	32	1	1	0	1	1	7.0	replan
20	1058383660	19:28:59	19:43:42	15	0	1	1	1	0	3.0	replan

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