RED ZONES:

IMPROVING THE ENEMY GROUND FORCE SITUATION DISPLAY IN DIGITAL BATTLE COMMAND AND CONTROL SYSTEMS

by

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ABSTRACT

The situation display of friendly force information in digital battle command and control systems has significantly improved with advances in position location technology. However, the timeliness, accuracy, and relevance of the enemy situation display (the red picture) lags behind the friendly situation display (the blue picture).

This paper argues that the projection of enemy vehicle locations and activity through spatial analysis tools will improve the enemy ground situation display in digital battle command and control systems. The circular line-of-sight view is a spatial analysis tool that can depict an enemy vehicle's battlespace by displaying its weapons engagement area. A movement projection model is another spatial analysis tool that displays numerous possible enemy vehicle locations as an area of probability.

This paper further argues to equip the digital battle command and control systems on combat platforms with these spatial analysis tools. The availability of these tools enables the warfighter to add value to combat information through simple, but on-demand analysis.

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Improving the Enemy Ground Force Situation Display in Digital Battle Command and Control Systems

by Major Ray M. Ceralde, USA

How can the U.S. military improve the display of enemy ground vehicle activity in its digital battle command and control systems? With advances in position tracking technology, the locations of friendly forces are continuously updated, providing commanders, battle staffs, and warfighters with a near real-time picture of friendly forces on the battlefield. However, the capability to track enemy forces does not yet approach the level of fidelity for friendly forces. The current challenge is to improve the display of enemy locations and activity in order to maintain timeliness, accuracy, and relevance with the friendly situation display.

This paper argues for the use of zones to display projected locations and activity of enemy vehicles in digital battle command and control systems for a ground combat environment. Instead of displaying the most recent enemy location as a point symbol, an enemy's location can be displayed as a "red zone" to indicate an area of probability where the enemy could be located based on the most recent intelligence.

Equipped with the proper software, digital battle command and control systems can display a stationary enemy vehicle's field of view and the known range of its weapon systems and project locations of moving enemy vehicles. While red zones do not display the exact locations of enemy forces, they focus the warfighter on areas of likely enemy activity in order to anticipate the enemy's next move.

An Unprecedented View of the Battlefield

During Operation IRAQI FREEDOM, a United States (U.S.)-led military coalition fielded a new digital battle command and control system called the Force XXI Battle Command Brigade & Below – Blue Force Tracking (FBCB2-BFT). Working in combination with other command and control systems, FBCB2-BFT presented the battlefield at the tactical level, but its display could also be viewed at operational and strategic levels. FBCB2-BFT utilizes satellite technology and GPS receivers mounted on select vehicles to broadcast their locations to other forces connected to the coalition's command and control network.[1] The process of reporting, displaying, and monitoring the positions and activities of friendly forces is informally called "blue force tracking."

[1] Office of the Project Manager Force XXI Battle Command Brigade & Below (PM FBCB2), brochure, *FBCB2 Blue Force Tracking,* n.p., n.d. See also Maryann Lawlor, "Keeping Track of the Blue Force," *Signal* 57, no. 11 (July 2003): 37.

The coalition's use of digital battle command and control systems during Operation IRAQI FREEDOM provided an unparalleled level of accuracy in displaying the locations of friendly forces. General (GEN) Tommy Franks, United States Army (USA) (retired), the coalition commander during Operation IRAQI FREEDOM, stated that he had a picture of the battlefield that was in "near real time, continuously updated, shared among friendly forces, and shared among allies."[2] However, the timeliness, accuracy, and relevance of the enemy situation display, commonly known as the "red picture," lagged behind the friendly situation display, also known as "the blue picture."

The positions of reported enemy forces do not update at the same rate as friendly forces on the display screens of command and control systems because enemy forces are not fitted with the same equipment to broadcast their locations to friendly forces. As a result, the locations and dispositions of enemy forces must be derived from battlefield reports and intelligence analysis and then manually entered into command and control systems.[3]

FBCB2-BFT was not specifically designed to be the primary display of enemy locations. However, the U.S. Army realized the potential of such a capability and envisioned that FBCB2-BFT would also display known enemy locations similar to the display of friendly forces.[4] This process of reporting, displaying, and monitoring the positions and activities of enemy forces is known colloquially as "red force tracking."

Improving Red Force Tracking

The challenge with red force tracking is that it does not compare with blue force tracking in terms of timeliness, accuracy, and relevance of information. While the users commended FBCB2-BFT for its ability to display an accurate picture of friendly force locations, they felt that the display of known enemy locations significantly lagged behind the accuracy of friendly location reporting. This disparity has caused the users to distrust and dismiss the enemy situation display in their command and control systems.[5]

The current emphasis on improving red force tracking is focused on the collection of raw data and the reporting process of current enemy information. The collection of raw enemy data remains a constant challenge while the reporting of current enemy

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[2] GEN Tommy Franks, USA (ret), former Commander, U.S. Central Command, Operation IRAQI FREEDOM, "Impact of the Network on Operation IRAQI FREEDOM," briefing presented at the Network Centric Warfare Conference 2004, Washington, DC, 22 January 2004.

[3] Roxana Tiron, "Army's Blue Force Tracking Technology Was a Tough Sell," *National Defense Magazine,* online ed., December 2003, URL: <http://www. nationaldefensemagazine.org/ article.cfm?Id=1286>, accessed 3 December 2003. Cited hereafter as Tiron, "Army's Blue Force Tracking Technology Was a Tough Sell."

[4] Tiron, "Army's Blue Force Tracking Technology Was a Tough Sell."

