

MOG93: A Case Study of a New Approach to a Web-based MOUT Simulation

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ABSTRACT: We introduce here a new method for modeling a web-based MOUT simulation in which the Opposition Forces (OPFOR) are represented not by units, or agents, but by the city itself in which the operations are carried out. As more units are introduced into the city the hostility level of the city increases. As Blue Force units move through hostile neighborhoods in an attempt to secure and return with a High Value Target they are subject to casualties. Other factors, such as time of day in relation to *khat* consumption, also affect Blue Force casualties.

1. Introduction

The need for MOUT (defined as either Military Operations on Urban Terrain or Military Operations on Urbanized Terrain) [1, 2] simulations has increased significantly over the past several years [3]. Furthermore, the public interest in MOUT has been piqued first by the publication of *Black Hawk Down* [4] and later by the release of the movie based on the book. We were approached by a commercial web

site, Wargamer.com, just prior to the release of the movie to create a web-based simulation of the events in Mogadishu October 3, 1993. We had an extremely short development cycle (only six weeks) and no budget to speak of. Because of these limitations, as well as a desire to approach the problem of MOUT simulations differently, we opted for a new model in which the entire city of Mogadishu was OPFOR and only Blue Forces (U.S.) were displayed and movable by the user. This differs from most MOUT simu-

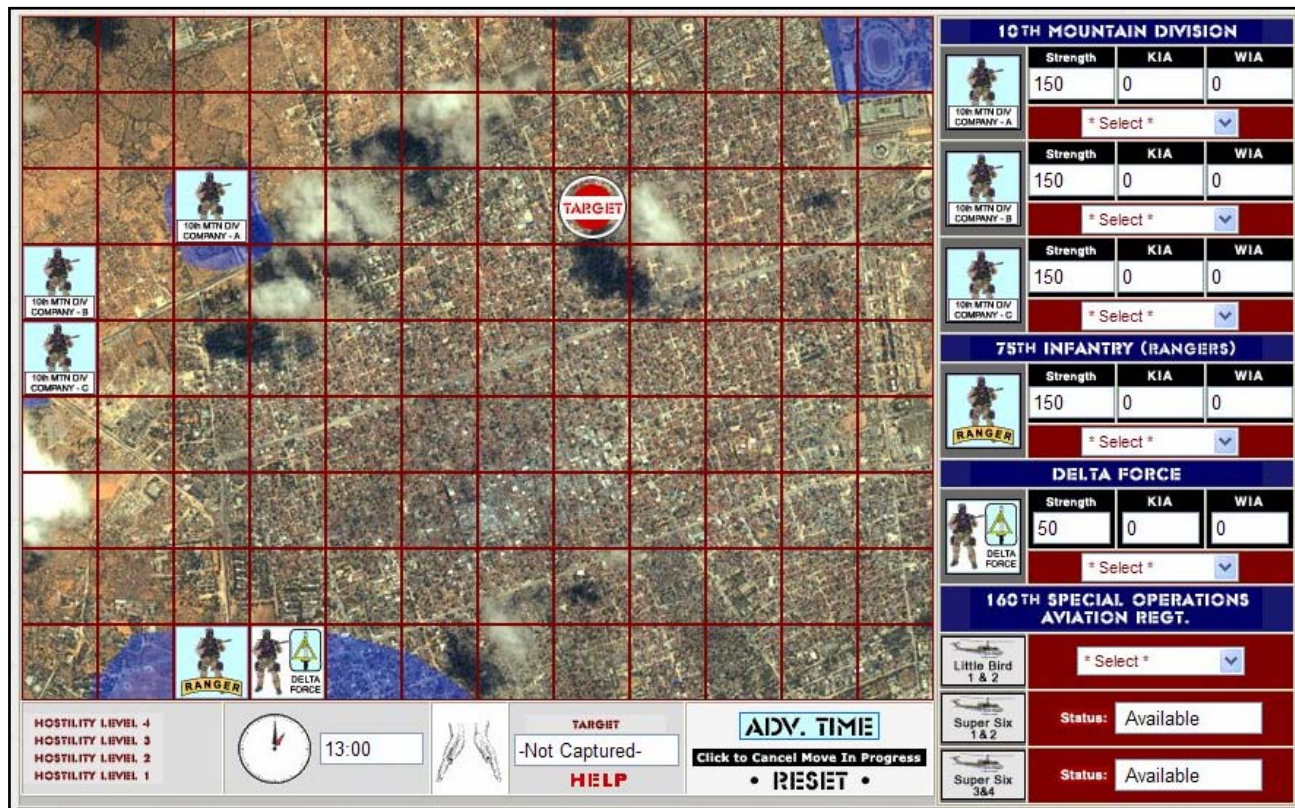


Figure 1. Starting positions for MOG93. Screenshot from www.MOG93.com [9].

lations that rely on modified first person shooter (FPS) engines such as Quake, Unreal and Half-Life [5, 6].