[5] Colonel (COL) Nick Justice, USA, Project Manager, Force XXI Battle Command Brigade and Below, telephone interview by the author, 10 September 2003.

information is a process that can be expedited. There are two major approaches to improve red force tracking based on these tasks: sensor proliferation and sensor integration.

Sensor proliferation calls for a large quantity of unmanned ground and aerial sensors to increase the area coverage of battlefield surveillance through directed reconnaissance. The premise is that more battlefield sensors will increase the chances of detecting and identifying enemy forces. The U.S. Army's Future Combat Systems (FCS) will have a widespread use of organic sensors such as unmanned aerial vehicles (UAVs), unmanned ground vehicles (UGVs), and unattended ground sensors (UGSs).[6]

Sensor integration involves connecting selected battlefield surveillance sensors with digital battle command and control systems in order to forward information to the warfighter in the most expeditious manner. Currently, raw data collected by sensors usually goes through a circuitous route consisting of several levels of processing and dissemination. As a result, information derived from sensors takes longer to get to the warfighter. In sensor integration, a sensor is capable of collecting raw data and processing it into a report and then immediately sending it to the warfighter with minimal human interaction. The link between the sensor and the shooter is significantly faster in sensor integration.

These two approaches will foster improvements, but they are not the complete solution to improve red force tracking. Sensor proliferation increases the chances of detecting enemy forces, but even the most effective sensors have limitations and cannot ensure continuous observation. Sensor integration decreases reporting time, but if the sensors are not effective in detecting and maintaining contact with the enemy, then the advantage of decreased reporting is diminished.

The Use of Spatial Analysis Tools

A way to improve red force tracking when friendly forces can detect enemy positions, but cannot maintain continuous observation is to use spatial analysis tools that project possible enemy locations based on the last known enemy location. Spatial analysis tools are automated processes that display the spatial relationships of objects to one another.

Two spatial analysis tools that can improve the enemy situation display are the circular line-of-sight tool and the movement projection model. The circular line-of-sight tool displays all the areas that are visible from a specific point. The movement projection model displays the possible locations of an enemy entity based on its last known location within a specific time. These two spatial analysis tools display areas of probability for enemy locations or activity.

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[6] U.S. Army Office of the Chief of Staff, Army, *United States Army Posture Statement 2003* (Washington, DC: Headquarters, Department of the Army, February 2003), 25-30.

The Contemporary Operational Environment

Potential adversaries are unlikely to engage U.S. military forces with large formations operating on a linear battlefield and fighting in a style symmetric to the U.S. "Force-on-force combat exposes the threat to U.S. advantages, which are most pronounced in open/rolling terrain and uncluttered battlefields."[7]

Instead of massed formations, potential adversaries would operate in small numbers dispersed over complex terrain in order to degrade or negate the U.S. advantages of intelligence collection, precision targeting, and stand-off weapons. Adhering to dispersal tactics and decentralized operations, tanks and armored personnel carriers are expected to operate in small units. They could operate in pairs or in platoon-size elements of three to four vehicles.

These assessments of the contemporary operational environment justify the focus on individual threat vehicles operating in small units and the use of spatial analysis tools to display their locations and activities. The circular line-of-sight tool defines an enemy's battlespace while the movement projection model can display probable vehicle locations when a sensor has lost contact with the enemy vehicle.

Displaying the Enemy's Battlespace

The FBCB2 system is already equipped with a circular line-of-sight tool that draws a circle defined by the user. The user selects a point location on the screen, specifies the radius of the circle, and the height above the ground. The circle displays all the areas that are visible from the point location. The areas that are not within the line of sight are marked with red lines. See Figure 1, Circular Line of Sight.

The circular line-of-sight tool allows a user to determine the areas he can see and cannot see. If he cannot see an area, he cannot engage anything with direct fire weapons and is limited in his ability to use indirect fire weapons.

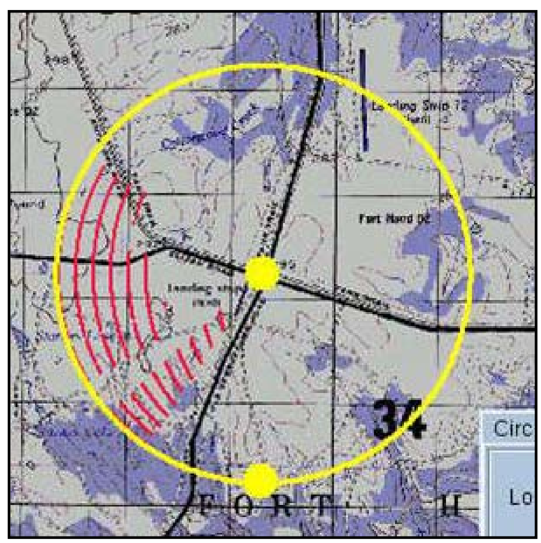

Figure 1. Circular Line of Sight.

Source: Steve Srolovitz, Office of the Program Manager-FBCB2, 12 March 2004.

[7] Gary E. Phillips, "Implications of the Contemporary Operational Environment for Combat Service Support – Draft," unpublished paper, U.S. Army Training and Doctrine Command, Assistant Deputy Chief of Staff Intelligence –Threats, n.d., provided on 6 August 2004 by Gary E. Phillips, 3.

The circular line-of-sight tool is an effective visual aid for displaying one's battlespace. Battlespace is the three-dimensional area in which an individual soldier or vehicle can acquire enemy forces and influence them with effective fires.[8] See Figure 2, Battlespace.

Displaying an enemy's battlespace in the FBCB2 system is not an automatic process. The user has to select the circular line-of-sight tool and then point to the location of an enemy vehicle displayed on the screen. The user has to know, or at least estimate, the maximum effective range of the enemy's direct fire weapons.