Though solitaire wargames have existed for many years [7, 8], we believe that representing OPFOR as a hostile areas within the city is unique. We have recently learned that our work in this area [9] has been used as the basis of a proposed Stability and Support Operations (SASO) simulation for Baghdad [10].

2. Overall Design Issues

We were fortunate to be supplied with a satellite photo of Mogadishu on October 3, 1993 by the Space Imaging Corporation (<http://www.spaceimaging.com>) which became the central ‘playing area’ of the simulation (see Figure 1). The Order of Battle (OOB) of U. S. forces was readily available [4], whereas any attempt to create an OOB for the Somalia National Alliance (SNA) forces led by General Aideed was frankly impossible.

The scenario starts at 1300 hours when Major General William F. Garrison received information that there was a gathering of Habr Gidr clan leaders in a building on Hawlwadig Road [4] (location indicated by ‘Target’ in Figure 1). The probability of finding the High Value Targets at their last known location decreases in relationship to the elapsed time.

Some U.S. forces (Company B 3/75 Rangers and C Squad, Delta Force) can be deployed via ‘fast rope’ technique from Black Hawk helicopters (Super 63 and Super 64 units). After these units are deployed on the map they can move only on the ground. The other U. S. forces (Companies A, B and C 2/14 10th Mountain) can only move on the ground from their starting positions through the streets of Mogadishu. In addition, two ‘Little Bird’ (MH6 helicopters of the 160th Special Operations Aviation Regiment ‘Night Stalkers’) can be assigned fire-support missions.

Another interesting variable in the simulation was the SNA’s consumption of *khat*. *Khat* is a stimulant containing cathine (d-norisoephedrine), cathidine, and cathinine found in the fresh leaves of the *Celastrus edulis* tree [11]. During daytime hours the Habr Gidr militiamen chewed *khat*. At approximately 1500 hours they were in a frenzied state; however their efficiency dropped off sharply after this time as they began to crash from their daytime high. Operations taking place in Mogadishu before 1500 hours incur greater casualties.

The SNA communicated not by electronic means but rather by burning tires at the intersections of roads. Shortly after U. S. forces were on the ground on Hawlwadig Road warning fires were lit. SNA militiamen were soon drawn to the combat zone.

An important component to the actual events was the shooting down of Black Hawk helicopters and the resulting

recovery efforts. Consequently, every helicopter mission was assigned a probability of loss.

Lastly, we decided to write MOG93 in JavaScript and HTML rather than Flash or another system that required the user to download special software. We wished to make MOG93 accessible to the widest possible range of Internet users and to minimize download times.

3. Mogadishu’s Hostility Level

In essence we modeled the city of Mogadishu as a sleeping giant that would be awakened as the Hostility Level (HL) increased. The status of each Blue Force results in Provocation Points (PP) which are used in the calculation of the HL. Every Blue Force unit’s status results in the following PP:

- Stand Down returns a PP of -1. It is not available if the unit occupies a Base or a hostile square.
- Based returns a PP of 0. It can only be selected if the unit occupies a Base (blue areas in Figure 1).
- Movement returns a PP of +1. Moving a unit through the city can potentially increase the HL.
- Defend returns a PP of +2. A unit in ‘defend’ status will take fewer casualties if attacked.
- Attack returns a PP of +3. A unit in ‘attack’ status will take the least amount of casualties but cause the greatest increase in HL.

Therefore, the Provocation Level (PL) for Blue Forces (BF) is:

$$PL = K + \sum_{i=1}^n BF_i$$

where n = the number of Blue Force units

BF_i is the resulting PP for that Unit’s Status.

and K is effect of *Khat* intoxication modeled as follows:

Table 1. Effect of time on <i>Khat</i> intoxication model	
Time	Result
0900 – 1200 hours	K = + 2
1201 – 1500 hours	K = + 3
1501 – 1700 hours	K = + 2
1700 – 2400 hours	K = - 4

The Hostility Level is affected by the Provocation Level as follows:

Table 2. Effect of Provocation Level on Hostility Level.	
PL Value	Effect on HL
PL < -2	HL = HL -1
-2 < PL < 1	HL = HL
PL > 1	HL = HL + 1

As the HL increases more of the city becomes hostile (the squares become red). Any Blue Force unit in a red square at the end of a turn is attacked. If a helicopter has been assigned to Ground Support casualties are cut in half.

Because of limited development time constraints we implemented the four Hostility Levels as four pre-set patterns superimposed on the city of Mogadishu. Given more development time we would have preferred to use a combination of Influence Mapping [12, 13] and Range of Influence [14] in which the HL effects would be mapped to Blue Force unit locations.