The utility of an automated capability to immediately display a known enemy position's battlespace would be of great value to a combat vehicle commander. Against a stationary or dug-in enemy, a combat vehicle commander is most concerned about how he can approach an enemy position while staying out of the enemy's engagement areas.

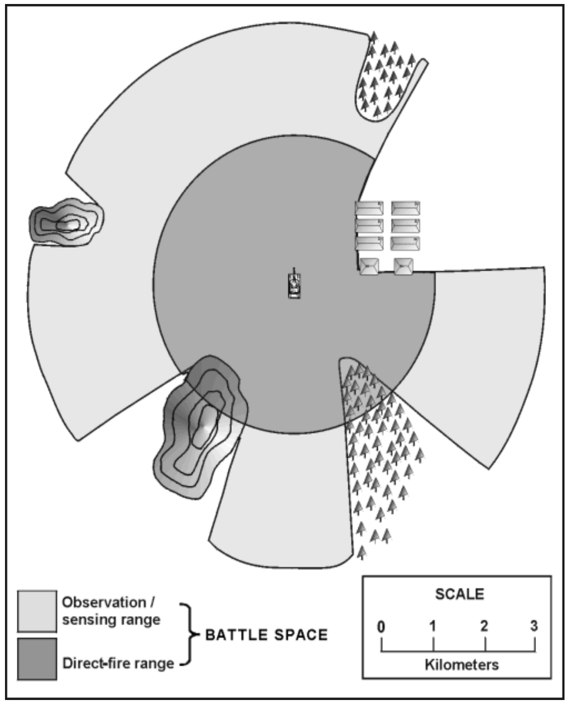

Figure 2. Battlespace.

Source: U.S. Army, Field Manual 3-20.15 Tank Platoon (Washington, DC: Department of the Army, November 2001), 2-13.

Figure 3 displays a proposed concept of an enemy vehicle's direct-fire range of its battlespace. The areas where the enemy can see and engage with direct line-of-sight weapons are marked to indicate to the vehicle commander to stay out of that area. The areas where the enemy cannot see or engage through direct line of sight are clear. These areas are where friendly forces can maneuver in order to gain a positional advantage over the enemy.

The enemy's circular engagement area can be defined by the identification of the weapon system from a digital report in the command and control system. For example, a variant model of a T-72 tank has a maximum effective range of 2100 meters for its main gun with a height 1.8 meters above ground. An automated circular engagement area tool would take the enemy vehicle's identification, retrieve these specifications from a database of enemy vehicles, and then display the calculations.

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[8] U.S. Army, Field Manual (FM) 3-20.15 *Tank Platoon* (Washington, DC: Department of the Army, November 2001), 2-13.

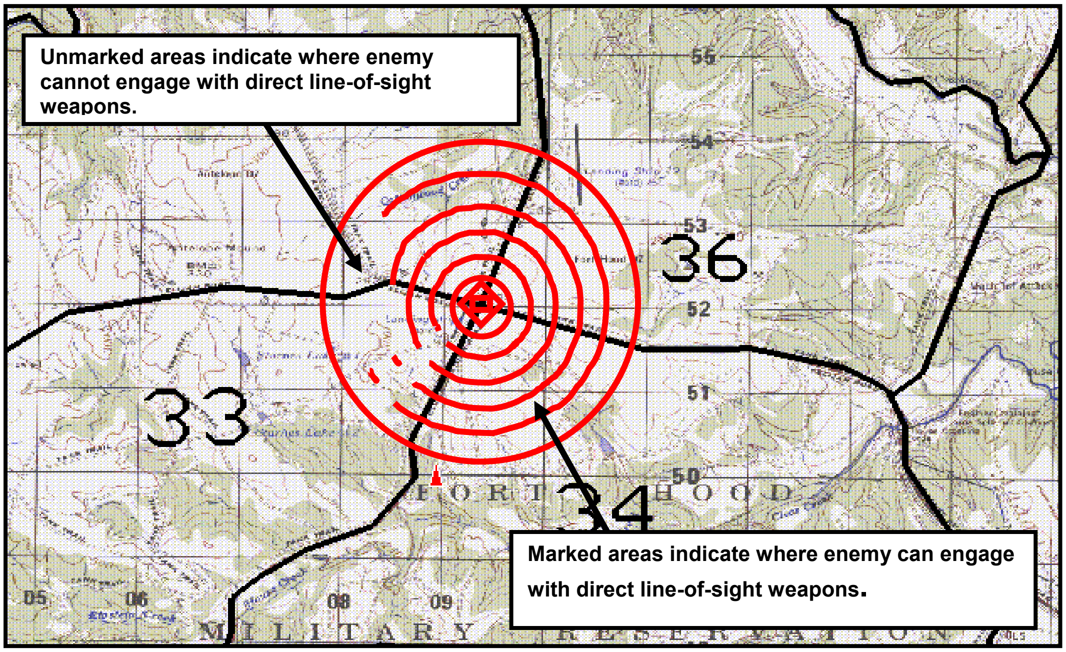

Figure 3. Proposed Display for Enemy Direct-Fire Battlespace.

Source: Author's proposal.

For vague reports where a specific vehicle is not identified, a default setting for tracked or wheeled vehicles can be used instead. The default setting should be a feature that can be defined by the user. While it may not be an entirely accurate presentation, it provides an idea of what kind of enemy vehicle is present and where it can see and engage.

The FBCB2 system is not currently capable of displaying an enemy vehicle's direct-fire weapons engagement area as proposed. While the FBCB2 system is able to identify combat platforms by type (such as a tank), it cannot further identify by model (for example, a T-72 tank).[9]

There are limitations with this feature: the accuracy of the digital terrain elevation database (DTED), the proper identification of enemy vehicles, and inclusiveness of the threat database. The accuracy of the terrain database is by far the most important factor in the visual display of a stationary enemy. The accurate portrayal of the terrain is based on the DTED level of detail. An inaccurate depiction of the terrain can cause a combat vehicle commander to expose his vehicle to the enemy and threaten his survival.

Despite these challenges, the development of an accurate display of an enemy vehicle's circular engagement area has great potential to aid the combat vehicle

[9] Steve Srolovitz, Software Engineer, Office of the Project Manager, Force XXI Battle Command Brigade and Below (PM FBCB2), Fort Monmouth, NJ, interview by the author, 12 March 2004.

commander while in contact with a stationary or dug-in enemy vehicle. By depicting an enemy vehicle's battlespace, vehicle commanders can determine where to move in order to gain a positional advantage over an enemy's position. Most importantly, it indicates to vehicle commanders to stay out of the areas where the enemy is likely to see them and engage with direct fire.

The Challenge of Locating an Elusive Enemy

One of the greatest challenges so far in maintaining an accurate enemy situation display has been tracking the location of a moving enemy force after friendly forces have lost contact with them. Friendly force locations update automatically because they are equipped with tracking devices. However, an elusive enemy will attempt to break contact with friendly forces once it has been detected.

This challenge can be further defined as attempting to track the enemy when there is only a snapshot of his location at a particular point in time. One approach is to take the information from the enemy's last known location and extrapolate possible locations. A civilian application of projecting possible locations of a particular phenomenon is found in storm tracking.

Storm Tracking

Weather forecasters depict the locations that lie in the potential paths of storms such as hurricanes by displaying a "track area." Created with the aid of supercomputers, a track area displays the areas that lie in the probable paths that a storm could take from its current position. In Figure 4, the track area for Hurricane Ivan is shaded in white. A line extending from the storm's current position indicates the most likely path that the storm will take.

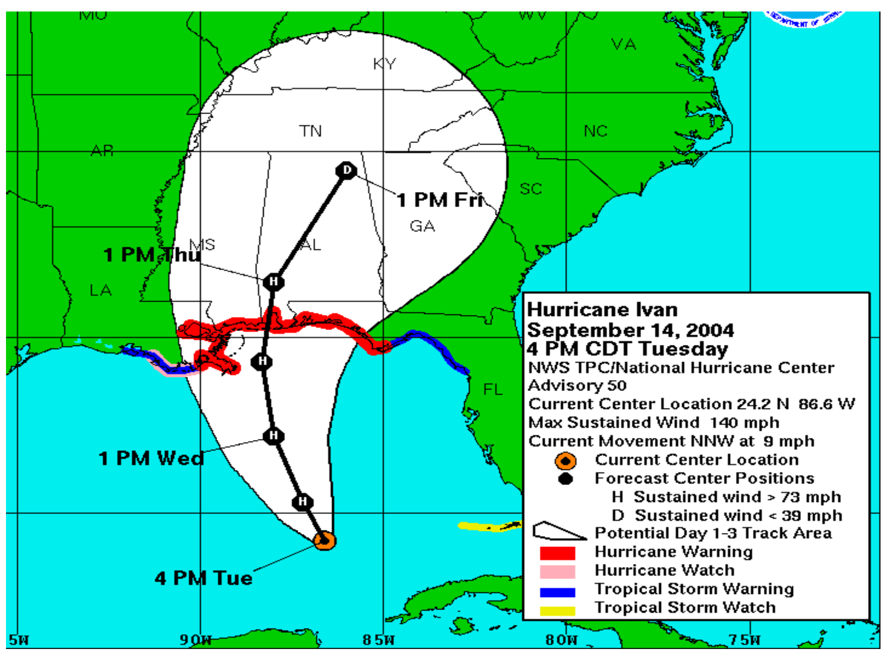

Figure 4. Hurricane Ivan Track Area

Source: National Oceanic and Atmospheric Agency (NOAA) website, URL:<http://www.nhc.noaa.gov/ftp /graphics/AT09/refresh/ AL0904W+GIF/312103W.gif>, accessed 14 September 2004.

Areas of Uncertainty

The use of track areas to display the projected paths of storms is similar to the U.S. Navy's use of movement projection models in naval surface warfare. The U.S. Navy accepted that it could not always obtain an accurate point location of a moving enemy target such as a ship. It settled on narrowing its location to an area and using areas of uncertainty to depict the possible locations of a moving enemy target. This allowed them to focus on areas with the highest probability of enemy contact.

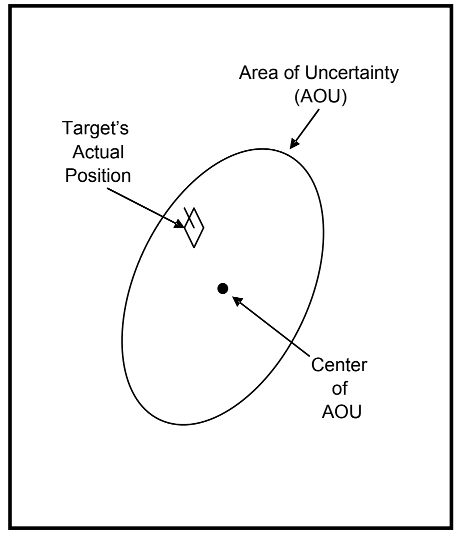

Figure 5. Area of Uncertainty.

Source: Andy Doty and Kurt Kalbfleish, "Tomahawk Targeting: Welcome to the Real World," *Naval SITREP* no. 2, January 1995, 8.