4. Helicopters

Helicopter units do not appear on the map. Rather they are assigned missions, such as transport or ground support. The probability of a helicopter being shot down is $Pr = .50$. A

downed helicopter must be recovered by a ground unit moving to that location (which, in turn, increases the HL level).

Figure 2 shows the results of assigning just two units to the Target location: one Black Hawk helicopter is down and the HL of the city (as indicated by the red squares) has dramatically increased.

5. Rules of the Simulation

Every unit must be assigned a unit status every turn, except for the Black Hawk units which are automatically assigned the appropriate unit status. The Black Hawk helicopter units may be used only once to transport the Delta Force unit or the Rangers unit on the first move executed by either unit.

A unit is moved either by clicking on the unit on the simulation screen and clicking on an adjacent square, or by selecting 'Movement' in the OOB; note: The Ranger unit and the Delta Force unit can make one jump via Black Hawk transport helicopters to anywhere on the map on their first move. The unit being moved will 'flash' and automatically be assigned Movement status. To cancel a unit's move before the move is completed, click the 'Reset' button, located below the "Advance Time" button.

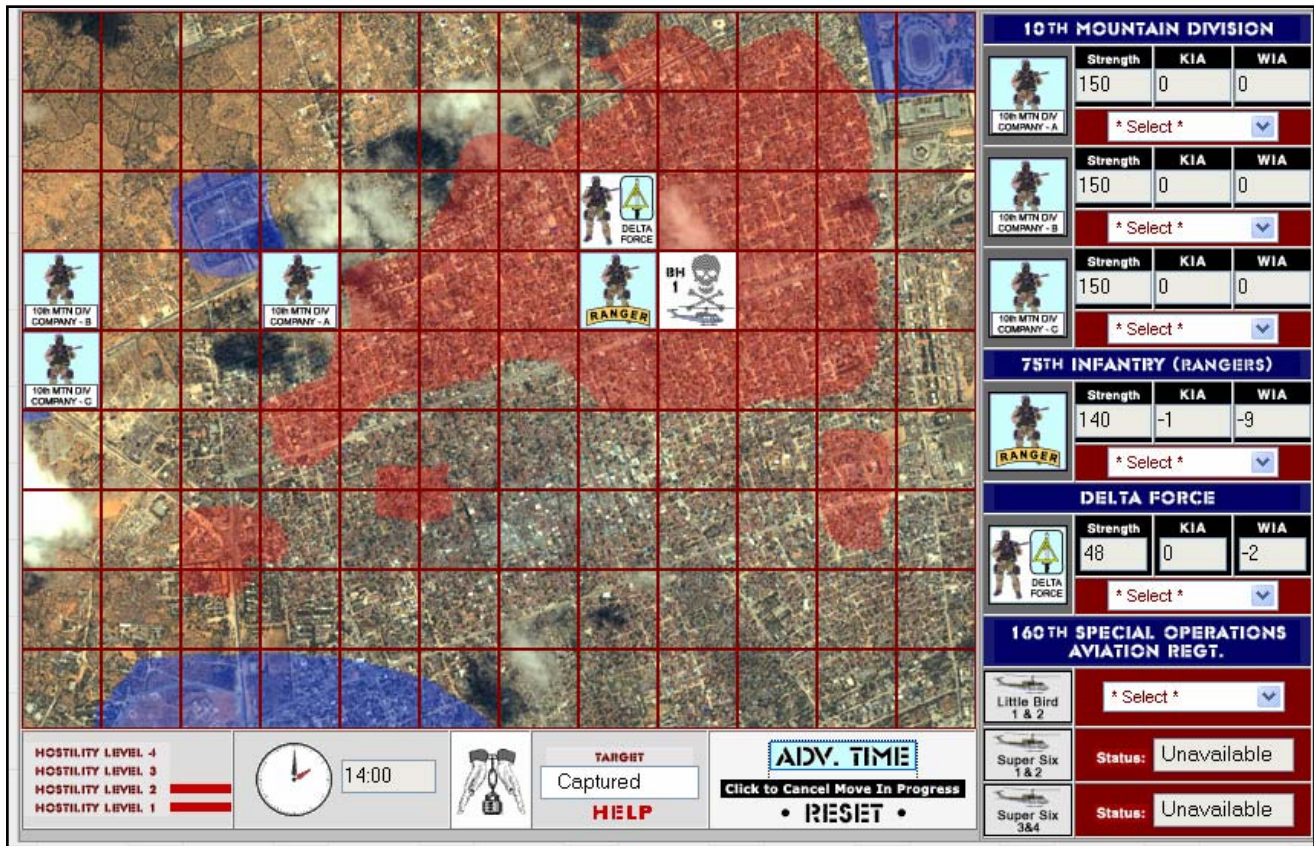


Figure 2. Target captured, Black Hawk 1 down, Hostility Level = 2. Screenshot from www.MOG93.com [9].