The U.S. Navy uses movement projection models in surface warfare to attack enemy ships that are beyond their line of sight, or over the horizon. Upon detection of an enemy ship, the U.S. Navy can send Tomahawk sea-launched cruise missiles to attack it. The challenge is that the enemy ship will most likely move from its location upon detection.

In order to account for navigation and sensor errors as well as the movement of the enemy ship, the targeting data for the firing platform can include an area of uncertainty (AOU). See Figure 5, Area of Uncertainty.

An AOU is an ellipse that has a high probability of containing the target. They are known as AOUs because the exact location of the target is uncertain, though it is confined to an area.[10]

As the Tomahawk missile approaches the AOU, its missile seeker conducts search patterns to find the target. A small AOU provides the missile seeker a greater probability of detecting the target. As the AOU grows, there is a lesser probability of the missile seeker detecting the target. A large AOU is not worth engaging, but it provides an area to focus efforts to pinpoint the enemy's location.[11] See Figure 6, Area of Uncertainty Growth.

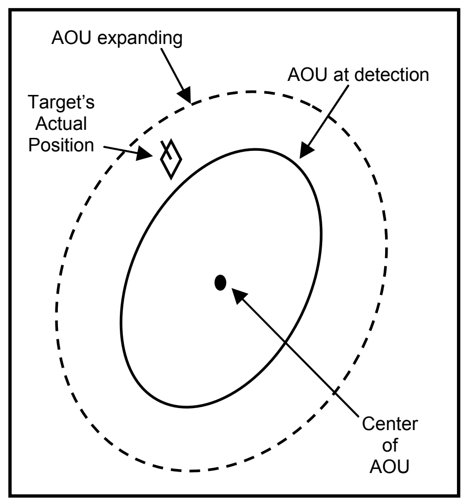

Figure 6. Area of Uncertainty Growth

Source: Andy Doty and Kurt Kalbfleish, "Tomahawk Targeting: Welcome to the Real World," *Naval SITREP* no. 2, January 1995, 8.

[10] Andy Doty and Kurt Kalbfleish, "Tomahawk Targeting: Welcome to the Real World," *Naval SITREP* no. 2, January 1995, 8. Cited hereafter as Doty and Kalbfleish, "Tomahawk Targeting: Welcome to the Real World," 1995.

[11] Doty and Kalbfleish, "Tomahawk Targeting: Welcome to the Real World," 1995, 8.

Movement projection models in land warfare have largely been used in the detection and location of ballistic missile transporter-erector-launchers (TELs).[12] The missions directed against the TELs are described as counterforce operations but, they are better known as “Scud Hunts” from the 1991 Persian Gulf War. One of the best opportunities for the detection of a TEL is when it launches its missile. In order to prevent the TEL from being reused to fire another ballistic missile in the future, a movement projection model can be used to determine the possible locations of a TEL after its launch with a follow-on counterforce mission to destroy it.

The applications of movement projection models in naval surface warfare and “Scud Hunts” demonstrate their use in locating mobile and stealthy targets. This approach is useful because it defines areas of probability when precise locations of the enemy cannot be determined. This philosophy can be applied to further applications in land warfare because potential adversaries will attempt to keep moving and remain undetected.

Distinguishing Projection and Prediction

While the process used to determine probable enemy locations is predictive in nature, this paper uses the term *projection* instead of *prediction* because prediction implies a sense of certainty. Instead of predicting where the enemy will go, projection displays possible locations. It does not state that the enemy is at a specific location, but rather, in a general area.

A chess game is a situation where one can definitively calculate an opponent’s possible moves. The chess pieces have clearly defined movement abilities and the terrain is neatly divided into a grid with no constraints. These are the only two factors that affect the movement of the chess pieces, so it is simple to calculate an opponent’s immediate move. See Figure 7, Calculating an Opponent’s Chess Moves.

The calculation of all of the possible moves for one chess piece is projection. Through projection, one can determine an enemy’s most likely moves and least likely moves. By examining the black knight’s possible moves in Figure 7, one can determine that two positions are highly unlikely because of the risk of imminent capture. Two more positions are also unlikely because of the risk of capture even with cover from other pieces.

While two positions offer the opportunity of capturing an opponent’s piece, only one offers the ability to escape in the next turn. The black knight can also remain in place since it is safe in its current position. Capturing the white pawn in square F2 or remaining in place are the most likely moves for the black knight. Through projection, one has an idea of the opponent’s next move for that particular piece. Projecting an opponent’s chess moves can be repeated for all other pieces.

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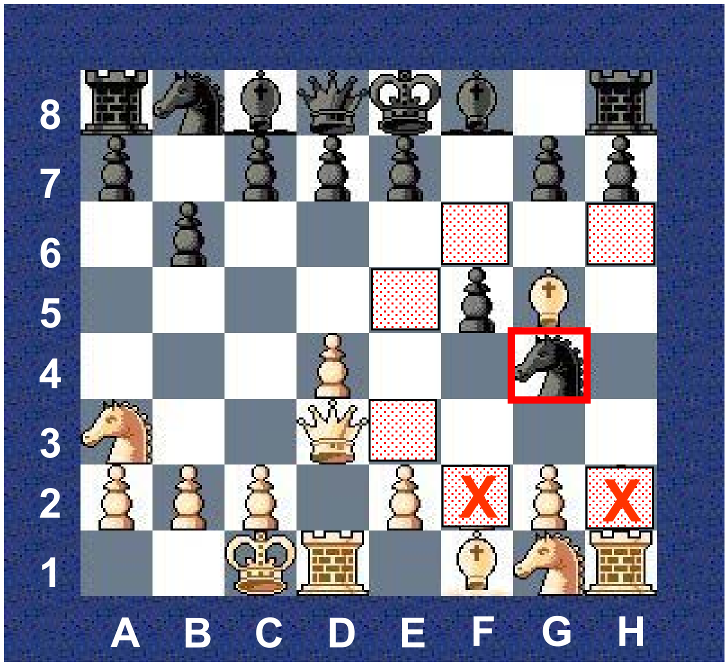
[12] The U.S. Army has used a system called Generic Area Limitation Environment (GALE) to create movement projection models for TELs.



Squares in red are possible moves that the black knight chess piece can make. White pawns marked with an “X” indicate that the black knight can capture these pieces.

Figure 7. Calculating an Opponent’s Chess Moves.

(U) Source: Author’s concept. Chessboard from BYOND Games, URL: <http://www/games.byond.com/start/images/chess.jpg>, accessed 25 March 2004.

An automated ability to display an opponent’s moves can be helpful because it allows one to see all possible moves where one may have overlooked. By using an automated ability to display an opponent’s possible moves, it allows one to rapidly discern the enemy’s most probable following move.

Movement Projection for Enemy Vehicles

A movement projection model for enemy vehicles displays the probable area that an enemy vehicle can be located based on its last known location. Calculations take into account the vehicle’s movement capability over specified terrain within a specified time. A movement projection model for ground combat is similar to the U.S. Navy’s area of uncertainty concept used in targeting ships in naval surface warfare.

In a future digital battle command and control system, spatial analysis software could create a movement projection model either on demand by the user or automatically upon receipt of an enemy report. The enemy information required for calculation is vehicle classification (tracked or wheeled), speed, and if available, direction of travel.

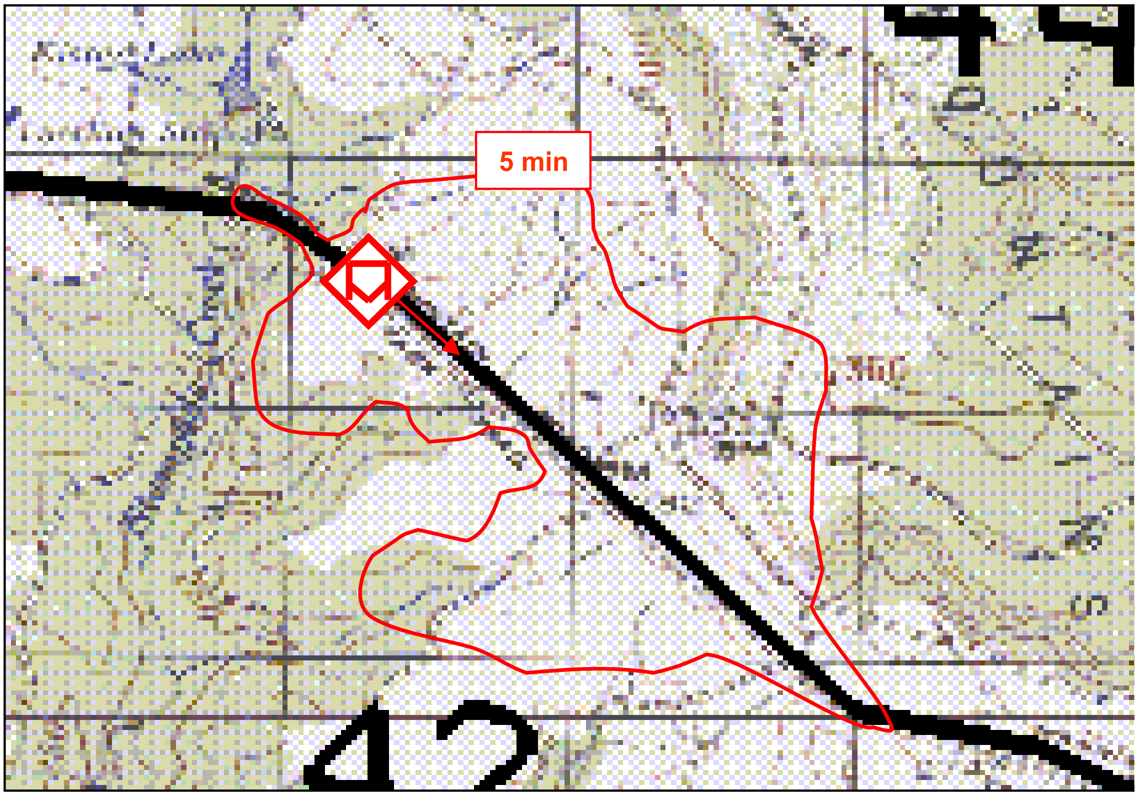


Figure 8. Proposed Display for an Area Projection for a Moving Enemy Vehicle.

Source: Author's proposal.

An enemy vehicle's area of projected locations would be represented by a polygon whose shape is defined by the difficulty of the terrain within a specified time. The enemy vehicle icon denotes its last reported location. The area inside the polygon would be mostly transparent to allow the user to see the terrain. An arrow in front of the enemy vehicle icon is used to display the vehicle's last known direction of travel. Time tags can display the size of the projected area as a function of time.

The specified time to begin and stop projection should be user-defined. The user can specify that after certain time, the program can stop projecting locations because it may no longer be useful. See Figure 8, Proposed Display for an Area Projection for a Moving Enemy Vehicle.

Like the circular engagement area tool, there are also limitations with movement projection: database accuracy, the need for more enemy data, and clutter. The single most important factor that will affect projection is the accuracy of the digital terrain elevation database (DTED). An inaccurate terrain database will significantly affect the projection area. While terrain is generally constant, vegetation can dramatically change. The terrain database has to be accurate and detailed to make the projection of enemy locations accurate.