Black Hawk helicopters may be shot down. If a Black Hawk helicopter is shot down an icon is displayed on the map.

To recover the crew of a downed Black Hawk helicopter, another unit must move onto the square.

A unit that suffers greater than 30% casualties automatically goes into defend status and cannot be moved. This represents the unit setting up a defensive perimeter in the city. This unit remains where it is until it is rescued by another unit moving onto the same square. Once a unit that has suffered greater than 30% casualties is rescued by another unit it is removed from the OOB.

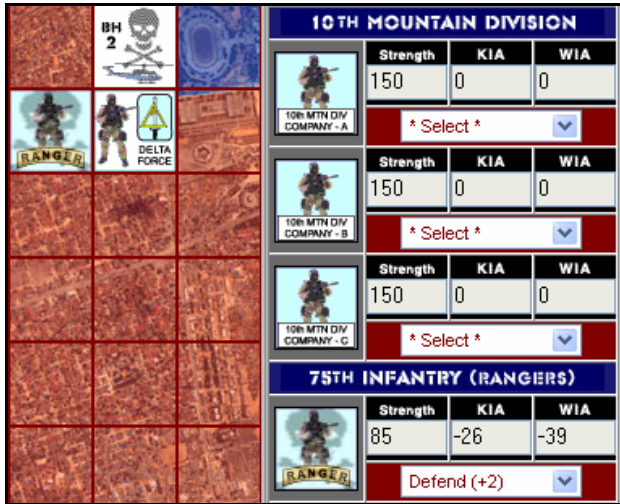


Figure 3. When a unit has taken > 30% casualties it automatically goes into Defend status. Here the Ranger unit is in Defend status and the Delta Force unit that has been dropped to rescue it. The Black Hawk helicopter transporting Delta Force has been shot down requiring a rescue operation as well. Screenshot from www.MOG93.com [9].

If a unit suffers total casualties it is destroyed.

The simulation continues until either:

- The mission is complete. (The Target has been captured and all units return to safe blue base squares.)
- Time has expired. The simulation ends at 2400 hours.

At the end of the simulation, a 'Mission Complete' screen is displayed indicating the number of casualties incurred (see Figure 4).

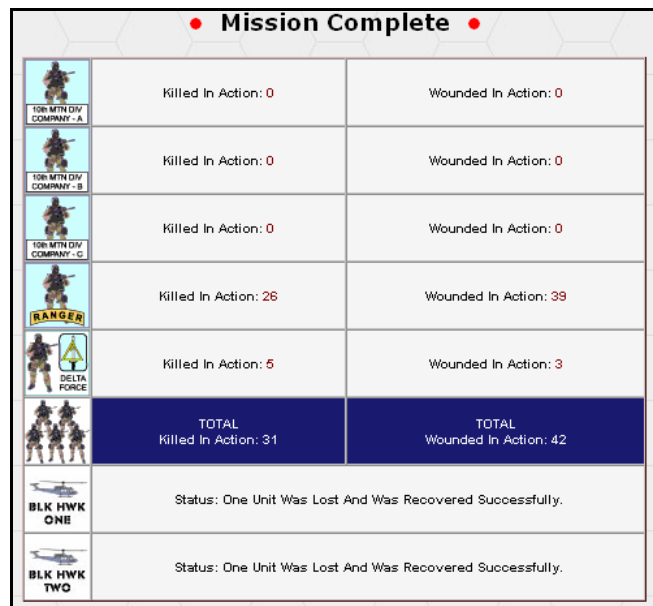


Figure 4. Sample 'Mission Complete' screen with results. Screenshot from www.MOG93.com [9].

6. Risk versus Rewards

We have tried to create a risk versus reward environment that simulates the problems that the U.S. commander faced on October 3, 1993 in Mogadishu. While he had a large numbers of troops to employ in the capture of the HVT the more troops within the city of Mogadishu the greater the Hostility Level which, in turn, would increase the casualties. Furthermore, if the commander waits until after 1500 hours to initiate the mission his forces will sustain fewer casualties however the likelihood of finding the HVT at the original target location diminishes linearly after 1300 hours.

Once the U.S. forces begin to take casualties, or a helicopter is shot down, new problems arise. Rescuing or recovering attrited units will often require the commitment of new forces which, in turn, increases the city's HL.

7. Conclusions

We have been very gratified by the positive email and feedback from users of MOG93. The simulation is still online and is available without cost at <http://www.MOG93.com>.

We believe that the method of assigning hostility levels to terrain is a valuable tool for future MOUT simulations. It is especially useful when it is difficult, or impossible, to create an OOB for OPFOR.

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