An expedient solution to overcome the current challenge of a lack of detailed terrain databases is to display an enemy vehicle's movement projection area as an ellipse. While an ellipse does not provide an accurate assessment of an enemy vehicle's possible locations, the intent is to give the warfighter an idea that an enemy vehicle was located in a specific area and is continuing to move. The ellipse is an area of uncertainty that the warfighter can analyze over the map to determine where the enemy may have moved based on its last reported location as depicted by its icon. See Figure 9, Proposed Area of Uncertainty for Enemy Ground Vehicle.

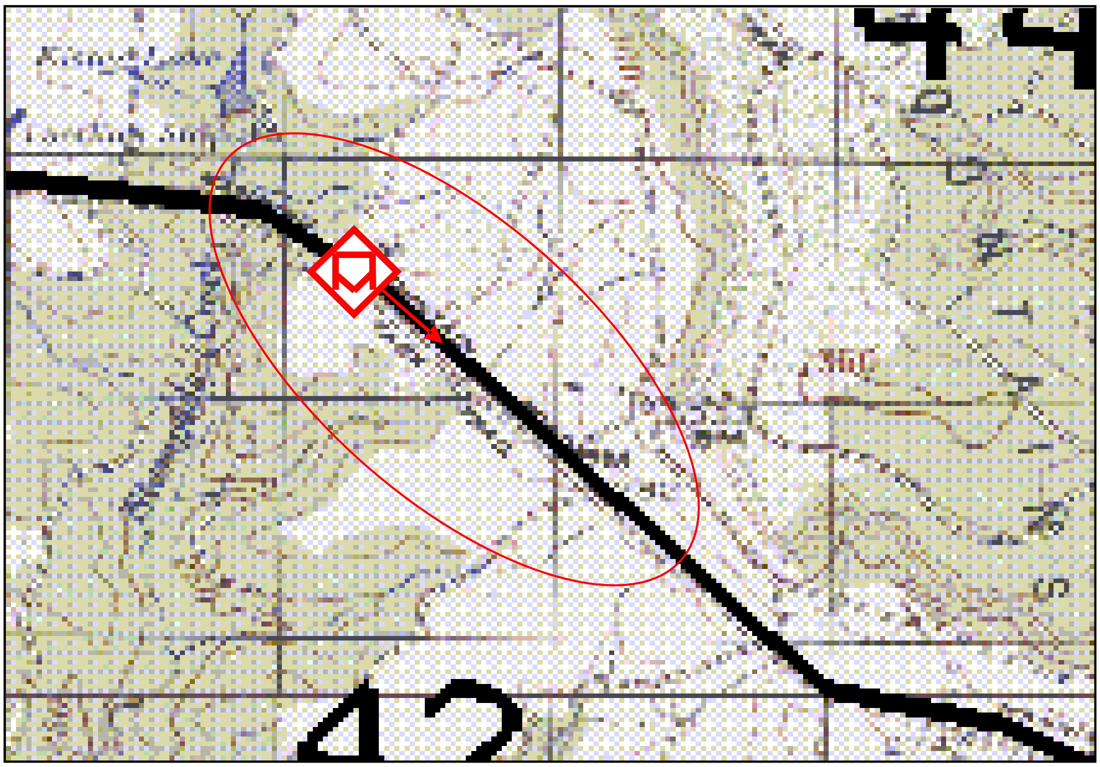


Figure 9. Proposed Area of Uncertainty for Enemy Ground Vehicle.

Source: Author's Proposal

The calculations for projection will require more data than is normally found in a spot report or contact report. While the vehicle class (tracked or wheeled) is usually identified, specific vehicle model, reported speed, and direction of travel can provide a more accurate movement projection.

Despite these limitations, the projection of enemy vehicle locations can be useful when friendly forces lose contact with the enemy and are trying to reacquire their target. Movement projection as a visual decision support tool can help friendly forces focus their efforts to reacquire enemy forces if they lose contact with them.

Another Perspective to View the Enemy Situation Display

Thomas S. Kuhn, the author of *The Structure of Scientific Revolutions,* is attributed with the following quote, “All the significant breakthroughs were breaks in the old ways of thinking.” An approach to break old ways of thinking in viewing the enemy situation display is to change how we see enemy locations. Displaying probable enemy locations as areas or zones as opposed to point symbols is a different perspective to view the enemy ground force situation display in digital battle command and control systems. Perhaps it may be useful to adapt a different set of conventions in displaying enemy locations because the enemy is not tracked with the same fidelity as friendly forces.

Current digital battle command and control systems display both friendly and enemy forces as point symbols to indicate a specific location on the ground. A point symbol indicates a sense of certainty that an entity is at or around the symbol’s location. However, the use of point symbols to represent an enemy on the move can be a disadvantage in red force tracking. Because the enemy positions are not automatically updated, the positions displayed are old information. Users focus on the point symbol because that is the only reference to the enemy position, even if it may be old information.

The use of an area symbol is a proposal of probable enemy locations. While an area symbol communicates a lesser degree of certainty about an enemy’s location, it expands the perception that the enemy could be located anywhere within that area. Instead of focusing on a point, the user looks at an entire area.

The term “red zone” is a non-doctrinal U.S. Army term that is synonymous with the enemy’s battlespace. It is a term borrowed from American football that describes the last 20 yards before an opposing team’s end zone. The red zone is the enemy’s battlespace where friendly forces have the toughest time maneuvering to close with and destroy the enemy. It is perhaps the most dangerous place on the battlefield because enemy forces can immediately observe and engage with direct and indirect fires.[13]

Circular engagement areas and movement projection models help to define the enemy’s battlespace. In addition to providing an idea of the enemy’s possible locations, they can display where the enemy can see and engage them. These capabilities can contribute towards the warfighter’s survivability as well as mission accomplishment.

The use of red zones to depict enemy locations instead of point symbols is a significant mental shift in viewing the enemy’s locations. While the use of point symbols should be retained to depict confirmed enemy locations, the addition of area symbols indicates uncertainty about an enemy’s location, either due to time, movement, or accuracy of the report. See Figure 10, Red Zones.

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[13] LTC (now COL) James B. Hickey, USA, *Closing with the Enemy: Company Team Maneuver* (Fort Leavenworth, KS: Center for Army Lessons Learned, 1999), 4.

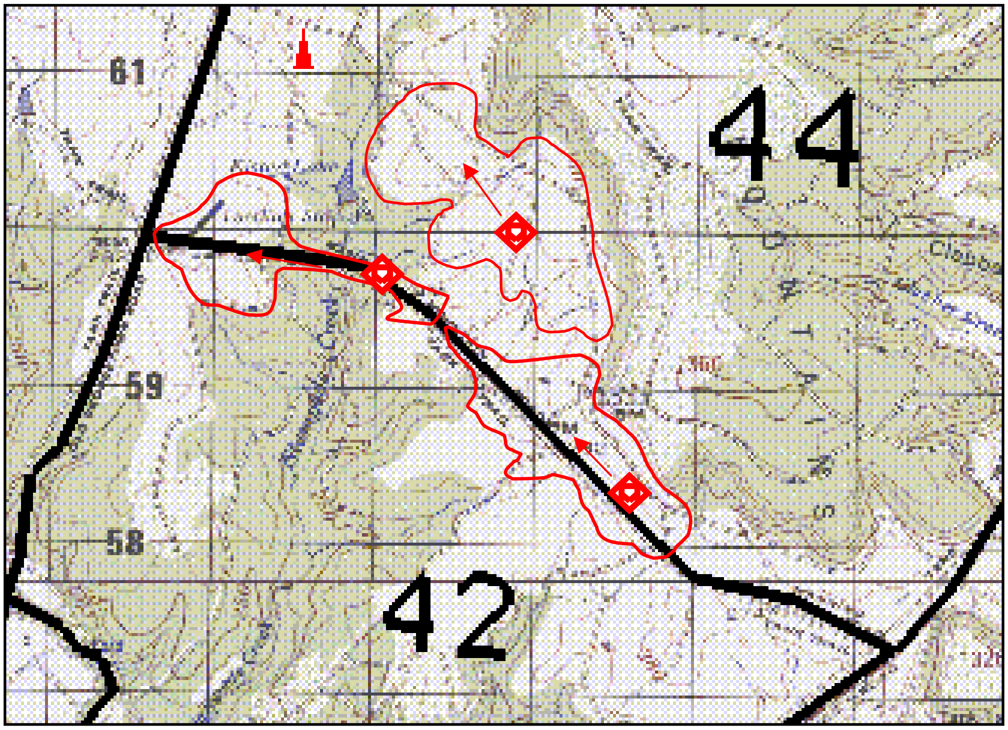

Figure 10. Red Zones.

Source: Author's proposal.

A concern with the use of red zones is that their use could potentially clutter the common operational picture (COP). This is a valid concern, but this can be controlled by proper scaling of the COP. The use of large map scales at the tactical level is conducive to displaying red zones because it is focused on a specific area. With the use of smaller map scales at the operational and strategic level, red zones can be programmed to display only the center mass of the area, or point of origin of the red zone calculation.

Implementation

The technology to provide spatial analysis tools in the digital battle command and control systems of combat platforms is already available, but because of hardware and software limitations, the technology cannot be readily implemented in current digital battle command and control systems. A recently released software package called the Commercial Joint Mapping Toolkit (C/JMTK) can provide some of the capabilities described, but the greatest challenges to utilizing these tools are data availability, data storage, and customization for the warfighter.[14]

[14] For more information on the Commercial Joint Mapping Toolkit (C/JMTK), see the C/JMTK website at URL: <http://www.cjmtk.com>.

Highly detailed terrain data is scarce and it is not always possible to immediately prepare this data for countries where a crisis had not been anticipated. Highly detailed terrain data requires vast amounts of computer storage space that is not currently practical for maintaining in current digital battle command and control systems. The spatial analysis tools must also be customized for the warfighter so that they require minimal user interaction.

Despite these challenges, the National Geospatial-Intelligence Agency (NGA) continues to provide highly detailed terrain data for more areas of the world, the computing power and storage space of digital battle command and control systems continues to improve, and new software tools such as C/JMTK are being developed and fielded. These developments are promising steps towards empowering the warfighter with spatial analysis tools in order to add value to combat information.

Conclusion

This paper has argued that the use of spatial analysis tools in digital battle command and control systems will improve the enemy ground situation display. The spatial analysis tools of circular line of sight and movement projection can improve the enemy situation display because they provide a projection of enemy vehicular activity based on the most current intelligence. These projections can be displayed as “red zones” to indicate areas of probable enemy locations and activity. While red zones do not display the exact locations of enemy forces, they focus the intelligence analyst and the warfighter on areas of likely enemy activity.

These proposals are largely based on the use of technological tools to improve the continuous challenge of obtaining the most complete and accurate view of the enemy situation. The technological aspect of projecting enemy activity is perhaps the easiest part. What is even more difficult is adapting new intellectual and cultural mindsets to improve one’s view of the enemy situation. In light of these challenges, these proposals should be further developed and tested in order to provide the U.S. military with a new perspective of viewing the enemy situation.

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